

ACCIDENT PREVENTION PLAN

FUSRAP MAYWOOD SUPERFUND SITE MAYWOOD, NEW JERSEY

**SITE-SPECIFIC ENVIRONMENTAL RESTORATION
CONTRACT NO. W912DQ-13-D-3016 TASK ORDER 001**

Prepared for



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RADIOLOGICAL • ENGINEERING • REMEDIATION

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APPROVALS

ACCIDENT PREVENTION PLAN

FUSRAP Maywood Superfund Site Maywood, New Jersey

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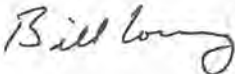
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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 BACKGROUND INFORMATION	1-1
1.1 Contractor Information	1-1
1.2 Safety Performance	1-1
1.3 Project Description.....	1-2
1.4 Site Description and Location.....	1-2
1.5 Investigation Tasks	1-6
2.0 CABRERA SAFETY AND HEALTH POLICY.....	2-1
2.1 Project Safety Goal	2-1
3.0 RESPONSIBILITIES AND LINES OF AUTHORITY	3-1
3.1 Project Roles and Responsibilities.....	3-1
3.1.1 Program Manager.....	3-3
3.1.2 Project Manager	3-3
3.1.3 Occupational Health & Safety (OH&S) Manager	3-3
3.1.4 Project Certified Health Physicist.....	3-4
3.1.5 Field Site Manager.....	3-4
3.1.6 Site Safety and Health Officer.....	3-4
3.1.7 Radiation Safety Officer.....	3-5
3.1.8 Other Project Personnel	3-5
3.2 Competent and Qualified Personnel	3-6
3.3 Pre-Task Safety and Health Analysis Requirements	3-6
3.4 Stop Work Authority.....	3-7
3.5 Lines of Authority.....	3-7
3.6 Noncompliance Policies and Procedures	3-7
3.7 Manager and Supervisor Accountability	3-8
4.0 SUBCONTRACTORS AND SUPPLIERS	4-1
5.0 TRAINING	5-1
5.1 New Employee Occupational Health & Safety Orientation	5-1
5.2 Basic OSHA Training: Requirements for Mandatory Training/Certifications....	5-1
5.2.1 HAZWOPER Refresher Training	5-1
5.2.2 HAZWOPER Management and Supervisor Training.....	5-2
5.3 Site-Specific Health and Safety Training	5-2
5.3.1 Training Elements for Site Workers.....	5-2
5.3.2 Railroad Safety Training.....	5-2
5.3.3 Radiation Worker Training (RWT)	5-3
5.4 Emergency Response Training	5-3
5.5 Specialized Training	5-3
5.5.1 First Aid and Cardio-Pulmonary Resuscitation Training.....	5-3
5.5.2 Hearing Conservation Training.....	5-4
5.5.3 Bloodborne Pathogen Training.....	5-4
5.5.4 Hazard Communication Training	5-4

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Page</u>
5.5.5	5-4
5.5.6	5-4
5.5.7	5-5
5.6	5-7
5.6.1	5-7
6.0	6-1
6.1	6-1
6.2	6-1
7.0	7-1
7.1	7-1
7.2	7-1
7.3	7-2
8.0	8-1
8.1	8-1
9.0	9-1
9.1	9-1
9.2	9-1
9.3	9-2
9.3.1	9-2
9.3.2	9-2
9.3.3	9-3
9.3.4	9-3
9.4	9-3
10.0	10-1
10.1	10-1
10.2	10-1
10.2.1	10-2
10.2.2	10-2
10.2.3	10-4
10.2.4	10-5
10.3	10-5
10.4	10-6
10.4.1	10-6
10.4.2	10-7
10.4.3	10-8
10.4.4	10-8
10.4.5	10-9
10.4.6	10-9
10.4.7	10-9

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Page</u>
10.4.8 Respiratory Protection, Inspection, Cleaning and Maintenance of Respirator.....	10-10
10.4.9 Respiratory Protection, Recordkeeping	10-10
10.5 Health Hazard Control Plan	10-11
10.6 Lead Abatement Plan	10-12
10.7 Asbestos Abatement Plan	10-12
10.8 Radiation Safety Program	10-12
10.9 Abrasive Blasting Plan.....	10-12
10.10 Crystalline Silica Monitoring Plan.....	10-12
10.11 Confined Space – Non-Marine Facilities.....	10-12
10.12 Hazardous Energy Control Plan (Lockout/Tag-out).....	10-13
10.13 Critical Lift Procedures.....	10-14
10.14 Floating Plant Contingency Plan for Severe Weather	10-14
10.15 Float Plans.....	10-14
10.16 Access and Haul Road Plan	10-14
10.17 Demolition Plan (Engineering and Asbestos Surveys).....	10-16
10.18 Emergency Rescue (Tunneling).....	10-16
10.19 Underground Construction Fire Prevention and Protection Plan	10-16
10.20 Compressed Air Plan (Handling Compressed Gasses).....	10-16
10.21 Formwork and Shoring Erection and Removal Plans.....	10-18
10.22 Lift Slab Plans.....	10-18
10.23 SHP and SSHP	10-19
10.24 Blasting Plan	10-19
10.25 Diving Plan	10-19
10.26 Plan for Prevention of Alcohol and Drug Abuse	10-19
10.27 Excavation and Trenching	10-19
10.27.1 Heavy Equipment Operations.....	10-21
10.28 Site Specific Fall Protection and Prevention Plan	10-22
10.28.1 Railcar Loading Operations Fall Protection	10-23
10.28.2 Excavation/Leading Edge Fall Protection.....	10-26
10.28.3 Water Treatment System Fall Protection.....	10-26
10.28.4 Fall Protection Rescue.....	10-26
10.29 Steel Erection Plan	10-27
10.30 Night Operations Lighting Plan.....	10-27
10.31 Site Sanitation Plan.....	10-27
10.32 Fire Prevention and Protection Plan	10-29
10.33 Wild Land Fire Management Plan.....	10-30
10.34 Pre-Cast Concrete Plan	10-30

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Page</u>
10.35 Heat/Cold Stress Monitoring Plan	10-30
10.35.1 Heat Stress	10-30
10.35.2 Cold Exposure	10-33
11.0 RISK MANAGEMENT PROCESS	11-1
12.0 REFERENCES.....	12-1
13.0 ACKNOWLEDGEMENT.....	13-1

LIST OF TABLES

Table 1-1: Cabrera Services Safety Performance.....	1-1
Table 3-1: Key Cabrera Project Personnel	3-1
Table 3-2: Competent Persons.....	3-6
Table 8-1: Emergency Telephone Numbers.....	8-2
Table 9-1: PPE Levels by Task	9-1
Table 10-1: Screening Criteria for Heat Stress Exposures.....	10-31
Table 10-2: Work Demand Categories.....	10-31
Table 10-3: Wind Chill Factors.....	10-34

LIST OF FIGURES

Figure 1-1: Site Location	1-3
Figure 3-1: Cabrera Safety Organizational Chart	3-2
Figure 10-1: Location of Maywood Bergen County, New Jersey Master Haul Route	10-15

LIST OF APPENDICES

- APPENDIX A:** Site-Specific Safety & Health Plan
- APPENDIX B:** Resumes and Training Certificates for project personnel
- APPENDIX C:** Applicable Safety Procedures
- OP 511, Safe Work Standards
 - OP 512, Incident, Near Miss & Observation Reporting
 - OP 513, Incident Investigation
 - OP-517, Hazardous Materials Communication
 - OP 518, Housekeeping
 - OP 519, Manual Lifting
 - OP 520, Driver & Vehicle Safety
 - OP-531, First Aid and Medical Services
 - OP 555, Safety Meetings
 - OP 562, Respiratory Protection
 - OP 563, Heat Stress
 - OP-565, Hearing Conservation
 - OP 566, Hand & Power Tools
 - OP 567, Electrical Safety
 - OP 568, Ladder Safety
 - OP 582, Confined Spaces
 - OP 583, Excavation & Trenching
 - OP 584, Heavy Equipment
 - OP 585, Fall Protection
 - OP 589, Utility Clearance & Isolation
 - OP 592, Forklifts
 - OP 593, Hazardous Energy Control
 - OP 594, Hot Work
- APPENDIX D:** Safety Forms
- APPENDIX E:** Hazardous Substances Inventory

LIST OF ACRONYMS AND ABBREVIATIONS

AEC	Atomic Energy Commission	LOTO	Lockout/tag-out
AHA	Activity Hazard Analysis	MCW	Maywood Chemical Works
ALARA	As-Low-As-Reasonably Achievable	MHTDP	Material Handling Transportation & Disposal Plan
ANSI	American National Standards Institute	MISS	Maywood Interim Storage Site
APP	Accident Prevention Plan	MNA	Monitored Natural Attenuation
APR	Air Purifying Respirator	MSDS	Material Safety Data Sheet
Cabrera	Cabrera Services, Inc.	MUC	Maximum Use Concentration
CFR	Code of Federal Regulations	NCCI	National Council on Compensation Insurance
CIH	Certified Industrial Hygienist	NJDEP	New Jersey Department of Environmental Protection
CNC	condensation nuclei counter	NRC	Nuclear Regulatory Commission
CPR	Cardio-Pulmonary Resuscitation	OHSMS	Occupational Health & Safety management System
CSP	Certified Safety Professional	OSHA	Occupational Safety and Health Administration
cyds	cubic yards	PCHP	Project Certified Health Physicist
DDT	dichlorodiphenyltrichloroethane	PLHCP	Physician or licensed health care professional
DI	deionized	PM	Project Manager
DOE	Department of Energy	PPE	Personal Protective Equipment
DOT	Department of Transportation	QLFT	Qualitative Fit Testing
DQCR	Daily Quality Control Report	QNFT	Quantitative Fit Testing
EAP	Employee Assistance Program	RI	Remedial Investigation
EM	Engineering Manual	RSO	Radiation Safety Officer
EMS	Emergency Medical Services	RWT	Radiation Worker Training
ERP	emergency response plan	SDS	Safety Data Sheet
ESLI	end-of-service life indicators	SOHM	Safety and Occupational Health Manager
EZ	Exclusion Zone	SOW	Scope of Work
°F	degrees Fahrenheit	SRL	Self-Retracting Lifeline
FMSS	FUSRAP Maywood Superfund Site	SSHP	Site-Specific Safety & Health Plan
FS	Feasibility Study	SSHO	Site Safety and Health Officer
FSM	Field Site Manager	T&D	Transportation and Disposal
FSS	Final Status Survey	UFML	USACE FUSRAP Maywood Lab
ft	feet	USACE	U.S. Army Corps of Engineers
FUSRAP	Formerly Utilized Sites Remedial Action Program	USEPA	U.S. Environmental Protection Agency
GDA	Government Designated Authority	WBG	Wet Bulb Globe Thermometer
GPS	global positioning system	WP	Work Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response		
HEPA	High efficiency particulate air		
HS&E	Health Safety & Environment		
ICP-AES	inductively coupled plasma atomic emission spectrometer		
IDW	Investigative Derived Waste		

1.0 BACKGROUND INFORMATION

1.1 CONTRACTOR INFORMATION

This Accident Prevention Plan (APP) establishes standard safety and health procedures for:

Cabrera Services Inc. (Cabrera)
473 Silver Lane
East Hartford, CT 06118

This APP was prepared by Cabrera under Contract No. W912DQ-13-D-3016.

This APP applies to personnel and subcontractors involved in the field implementation of the Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS), Maywood New Jersey.

This APP has been prepared to cover each APP element in Appendix A of Engineering Manual (EM) 385-1-1 (United States Army Corps of Engineers, (USACE), 2008 and meets the Hazardous Waste Operations and Emergency Response (HAZWOPER) requirements set forth by the Occupational Safety and Health Administration (OSHA) in the Code of Federal Regulations (CFR) Part 20, Sections 1910.120 and 1926.65 (OSHA, 2011). The Site Safety and Health Plan (SSHP) attached to this APP (Appendix A) will cover each of the SSHP elements in Section 28.A.02 b of EM 385-1-1.

The purpose of this APP is to establish site-specific safety and health procedures, practices, and equipment to be implemented and used to protect personnel, as well as the local community and the environment, from potential occupational safety and health hazards during execution of the project. This APP is considered a working document and may be modified during fieldwork based upon review of additional information regarding unexpected site conditions and/or implementation issues.

Field activities specified in the work plan (WP) shall be performed in accordance with policies and procedures in Cabrera's Occupational Health & Safety Manual (Cabrera, 2013); other applicable site health safety and environmental (HS&E) regulations; OSHA requirements; and, other applicable Federal, State, and local statutes. Onsite personnel shall follow the health and safety guidelines specified in this APP, be alert to potential changes in site hazards, and exercise reasonable caution at all times.

1.2 SAFETY PERFORMANCE

Cabrera's safety performance over the past three years of available records, shown in Table 1-1, has been substantially better than the national average for comparable services (NAICS Code 562190, Waste Management & Remediation Services). This is reflected in the National Council on Compensation Insurance, Inc. (NCCI) experience modifier rates shown in Table 1-1.

Table 1-1: Cabrera Services Safety Performance

<i>Year</i>	<i>Total Recordable Case Incidence Rate</i>	<i>Days Away from Work and Restricted Time Case Rate</i>	<i>Experience Modification Rate</i>
2011	0.6	0.0	0.83
2012	0.0	0.0	0.79
2013	0.0	0.0	0.77

1.3 PROJECT DESCRIPTION

The FMSS is located in Bergen County, New Jersey, approximately 20 kilometers (12 miles) north northwest of New York City and 21 kilometers (13 miles) northeast of Newark, New Jersey. The location of the site is depicted on the Site Location Map (Figure 1-1).

1.4 SITE DESCRIPTION AND LOCATION

The Maywood Chemical Works (MCW) site was constructed in 1895. In 1916, the plant began extracting thorium and rare earth metals from monazite sands via an acidic process for use in manufacturing industrial products, such as mantles for gas lanterns. The plant also produced a variety of other materials, including lithium compounds, detergents, alkaloids, and oils. The plant stopped accepting monazite sands for extraction of thorium in 1956, but it processed stockpiled materials until 1959. Based on available historical information and knowledge of the chemical processes involved, the chemicals identified as having been used in the thorium extraction process include sulfuric acid, nitric acid, ammonium hydroxide, and ammonium oxalate. Oxalic acid was also used at the site in the production of higher grade thorium (U.S. Department of Energy [DOE], 1995).

In the extraction process, waste in a slurry form was produced. Until 1932, the slurry was pumped to two earthen diked areas west of the plant. The slurry from these ponds was later transferred to Burial Pits 1 and 2. The liquids containing the thorium and rare earth metals were separated from the tailings, and thorium was separated from the rare earth material. Some concentrated thorium residues were pumped into a holding pond, where the source material precipitated as a phosphate. This waste currently resides in Burial Pit 3. In 1932, the disposal areas were affected by the construction of State Route 17, which separated the diked areas from the plant and partially buried them. Waste retention ponds also were located throughout the area of MCW, which is now FMSS.

The MCW also produced detergents, alkaloids, essential oils, and lithiated compounds, including lithium chloride and lithium hydroxide. Lithium wastes are believed to have been disposed in diked areas on the MCW site. Protein extraction from leather digestion was also performed. Leather wastes are believed to have been buried in two primary shallow disposal areas on the Stepan Company property, just east of the FMSS property boundary.

Some of the process wastes were removed and used as mulch and fill on nearby properties, thereby contaminating those properties with radioactive materials. Although the fill consisted primarily of tea and coca leaves from other MCW processes, these materials were apparently contaminated with the thorium processing wastes. Other wastes moved off site from the property through natural drainage of the former Lodi Brook. Most of the open stream channel in Lodi has been replaced by an enclosed storm drain system. The principal radioactive contaminant found at the site has been thorium-232, with lesser amounts of radium-226, uranium-238, and decay products.

The MCW received a radioactive materials license from the Atomic Energy Commission (AEC) in 1954. They stopped extracting thorium in 1957. The property was sold to the Stepan Company in 1959, which received a license from the AEC in 1961 for storage only. Although the Stepan Company never processed radioactive materials, the company agreed to carry out certain

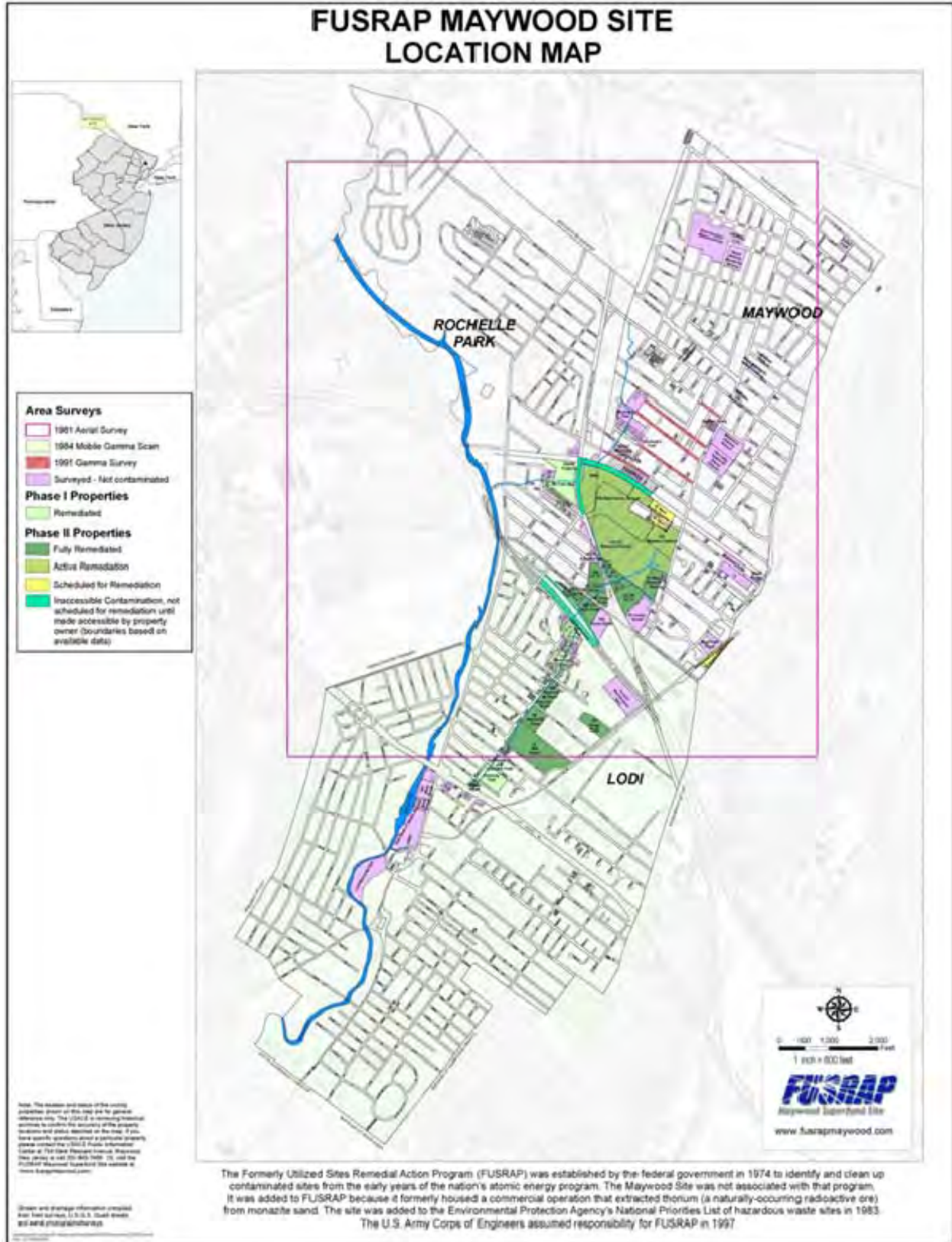


Figure 1-1: Site Location

remedial measures in the former disposal area on the west side of State Route 17 (now known as the Ballod property). Stepan Company began to clean up the thorium processing wastes in 1963, partially stabilizing residues and tailings. From 1966 through 1968, Stepan Company removed residues and tailings from the Ballod property and reburied them on the Stepan Company property in three burial pits. After these actions were completed, AEC certified that the portion of the property west of State Route 17 could be used without radiological restrictions.

Additional radioactive contamination, however, was discovered in the northeast corner of the Ballod property in 1980. The discovery was made after a private citizen reported radioactive contamination near State Route 17 to the New Jersey Department of Environmental Protection (NJDEP). A survey of the area (State Route 17, Ballod property, and Stepan Company property) conducted by NJDEP identified the contaminants as thorium-232 and radium 226. The Nuclear Regulatory Commission (NRC) was notified of the results and conducted additional surveys from November 1980 to January 1981. These surveys confirmed that there were high concentrations of thorium-232 in soil samples collected from both the Stepan Company and Ballod properties. The NRC, therefore, requested a thorough survey of the area.

In January 1981, the EG&G Energy Measurements Group conducted an aerial radiological survey of the Stepan Company property and surrounding properties. The survey, which covered a 10.1 square kilometers (3.9 square miles) area, indicated contamination not only on the Stepan Company and Ballod properties but also in areas to the north and south of the Ballod property. During February 1981, Oak Ridge National Laboratory performed a separate radiological ground survey of the Ballod property. Those results eventually led to the designation of the property for remedial action under FUSRAP. In June 1981, another radiological survey of the Stepan Company and Ballod properties commissioned by the Stepan Company produced similar findings.

In late 1983, the DOE began a program of surveys of properties in the vicinity of the former MCW plant. Through a provision of the Energy and Water Development Appropriations Act of 1984, Congress authorized DOE to conduct a decontamination research and development project at the Maywood site. The site was assigned to FUSRAP. The DOE, acting under FUSRAP, initiated soil removal from affected residential properties. Since no adequate low level radioactive disposal sites existed at the time, DOE negotiated a Memorandum of Understanding with the Borough of Maywood, dated August 10, 1984, to allow it to store removed soils on an 4.7 hectare (11.7 acre) portion of the Stepan Company property (part of the original MCW property). This area, which was used as an interim storage facility for the contaminated materials, is now known as the FMSS. In September 1985, ownership of the FMSS was transferred to the DOE.

From 1984 to 1986, DOE completed removal actions at 25 residential properties, and partially remediated one commercial property (Ballod). The waste from these removal actions was placed in storage at the FMSS. Removal actions at the vicinity properties were halted in 1986 in response to community concerns about additional wastes being brought to the FMSS.

In July 1991, DOE conducted a time critical removal action to decontaminate one additional residential property in Lodi. This action was taken in response to radiological surveys that identified gamma exposure rates that exceeded DOE guidelines. The radiological survey was taken inside a portion of a building. The original owner of the residence was an employee of the MCW, who apparently used discarded building and fill materials from the MCW to construct an

addition to a house. Contaminated soil and building materials generated during this removal action were packaged in appropriate containers and placed in Building 76 at the FMSS for storage.

Concurrent with DOE radiological characterization of the site, Ebasco Services, Inc. performed a characterization study of nonradiological pollutants for the U.S. Environmental Protection Agency (USEPA). The soils from vicinity properties analyzed by Ebasco Services, Inc. in 1986 exhibited elevated concentrations of volatile organic compounds (methylene chloride, acetone, methyl ethyl ketone, benzene, toluene, and ethylbenzene in the parts per million [ppm] range), acid extractable semivolatile organic compounds, and six metals (arsenic, cadmium, chromium, lead, beryllium, and nickel varying in concentrations up to several hundred ppm). In addition, nine pesticides (dieldrin, lindane, alpha benzene hexachloride, endosulfan I, endosulfan sulfate, 4,4' dichlorodiphenyldichloroethylene, 4,4' dichlorodiphenyldichloroethane, 4,4' dichlorodiphenyltrichloroethane [DDT], and aldrin) were detected in various levels up to several hundred parts per billion. Some soil borings also exhibited the presence of gasoline and fuel oil components, various methylated benzenes, caffeine, and the essential oils alpha pinene and d limonene.

On April 27, 1987, the USEPA issued a Special Notice to Stepan Company and all persons it knew to be an owner of property found to be chemically contaminated. Following this issuance to these potentially responsible parties, the USEPA received a good faith offer and undertook negotiations with Stepan Company to perform appropriate investigations and studies (i.e., Remedial Investigation [RI]/Feasibility Study [FS]) at these contaminated properties. The USEPA issued the Order on Consent to Stepan Company on September 21, 1987, to perform such investigations and studies.

Between August and October 1987 and March and April 1988, the USEPA's contractor, Ebasco Services, Inc., collected samples of soil and groundwater, respectively, from the Stepan Company property, where the DOE contractor, Bechtel National, Inc., was installing monitoring wells. The soil analyses showed detection of volatile organic compounds and semivolatile organic compounds, including benzenes, toluene, and xylenes; pesticides, including beta benzene hexachloride and 4,4' DDT; and contaminants of the metals/cyanide series, including aluminum, barium, cadmium, lead, and nickel. The groundwater analyses also showed detection of volatile organic compounds and semivolatile organic compounds, including benzenes, toluene, xylenes, 1,2 dichloroethene, and phenol; pesticides, including beta benzene hexachloride, 4,4' DDT, dieldrin, and aldrin; and contaminants of the metals/cyanide series, including aluminum, arsenic, barium, cadmium, lead, and nickel.

The USEPA notified Stepan Company of the presence of hazardous substances, pollutants, or contaminants in the groundwater and soil on the Stepan Company property in a letter dated January 6, 1989. The USEPA also advised the Stepan Company that an investigation of the Stepan Company property should be undertaken as part of the RI/FS that the Stepan Company was conducting, pursuant to the Order on Consent.

A separate removal action was initiated in October 1994 to dispose of contaminated soil and debris from the waste storage pile at FMSS. These materials were generated from the previous removal actions at 25 vicinity properties between 1984 and 1986. The pile was constructed with an impermeable liner and cover, and a leachate collection system. The removal action was completed in 1996 (USACE, 1999). In September 1995, DOE published an Engineering

Evaluation/Cost Analyses to address the cleanup of all residential, one commercial, and four municipal properties.

Also in 1994, DOE initiated discussions about a radioactive soil processing technology called soil washing with the USEPA, NJDEP, and local community. Soil washing is a technique that separates radioactive soil particles from clean soil particles. At the time, the community strongly opposed on-site treatment, specifically soil washing. The DOE had planned to conduct pilot scale treatment studies at the site in 1994 but agreed not to do so in response to the strong community opposition. Pilot scale treatment tests were subsequently conducted at a DOE reservation in Oak Ridge, Tennessee, in October 1995, using soils from the interim storage pile.

On September 8, 1993, the Maywood site was added to the USEPA National Priorities List. Therefore, all remedial activities at the site are conducted under the Comprehensive Environmental Restoration, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act. National Priorities List sites must undergo a detailed, two-part study called an RI/FS. The RI describes the nature and extent of contamination and related risks. That information is then used in the FS to evaluate remedial action alternatives. The RI report for the Maywood site (DOE, 1992) was placed in the administrative record file for public review in January 1993.

In 1997, FUSRAP was transferred from the DOE to the USACE by Congressional action. The limits of the USACE's responsibilities for the Maywood site are defined under a negotiated Federal Facilities Agreement between the DOE and the USEPA Region 2 that became effective April 22, 1991.

1.5 INVESTIGATION TASKS

The Definable Features of Work for the FMSS are as follows:

- **Task 1 – Mobilization/Demobilization:** Mobilization consists of setting up the site office; moving drilling equipment, project personnel and materials to the site; performing utility locations (NJ One Call); and conducting project-specific training for onsite workers. All utility clearance shall be obtained by the authorizing authority for the subject site. If utility locations cannot be verified on-site by the public authority, then a private utility location contractor may need to be utilized to confirm/deny the presence of private underground utilities on the site.

Activities will also include setting up and delineating work areas, and staging and setup of equipment and material. Exposures to potential contaminants of concern are not anticipated, however; physical hazards will exist from the unloading and movement of equipment and vehicular traffic.

Demobilization includes reversing some of the steps listed above with the goal of leaving the site as close to the same condition as it was prior to mobilization. All sampling equipment and other site remediation equipment will be decontaminated, as necessary, prior to leaving the site.

- **Task 2 – Excavation of Impacted Soils**

Cabrera (using subcontractor) will excavate approximately 3,720 cubic yards (cyds) of impacted materials from the SLS (or SOU 1) area of the project site for load out to the

Maywood Interim Storage Site (MISS) with an anticipated production of ~250 cyds per day. Soils will be loaded into dump trucks and hauled via road to the MISS for disposition. This excavation will take place in 4 phases to consist of the following:

1. Excavation (Phase 1) – Beginning at intersection of Maywood and Beech Street, excavation will progress from east to west, and conclude adjacent to the culvert.
2. Culvert and Road Bypass – The stream bypass and temporary access road will be installed.
3. Excavation (Phase 2) – Based on field screening and sample results, the excavation will continue in an east to west direction.
4. Backfill and Site Restoration – Once the excavation is complete, backfilling and site restoration activities will commence. This will include the import and placement of structural fill, topsoil, culvert pipe replacement/repair, and road repairs, to consist of asphalt road (including sub-base) and concrete curbing replacement.

Equipment operators will be supported by a crew of technicians who will perform dust control/suppression, spotting activities, provide traffic control, securing trucks and general housekeeping activities on the site. Confirmation sampling of the excavation will be performed under this task as well.

Personnel will perform decontamination of equipment used to perform work within controlled work areas using a combination of dry brush and wet (wash/rinse) techniques. Decontamination pads will be constructed and wastes generated through this process will be containerized and transported to the MISS for disposition.

- **Task 3 – Waste Management (Load-out and Waste Handling)**

Cabrera shall transition and continue ongoing waste handling and load-out for the Project. This work, performed under the direction of the Transportation and Disposal (T&D) Coordinator and in accordance with the Material Handling Transportation & Disposal Plan (MHTDP), takes place on the MISS after waste soils/debris has been transferred from the survey unit undergoing remediation.

3.1 - Waste Soils/Debris Handling on the MISS

- Soils will be delivered via dump truck at the MISS from active remediation sites under separate task.
- The soils are carefully dumped and consolidated by heavy equipment into the existing load-out stockpile.
- Basic decon and radiological surveys are performed to release the truck to pick-up additional waste soils.
- Further conditioning of the soils/debris to address WAC requirements and HS&E considerations are performed, as necessary, including the use of a hoe ram to size concrete and other debris.

- Dust suppression techniques are used to maintain exposures As-Low-As-Reasonably Achievable (ALARA).
- The T&D Coordinator identifies regions of the soil stockpile for shipment and directs the sampling to support shipping paper development
- Spill response support will be provided for under this task. Spill kits will be strategically placed and maintained by the field crew.
- Maintenance of the sedimentation pond and asphalt will be provided for under this task.

3.2 - Soils Load-out

- Gondolas are delivered by the railroad and staged, inspected, and surveyed according to the T&D Coordinator's direction and the WP requirements.
- Gondolas are first filled with a strong-tight plastic liner to provide addition soils control during transport to the disposal facility.
- A front-end loader with calibrated scale is used to load each lined gondola with a mix of soils, debris, and desiccant that meets the Department of Transportation (DOT)/WAC/Railroad requirements.
- Dust suppression techniques are used to maintain exposures ALARA.
- After filling, the gondola liners are sealed to protect loaded soils from water infiltration and wind-blown erosion while measurements are collected by a Field Engineer to determine the remaining unused volume and; DOT shipping radiological surveys are performed by the Radiation Protection (RP) Technicians providing HS&E oversight to the operation.
- Work on railcars performed using site specific fall protection system.

3.3 - Wastewater Management

- Industrial pre-treatment and discharge of wastewater will be provided for under this task.
- Cabrera and Team subcontractor EQNE will operate and maintain the existing MISS wastewater treatment plant and transition the existing Bergen County Utilities Authority industrial pretreatment discharge permit to support ongoing project remediation objectives
- This work includes multiple permit required confined space entries into various tanks for cleaning and maintenance purposes.

3.4 – Decontamination

- Personnel will perform decontamination of equipment used to perform work within controlled work areas using a combination of dry brush and wet (wash/rinse) techniques.

- Decontamination pads will be constructed and wastes generated through this process will be processed for disposition.
- **Task 4 – Radiological Surveys & Sampling**

Ongoing radiological surveys, to include Final Status Survey (FSS) and Close-out, will be fully integrated into the remedial process to ensure responsiveness (to support remediation milestones) and completeness of data collection to support thorough and accurate close-out and post remedial action reporting.

The RP and FSS staff will use the transitioned government-owned global positioning system (GPS) and radiation survey equipment to perform this task. Refer to the Radiation Protection Program (RPP, Appendix B of the SSHP) for more complete details of radiological detection equipment.

Radiological surveys (i.e., radiation, contamination, and airborne radioactivity) will be performed to evaluate radiological conditions and to verify that radiological work activities are being adequately controlled. Survey data will be used to develop Activity Hazard Analyses (AHAs); perform job evaluations; conduct environmental reporting, trend analysis, and ALARA planning; and inform personnel of radiological conditions. Survey results will be made available to workers entering Restricted Areas.

Radiation Protection Staff will perform the required type of radiological surveys at the frequency specified in RPP. The Radiation Safety Officer (RSO) or designee will routinely review surveys with regard to necessity and frequency consistent with good radiation protection practices and regulatory requirements.

The following surveys will normally be conducted at the project:

- Surveys of Restricted Area Access Control Points
- Surveys of offices and break areas
- Surveys to support AHA requirements
- Radiological air monitoring of workers and active work areas
- Perimeter air monitoring
- Surveys prior to release of material from Restricted Areas
- Surveys of personnel leaving Restricted Areas
- Surveys of transport vehicles involved in radioactive material shipments
- Surveys and monitoring of spills or spread of radioactive material
- Surveys to establish and verify the placement of radiological boundaries and postings
- Surveys and monitoring of areas and access locations that may have a high potential for change

Additional survey work will consist of:

4.1 – Gamma Walk-over Surveys

Field screening of soil surfaces will be conducted for elevated radiological activity utilizing gamma scintillation detectors (or other device as specified by RSO). These real time field data will be used to help delineate the extent of contamination at each source area, provide for worker protection from exposure to contaminants, and will determine the actual number of confirmation samples to be collected. Samples will be collected from each boring and will be submitted to the on-site laboratory for analysis.

4.2 – Air sampling

Air quality samples will be collected at specified locations for radioactive particulates and radon/thoron. Radon/thoron air samples will be collected in canisters and the samples will be sent to the on-site laboratory to obtain definitive data.

Particulate air sampling will be conducted for both occupational and effluent (perimeter-general public) using breathing zone, low-volume, and high-volume air samplers. Air filters will be collected and counted on onsite laboratory counting systems.

The major activities involved with this task include pre-sampling event notifications and approval, set-up of equipment and supplies for sampling, onsite filter counting, and sample preparation and shipment.

4.3 – Groundwater Sampling

This activity will include the collection of groundwater samples from existing monitoring well network for Monitored Natural Attenuation (MNA) purposes. Groundwater samples will be collected through low-flow sampling techniques using submersible and/or peristaltic pumps. The major activities involved with this task include pre-sampling event notifications and approval, set-up of equipment and supplies at the well for sampling activities, delineation of the work area, and sample preparation and shipment.

4.4 – Surface Water and Sediment Sampling

This activity will include the collection of samples from surface water and sediments from Lodi Brook. Samples are collected from collection points accessible from the ground surface along the water's edge. The major activities involved with this task include set-up of equipment and supplies at the sampling point, delineation of the work area, and sample preparation and shipment.

4.5 – Investigative Derived Waste (IDW) Management

Pre-cleaned and dedicated sampling materials/equipment will be used to collect the soil and groundwater samples for laboratory analysis. After the samples are collected, any disposable, or one-time use equipment (tubing, bladders) will be placed in a plastic bag for disposal. Non-disposable sampling and drilling equipment that contacted the soil and/or groundwater will be decontaminated between each sampling location. Gross sediments and/or contamination will first be removed from the sampling and drilling equipment. The equipment will then be washed with deionized (DI) water and Alconox detergent and then rinsed with DI water.

IDW will be collected and categorized as non-hazardous or hazardous. Potentially hazardous IDW (purge water and decontamination fluids, and soil cuttings (if any) will

be taken to the MISS for further disposition. Non-hazardous IDW (normal trash) will be disposed of in a timely fashion during fieldwork.

- **Task 5 – On-site Laboratory Operations**

This task includes the transition and continuation of onsite USACE FUSRAP Maywood laboratory (UMFL) operations and management. The capabilities of the onsite lab shall include analyses of air, water, soil, and materials using standard radiological methods. The capabilities of the onsite lab shall also include, but not be limited to, analyses of soil and water for selected elements (Li, Cr, and As) using standard inductively coupled plasma atomic emission spectrometer (ICP-AES). Cabrera's transition efforts will ensure that existing NJDEP-OQA Certifications for Metals & Rad are maintained; ongoing data quality is assured and; the UFML remains responsive to the Project's operational needs.

2.0 CABRERA SAFETY AND HEALTH POLICY

It is the policy of Cabrera to provide a safe and healthy work environment for all of its employees. We consider no phase of operations or administration to be of greater importance than injury and illness prevention. Safety takes precedence over expediency and shortcuts. We strongly believe that every accident and every injury is avoidable and every reasonable step will be taken to reduce the possibility of injury, illness, or accident.

Cabrera is fully committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We strive to ensure that our operations do not pose unreasonable safety or environmental risks. In all of our activities, we will develop and implement appropriate systems and procedures designed to comply with applicable laws, legislation, licensing requirements, and stakeholder expectations.

In order to guide the implementation efforts required by this policy, Cabrera has established an HS&E program that:

- Incorporates a “ZERO injury” and “environmental sustainability” philosophy into design standards and project review processes;
- Recognize those who contribute to their improved HS&E performance;
- Comply with all applicable HS&E rules and regulations at the local, state, and national level;
- Meet client requirements and standards (where no specific regulation exists, comply with Cabrera standards and appropriate industry practices);
- Report on performance relative to short- and long-term HS&E metrics designed to help achieve established goals; and,
- Consult with, listen to, and respond to employees, customers and partners in order to continuously improve HS&E performance.

Cabrera’s HS&E policy is formally reviewed annually. However, if substantial changes occur in legislation, organization and/or other business drivers, changes may be made on an interim basis. A copy of the current HS&E policy statement is included below.

2.1 PROJECT SAFETY GOAL

Consistent with the Cabrera’s corporate HS&E policy, the safety program goals under this contract are ZERO injuries and accidents. Cabrera regards safety as a Core company value. The process of planning the project work is done in order to identify, evaluate, and control the site hazards and to help achieve the goal of zero accidents and injuries. Exposure data and work-hours, to include accident free work-hours will be reported at the periodic project status meetings.

Safety performance at each Cabrera project site is reviewed on a regular (minimum monthly) basis. *Project Managers and Site Supervisors are held accountable for maintaining safe working conditions.* Annual performance evaluations include safety as a key metric on which their overall job ratings are made.

Cabrera HS&E Policy Statement:



Health, Safety & Environment Policy Statement

The purpose of this policy is to establish and maintain a framework for a safe and healthy workplace for all Cabrera Services Inc. (Cabrera) employees and minimize our impact on the environment. It is meant to outline expectations relative to compliance with governing occupational health, safety and environmental legislation.

COMMITMENT

Cabrera is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment in which we operate. In all of our activities we will develop and implement appropriate systems and procedures designed to comply with applicable laws, legislation, licensing requirements and stakeholder expectations. Attaining this objective requires the commitment of each employee to create and maintain an injury free, environmentally safe workplace. This commitment requires strict adherence to established safety rules and practices, performing work in accordance with established procedures and ensuring that unsafe acts and conditions are eliminated from the workplace.

OBJECTIVES

Our ultimate goals are simple and are derived from Cabrera's Core Values:

- Prevent work-related injuries or illnesses
- Prevent damage to property and/or equipment from our activities
- Prevent adverse impacts to the environment from our ongoing projects or operations

IMPLEMENTATION

In order to guide the implementation efforts required by this policy, the **Senior Management** will collaborate to establish Health Safety and Environmental (HS&E) programs that:

- Embrace the Cabrera HS&E Guiding Principles and this policy statement.
- Comply with all applicable health, safety and environmental rules and regulations at the local, state, and national levels.
- Meet client requirements.
- Where no specific regulation exists, comply with Cabrera standards and appropriate industry practices.
- Report on performance relative to short- and long-term HS&E metrics designed to help achieve established goals.
- Consult with, listen to, and respond to employees, customers and partners in order to continuously improve their HS&E performance through the Safety & Quality Council, or other similar means.
- Recognize those who contribute to their improved HS&E Performance.

EMPLOYEE RESPONSIBILITIES

All employees will be responsible for:

- Conducting themselves in accordance with directives, standards and procedures established by the HS&E program.
- Temporarily suspending work activities and requesting guidance from supervision before continuing a task when a condition or practice that creates a serious health, safety or environmental risk is identified.
- Immediately reporting safety, health and/or environmental incidents to their supervisor.

COMMUNICATION

This policy is to be displayed prominently in all permanent and temporary offices of Cabrera where employee information is normally communicated. An electronic version will also be posted on the Cabrera Safety SharePoint Site.

Alan Solow, CHP
Chief Executive Officer

Issued: October 28, 2013

3.0 RESPONSIBILITIES AND LINES OF AUTHORITY

Cabrera has the ultimate responsibility for the safe implementation of work assignments on the project. Personnel having the potential for exposure to site hazards are subject to the requirements of this APP. Work shall not be performed in a manner that conflicts with the intent of this plan or the inherent safety, health or environmental precautions expressed herein. After due warnings, personnel violating health and safety procedures will be dismissed from the site and their supervisor shall be notified. The individual's supervisor shall take appropriate disciplinary action.

Specific responsibilities of the key personnel, as they relate to project health and safety, are discussed below. Site contacts and their emergency telephone numbers are identified in Section 6 of this plan. Work shall not be performed unless a Site Safety and Health Officer (SSHO) is present on the job site.

3.1 PROJECT ROLES AND RESPONSIBILITIES

Although changes are not currently anticipated, it may be necessary during the project to modify some elements of Cabrera's project organization, such as personnel, responsibilities, and authorities, so that individual tasks can be performed safely and efficiently. Any changes to the overall Cabrera project organization will be recorded in the appropriate sections of this plan as addenda, and will be discussed with USACE prior to their implementation.

Table 3-1 lists the names and telephone numbers of key project personnel and Figure 3-1 shows the organizational structure of Cabrera's project team.

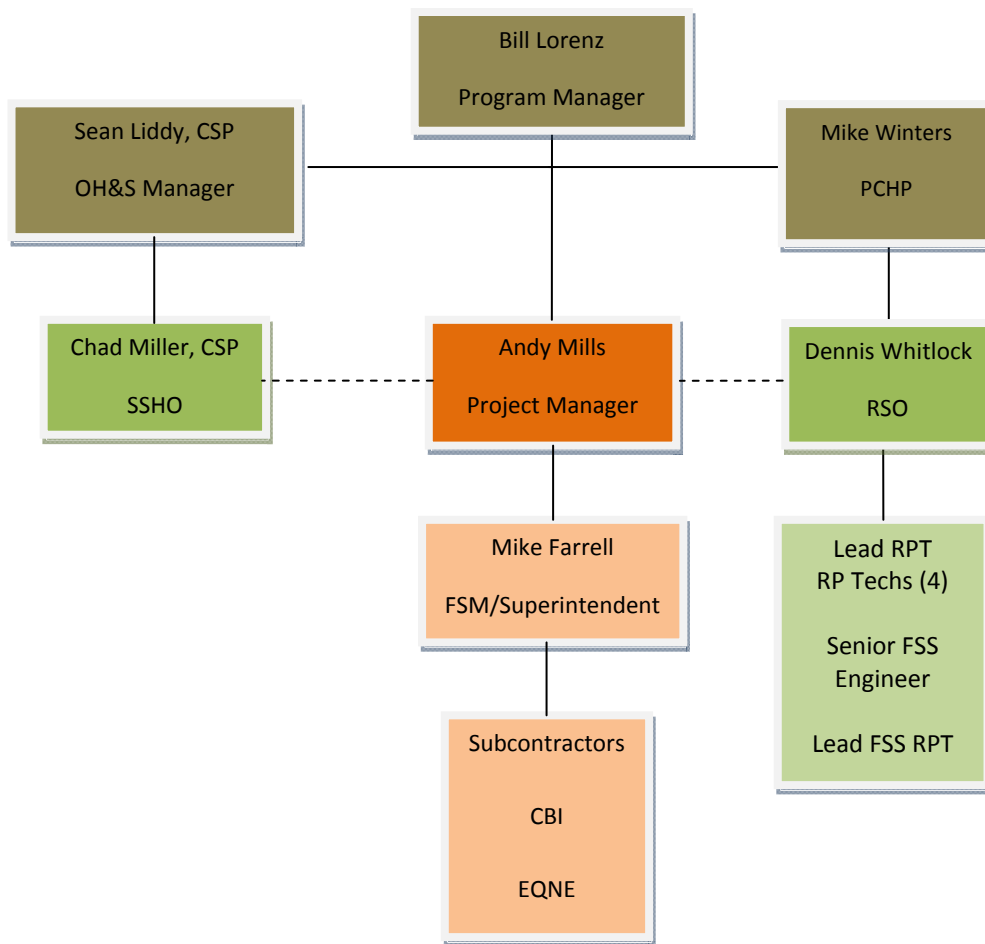
Table 3-1: Key Cabrera Project Personnel

TITLE	NAME	TELEPHONE
USACE PM	Jim Moore	201-226-6608/917-790-8230 (work) 347-271-0226 (cell)
USACE Team Leader	Mike Johnson	201-226-6608 (work) 973-418-0586 (cell)
Program Manager	Bill Lorenz	716-635-4755 (work) 716-374-0835 (cell)
Project Manager	Andy Mills	201-982-7886 (work) 716-374-1501 (cell)
Contractor Quality Control Manager	Joe Fort	201-982-7891 (work) 830-285-8898 (cell)
Field Site Manager/Superintendent	Mike Farrell	201-321-1411 (cell)
Site Safety and Health Officer	Chad Miller	201-982-7895 (work) 570-872-4711 (cell)
Radiation Safety Officer	Dennis Whitlock	716 374 0895 (work) 201 982 7898 (cell)
Project Certified Health Physicist	Mike Winters	352-610-2150 (cell)
Project Engineer	Joe Gurda	201-982-7887 (work) 201-370-7514 (cell)
Lab Manager	Doug Black	972-883-5643 (cell)

Table 3-1: Key Cabrera Project Personnel (Cont'd)

TITLE	NAME	TELEPHONE
T&D Coordinator	Jim Imbornoni	201-982-7894 (work) 201-321-4342 (cell)
Regulatory Specialist	Wade Fillingame	865-300-5789 (cell)
Corporate Occupational Safety & Health Manager/QA Manager	Sean Liddy	410-982-0726 (work) 443-553-1403 (cell)
Corporate Radiation Safety Officer	Hank Siegrist	860-569-0095 (work) 860-416-0196 (cell)

Figure 3-1: Cabrera Safety Organizational Chart



3.1.1 Program Manager

The Program Manager, Bill Lorenz, is responsible for overall project objectives, scope, budget, and quality of submittals. He will ensure that adequate and appropriate resources are made available to the Project Manager (PM).

3.1.2 Project Manager

The PM, Andy Mills, is responsible for establishing and executing project administration and controls, ensuring appropriate project staffing and training, and establishing personnel responsibilities and lines of communication. The PM is responsible for ensuring that appropriate HS&E personnel have been assigned to the project, and that the required HS&E documents and notifications have been submitted prior to the commencement of field activities. Additional responsibilities include:

- Coordinating all work performed by Cabrera personnel and subcontractors for the project.
- Ensuring all required Personal Protective Equipment (PPE), other types of equipment and instruments, safety incentives, and other safety-related items are budgeted and provided.
- Ensuring that subcontractor Statements of Work include appropriate safety provisions and expectations.
- Ensuring that safety and health requirements are covered during preparatory meetings;
- Participating in the investigation of, and ensuring that unplanned events, high loss potential incidents, and incidents are properly reported to USACE.
- Notifying the SSHO and Occupational Health & Safety Manager (OH&S) of any changes in the scope of work (SOW) or site conditions, and ensuring that the APP/SSHP is updated to address new hazards.
- Preparing and submitting required work progress reports.

3.1.3 Occupational Health & Safety Manager

The OH&S Manager, Sean Liddy, Certified Safety Professional (CSP), is responsible for the development and implementation of the APP. No hazardous waste project work shall commence without a signed and approved APP and SSHP. Additionally, the OH&S Manager shall:

- Ensure that the APP/SSHP complies with Federal, State, USACE, and local HS&E requirements. If necessary, modify specific aspects of site-specific activities in order to address field changes, to the WP, that may impact safety.
- Ensure that the SSHO is appropriately qualified and trained to implement the APP/SSHP. Maintain communication with the SSHO toward ensuring proper implementation of the APP/SSHP, and provide direction on any significant safety issues that arise in the field.
- Assist in the training of field personnel with respect to the identification and mitigation of site-specific hazards and the use of air monitoring instruments, PPE, decontamination procedures, and emergency/spill response.
- Conduct periodic site HS&E inspections.

3.1.4 Project Certified Health Physicist

The Project Certified Health Physicist (PCHP), Mike Winters, is responsible for the acceptance of the portion of this APP that addresses radioactive material and/or radiological contamination. Additionally, the PCHP will:

- Assist the PM in development of site-specific radiation protection procedures and insure that the APP/SSHP complies with Federal, State, and local requirements related to the handling and transportation of radioactive and/or radiologically-contaminated materials.
- Insure that the SSHO and/or RSO is appropriately qualified and trained to implement the portions of the APP/SSHP related to radiation safety.
- Maintain communication with the SSHO and/or RSO in order to ensure proper implementation of radiation protection procedures.
- Provide direction on any significant radiation safety issues that arise in the field.

3.1.5 Field Site Manager

The Field Site Manager (FSM), also referred to as Site Superintendent, Mike Farrell, will supervise the day-to-day activities of the project team. The FSM reports directly to the PM and is responsible for implementing the WP in accordance with the requirements of the APP. The FSM has the authority to stop work, if necessary, and take appropriate actions to ensure the health and safety of field personnel, the surrounding community, and the environment. In addition, the FSM shall:

- Conduct daily plan-of-the-day/safety briefings, with assistance from the SSHO, to include AHA preparation/review.
- Provide direction and supervision to field personnel for ensuring that the requirements of the WP are being met and that HS&E procedures are being followed.
- Ensure that the work zones and staging areas are established in such a way as to minimize potential HS&E hazards and contamination risks.
- Maintain close communication with the PM regarding project progress and any problems encountered in the field, including those related to HS&E. Coordinate with the PM to initiate corrective actions, as necessary.
- Prepare Daily Quality Control Reports (DQCRs) and provide copies of such to the PM and USACE Contracting Officer's Representative or designee.

3.1.6 Site Safety and Health Officer

The SSHO, Chad Miller, will be responsible for the day-to-day implementation of the APP and will report directly to OH&S Manager. The SSHO's resume and certifications are presented in Appendix B of this APP. Like the FSM, the SSHO has the authority to shut down any operation that jeopardizes the health and safety of site personnel, the environment, or the local community. In addition the SSHO has the following responsibilities:

- Provide onsite training of field personnel that conveys site-specific health and safety requirements.

- Ensure proper implementation of the APP during field activities, including requirements for PPE and air monitoring.
- Provide daily updates during the morning safety briefings that review applicable activity hazard analyses and alert the field crew to any changed conditions and/or additional safety hazards likely to be encountered that day.
- Maintain site documentation such as training records, air monitoring equipment calibration forms, air monitoring results, accident report forms, etc. Ensure that the PM and OH&S Manager receive copies of documentation on a daily basis.
- Maintain communication with the OH&S Manager during field activities and coordinate on any HS&E issues that may arise.
- Investigate any accidents/incidents or "near misses," and coordinate with the OH&S Manager to ensure that reporting requirements are met.
- Monitor the work place for unsafe acts or conditions, and initiate corrective actions, as necessary.

3.1.7 Radiation Safety Officer

The RSO, Dennis Whitlock, assists the PCHP and SSHO in implementation of the SSHP as it pertains to the Radiological concerns on-site. The RSO provides direct supervision of field staff ensuring that personnel adhere to the requirements of this SSHP. The RSO has the following additional responsibilities:

- Coordinate with the PM, PCHP, SSHO, and OH&S Manager regarding monitoring procedures and action levels for ionizing radiation concerns
- Provide consultation to the SSHO on matters pertaining to radiation.
- Ensuring compliance with applicable regulations concerning the handling and transportation of radioactive material.
- Provide radiation training to on-site personnel who may be exposed to ionizing radiation.

3.1.8 Other Project Personnel

Each person assigned to the project is ultimately responsible for his or her own safety and health while working on this project. Personnel shall take reasonable precautions to prevent injury to themselves and their fellow employees and be alert to potentially unsafe or harmful situations. All project personnel have stop work authority with respect to any activity they observe or anticipate that they feel is unsafe. In addition, project personnel shall:

- Know and understand the requirements of the WP and APP with respect to their individual responsibilities.
- Review and acknowledge the AHA written for specific task prior to commencement of work.

- Perform tasks that they can perform safely and for which they have the proper tools and training.
- Comply with necessary PPE and personal monitoring requirements, as directed by the SSHO.
- Notify the SSHO of special medical conditions (i.e. allergies, contact lenses, illnesses, etc.), as well as prescription or non-prescription medication they are taking, which might cause drowsiness, dizziness, anxiety, and/or other unfavorable effects.
- Prevent spillage and splashing of materials to the greatest extent possible in order to prevent the spread of contamination and/or safety hazards.
- Practice good housekeeping by keeping their work areas neat, clean, and orderly.
- Immediately report injuries to the SSHO.

3.2 COMPETENT AND QUALIFIED PERSONNEL

In order to complete certain tasks, an OSHA-designated competent person must be onsite to perform the required daily inspections of equipment and/or operations. No work will be performed unless the designated competent person for the specific task is present on the job site. Competent persons are qualified individuals that can identify existing and predictable hazards in the working environment or working conditions that are dangerous to personnel and have authorization to take prompt corrective measures to eliminate them. Any specific certifications required to be held by the designated Competent Person will be included in Appendix B. The following competent/qualified persons have been identified for the FMSS.

Table 3-2: Competent Persons

Title	Inspection Role	Name	Proof of Competency
SSHO	Overall oversight of field activities.	Chad Miller	See Appendix B
Heavy Equipment Operator	Inspect heavy equipment daily for functionality.	TBD-Task Dependent Refer to AHA	Submitted to SSHO prior to operation.
Excavation Superintendent	Inspect excavation daily to ensure safety of workers and surrounding area.	TBD-Task Dependent Refer to AHA	Submitted to SSHO prior to operation.
MISS Railcar Load-Out Supervisor	Inspect Fall protection system for functionality	Chad Miller	Submitted to SSHO prior to operation.
Confined Space Entry Supervisor	Ensure safety of personnel during permit required confined space entries.	TBD-Task Dependent Refer to AHA	Submitted to SSHO prior to operation.

3.3 PRE-TASK SAFETY AND HEALTH ANALYSIS REQUIREMENTS

AHAs are used to identify hazards and hazard controls associated with a specific job function. AHAs focus on the relationship between the workers, the task, resources required to complete the task, and the work environment. These variables must be evaluated to identify the potential hazards associated with the task. Once the hazards associated with each step of the task are

identified, steps can be taken to eliminate, reduce, or control the hazards to an acceptable risk level.

Section 2 describes the work activities anticipated to be performed during the project. Individual AHAs for the tasks associated with this work are provided as an attachment to the SSHP.

3.4 STOP WORK AUTHORITY

All employees have the right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions. Whenever an employee determines that workplace conditions present an uncontrolled risk of injury or illness to themselves, or co-workers, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the employee is authorized and required to temporarily suspend or stop work, which shall be immediately binding on all affected site employees and subcontractors.

Upon issuing the stop work order, the FSM and/or SSHO shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the OH&S Manager has concurred that workplace conditions meet acceptable safety standards. All stop work actions must be documented using the Stop Work Order (Appendix D) and immediate contact made with the PM. Reviewing and updating the appropriate AHA and other documentation may be necessary to document the change. Refer to Cabrera OP 511, Safe Work Standards, for additional information regarding Stop Work authority, and responsibilities.

3.5 LINES OF AUTHORITY

Figure 3-1 illustrates the lines of authority for the personnel responsible for project safety.

3.6 NONCOMPLIANCE POLICIES AND PROCEDURES

Employee non-compliance with safety requirements is taken very seriously. Personnel not following procedures are warned and counseled on the proper safety procedures and if the problem persists, are again counseled with notations made in their permanent record. Continued non-compliance can lead to termination of employment.

Cabrera has developed the following progressive discipline policy for the violation of safety requirements. Extremely careless or reckless violations may result in immediate termination.

First Violation: An oral warning will be given for the first violation depending on severity. The employee will be informed by his or her supervisor of the violation and of the correct safe practice or procedure. The supervisor will review with the employee all applicable safety and health workplace requirements and guidelines. The employee must sign a statement indicating understanding of those requirements and guidelines. The supervisor should inform the employee that future violations will result in higher levels of discipline and may lead to dismissal.

Second Violation: The employee may be given a written warning for the second documented violation. This warning will specifically identify the violation, refer the employee to applicable safety and health requirements/guidelines, and also show the date of the employee's previously

acknowledgement and understanding of safety and health requirements. The employee, the employee's supervisor, the department head, Human Resources, and the employee's personnel file receive copies of the warning.

Third or Subsequent Violation: The employee may be dismissed for a third or subsequent violation. If dismissed, the employee will receive a letter specifically identifying the violation of the safety and health requirement or guideline, as well as rights of appeal through the grievance process.

Immediate Termination: On occasion, an employee will commit a violation of a safety and health requirement or guideline that is so careless and reckless, or that so endangers life or property, that it can be considered imminently dangerous. When this occurs, an employee may be dismissed immediately, without benefit of any warnings. An employee dismissed in this fashion will receive a letter specifically identifying the violation and setting out his/her right of appeal within the grievance process.

Discipline for Subcontractor Personnel: If noncompliance actions are committed by subcontractor personnel, Cabrera will recommend that the employer discipline the employee, and if the action continues, have the employer remove the employee from the site.

3.7 MANAGER AND SUPERVISOR ACCOUNTABILITY

Managers and supervisors are responsible for enforcing safety and health as part of their job descriptions. They are ultimately responsible for protecting the welfare of the employees, as well as minimizing the potential liability associated with on-the-job accidents. Annual performance reviews and incentive plans for managers and supervisors include the assessment of both the individual's safety performance as well as their project safety performance.

4.0 SUBCONTRACTORS AND SUPPLIERS

Cabrera considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. In addition to the requirements set forth in this APP, each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, in order to ensure that hazards associated with the performance of the work activities are properly controlled.

Each subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE) and all required training. Copies of any required safety documentation for a subcontractor's work activities will be provided to Cabrera for review prior to the start of onsite activities.

Hazards not listed in this APP, but known to the subcontractor, or associated with a subcontractor's services, must be identified and addressed to the FSM and SSHO prior to beginning work operations. The FSM and/or SSHO have the authority to halt any subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

Cabrera will perform oversight and daily inspections of the subcontractors' work activities and will take appropriate action to ensure safety, as needed. Appropriate action will include, but not be limited to, advising the subcontractor of potential problems or violations and stopping work. Cabrera's SSHO will be responsible for ensuring that subcontractor provided PPE is correct and appropriate for the work being performed.

Subcontractors and suppliers contracted to Cabrera will be held to the same standard that Cabrera expects its own staff to meet, as outlined in this document. All onsite subcontractor employees will be required to review this APP, understand its contents, and sign the APP acknowledgement form (Section 13). This information will be maintained onsite during field operations.

A list of Cabrera's onsite subcontractors is provided below:

- Shaw/CBI:
 - Project Engineer
 - Field Engineer
 - Construction Superintendent
 - Public Relations Manager
 - Chemical Quality Control Coordinator
 - Geologist/Certified Sampler
 - Meteorologist
 - Equipment Operators
 - Technicians/Laborers
 - Database Manager (Lab)
 - WWTP Operator

- EQNE:
 - Dump Truck Drivers
 - Water Truck (dust suppression) Driver
 - Vac Truck Operator
 - WWTP Lead Operator
- ERS: Waste Disposal Coordinator
- Fire Extinguisher Maintenance Contractor (TBD)
- Plumbing Maintenance Contractor (TBD)
- Electrical Maintenance Contractor (TBD)
- HVAC Maintenance Contractor (TBD)
- Data Validation Subcontractor (TBD)
- Direct Push/Boring Subcontractor (TBD)

All suppliers of safety-related items are required to provide approved and/or appropriate materials for the project, and meet applicable specifications, testing criteria or third party certifications. These items will be inspected upon receipt by the FSM and/or SSHO.

Each hazardous material supplied for site use will be accompanied by a Safety Data Sheet (SDS) or Material Safety Data Sheet (MSDS), and will be added to the site list of hazardous materials (Site Specific Hazardous Substances Inventory, Appendix E). SDSs and the list will be maintained by the SSHO.

5.0 TRAINING

The project training program is in compliance with 29 CFR 1910.120(e), and is designed to ensure that workers receive the training they need to work safely on field assignments. Site safety and health training requirements are based on the job hazard assessments contained in this APP, and relevant OSHA requirements. The SSHO, with assistance from the OH&S Manager, oversees the implementation of this training program and is responsible for ensuring that personnel are adequately and currently trained for tasks they are asked to perform. Personnel who have not been trained to a level required by their job function and responsibility are not permitted to participate in or supervise field activities.

5.1 NEW EMPLOYEE OCCUPATIONAL HEALTH & SAFETY ORIENTATION

Prior to any field activities, all new Cabrera employees shall receive the “New Employee Orientation” briefing by the hiring supervisor. The briefing checklist of topics covered is sent to all new hires in their offer package. The checklist of topics will include, but not be limited to, confirmation of OSHA 40-hour HAZWOPER and current eight-hour refresher, successful completion of Cabrera’s Radiation Worker Training and familiarization with Cabrera’s Occupational Health & Safety Management System (OHSMS). The OHSMS contains Cabrera’s safety policies and procedures. Each new hire will be required to read and acknowledge, by signature, their understanding of the policies and procedures.

5.2 BASIC OSHA TRAINING: REQUIREMENTS FOR MANDATORY TRAINING/CERTIFICATIONS

General site workers must have the 40-hour HAZWOPER training course and three days of documented field experience under the direct supervision of a trained experienced supervisor. Onsite supervisory personnel (FSM) must have an additional eight hours of specialized supervisory training. Workers must have an annual refresher (eight hours) if initial training is over one year old. Additionally, the SSHO will have completed the OSHA 30-Hour Outreach Training for the Construction or General Industry. Copies of training certificates will be maintained at the site.

5.2.1 HAZWOPER Refresher Training

Personnel on this project, including managers and supervisors, must have received annual HAZWOPER refresher training consistent with the requirements of 29 CFR 1910.120 (e) (8). Refresher training will include, at a minimum, regulatory review including changes to pertinent provisions of USEPA or OSHA standards and laws. Project personnel receive general training regarding proper selection, use, and inspection of PPE during initial HAZWOPER training (or equivalent) and subsequent refresher training.

Web-based refresher training is acceptable. It has been reviewed by the OH&S Manager and determined to meet OSHA and EM 385-1-1 requirements.

5.2.2 HAZWOPER Management and Supervisor Training

In accordance with 29 CFR 1910.120(e)(4), onsite managers and supervisors, who are directly responsible for or who supervise personnel engaged in this project, will receive eight additional hours of specialized supervisory training in addition to the appropriate level of worker HAZWOPER training, described above.

5.3 SITE-SPECIFIC HEALTH AND SAFETY TRAINING

Site-specific health and safety training will be conducted prior to field activities for workers and site visitors. The FSM and SSHO will review the APP/SSHP, WP and other associated plans with other field team members and afford them the opportunity to ask any questions. Employees will receive a full briefing on the content of the APP/SSHP as it relates to their applicable scopes of work on the site. Subjects to be covered include site history, emergency actions (including assembly points, emergency contact, hospital and clinic routes), and safety meeting requirements. Site-specific PPE requirements, including task-specific PPE, ensemble components, cartridge/canister use times, and inspection and maintenance procedures are communicated as identified in specific subsections of this APP.

If an unanticipated or new task is to be conducted, the plans will be revised and submitted to USACE for review. Additional HS&E training will be given to the new/changed plan requirements. Periodic supervisory meetings between Cabrera and USACE will be held and if additional training is necessary, it will be conducted and documented in those meeting minutes for inclusion in the project files. The record of acknowledgement of this training, the APP Acknowledgement Form, is included in Section 13.

5.3.1 Training Elements for Site Workers

The project training program addresses the following for site workers:

- Names of personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present on the site
- Site Control
- Emergency Response
- Medical surveillance requirements
- Proper use of PPE
- Decontamination procedures
- Work practices by which personnel can minimize risks from hazards
- Safe use of engineering controls and equipment onsite

5.3.2 Railroad Safety Training

All personnel assigned to soil load-out activities must attend a training session to become familiar with railroad (New York, Susquehanna and Western Railroad) safety requirements, as well as soil load-out procedures and DOT requirements. Additional site specific training is required for the review of the safety protocols outlined for the site (refer to SSHP, Section 3.3.11). A link to Railway Worker Protection Safety Training is provided below.

http://www.railroadeducation.com/development/reliant/frame_set.asp

5.3.3 Radiation Worker Training (RWT)

All personnel who will enter a Restricted Area unescorted will be required to successfully complete FMSS GERT in compliance with 10 CFR 19 and Section 6E.03.b of the Safety and Health Requirements Manual (USACE, 2008). This training is performance based and will consist of the following:

- Classroom lecture covering basic radiation principles, interaction of radiation in matter, personnel monitoring, associated health risks, environmental radiation, embryo fetus protection, use of PPE, regulatory and project specific dose limits, worker's rights and responsibilities, and other topics as appropriate.
- A closed book exam based upon the classroom lecture (80 percent is a passing score).
- A simulated practical work experience (i.e., dress out) involving donning and doffing of clothing, use of frisking equipment, recognition of postings, and use of the basic radiation protection principles of time, distance, and shielding.
- Radiation Worker Refresher Training will be provided annually to site personnel who require continued status as a Radiation Worker. Refresher training includes lessons learned, a short review of classroom lecture topics, followed by the written examination and dress out. Personnel who frequently work in Restricted Areas may be excused from the refresher dress out with RSO approval. All radiation protection personnel are exempt from RWT refresher training.
- Personnel may "challenge" any portion of the RWT, with RSO approval.
- Remedial training for individuals who fail to successfully complete RWT is at the discretion of the RSO in consultation with the SSHO.

5.4 EMERGENCY RESPONSE TRAINING

Cabrera will provide training in the handling of emergency situations that may arise from project activities or equipment operation. Prior to commencement of project activities, all site personnel will be trained on the posted emergency telephone numbers, location and use of spill kit materials, directions to the hospital, location and use of fire extinguishers, location of first aid kits, and the persons who are certified in First Aid and Cardio-Pulmonary Resuscitation (CPR). Additional details on applicable emergency response training and procedures are provided in Section 10.2, Emergency Response Plans.

5.5 SPECIALIZED TRAINING

5.5.1 First Aid and Cardio-Pulmonary Resuscitation Training

Since it may take more than five minutes to reach a medical facility, multiple First Aid and CPR trained personnel will be assigned to this project, per EM 385-1-1. Those personnel are identified in Table 8-1, and copies of certifications provided in Appendix B.

5.5.2 Hearing Conservation Training

Hearing conservation training will be conducted by the SSHO in accordance with OP-565, *Hearing Conservation*, in order to demonstrate the proper fitting and use of hearing protection devices (ear plugs or ear muffs). Such training will be documented in project records.

5.5.3 Bloodborne Pathogen Training

Any person who has received first aid and/or CPR, and who may need to provide emergency service to an injured/unconscious co-worker shall have received awareness level training, in controlling exposures to Bloodborne Pathogens. Additional Information on Blood borne Pathogen can be found in OP 531, *First Aid and Medical Services*, in Appendix C.

5.5.4 Hazard Communication Training

In order to comply with applicable hazard communication practices, the OSHA Hazard Communication Standard 29 CFR 1910.1200 Hazard Communication and OP-517, *Hazardous Materials Communication* shall be followed.

5.5.5 Temperature Extremes Training

Workers will be trained on the signs and symptoms of heat and/or cold stress as appropriate for the work schedule. The SSHO will assess the condition of the employees, specific weather conditions, work tasks, and other environmental factors and conditions to determine when to begin monitoring.

Workers will be encouraged to be aware of their own physiological responses after receiving proper training, but a monitoring program will be implemented if ambient temperatures exceed 85 degrees Fahrenheit (°F) or work/rest periods are not sufficient. Heart rate and/or internal body temperatures will be monitored per the procedures outlined in Section 10-35.

5.5.6 Site Specific Fall Protection Training

Site specific fall protection training will be provided to all employees working in the MISS that will utilize the existing fall protection system during railcar load-out. Training will consist of a hands-on practical demonstration of the proper use of the system, to include anchorage and clip-in points, proper care and maintenance of the system.

The designated Competent Person for fall protection will train each worker, who might be exposed to fall hazards from heights above 6 feet (ft) and using fall protection equipment, in the safe use of fall protection systems/equipment, the recognition of fall hazards, and the rescue procedures that may become necessary. Only trained personnel will be authorized to use fall arrest systems and perform rescue activities. These Authorized Persons/Authorized Rescuers will be trained in the following:

- Fall hazard recognition (the nature of fall hazards in the work area)
- The requirements of Cabrera OP 585, *Fall Protection*.
- The applicable fall protection regulations, standards, and requirements (Occupational Safety and Health Administration, ANSI, and USACE)

- Fall protection basics “hierarchy of fall protection”
- Fall hazard elimination, fall prevention, fall protection, and fall arrest systems
- Recognition of unsafe practices that could lead to a fall, such as complacency, hurrying, or horseplay
- Recognition of unsafe working conditions that could lead to a fall, such as windy or slippery conditions
- Review of the pertinent Activity Hazard Analyses (refer to Appendix A of the SSHP)
- The responsibilities of Authorized Persons/Authorized Rescuers
- The use of anchorages (certified [engineered] and noncertified [improvised])
- Before use inspection and proper storage/care of fall protection equipment components and systems, which includes harnesses, lanyards, Self-Retracting Lifeline (SRL), and any additional connectors
- Importance of proper body support (correct donning of full body harnesses)
- Use and limits of equipment components and systems
- Application limits, free fall distance, total fall distance, and clearance requirements of fall protection systems and equipment
- Hands-on training and practical demonstrations
- Fall protection rescue equipment and procedures

Upon successful completion of this training, including a passing score on a written exam, workers will be certified as Authorized Persons/Authorized Rescuers by the Competent Person in the use of specified systems when working at heights at FMSS. This authorization will be documented by a written certification record identifying the worker trained, the date of the training, and the signature of the trainer and trainee. Personnel will be retrained, as determined by the Competent Person, to maintain an understanding of the necessary fall protection and prevention subjects and procedures.

5.5.7 Equipment Training

Personnel will be trained in the use of certain equipment that will be utilized for screening activities, as well as hazards associated with the use of this equipment. This equipment includes the following:

- A hand-held Multi-gas meter (Multi-Rae) will be used for detecting the presence of organic vapors, oxygen content, explosive limits, carbon monoxide, and hydrogen sulfide in soil and ambient air.
- An XRF analyzer will be used to detect metal concentrations in soil.
- A Geiger-Muller detector (or equivalent radiological detector as specified by the RSO) will be used to identify possible radioactive contamination of personnel or materials.

Personnel operating these meters will be verified to be trained in the proper operation and appropriate hazards and their documentation filed onsite by the SSHO and/or RSO.

5.5.8 Laboratory Safety Training

Site specific safety protocols for safe operations within the lab have been included in Section 3.8 of the SSHP. The acknowledgment forms for the APP review will serve as proof of training for general laboratory safety for lab personnel. Personnel working inside of the lab will be required to perform additional training on the Operating Procedures that have been established for lab operations. These trainings will be both awareness and performance based level, and include the following subjects:

- Laboratory Internal Data Evaluation
- Document Control
- Sample Identification and Storage
- Sample Container Control
- Reagent, Solution, and Preparation
- UFMLDB Technical User Manual
- Laboratory Contamination Control
- Sample Disposal
- Hazardous Waste Management
- ORTEC - Dspec Gamma Spectroscopy System Operation
- Operation of Protean WPC - 9550 Gas Proportional Automatic Planchet Counter
- ORTEC – Alpha Spectroscopy System Operation
- Operation of Protean MPC – 9604 Gas Proportional Multi – Detector System
- Balance Operation
- Receipt and Preparation of Soil and Air Filter Samples for Analysis
- Microwave Digestion and Evaporation
- Receipt and Preparation of Water Samples for Analysis
- Uranium and Thorium Analysis Separation Method
- Uranium Analysis Separation Method
- Thorium Separation Method
- Radium 226 Separation Method
- Radium 228 Separation for Isotopic Analysis – EPA 904 Modified
- Radium 228 Separation for Isotopic Analysis – EPA 9320
- Gross Alpha and Gross Beta Radioactivity in Drinking Water
- Gross Alpha by SM 7110C method
- KPA Instrument Operation for measurement of Uranium in Drinking Water
- Uranium and Thorium Analysis Separation Method for Waste Water
- Thorium Separation Method for Waste Water
- Radium 226 Separation Method for Waste Water
- Radium 228 Separation for Isotopic Analysis for Waste Water
- Gross Alpha and Gross Beta Radioactivity in Waste Water

5.6 TRAINING RECORDS

Written documentation of the successful completion of applicable training requirements for personnel required to be in the work zone will be maintained onsite at the administration area of the project site. Additionally, a personnel sign-off sheet indicating that each worker has reviewed this APP and understands its contents (Section 13) is maintained at the same location. Copies of all training records for the Laboratory will be maintained on-site by the Lab Manager .

5.6.1 Procedures for Periodic Safety & Health Training

The SSHO will maintain training/certification records onsite for all personnel as well as track training expiration dates. Prior to expiration, the FSM and/or SSHO will coordinate training of all site personnel with the PM to maintain valid training/certification requirements.

6.0 SAFETY AND HEALTH INSPECTIONS

Safety reviews and inspections are conducted by all tiers of management and are documented. A list of all corrective action items is required to be maintained showing the corrective action, responsible person, and the proposed completion date.

6.1 DAILY SAFETY MEETINGS

The FSM and/or SSHO will conduct daily safety toolbox meetings in order to review the day's tasks, the associated hazards, controls to be used, and answer any questions raised and document any lessons learned from the previous day. Names and topics will be documented and maintained on file. Pertinent elements of the APP, including AHAs for the specific task being performed, will be reviewed and changes in hazards and safety precaution measures will be communicated during daily safety briefings.

In the event that a new and previously unanticipated task is to be conducted each employee and supervisor will receive the necessary training to safely perform that task. Personnel will be informed about the nature and level of hazardous substances at the site and the likely degree of exposure to workers who participate in site operations. Site visitors will be provided a safety briefing to communicate awareness of onsite hazards. This daily orientation will be required for personnel working that day.

An example of the daily safety meeting form is contained in Appendix D (equivalent form acceptable per SSHO concurrence). Refer to OP 555, Safety Meetings, for additional information regarding content, responsibilities, and requirements for safety meetings at Cabrera project sites.

6.2 DAILY SAFETY INSPECTIONS

Safety reviews and inspections are conducted daily by the SSHO per accordance with Cabrera OP 556, Project Inspections, and recorded on the Safety Audit Report included in Appendix D. Safety deficiencies will be tracked using this form, or the Corrective Action Plan form (OP-502). As indicated above the corrective action items will be maintained showing the corrective action, responsible person, and the proposed completion date. Follow-up inspections will be conducted daily by the SSHO to verify implementation of corrective measures.

Supervisory personnel will also inspect the site daily to identify changing conditions or potential hazards. Identified potential hazards and deficiencies will be brought to the attention of the SSHO and FSM and tracked through resolution.

Onsite safety reviews and inspections by external sources may be conducted at any time during field activities. External sources may include Cabrera's OH&S Manager, USACE, or OSHA personnel. In the event that an OSHA or other regulatory agency inspection, Cabrera will immediately notify and provide USACE the opportunity to accompany Cabrera on the inspection. Cabrera will provide USACE a copy of any citations or reports issued by the inspector and any corrective action responses to the citation(s) or report(s).

7.0 ACCIDENT REPORTING

All occupational injuries, illnesses, vehicle accidents, and near miss incidents must be promptly reported and investigated. Reporting the incident and exposure information to the PM must be made as soon after the incident as possible but in no instance greater than four hours. As required by USACE EM 385-1-1 01.D.01, such incidents will be reported within twenty four hours of the incident to the Government Designated Authority (GDA) as well. Attempts to make prompt (immediate) notification to the GDA will be facilitated by site personnel (SSHO). Accident investigation findings and corrective actions will be reported within five days of the incident including the submission of a USACE Form DD3394 (Appendix D). Notification to the appropriate personnel will be in the form of phone calls and/or emails.

7.1 INCIDENT REPORTING SEQUENCE

The Cabrera Incident Reporting sequence is presented below. The reporting requirements are designed to alert senior management of the incident. The notifications should be made immediately in accordance with OP-512, Incident, Near Miss & Observation Reporting and are summarized below. Reports will include basic facts about the incident, actions being taken, agencies and Cabrera personnel notified, and any requests for assistance.

An incident occurs...

Step 1: The affected employee must notify their direct supervisor immediately. The supervisor will in-turn report the incident to the SSHO. For life threatening injuries, the Supervisor or SSHO will call 911 (Emergency Response). For all non-life threatening injuries/illnesses, the SSHO shall contact the PM and OH&S Manager prior to arranging for any off-site medical treatment.

Step 2: The employee fills out the applicable incident report and forwards to their supervisor for review. This is an initial report and the report's status is still pending approval by the appropriate reviewer (PM and/or SSHO). The client specific incident reporting form (Eng 3394) must be completed as well, and will be forwarded to the PM for review prior to submittal.

Step 3: Depending on the nature/extent of any injury/illness, an incident investigation and root cause analysis occurs.

Step 4: Upon completion of an incident investigation and determination of a root cause, the initial investigation report must be finalized and submitted for approval. Once approval is obtained, corrective action(s) are identified, assigned, distributed and monitored through completion.

7.2 IMMEDIATE NOTIFICATIONS

The following require immediate accident notification to the Cabrera OH&S Manager, Program Manager and on-site USACE representative:

- A fatal injury
- A permanent total disabling injury
- An injury causing permanent partial disability
- The hospitalization of three or more people resulting from a single occurrence

- Property damage of \$200,000 or more

After the incident has stabilized, all incidents as noted above involving a fatality, major injury, illness, or resulting in significant property damage will be immediately reported to the CEO and the USACE project contact.

7.3 EXPOSURE DATA

The OH&S Manager is responsible for submitting a monthly safety report for this project to the USACE PM. The report shall include total site work hours and OSHA recordable illnesses and/or injuries as required by EM 385-1-1, (USACE, 2008) and be submitted by the 10th day of the month for the prior month's activities.

8.0 MEDICAL SUPPORT

Minor injuries will be treated onsite by qualified First Aid/CPR providers within their capabilities. A minimum of two onsite personnel will be first-aid and CPR-trained and their current certifications dates will be maintained during the field efforts. Certifications of qualified personnel are included in Appendix B. Emergency medical will be summoned in the event an injury is deemed outside the first responders' ability to render treatment.

Emergency Medical Services (EMS) will be summoned in the event of moderate to severe physical injury using onsite telephones or cell phones which will require dialing 911 for emergency services and/or the direct Hospital telephone number listed below (Table 8-1). This will connect the caller directly with central dispatching or the hospital, respectively.

8.1 FIRST AID AND MEDICAL TREATMENT PROCEDURES

In the event of an emergency, personnel who have been trained and certified in first aid may administer general onsite treatment. General treatment procedures include:

Removing the injured or exposed person(s) from immediate danger

- Assessing the nature and extent of the injury.
- Notifying the SSHO.
- Administering first aid, if necessary, by first aid/CPR certified project staff on site.
- Determining whether medical attention is required and, if so, notifying local EMS.
- Evacuating other project personnel to a safe place, if necessary, until the SSHO determines that it is safe for work to resume.

Accidents shall be reported to the SSHO immediately. If it is determined that medical treatment is required, personnel knowledgeable about the accident and site contaminants shall accompany the victim to the hospital. The phone number, address and directions to the hospital, are provided below.

At a minimum, two 25-person first aid kits shall be maintained onsite. Where eye hazards exist, a portable eyewash station will be available at the specific work location. Any employee who becomes ill resulting from possible exposure to site hazards shall immediately notify the SSHO or FSM, who will make immediate arrangements for medical consultation. Injuries or illnesses shall be reported to the SSHO immediately.

The hospital is within 3 miles of the USACE trailer complex at the MISS, adjacent to the Stepan Company in Maywood.

The route to the hospital will be posted in the project office prior to the initiation of onsite activities and maintained in all field vehicles. A hospital route map, phone number and directions are included below.

Table 8-1: Emergency Telephone Numbers

Emergency Telephone Numbers FUSRAP Maywood Superfund Site		 CABRERA SERVICES RADIOLOGICAL · ENGINEERING · REMEDIATION
EMPLOYEE MUST REPORT ALL INCIDENTS TO SSO AND OH&S MANAGER IMMEDIATELY		
For Life Threatening emergencies, call 911 . For all other incidents, contact OH&S Manager prior to visiting clinic. OH&S Manager, Sean Liddy, Office: 410-982-0726, Cell: 443-553-1403		
FIRST AID & CPR TRAINED PERSONNEL		
CHAD MILLER, SSO		201-226-6639 (work) 201-543-1965 (cell)
DENNIS WHITLOCK, RSO		CELL: 716-374-0895
JOE FORT, CQC		CELL: 830-285-8898
EMERGENCY NUMBERS		
POLICE/FIRE/MEDICAL SERVICES		911
HOSPITAL Hackensack University Medical Center 30 Prospect Avenue, Hackensack, NJ		201-996-2000
OCCUPATIONAL CLINIC Concentra, Teterboro 150 North Street, Teterboro NJ		201-393-9199
CENTER For DISEASE CONTROL		404-498-1515 or 800-311-3435
NJ POISON CONTROL CENTER		800-764-7661
NATIONAL RESPONSE CENTER		800-424-8802
CHEMTREC		800-424-9300
NJ ONE CALL		800-272-1000
PSE&G (ELECTRIC & GAS)		800-436-7734
UNITED WATER CO. (MAYWOOD/ROCHELLE PK)		800-422-5987
PASSAIC VALLEY WATER COMMISSION (LODI)		973-340-4300

Hospital Directions/Route Map FUSRAP Maywood Superfund Site



*****IF WORK RELATED, EMPLOYEE MUST REPORT INCIDENT TO SSO AND OH&S MANAGER AND COMPLETE INCIDENT REPORT*****

For Life Threatening emergencies, call **911**. For all other incidents, contact OH&S Manager prior to visiting clinic.
OH&S Manager, Sean Liddy, Office: 410-982-0726, Cell: 443-553-1403

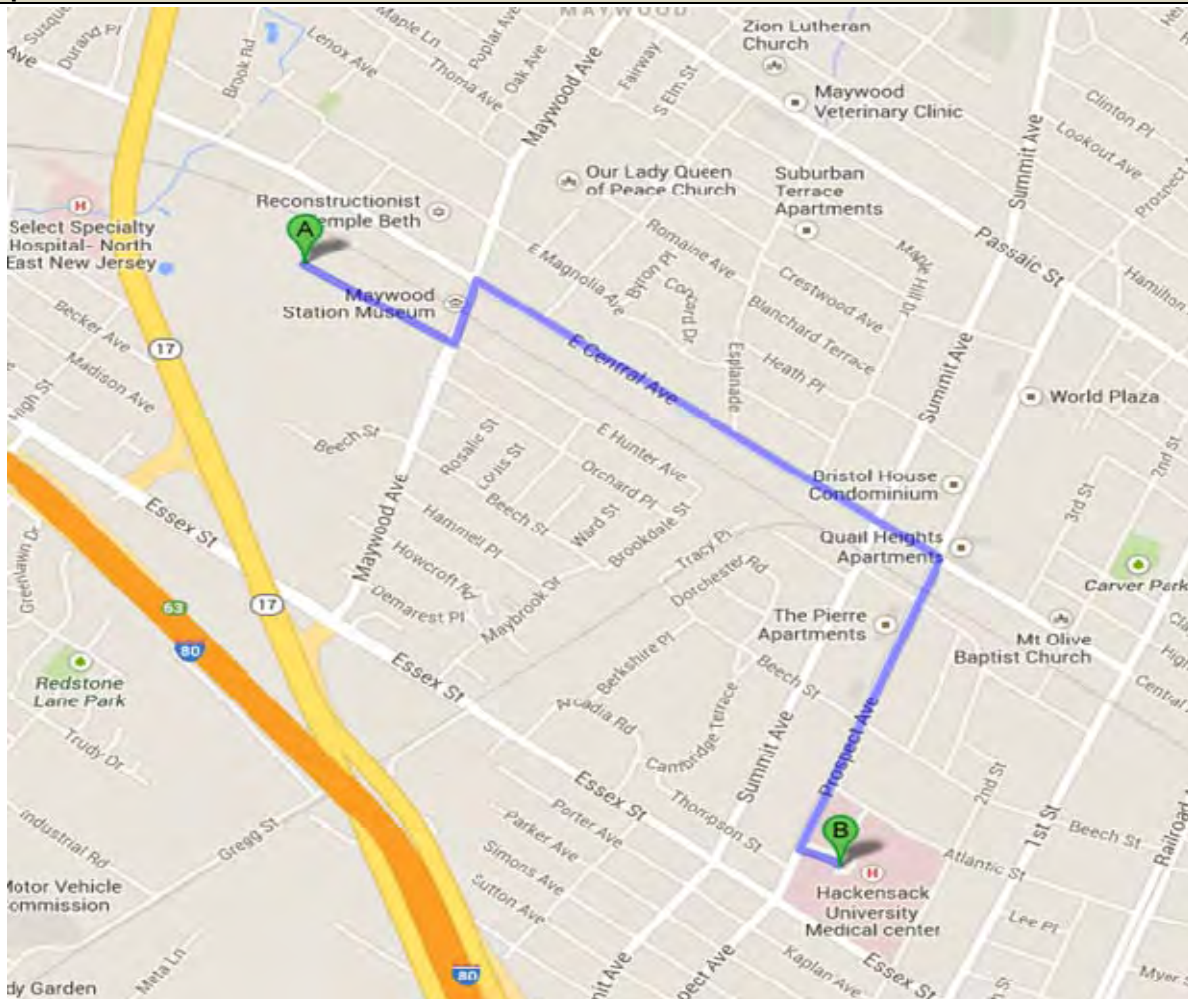
Hackensack University Medical Center – (201-996-2000)

Driving directions to 30 Prospect Avenue, Hackensack, NJ

To drive from the MISS trailer complex to Hackensack University Hospital:

- Exit the site on West Hunter Street.
- Turn Left on Maywood Avenue.
- Turn Right on Central Avenue
- Turn Right on to Prospect Avenue. The Hospital is located at 30 Prospect Avenue.

Route Map



**Hospital Directions/Route Map
FUSRAP Maywood Superfund Site**



Additional Directions from property locations (cont.):

Directions from:

113 Essex Street, Maywood

Turn right as you exit the property on to Essex Street west. Take the first right on to Midland Street then the first left on to Lexington Avenue and the first left on to West End Street. Turn left and reenter Essex Street. Follow Essex Street east over Route 17. Continue east over Summit Avenue to Prospect Avenue in Hackensack. At Prospect Avenue turn left.

Directions from:

Property at Route 17B and Essex Street, Maywood

Turn right as you exit the property on to Essex Street west. Take the first right on to Midland Street then the first left on to Lexington Avenue and the first left on to West End Street. Turn left and reenter Essex Street. Follow Essex Street east over Route 17. Continue east over Summit Avenue to Prospect Avenue in Hackensack. At Prospect Avenue turn left.

Directions from:

160 Essex Street, Lodi

Turn right as you exit the property on to Essex Street east. Follow Essex Street east over Route 17. Continue east over Summit Avenue to Prospect Avenue in Hackensack. At Prospect Avenue turn left.

Directions from:

174 Essex Street, Lodi

Turn right as you exit the property on to Essex Street east. Follow Essex Street east over Route 17. Continue east over Summit Avenue to Prospect Avenue in Hackensack. At Prospect Avenue turn left.

Directions from:

61 West Hunter Street, Maywood

Follow West Hunter Street east to its intersection with Maywood Avenue. At Maywood Avenue turn right and travel south to Maywood Avenue's intersection with Essex Street. Turn left on to Essex Street and travel east over Summit Avenue to Prospect Avenue in Hackensack. At Prospect Avenue turn left.

Directions from:

205 Maywood Avenue, Maywood

Exit the property and turn right on to Maywood Avenue. Travel south to Maywood Avenue's intersection with Essex Street. Turn left on to Essex Street and travel east over Summit Avenue to Prospect Avenue in Hackensack. At Prospect Avenue turn left.

Directions from:

149-151 Maywood Avenue, Maywood

Exit the property and turn right on to Maywood Avenue. Travel south to Maywood Avenue's intersection with Essex Street. Turn left on to Essex Street and travel east over Summit Avenue to Prospect Avenue in Hackensack. At Prospect Avenue turn left.

Directions from:

23 West Howcroft Road, Maywood

Follow West Howcroft Street east to its intersection with Maywood Avenue. At Maywood Avenue turn right and travel south to Maywood Avenue's intersection with Essex Street. Turn left on to Essex Street and travel east over Summit Avenue to Prospect Avenue in Hackensack. At Prospect Avenue turn left.

Directions from:

85-99 Route 17N, Maywood

Exit the property on to Route 17N. Follow Route 17N and take the Woodland Avenue exit on to West Central Avenue. Turn right on to West Central Avenue. Travel east on West Central Avenue. Cross over Maywood Avenue where the road name changes to East Central Avenue. Turn right on to Summit Street and travel south to the intersection with Essex Street. Turn left on to Essex Street, and then take the first left on to Prospect Avenue.

**Hospital Directions/Route Map
FUSRAP Maywood Superfund Site**



Additional Directions from property locations (cont.):

Directions from:

137 Route 17N, Maywood

Exit the property on to Route 17N. Follow Route 17N and take the Woodland Avenue exit on to West Central Avenue. Turn right on to West Central Avenue. Travel east on West Central Avenue. Cross over Maywood Avenue where the road name changes to East Central Avenue. Turn right on to Summit Street and travel south to the intersection with Essex Street. Turn left on to Essex Street, and then take the first left on to Prospect Avenue.

Directions from:

167 Route 17N, Maywood

Exit the property on to Route 17N. Follow Route 17N and take the Woodland Avenue exit on to West Central Avenue. Turn right on to West Central Avenue. Travel east on West Central Avenue. Cross over Maywood Avenue where the road name changes to East Central Avenue. Turn right on to Summit Street and travel south to the intersection with Essex Street. Turn left on to Essex Street, and then take the first left on to Prospect Avenue.

Directions from:

239 Route 17N, Maywood

Exit the property on to Route 17N. Follow Route 17N and take the Woodland Avenue exit on to West Central Avenue. Turn right on to West Central Avenue. Travel east on West Central Avenue. Cross over Maywood Avenue where the road name changes to East Central Avenue. Turn right on to Summit Street and travel south to the intersection with Essex Street. Turn left on to Essex Street, and then take the first left on to Prospect Avenue.

Directions from:

72 Sidney Street

Take Money Street North. Go about 500 ft until Money Street tees at Kennedy Drive. Take a right onto Kennedy Drive and a quick left onto Brook Street. Go one block on Brook Street and take a right onto Garibaldi Avenue. Drive on Garibaldi Avenue for ¾ mile. (Note: Garibaldi Avenue changes to West Pleasant Avenue when you cross from Lodi into Hackensack.) Take a left onto Summit Avenue. Drive on Summit Avenue for 2/3 mile. Take a right onto Essex Street and drive 0.1 mile. Turn left onto Prospect Avenue.

Directions from:

NJ Vehicle Inspection Station

Exit property and make a right (head southwest) onto Gregg Street. Go about 0.1 mile to Garibaldi Avenue. Take a left onto Garibaldi Avenue and drive about 0.6 mile to Summit Avenue. Take a left onto Summit Avenue and drive 2/3 mile to Essex Street. Take a right onto Essex Street and drive 0.1 mile. Turn left onto Prospect Avenue.

Directions from:

100 Hancock Street

Go southwest on Hancock Street about ¼ mile to Garibaldi Avenue. Take a left onto Garibaldi Avenue and drive ¾ mile to Summit Avenue. Take a left onto Summit Avenue and drive 2/3 mile to Essex Street. Take a right on Essex Street and go to Prospect Avenue.

Directions from:

80 Industrial Road and 80 Hancock Street

Go southwest on Hancock Street about ¼ mile to Garibaldi Avenue. Take a left onto Garibaldi Avenue and drive ¾ mile to Summit Avenue. Take a left onto Summit Avenue and drive 2/3 mile to Essex Street. Take a right on Essex Street and go to Prospect Avenue.

Directions from:

170 Gregg Street

Go south on Gregg Street to Garibaldi Avenue. Take a left onto Garibaldi Avenue and go straight to Summit Avenue. Take a left onto Summit Avenue and go to Essex Street. Turn right on Essex Street and proceed to Prospect Avenue. Turn left on Prospect Avenue.

**Hospital Directions/Route Map
FUSRAP Maywood Superfund Site**



Additional Directions from property locations (cont.):

Directions from:

239 Route 17N, Maywood

Exit the property on to Route 17N. Follow Route 17N and take the Woodland Avenue exit on to West Central Avenue. Turn right on to West Central Avenue. Travel east on West Central Avenue. Cross over Maywood Avenue where the road name changes to East Central Avenue. Turn right on to Summit Street and travel south to the intersection with Essex Street. Turn left on to Essex Street, and then take the first left on to Prospect Avenue.

Directions from:

72 Sidney Street

Take Money Street North. Go about 500 ft until Money Street tees at Kennedy Drive. Take a right onto Kennedy Drive and a quick left onto Brook Street. Go one block on Brook Street and take a right onto Garibaldi Avenue. Drive on Garibaldi Avenue for ¾ mile. (Note: Garibaldi Avenue changes to West Pleasant Avenue when you cross from Lodi into Hackensack.) Take a left onto Summit Avenue. Drive on Summit Avenue for 2/3 mile. Take a right onto Essex Street and drive 0.1 mile. Turn left onto Prospect Avenue.

Directions from:

NJ Vehicle Inspection Station

Exit property and make a right (head southwest) onto Gregg Street. Go about 0.1 mile to Garibaldi Avenue. Take a left onto Garibaldi Avenue and drive about 0.6 mile to Summit Avenue. Take a left onto Summit Avenue and drive 2/3 mile to Essex Street. Take a right onto Essex Street and drive 0.1 mile. Turn left onto Prospect Avenue.

Directions from:

100 Hancock Street

Go southwest on Hancock Street about ¼ mile to Garibaldi Avenue. Take a left onto Garibaldi Avenue and drive ¾ mile to Summit Avenue. Take a left onto Summit Avenue and drive 2/3 mile to Essex Street. Take a right on Essex Street and go to Prospect Avenue.

Directions from:

80 Industrial Road and 80 Hancock Street

Go southwest on Hancock Street about ¼ mile to Garibaldi Avenue. Take a left onto Garibaldi Avenue and drive ¾ mile to Summit Avenue. Take a left onto Summit Avenue and drive 2/3 mile to Essex Street. Take a right on Essex Street and go to Prospect Avenue.

Directions from:

170 Gregg Street

Go south on Gregg Street to Garibaldi Avenue. Take a left onto Garibaldi Avenue and go straight to Summit Avenue. Take a left onto Summit Avenue and go to Essex Street. Turn right on Essex Street and proceed to Prospect Avenue. Turn left on Prospect Avenue.

Occupational Clinic Directions/Route Map FUSRAP Maywood Superfund Site



*****IF WORK RELATED, EMPLOYEE MUST REPORT INCIDENT TO SSSH AND OH&S MANAGER AND COMPLETE INCIDENT REPORT*****

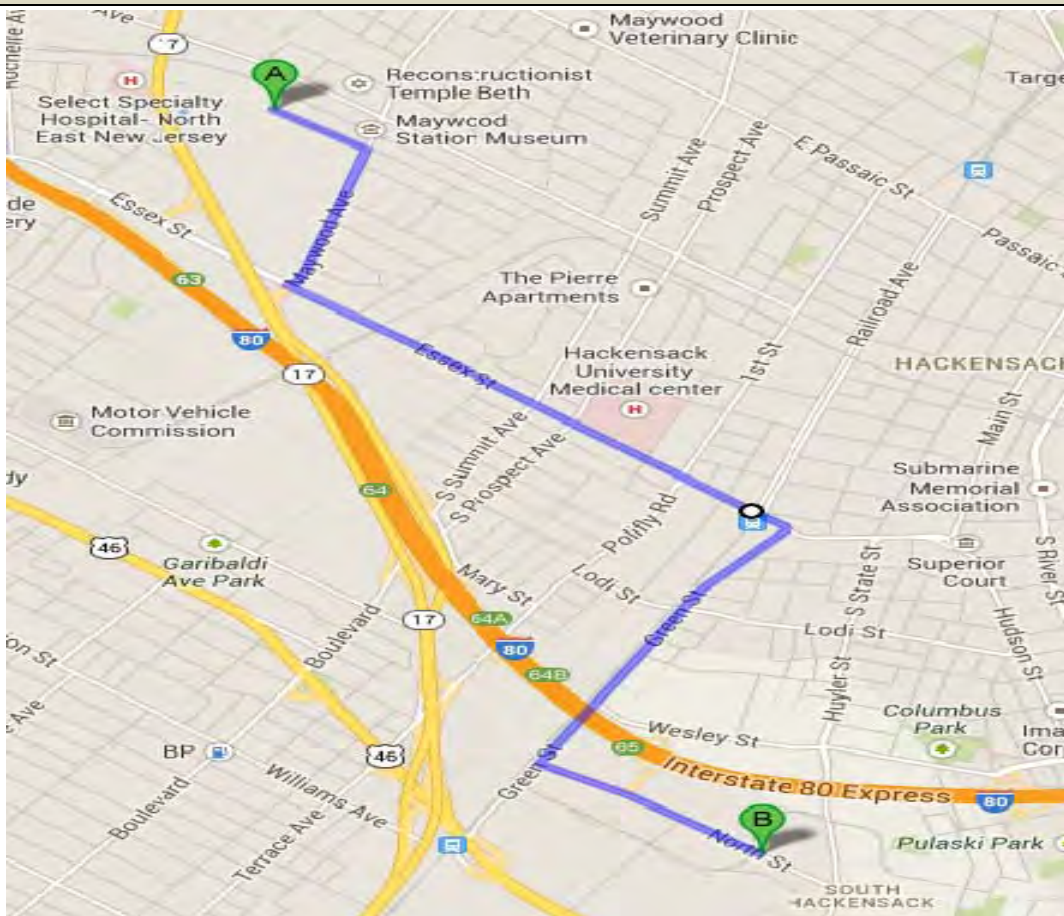
For Life Threatening emergencies, call **911**. For all other incidents, contact OH&S Manager prior to visiting clinic.
OH&S Manager, Sean Liddy, 410-982-0726, 443-553-1403

Occupational Clinic – Concentra, Teterboro – (201-393-9199)

Driving directions to 150 North Street, Teterboro, NJ

- Exit the site on West Hunter Street.
- At the intersection with Maywood Avenue, turn right and follow Maywood Avenue south to its intersection with Essex Street.
- Turn left on to Essex Street.
- Turn right on Green Street
- Turn left onto North Street. Concentra is located at 150 North Street.

Route Map



9.0 PERSONAL PROTECTIVE EQUIPMENT

During this project, PPE is used to protect against personnel exposures to contaminants and other on-site hazards, including those presented by decontamination processes. Specific uses and procedures are addressed in further detail within the applicable AHA for the task. AHAs for the project may be found in Attachment A of the SSHP.

9.1 HAZARD ASSESSMENT OF PPE USE

The person with overall responsibility for the PPE program for projects is the SSHO in consultation with the OH&S Manager. AHAs have been developed for the anticipated tasks to be executed in the field and shall be reviewed by project staff prior to the initiation of field work. The SSHO will make the final determination for PPE levels based on a review of the AHAs and physical characteristics of the work area. As field tasks progress the SSHO will review each AHA and the monitoring data for chemical contaminants daily. Should the SSHO deem a change in PPE necessary, the SSHO will follow the procedures listed in Section 9.3, below.

The major tasks to be accomplished during this project will be conducted under the following levels of personnel protection:

Table 9-1: PPE Levels by Task

Task#/Name	PPE Level	Additional Information
Task 1- Mobilization/ Demobilization	Level D	Hard hat, safety glasses, work boots, high-vis vest, gloves, hearing protection (if applicable)
Task 2 – Excavation & Restoration	Modified Level D	Level D plus chemical gloves (nitrile), chemical boots (overbooties or dedicated) and/or chemical coveralls (Tyvek).
Task 3 – Waste Disposition (MISS)	Modified Level D	Level D plus chemical gloves (nitrile), chemical boots (overbooties or dedicated) and/or chemical coveralls (Tyvek).
Task 4 – Radiological Surveys and Sampling	Modified Level D	Level D plus chemical gloves (nitrile), chemical boots (overbooties or dedicated) and/or chemical coveralls (Tyvek).
Task 5 – Lab Operations	Modified Level D	Level D to consist of safety glasses and work boots, plus chemical gloves (nitrile), chemical goggles, face-shields, and chemical resistant PPE (aprons)

Multiple AHAs have been prepared for each of the above tasks. The AHAs, presented in Attachment A of the SSHP, describe the hazards associated with each step required to perform the task and define the appropriate safety controls, including upgrade triggers.

New AHAs will be developed in the event that new tasks, that had not been previously anticipated, are added to the field program; or, a new subcontractor has mobilized to begin work at the site. Revisions and/or new AHAs will be submitted to USACE, for approval, prior to the start of activities for which changes have been made.

9.2 USE OF PROTECTIVE EQUIPMENT

Every effort must be taken to avoid contact with potentially contaminated material. In accordance with OSHA 29 CFR 1910, Subpart I, PPE will be provided, used, and maintained in a sanitary and reliable condition (refer to Section 5 of this APP for training requirements). PPE will be of construction, design, and material to provide employees protection against known or

anticipated hazards. PPE will be selected on the basis of the proper and appropriate fit for the employee. Personnel shall be provided with training on the selection, use, and limitations of PPE in accordance with the standard. Any concerns regarding the use of appropriate PPE will be brought to the attention of the SSHO. The SSHO is responsible for ensuring that necessary PPE is available on site.

9.3 PPE SELECTION CRITERIA

Additional PPE, engineering controls, and contaminant-specific monitoring will be conducted by the SSHO if monitoring for contaminants indicates action levels are exceeded. If such site conditions change, the SSHO, in consultation with OH&S Manager as appropriate, will decide upon the upgraded PPE levels. These changes will be documented in the DQCR and Health and Safety Inspection Form. USACE will be informed of these intended changes for concurrence.

An employee or subcontractor will be immediately addressed, by the FSM or SSHO, if observed using PPE improperly or if that individual enters an area without adequate PPE. The individual will be removed from the area until inadequacies are corrected. If a site supervisor or manager has reason to believe an employee does not have a sufficient understanding of PPE use, he/she may require the individual receive additional training. Repeated offenses may result in removal of the individual from the site, or termination, depending on the severity of the infraction. Training records will be maintained onsite by the SSHO and copies sent to the OH&S Manager for tracking in training database.

Personnel performing field work will be required to use the appropriate level of protection indicated in the table above, and the corresponding AHA for the task. If conditions are identified requiring a lower or a higher level of protection, then PPE will be upgraded or downgraded according to these guidelines.

9.3.1 General Work Attire

Personnel shall use general work attire as the minimum starting point for all PPE ensembles. If heat stress is a concern, workers shall dress appropriately for weather conditions.

- Long or short-sleeved shirt (no “tank-style” tops)
- Long pants
- Sturdy footwear (leather work boot with min 6” cuff) providing ankle support
- Hat with visor (recommended)
- Safety glasses providing UV protection for the eyes (recommended)

9.3.2 Level D Personal Protective Equipment

Level D PPE will be worn during tasks where the atmosphere contains no known or suspected contaminants that meet or exceed the established exposure limits, contact with levels of contaminants through inhalation, absorption, or adsorption will not occur, and there is not any potential for unexpected contact with other contaminants. This includes personnel performing activities such as equipment operation, truck driving, inspections, or site set-up or demobilization. Level D PPE consists of the following:

- General Work Attire

- Work gloves, leather or cotton as necessary for physical hazards
- Boots (with steel toes where required), certified according to the American National Standards Institute (ANSI)
- Safety glasses (ANSI Approved)
- Hard hats (ANSI Approved)
- High Visibility (DOT Class 2 or 3) work vest
- Hearing protection (during noise-generating activities)

9.3.3 Modified Level D Personal Protective Equipment

Modified Level D PPE will be worn when conducting activities with known or potential contact with minimally contaminated materials, or those that only pose a direct contact (dermal) hazard. Modified Level D consists of the following:

- Level D PPE
- Chemical protective coveralls (Tyvek)
- Chemical protective over boots or boot covers
- Chemical protective gloves (nitrile)

9.3.4 Level C Personal Protective Equipment

Level C PPE will be worn when conducting activities during tasks where the atmosphere contains known or suspected contaminants that meet or exceed the established exposure limits, contact with levels of contaminants through inhalation, absorption, or adsorption may occur, and there is potential for unexpected contact with other contaminants. Level C PPE consists of the following:

- Modified Level D PPE
- Full Face or ½ Face Air Purifying Respirator (APR) with appropriate chemical cartridges (P100 particulate cartridge anticipated for use).

The appropriate cartridges for the prescribed respirators will be outlined in the SSHP.

9.4 PROCEDURES FOR DETERMINING WORK DURATION

The SSHO identifies task-specific and site-specific work duration based on the following:

- Physiological requirements of the task
- PPE level for that task
- Ambient temperature and humidity
- Protective clothing capacity
- Acclimatization of site workers

Personnel are informed about task-specific work duration by the SSHO during pre-shift meetings for personnel entering the work zones.

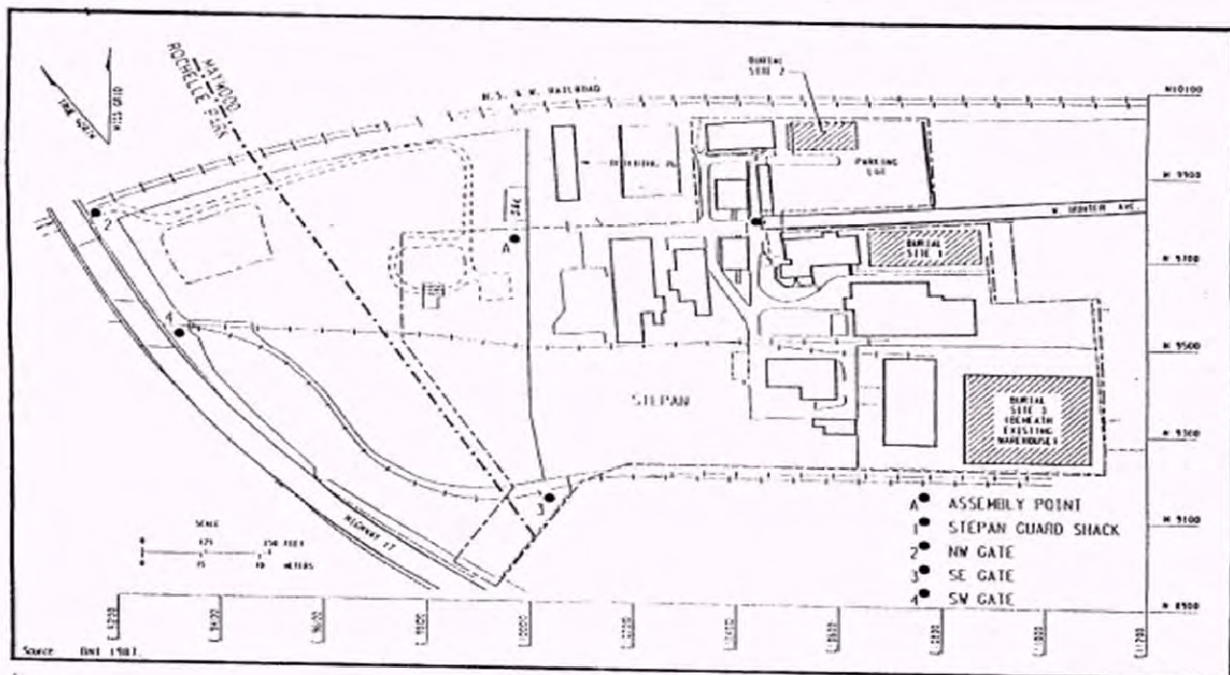
Work duration is continuously re-evaluated in response to changes in working conditions. Evaluation of the effectiveness of site-specific PPE selections occurs throughout site activities in response to personnel exposure monitoring results and personnel feedback.

10.0 PLANS (PROGRAMS, PROCEDURES) REQUIRED BY THE SAFETY MANUAL

Certain plans are required by EM 385-1-1 in order to provide adequate protection for onsite workers and vary based on site specific conditions. Corresponding plans for the project site are listed below.

10.1 LAYOUT PLANS

During the project WP phase, the site layout will be planned to show the work sites, administrative areas, access and egress routes and parking areas. Temporary facilities will be properly anchored and grounded to prevent damage from high winds and severe weather. Staging areas for the temporary storage of equipment and supplies, as well as waste materials will be sited adjacent to the temporary facility/office. Employees will park vehicles adjacent to the temporary office. Site Layout Maps with Emergency assembly points is located below.



Emergency Assembly Points

10.2 EMERGENCY RESPONSE PLANS

The emergency response plan (ERP) will be discussed during initial site training and discussed regularly during the Daily Tailgate Safety Meetings. Annually, or as needed, the SSHO and the PM will review the plan and make any changes necessary to keep the plan current with new or changing site conditions and information. The SSHO will conduct drills quarterly or more frequently if conditions change to evaluate the response and testing the effectiveness of the plan.

An employee alarm system will consist of the use of air horns or verbal instructions, either directly or via radio. Air horn signals, (and hand signals if necessary) will be established and employees will be trained in the signals and appropriate response. Telephones will be used to contact off-site emergency responders.

During emergency response actions, evacuation of the area may be warranted if project personnel cannot safely respond. The local Fire Department/EMS will be notified by calling 911, and USACE will be notified in the event of a significant spill. The SSHO will brief emergency responders of the current status and any potential hazards upon their arrival at the Site.

For all emergency response actions, Cabrera and subcontractor personnel will rally at the sign-in area located at the administration/laydown area (refer to above map for Assembly Point A). Personnel will be accounted for by the SSHO (or designee) based on the morning meeting sign-in log. Those not accounted for will be contacted by cell phone (phone numbers of all personnel will be kept on file). If still not reached, a rescue team will be assembled to search for the missing individual(s). Evacuation routes will be discussed during the morning safety meeting and the primary emergency route will be posted in the administrative area.

10.2.1 Site Communications

A combination of communication methods will be used. For verbal or visual communication, site personnel will use an assortment of common hand signals. If verbal or visual communication is not possible, radios or cellular telephones will be used. Individuals and buddy teams will be capable of requesting assistance via one or more of these methods.

Due to the proximity to the Stepan Chemical Company facility and operations there may be the need to evacuate the project site due to an incident within the Stepan facility. If a situation within Stepan warrants evacuation, Cabrera will be notified via telephone or walkie-talkie as to what level of evacuation is requested. The Stepan Environmental Health and Safety Director will communicate this request directly to the SSHO. The SSHO has been issued a walker-talkie by Stepan Chemical. Once notification is made the project's evacuation procedures will be implemented.

Portable air horns will be used to provide area alarms such as "Warning Evacuation." Air horns will be located in the site office trailer, and each active work area. The evacuation signals are as follows:

- One long blast (approximately five second duration) equals radiological or chemical emergency
- Three short blasts equals fire emergency

The appropriate signal will be repeated for a total of three complete sets.

10.2.2 Emergency Response Plans (Spills)

This spill prevention and control section sets forth the procedures for coordination of and response to potential spills/discharges of contaminated soil, chemicals, or water.

10.2.2.1 Preemptive Measures

The following measures will be taken to minimize the possibility of spills/discharges:

- Site controls will to be maintained so that only authorized personnel have access to work areas;
- Project personnel will be advised of appropriate spill/discharge control measures; and
- Appropriate secondary containment structures will be used for storage and transfer of hazardous materials and liquid wastes on site.

10.2.2.2 Spill Control Equipment

A spill response kit will be available at the site to handle small liquid spills, which could cause contamination to spread to clean areas of the facility and the surrounding environment. The spill response equipment will be placed in a central location at the MISS and at the excavation area. The spill response equipment kit is intended to control spills from solid and liquid waste stored at the site as well as any minor spills of fuel, motor oil, etc. The immediate spill response kit consists of the following items:

- Broom,
- Dust pan,
- Speedi-Dry™ absorbent,
- Oil boom, and
- Flat shovel and empty drums or overpack drums for re-packing spilled material.

The following materials will be kept on site. They are not required to be specifically dedicated to spill response but may be used for other activities:

- Industrial hygiene and health physics instrumentation,
- Flagging tape,
- Barrier tape/rope (200 ft),
- Extension cord with ground-fault circuit interrupter,
- Duct tape,
- All-purpose markers,
- Black pen,
- Five-gallon buckets, and
- Polyethylene sheeting.

10.2.2.3 Spill Response

The SSHO will be immediately notified if a hazardous material release is observed at the project-site. An assessment will be made of the magnitude and potential impact of the release. Project personnel will attempt to locate the source of the release, prevent further release, and contain the spilled and/or affected materials as follows, if it is safe to do so. Spill response will be addressed as follows:

- The spill or release area will be approached from upwind;
- Hazards will be identified based on available information from witnesses or material identification documents (placards, SDS/MSDSs, logs). The potential hazards will be

evaluated to determine the proper personal protection levels, methods, and equipment necessary for response;

- If necessary, the release area will be evacuated, isolated, and secured;
- Work zones, including a controlled area, will be set up;
- If possible, spill containment will initially be made without entering the immediate hazard area;
- Entry to the release area will be made by personnel with the training, methods and equipment and PPE necessary to perform the work. Hazardous spill containment and collection will be performed in four steps as follows:
 - Contain the spill with absorbent socks, booms, granules, or construction of temporary dikes;
 - Control the spill at the source by plugging leaks, up righting containers, over packing containers or transferring contents of a leaking container;
 - Collect the spilled material with shovels, pumps, or heavy equipment as necessary; and
 - Store the spilled material for further treatment or disposal. Treatment and/or disposal options of the material will depend on the amount and type of material.

10.2.3 Emergency Response Plans (Fires)

In any fire situation, it is important to act quickly and decisively in order to contain the spread of the fire. Regardless of the size and nature of the fire, and employee's ability to respond, all fires will be reported immediately to the local fire department. The SSHO will:

- Sound the fire alarm (local or auxiliary);
- Determine the extent of the fire and Notify Fire Department – 911 (Fire Department is to be notified of any fires larger in size than a wastebasket).
- Coordinate and manage fire suppression efforts until the additional personnel arrive. If the SSHO has determined that it is safe to do so, site personnel may use available on-site fire extinguishers on incipient stage fires only;
- Remove or isolate flammable or other hazardous materials, which may contribute to the fire;
- Coordinate the evacuation of injured or non-essential personnel from the site upwind following the evacuation procedure;
- Check attendance and provide emergency first aid as required;
- Clear access routes for emergency vehicles. Fire Department officials will determine when it is safe for re-entry.

All project personnel will be responsible for observing and reporting fires and conditions that could lead to fires. During all on-site activities, the following practices will be used for fire prevention and protection:

- Smoking on-site is prohibited in designated work areas, contamination reduction zones, and other areas where smoking may create a fire hazard (e.g., dry fields or forested areas). A designated smoking area will be established as necessary by the SSHO or Site Supervisors when operations on site begin;
- Accumulations of combustible scrap and debris on-site will be promptly removed and properly disposed;
- Care will be taken with all equipment to reduce the possibility of sparks or open flames;
- Fire extinguishers (minimum [2] ABC, 10-lb, with current annual inspection tags) will be available at the work area and support area; and a fire extinguisher will be available on all pieces of heavy equipment.
- Fire extinguishers will be checked monthly by SSHO and annual inspection tag updated with date of inspection and initials of inspector.

Requirements for storage of flammable and combustible liquids will include:

- A suitable portable fire extinguisher will be available at the location where flammable or combustible liquids are stored;
- “No Smoking” signs will be posted in the storage area;
- Flammable liquids will be stored in closed containers. Type I or Type II metal safety cans (not greater than 5 gallons capacity) will be used for small quantities. Plastic storage containers are not allowed;
- Not more than 60 gallons of Class I or Class II liquids, nor more than 120 gallons of Class III liquids may be stored in a storage cabinet;
- Containers of flammable and combustible liquids shall be stored properly when not in use;
- Spills will be cleaned up promptly.

10.2.4 Emergency Response Plans (Marine Emergencies)

This section is not applicable to the tasks being performed for this project.

10.3 WRITTEN HAZARD COMMUNICATION PROGRAM

The following will apply to all commercial products containing hazardous substances brought onsite during the project, in accordance with the OSHA Hazard Communication Standard, 29 CFR 1910.1200) as follows:

- Cabrera’s Hazard Communication Program, as described in OP 517, *Hazardous Materials Communication*, will be followed for hazardous materials brought onsite. This program, a copy of which can be found in Appendix C, will be made available to all site personnel.
- The SSHO will maintain a Safety Data Sheet (SDS, formerly MSDS) for each hazardous material brought to or used onsite. Hazardous materials will be stored in appropriate

containers within Administration and Laydown Area. Appendix E includes a Hazardous Substances Inventory (HSI) for chemicals that are anticipated to be used onsite as of the latest revision date of this document. The HSI will be confirmed and updated with quantities upon initiation of the project by the SSHO.

- The SSHO will affix a hazard communication label providing information on health and physical hazards information to each container of hazardous material for those containers of hazardous materials not supplied with an adequate hazard label.
- The SSHO will train site personnel working with hazardous materials in accordance with the requirements of 29 CFR 1910.1200 and OP 517. As new hazardous and/or flammable materials are brought onsite the corresponding SDSs will be made available to all onsite personnel.
- The SSHO will maintain an inventory of hazardous materials used onsite.
- The SSHO will inform personnel, including those employed by subcontractors, of the hazards of hazardous materials onsite and the location of appropriate SDSs.
- Subcontractors are required to provide SDSs to Cabrera and obtain approval of the SSHO prior to bringing hazardous materials onsite.

Proper storage of potentially hazardous substances will be communicated to the team members through daily safety briefings.

10.4 WRITTEN RESPIRATORY PROTECTION PLAN

Level C protection may be required for use at the FMSS during field activities if real-time airborne concentrations of contaminants (via dust) or air sampling results exceed the established action levels. The selection of proper respirators, along with the other required components of a respiratory protection program are outlined below and within OP 562, Respiratory Protection (Appendix C), including copies of Fit Test Record Form, and Respiratory Protection Equipment Inspection forms. The type of respirator and filtering media anticipated for potential use is a ½ face APR (manufacturer TBD) equipped with P100 cartridges.

10.4.1 Respiratory Protection Medical Surveillance

No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that he/she is physically able to perform the work while using the required respirator. Prior to wearing a respirator, employees must complete an initial baseline medical surveillance examination performed by a Physician or licensed health care professional (PLHCP).

Employees who continue to use respiratory protection must receive an annual medical surveillance examination. Additional medical examinations will be provided to employees who wear respirators if/when:

- An employee reports medical signs or symptoms that are related to ability to use a respirator;
- A PLHCP, supervisor, or the respirator program administrator determines that an employee needs to be reevaluated;

- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature, etc.) that may result in a substantial increase in the physiological burden placed on an employee.

All medical surveillance examinations shall be confidential, during normal working hours, convenient, understandable, and the employee will be given chance to discuss results with examining physician.

10.4.2 Respiratory Protection Training

Employees who wear respiratory protection must receive training before they are assigned to a task that requires the use of respiratory protection. Respirator training will be included in the Initial 40-Hour and the Annual 8-Hour training classes for HAZWOPER and when respirators are otherwise required. Retraining shall be administered annually, and when the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete;
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or
- Any other situation arises in which retraining appears necessary to ensure safe respirator use.

Respiratory protection training records will be maintained on-site by the SSHO and at the corporate level by the OH&S Manager. On-site records of training and fit testing will be maintained as necessary by the SSHO. Respirator training classes will include, at a minimum, the following:

- Instruction in the nature of the respiratory hazards, whether acute, chronic, or both, and a description of potential health effects if the respirators are not used.
- Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator.
- The limitations and capabilities of the respirator.
- Proper fitting, including demonstrations and practice in wearing, adjusting, determining the fit of, and performing a user seal check each time respirator is donned.
- How to inspect, put on, use and remove the respirator.
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions.
- The procedures for maintenance and storage of the respirator.
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.
- The general requirements of the OSHA Respiratory Protection Standard.

10.4.3 Respirator Fit Testing

All employees who are required to wear a respirator with a tight-fitting facepiece must be fit tested for that respirator. Employees are only approved to wear the brand and model respirator for which they have been successfully fit tested within the past year. A written record of each fit test performed must be maintained in the employee's health and safety records.

Respirator fit-testing must be performed by a member of the Safety Department or a designated and qualified representative. One of the following types of respirator fit testing will be provided:

- Qualitative Fit Testing (QLFT) – Irritant Smoke, Banana Oil, Saccharin or equivalent protocol
- Quantitative Fit Testing (QNFT) – Ambient aerosol condensation nuclei counter (CNC) protocol (e.g., Portacount™) QNFT must be used for:
 - All air-supplied respirators with tight-fitting facepieces
 - Air purifying respirators that must achieve a fit factor of 100 or greater. All fit testing must be performed with the respirator facepiece operating in the negative pressure mode.

Fit tests will be performed:

- Prior to initial use of the respirator,
- Whenever a different respirator facepiece (size, style, model or make) is used; and,
- At least annually thereafter.

Additional fit tests will be performed:

- Whenever there is an indication that changes in the employee's physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- If the employee notifies his/her supervisor, project supervision or safety manager that the fit of his/her respirator is unacceptable.

10.4.4 Respiratory Protection, Seal Inference

Respiratory Protection will only be assigned to those employees without physical obstructions to a gas-tight face seal to jobs that may require the use of respiratory protection. Such obstruction can include facial hair, head hair, and the temple bars of eye glasses. Respirator wearers cannot be afforded protection from hazardous airborne contaminants when conditions prevent a complete gas-tight face seal. Since facial hair (even beard stubble) will interfere with a gas-tight seal, employees shall be required to be clean shaven whenever the use of respiratory protection is specified.

Eyewear issues are correctable by use of internally mounted spectacle kits. Management and supervisors shall assure that employees under their supervision who regularly wear eyeglasses, and who will require the use of a full-face respirator, are provided with appropriate spectacle kits at company expense. The use of contact lenses in hazardous atmospheres or in operations involving intense heat, molten metals or the potential for chemical splash shall be prohibited.

10.4.5 Respiratory Protection, Specification of Proper Level

The SSHO, in consultation with the OH&S Manager, is responsible for specifying the proper selection and use of all respiratory protective devices including half-face and full-face air purifying respirators, airline respirators, and self-contained breathing apparatus. This information is specified as part of the SSHP and the AHA's for individual tasks.

Employees engaged in activities not covered by this APP or related SSHP must consult with the SSHO to determine the proper equipment prior to use. Whenever appropriate, exposure levels will be measured to assure that the actual use conditions are within the limitations of the approvals specified by National Institute of Occupational Safety and Health (NIOSH)/MSHA for the selected respirator.

10.4.6 Respiratory Protection, Conditions Required for Air-Purifying Respirator Use

Air-purifying respirators shall only be specified for use when it can be determined that the following conditions exist:

- The oxygen concentration is greater than 19.5%;
- The contaminant is known and its concentration can be quantified;
- The airborne contaminant concentration is below its IDLH;
- A canister or cartridge is available which is approved for the contaminant;
- The contaminant concentration is below the concentration for which the canister is approved;
- The contaminant concentration is below the Maximum Use Concentration (MUC) of the respirator.

In all cases where OSHA has specified that a particular respirator be used (asbestos, formaldehyde, benzene, arsenic, lead, etc.), that respirator, or one providing equal or better protection, shall be specified.

10.4.7 Respiratory Protection, APR Filter and Chemical Cartridges

An adequate supply of the following cartridges shall be maintained in stock at each office location where respiratory protective equipment is used:

- High efficiency particulate air (HEPA) filter cartridges;
- Organic vapor cartridges; and
- Combination HEPA/acid gas/organic vapor cartridges

Filter cartridges shall be changed out whenever an increase in breathing resistance is detected by the user. When available, chemical cartridges that are equipped with end-of-service life indicators (ESLI) shall be utilized. In those cases, cartridges should be changed when indicated by the ESLI. In the absence of cartridges equipped with an ESLI, employees shall change chemical cartridges on the following schedule:

- Immediately if breakthrough is perceived;

- In accordance with the change out schedule developed by the SSHO and specified in the SSHP; and
- After each day's use.

The change out schedule will be based upon the anticipated contaminant concentration, environmental conditions, employee work rate, and the specific data provided by manufacturers. When PAPRs are worn, the same rules apply with the exception that filter cartridges should be changed when airflow through the filter elements decreases to an unacceptable level, as indicated by the manufacturer's test device.

10.4.8 Respiratory Protection, Inspection, Cleaning and Maintenance of Respirator

When respirator use is required, only properly cleaned and maintained NIOSH/MSHA approved respirators shall be used. Respirator facepiece assemblies shall be cleaned and sanitized after each day of use. Employees must leave the work area to wash, change cartridges, or if they detect break-through or resistance.

When not in use, respirator facepieces shall be placed in clean Zip-Lock style bags and stored to protect against dust, sunlight, extreme temperatures, excessive moisture, or damaging chemicals. Respiratory equipment shall be maintained according to manufacturer's instructions.

All respirators shall be inspected routinely by the user before, during, and after each use. Defects shall be reported to supervision. No defective respirator shall be issued or worn. Routinely used respiratory equipment shall be inspected by an individual qualified by experience or training to do the work.

The SSHO will conduct evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective. The OH&S Manager will regularly (i.e., during annual training) consult employees required to use respirators to assess their views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include, but are not limited to:

- Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);
- Appropriate respirator selection for the hazards to which the employee is exposed;
- Proper respirator use under the workplace conditions the employee encounters; and
- Proper respirator maintenance.

10.4.9 Respiratory Protection, Recordkeeping

Medical records under this section will be maintained at a minimum in accordance with 29 CFR 1910.1020 –Access to Employee Exposure and Medical Records.

Fit test records will include the name of the employee tested, the type of fit test performed, the specific style, make, model and size of the respirator tested, the date of the test and the pass/fail results for QLFTs or QNFT test documentation (i.e., strip charts).

10.5 HEALTH HAZARD CONTROL PLAN

All operations, materials, and equipment associated with this project will be evaluated/assessed to determine the presence of hazardous environments or if hazardous or toxic agents could be released into the work environment. Additional hazard assessment will be conducted if a change in conditions occurs.

The product SDS will be reviewed and the AHA procedure used to identify all substances, agents, and environments that present a hazard and recommend hazard control measures. Engineering and administrative controls will be used to control hazard and in cases where engineering or administrative controls are not feasible, PPE use will be mandated. These controls are detailed in the AHAs applicable to the project site and have been included in Attachment A of the SSHP.

The analyses will identify the workplace and activity evaluated; the name of the person certifying that the evaluation has been performed; and the date of the evaluation.

Operations, materials, and equipment involving potential exposure to hazardous or toxic agents or environments shall be evaluated by a Certified Industrial Hygienist (CIH), CSP, or other competent person.

Exposure, through inhalation, ingestion, skin absorption, or physical contact, to any chemical, biological, or physical agent in excess of the acceptable limits specified in the most recently published American Conference of Governmental Industrial Hygienists (ACGIH) guideline, "*Threshold Limit Values and Biological Exposure Indices*," or by OSHA, whichever is more stringent, shall be prohibited.

The following are the principal hazards that can be anticipated while conducting site work:

- Chemical hazards,
- Biological hazards, and
- Physical hazards.

Cabrera has adopted and implemented a composite risk management process, which includes the following steps:

- Identification of the Hazard,
- Assessment of the Hazard,
- Development of Controls and Risk Decision,
- Implementation of Controls, and
- Supervision and Evaluation during Task Performance.

The following methods will be utilized for the control of exposure to hazardous or toxic agents and environments:

- Substitution, if the substitute process or product is determined to provide the same outcome and to be less of a hazard;
- Engineering controls (such as local/general ventilation), to limit exposure to hazardous or toxic agents and environments within acceptable limits;

- Work practice controls, when engineering controls are not feasible or are not sufficient to limit exposure to hazardous or toxic agents and environments within acceptable limits; and
- Appropriate PPE (i.e., respirators, gloves, etc.) and associated programs shall be instituted when engineering, work practice controls or material substitution are not feasible or are not sufficient to limit exposure to hazardous or toxic agents.

10.6 LEAD ABATEMENT PLAN

This section is not applicable to the tasks being performed for this project.

10.7 ASBESTOS ABATEMENT PLAN

This section is not applicable to the tasks being performed for this project.

10.8 RADIATION SAFETY PROGRAM

Please refer to Attachment B of the SSHP for the RPP.

10.9 ABRASIVE BLASTING PLAN

This section is not applicable to the tasks being performed for this project.

10.10 CRYSTALLINE SILICA MONITORING PLAN

This section is not applicable to the tasks being performed for this project.

10.11 CONFINED SPACE – NON-MARINE FACILITIES

A confined space is defined as a space large enough and so configured that an employee can bodily enter and perform assigned work, but has limited means for entry or exit, and is not designed for continuous employee occupancy. A permit required confined space (PRCS) means a confined space that also has one or more of the following:

- Contains or has a potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward
- Contains any other recognized serious safety or health hazard

The following locations at FMSS are designated as PRCS:

- Tank 1 – 5,400 gallon capacity.
- Tank 2 – 5,400 gallon capacity.

- Frac Tank (All) – 21,000 gallon capacity (Based on the quantity of water requiring treatment, the actual number of Frac Tanks may increase or decrease. All Frac Tanks brought onto the site will be of the same capacity and configuration.)
- Storage Tank A – 10,000 gallon capacity.
- Storage Tank B – 10,000 gallon capacity.
- Storage Tank C – 10,000 gallon capacity.
- Mod U Tank – 50,000 gallon capacity (Based on the quality of the wastewater being generated and treated, the Mod-U-Tank may be reclassified as a non-permit required confined space as determined by the SSHO. Reclassification of the confined space will be performed in accordance with Cabrera OP-582, *Confined Spaces*.)
- All tanks used for storage of wastewater generated during excavation activities at vicinity properties.
- Sewer Manhole – 24 inch diameter.
- Permanent Water Treatment System:
 - Caustic Tank (200 gallon capacity)
 - pH Adjustment Tank (200 gallon capacity)
 - Clarifier (approximately 1,000 gallon capacity)
 - Poly Tank (approximately 1,000 gallon capacity)
 - Ion Exchange Vessel (two each) (48 inches by 72 inches)
 - Granular Activated Carbon Vessel (36 inches by 72 inches).

All PRCSSs at Maywood have been identified with a sign reading “DANGER PERMIT REQUIRED CONFINED SPACE DO NOT ENTER,” to inform personnel of the existence and location of, and the danger posed by the PRCSS. The SSHO will reevaluate the facilities on site at least once a year for the presence of confined spaces.

All confined space entries will be performed in accordance with Cabrera OP 582, *Confined Spaces*, or equivalent program if conducted by a subcontractor. Prior to beginning any PRCSS entry operation, a PRCSS entry permit will be completed by the entry supervisor. The PRCSS participants include the entry supervisor, authorized entrants, and attendants. Roles and responsibilities and further specifics regarding confined space safety are further described within OP-582.

10.12 HAZARDOUS ENERGY CONTROL PLAN (LOCKOUT/TAG-OUT)

Lockout/tag-out (LOTO) procedures will be implemented to assure the safety of personnel during servicing or maintenance of machines and equipment where the unexpected release of stored energy or the energizing of these machines or equipment could cause employee injury and during confined space operations when physical disconnection is not possible.

It is anticipated that LOTO will occur during routine operations and maintenance of the water treatment plant, and during equipment maintenance on an as needed basis. All lock-out/Tag-out operations will occur under the purview of the SSHO and be performed in accordance with the step/procedures outlined in Cabrera's OP 593, *Hazardous Energy Control*, or equivalent program if conducted by a subcontractor.

10.13 CRITICAL LIFT PROCEDURES

This section is not applicable to the tasks being performed for this project.

10.14 FLOATING PLANT CONTINGENCY PLAN FOR SEVERE WEATHER

This section is not applicable to the tasks being performed for this project.

10.15 FLOAT PLANS

This section is not applicable to the tasks being performed for this project.

10.16 ACCESS AND HAUL ROAD PLAN

Existing public and private roads are used for the majority of hauling materials and contaminated soils at the FMSS. These roads are shown on Figure 10-1 below; "Location of Maywood Bergen County, New Jersey Master Haul Route." Additional information may be found in the Construction Load/Haul Plan, Cabrera November 2013.

Temporary haul roads are designed by the Project Engineer and are generally designed in accordance with the American Association of State Highway and Transportation Officials guidelines. The temporary haul roads are constructed using geotextile fabrics and structural fill materials with an approximate width of 12 ft for each lane (two-lane maximum). All temporary haul roads are compacted and graded as necessary. Access to the private MISS roads is gained through the guarded gate on West Hunter Avenue. Access to the Scanel Vicinity Property haul road is through an operating traffic signal on Essex Street via the abandoned railroad.

The temporary haul roads are primarily used by tri-axel dump trucks; however, heavy construction equipment and other project vehicles may also use these haul roads for access to some site areas. In general, up to 100 trucks (filled and empty) may travel each day on the roads, but there is potential for that number to increase.

The temporary haul roads are generally constructed in a straight manner with few curves, providing for adequate sight distances. The temporary haul roads are typically traveled upon at speeds of less than 7.5 miles per hour. Other public and private haul roads are driven on at the posted speed limits. The installation of traffic control devices is typically not necessary on the temporary roads.

The roads are designed and constructed with crowns and/or sloped surfaces to allow for proper drainage. Drainage control is also accomplished by providing drainage swales alongside the roads. Dewatering can be used to maintain stable road surfaces.

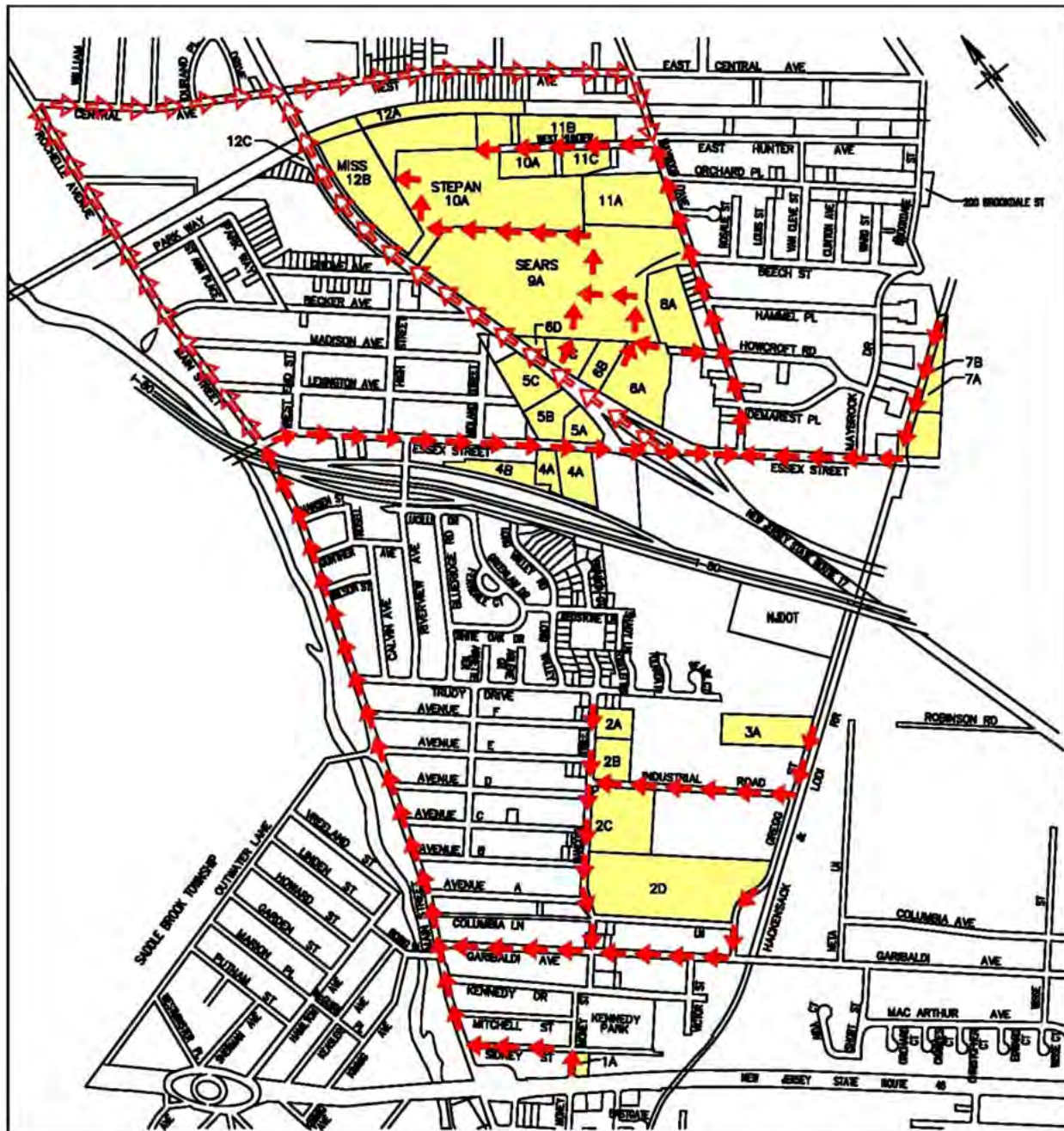


Figure 10-1: Location of Maywood Bergen County, New Jersey Master Haul Route

The work areas where the temporary haul roads are located are controlled by fencing and restricted by signage, so public access is prohibited. Existing traffic control signals, signs, curbs, marked crossings, and sidewalks are used to prevent public contact with vehicles using public streets and roads. All project personnel and authorized visitors wear high visibility vests when walking or working on or near the temporary haul roads.

The temporary haul roads are maintained by filling-in pot holes and/or grading, compacting, and smoothing as necessary. Dust control is provided by several applications of a calcium chloride solution each year, as well as by wetting with water as necessary.

Haul roads are sometimes located near (for access) excavated areas. Any associated hazards are controlled by the use of temporary fencing, cones, barrels, and/or concrete Jersey barriers when necessary.

10.17 DEMOLITION PLAN (ENGINEERING AND ASBESTOS SURVEYS)

This section is not applicable to the tasks being performed for this project.

10.18 EMERGENCY RESCUE (TUNNELING)

This section is not applicable to the tasks being performed for this project.

10.19 UNDERGROUND CONSTRUCTION FIRE PREVENTION AND PROTECTION PLAN

This section is not applicable to the tasks being performed for this project.

10.20 COMPRESSED AIR PLAN (HANDLING COMPRESSED GASSES)

The handling of compressed gas cylinders will comply with the requirements established in herein, and those outlined in the AHA for specific tasks. Refer to Section 3.8.7.12 of the SSHP for specifics regarding compressed gas handling at the UFML. All pressure vessels will be designed, inspected, and tested in accordance with American Society of Mechanical Engineers standards. The following applies to the handling of cylinders:

- Prior to the acceptance of a compressed gas cylinder it will be verified that the content has been identified by either labels or stencils. Never accept a cylinder if the contents are not clearly identified. Color coding must not be relied on to identify the contents of a cylinder since universal color coding standards have not been established. Each cylinder must meet the DOT requirements published in 49 CFR Part 178, Subpart C.
- Unless cylinders are firmly secured on a special carrier intended for this purpose, pressure regulators will be removed with valve protection caps in place prior to movement. The preferred equipment for the transport of cylinders is either a hand or fork truck equipped with an appropriate chain or belt for securing the cylinder(s). In the event that a hand or fork truck is not available the cylinder(s) will be moved by tilting and rolling them on their bottom edges.

- Ropes, chains, or slings will not be used to lift cylinders unless provisions have been made at the time of manufacture for appropriate lifting attachments, such as lugs. Where lifting attachments have not been provided, suitable cradles or platforms to hold the cylinders will be used for lifting.
- Personnel should never carry, slide, roll, or drag compressed gas cylinders. Cylinders will not be manually lifted higher than 6 inches or longer than the time required to properly place them into position. A fifty pound per person lifting limit will be adhered to during this activity.
- Cylinders will be secured in the immediate area in which they will be used prior to the removal of protective cylinder caps. These caps will be kept in place during all handling and storage activities regardless if the cylinder is full or empty.
- Suitable pressure relief and regulating devices will be used to protect systems that have a pressure ratio greater or less than the compressed gas supply source. If these devices appear to be damaged or defective in any way, their use will be discontinued until their condition is evaluated. Modification, alteration, and repair of all regulators and pressure relief devices will be done only by qualified personnel.
- Connections that do not fit will not be forced. Threads on regulator connections or other ancillary equipment will match those on cylinder valve outlets. Connections to piping, regulators, and other apparatus will be kept tight to prevent leakage. Where hose is used, it will be kept in good condition.
- Where compressed gas cylinders are connected to a manifold, the manifold and its related equipment will be of proper design for the product they are to contain. Regulators, gauges, hoses and other appliances provided for use with a particular gas, or group of gases, will not be used on cylinders containing gases having different chemical properties unless information obtained from the supplier indicates that this can be done safely.
- All cylinder valves will be opened slowly while keeping the valve outlets pointed away from personnel and sources of ignition. On valves without hand wheels, the wrenches recommended by the gas supplier will be used. On valves with hand wheels, wrenches will not be used. Valve wheels will not be hammered in attempts to open and close the valve.
- Compressed gas will not be used to dust off clothing. This could result in serious injury to the eyes or body, or create a fire hazard.
- When withdrawing a non-liquefied gas from a cylinder, the pressure will not be reduced below 20 pounds per square inch gauge so as to preclude the backflow of atmospheric air or other contaminants into the cylinder.
- When using cylinders in conjunction with a cutting or burning activity they will be placed so that sparks, hot slag, or flames will not reach them. Electrodes will not be struck against a cylinder to strike an ark.
- Before a pressure regulator is removed from a cylinder, the cylinder valve will be closed and the regulator drained of gas pressure.

- Cylinders containing oxygen or combustible gases will not be taken into confined spaces.
- Cylinders used to supply fixed process equipment will never be connected in a rigid manner. Flexible tubing bent in a loop will be used to allow some movement of the cylinder or process equipment.
- Cylinders will be stored in an upright position and secured with chains or straps to prevent them from falling over. The chains or straps should be of sufficient strength and placed high enough on the cylinder to prevent them from tipping over.
- Incompatible gases will never be stored together. Where gases of different types are stored at the same location, the cylinders will be grouped by types of gases, and the groups arranged to take into account the compatibility of the gases. Oxygen cylinders in storage will be separated from fuel gas cylinders or combustible materials by a minimum distance of 20 ft or by a noncombustible barrier at least 5 ft high having a fire resistance rating of at least one half hour.
- Full and empty cylinders will be stored separately so that older containers can be removed first with a minimum handling of other cylinders.
- Cylinders will be stored away from heat sources (never above 125 °F), including steam or hot water pipes, and away from areas where they might be subject to mechanical damage or contact with electrical circuits.
- Cylinders will not be stored near salt or other corrosive chemicals or fumes.
- Corrosion may compromise the integrity of the cylinders and will likely cause the valve caps to stick.
- Acetylene cylinders will always be stored and used in the upright position to minimize the possibility of solvent being discharged and valves becoming clogged.
- Cylinders may be stored outdoors but should be protected from the ground beneath to prevent bottom corrosion. They may also be stored in the sun except in localities where extreme temperatures prevail. If a supplier recommends storage in the shade for a particular gas, such recommendations will be followed.
- Storage of cylinders in indoor locations will occur only in areas where cylinders will not be subject to damage by passing or falling objects, where cylinders could not be knocked over, or subject to tampering by unauthorized personnel. Indoor areas will be well ventilated, well protected, dry, and at least 20 ft from combustible materials such as oil or gasoline. Cylinders will not be kept in unventilated enclosures such as lockers or cupboards.

10.21 FORMWORK AND SHORING ERECTION AND REMOVAL PLANS

This section is not applicable to the tasks being performed for this project.

10.22 LIFT SLAB PLANS

This section is not applicable to the tasks being performed for this project.

10.23 SHP AND SSHP

Refer to Appendix A - SSHP.

10.24 BLASTING PLAN

This section is not applicable to the tasks being performed for this project.

10.25 DIVING PLAN

This section is not applicable to the tasks being performed for this project.

10.26 PLAN FOR PREVENTION OF ALCOHOL AND DRUG ABUSE

Cabrera is committed to providing a safe work environment and to foster the well-being and health of its employees. That commitment is jeopardized when any Cabrera employee uses illegal drugs or alcohol on the job, comes to work with these substances present in his or her body, or possesses, distributes or sells drugs in the workplace. Thus, Cabrera has established a drug-free workplace policy to ensure that we can meet our obligations to our employees, customers, clients and the public.

Illegal drug use and alcohol abuse are incompatible with working at Cabrera. Whenever representing or conducting business for Cabrera or while on Cabrera premises or worksites, no employee may manufacture, use, possess, distribute, sell alcohol or illegal drugs, or report to work with alcohol or illegal drugs present in his or her body. The legal use of prescription drugs is permitted on the job only if it does not impair an employee's ability to perform the essential functions of the job safely and effectively.

Violations of this policy may lead to disciplinary action, including, but not limited to, termination of employment, and/or required participation in a substance abuse rehabilitation or treatment program.

Under the Drug-Free Workplace Act, an employee who performs work for a government contract or grant must notify Cabrera of a criminal conviction for drug-related activity occurring in the workplace within five (5) days of the conviction.

Cabrera offers a confidential Employee Assistance Program (EAP) to all employees and family members. The EAP provides counseling and referral services to employees and family members who are experiencing personal problems that may affect their health and/or work performance such as marital difficulties, stress, financial issues, alcoholism, drug abuse, emotional problems, etc.

10.27 EXCAVATION AND TRENCHING

It is anticipated that excavations will be properly sloped and/or benched back at a minimum of a 1.5:1 ratio, in anticipation of a Class C soil. When performing excavation activities at FSMM, the requirements of EM 385 (2008), Section 25, Excavation & Trenching, and Cabrera OP 583, *Excavation and Trenching* (October 2013), must be followed. The daily excavation safety inspection form can be found in the OP, and as a separate form within Appendix D.

Work in an excavation shall at all times be supervised by a competent person. This individual will remain outside of the excavation at all times, and will be responsible for identifying any unusual developments above ground that may warn of impending earth movement. The competent person shall make daily inspections of excavations, adjacent areas, such as haul roads, and protective systems for evidence of conditions or changing conditions that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. The inspection shall be made prior to the start of work, and as needed throughout the shift. Inspections shall be made after each rainstorm or other hazard increasing event and will be documented using the excavation permit (Appendix D).

Protection shall be provided to prevent personnel, vehicles, and equipment from falling into excavations. Protection shall be provided according to the hierarchy defined by Class I, Class II, and Class III perimeter protection in Section 25.B.01 of the Safety and Health Requirements Manual (USACE, 2008). Excavations shall be backfilled as soon as possible.

Excavation 5 ft deep or greater, will be shored, sloped, or otherwise made safe for entry. Sloping or benching designs for excavations greater than 20 ft deep will be supervised by a registered professional engineer. Protection shall be provided to prevent personnel, vehicles, and equipment from falling into excavations. Protection shall be provided according to the hierarchy defined by Class I, Class II, and Class III perimeter protection in Section 25.B.01 of the Safety and Health Requirements Manual (USACE, 2008). Excavations shall be backfilled as soon as possible.

Employees shall be protected from loose rock or soil that could fall or roll from the excavation face or edge. Such protection could consist of scaling to remove loose materials, or the installation of protective barriers. All spoil shall be placed at least 2 ft from the edge of the excavation. It is strongly recommended that spoil be placed 4 or more ft from the excavation edge so as not to cover surface indicators of subsidence (i.e., fissures or cracks).

No employees shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded provided the vehicles are equipped with a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.

Excavations greater than 4 ft in depth that require personnel to enter will have sufficient means of entry and egress (stairs, ladders, ramps). Ladders will be provided and secured as necessary. Ladders will extend at least 3 ft above grade. Means of entry/egress will not require personnel to travel laterally more than 25 ft.

If excavating equipment is being operated in the vicinity of overhead power lines, the Minimum Safe Work Distances outlined in Cabrera OP 589, Utility Clearance & Isolation, will be used to determine safe working distances. Maintain at least 10 ft from overhead power lines, up to 50 kilovolts. For voltages over 50 kilovolts, add 0.4 inch per kilovolt to obtain the safe distance between equipment and power lines. As a precaution, a spotter must be used at all times when it is possible to violate the minimum distance requirements for overhead utilities.

Before commencing intrusive activities, the existence and location of underground pipes, electrical equipment, telephone, gas lines, etc. must be determined and documented by calling 1.800.272.1000, NJ One-Call Utility Location Service. This call must be made a minimum of

three working days (72 hours) prior to commencement of activities. Additional clearances for privately owned utilities may be required as well.

While on site, the FSM and/or SSHO must conduct a site survey to search for signs of other buried or overhead utilities. This will include areas such as garages, basements, etc. The results of such surveys must be documented in field notes. The property owner or facility operator must be consulted on the issue of underground utilities. All knowledge of past and present utilities must be evaluated prior to conducting work.

As built drawings must be reviewed when available to verify underground utility locations are consistent with the utility location mark-outs. As built drawings may indicate other utilities that need to be identified and marked out. Also, the utility mark-outs should be drawn on a copy of the as builds in case the marks are removed due to the excavation.

If on site subsurface utility locations are in question, contract with a private locating service to verify locations. If digging within 5 ft of known/suspected utility, the line must be exposed to verify its exact location using soft dig techniques, such as hand digging, or air knitting/vacuum extraction. Only hand digging is permitted within 5 ft of underground high voltage, product or gas-lines. Once the line is exposed, heavy equipment can be used but must remain at least 5 ft from the exposed line.

10.27.1 Heavy Equipment Operations

There are various types of heavy construction equipment, such as excavators, hoe rams, concrete crushers, front-end loaders, and other equipment that may be using during the execution of this project. All operators of this equipment must be familiar with the requirements for inspection and operation of the equipment they will be using. Before equipment is placed into use, it will be inspected by the operator to ensure that it is in safe operating condition using the heavy equipment inspection form located in Appendix D. The following guidelines will be adhered to while operating heavy construction equipment:

- Operators will be qualified in conformance with the Safety and Health Requirements Manual (USACE, 2008).
- Equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded.
- Getting off or on any equipment while it is in motion is prohibited.
- Equipment will be operated in accordance with the manufacturer's instructions and recommendations.
- Determinations of road conditions and structures will be made in advance to assure that clearances and load capacities are safe for the passage of equipment.
- All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Equipment designed to be serviced while running is exempt from this requirement.
- Buckets, blades, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls will be in a neutral position,

with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

- No guard, safety appliance, or device will be removed from machinery or equipment, or made ineffective except for making immediate repairs, lubrications, or adjustments, and then only after the power has been shut off. All guards and devices will be replaced immediately after completion of repairs and adjustments and before power is turned on.
- Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shut off that prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.
- Each piece of heavy equipment and other similar equipment will be equipped with at least one dry chemical or carbon dioxide fire extinguisher with a minimum rating of 10 B:C.
- Back up alarms will be used on equipment as required by the Safety and Health Requirements Manual (USACE, 2008).
- Personnel will not work, pass under, or ride in the buckets or booms of loaders in operation.
- All self-propelled construction equipment with an obstructed rear view, whether moving alone or in combination, must be equipped with a reverse signal alarm.
- Seat belt use is required while operating equipment.

Spotters for tight areas, overhead and underground utilities, excavation limits, etc., will be the only personnel allowed in the vicinity of the heavy equipment (essential employees). Spotters will stay out of the boom and swing radius of the equipment. The swing radius will be clearly delineated by caution tape or flags.

All non-essential personnel will maintain a safe clear distance of at least 50 ft, plus the maximum swing radius of the piece of equipment being used. Personnel needing to approach heavy equipment while it is in operation will observe the following protocols:

- Make eye contact with the operator (and spotter).
- Signal the operator to cease heavy equipment activity and place bucket on ground.
- Approach the equipment only after the operator has given a signal to do so.

For additional information on the safe operation of heavy equipment, and the safety procedures to be followed when working in the vicinity of heavy equipment, refer to Cabrera OP 584, *Heavy Equipment*, and the AHA for the specific task being performed.

10.28 SITE SPECIFIC FALL PROTECTION AND PREVENTION PLAN

Those activities with fall hazards greater than 6 ft include railcar loading operations, excavation/leading edge work, use of man-lifts/bucket trucks, and water treatment operations. The competent person is responsible for establishing fall protection controls for each activity

where a fall hazard exists. The preferred hierarchy for establishing fall protection for each activity where a fall hazard exists is as follows, in order of importance (USACE, 2008):

1. **Elimination:** Remove the hazard from work areas or change task, process, controls, or other means to eliminate the need to work at heights and subsequent exposure to fall hazards (i.e., build roof trusses on ground level and then lift into place or design change by lowering a meter or valve at high locations to a worker's level).
2. **Prevention (traditional or same-level barrier):** isolate and separate fall hazards from work areas by erecting same level barriers, such as guardrails, walls, covers or parapets.
3. **Work Platforms (movable or stationary):** Use scaffolds, scissors lifts, or aerial lift equipment to facilitate access to work location and to protect workers from falling when performing work at high locations.
4. **Personal Protective Systems and Equipment:** Use of fall protection systems, including restraint, positioning, or personal fall arrest (i.e., requiring the use of full body harness, lanyard, and lifeline).

At any time when a fall hazard at heights greater than 6 ft arises, the Competent Person will make a determination for the appropriate fall protection that will be necessary. No work may be performed on or near the fall hazard until workers are protected. All inspection, maintenance and storage of fall protection equipment will be performed in accordance with Cabrera OP 585, *Fall Protection*.

10.28.1 Railcar Loading Operations Fall Protection

The FMSS project's primary task consists of the removal and off-site disposal of radiological contaminated soil. This is accomplished through excavating the soils and then loading the excavated soils into gondola railcars for transport and disposal.

A fall protection system is required to protect individuals from injury while working on top of filled gondola railcars. The process of filling and securing of the railcars require the following steps:

1. Workers line the empty railcar with a synthetic liner, which overlaps the sides of the car.
2. Workers place contaminated soil into the railcar using a front end loader.
3. Workers pull and wrap the liner over the contaminated soil.
4. Workers secure the liner over the contaminated soil using straps and wire ties.
5. Workers inspect the encapsulated soil, measure the wrapped soil (referred to as a "soil burrito"), and then scan the surface of the liner for radiological readings.

Working on top of the railcars is an identified fall hazard at heights greater than 6 ft. This work includes laborers installing and closing the railcar liners, radiological technicians performing radiological surveys, and quality control personnel inspecting loads for shipment. The Competent Person has made a determination that all activities performed in or on top of railcars require the use of the personal fall arrest systems.

Per requirements specified in EM 385-1-1 (USACE, 2008), a horizontal rigid rail fall arrest system with an SRL is in use. The horizontal rigid track system had been chosen due to

environmental conditions (year round exposure to the elements) and fall clearance considerations (minimum clearance requires 6.5 ft, if fall should occur on bulkhead side of the railcar). A horizontal rigid track system (fall arrest system) is provided for work being performed in and on top of railcars to protect the individuals working at heights.

This system was designed to meet ANSI/ASSE Z359.1 (2007a) load bearing requirements for certified fall arrest systems by a licensed Professional Engineer in the state of New Jersey. The horizontal rigid track system chosen has been installed by FallProof Networks Systems, Inc. All other components of the fall arrest system will be stamped, indicating that each manufactured component meets the Occupational Safety and Health Administration/ANSI load bearing requirement of 5,000 pounds.

The calculated clearance is 9.5 ft, top of railcar to ground surface and 6.5 ft, top of railcar to elevated bulkhead platform. A SRL fitted onto the system provides for the adequate clearance needed (4.5-ft deceleration distance and D-ring slide, plus the safety factor of 2 ft) to stop a falling worker from reaching the next lower level.

The procedure for protecting workers from falls and preventing falls using the horizontal rigid track system as part of the railcar load-out activity is as follows:

1. The maximum number of workers allowed on each span is limited to four. Each span (length between cantilevers) has been designed with a safety factor of two to support an impact force of up to four persons simultaneously falling at the same time.
2. Verify workers have been trained in the recognition of the fall hazards in the work area.
3. Limit access of immediate railcar area to Competent Persons and Authorized Persons/Authorized Rescuers.
4. Authorized Persons inspect (daily visual, documented monthly using inspection form) and don full body harnesses. The inspection requirements outlined in Cabrera OP 585, *Fall Protection*, and the manufacturer's instructions. The Authorized Persons will use the following procedure, at a minimum:
 - Visually inspect D-ring, buckles, straps, and webbing for deformities, burns, and tears.
 - Inspect the labels: all labels should be present and legible.
 - Remove all objects from front pant pockets.
 - Hold harness by back D-ring and make certain straps are not twisted.
 - Don harness from top to bottom, first slipping arms into shoulder straps.
 - Adjust chest strap.
 - Buckle and adjust leg straps, snug not tight.
 - Set trauma suspension safety straps while standing fully erect, when set, re-place in keepers.
 - Perform buddy checks for proper fit.

5. Authorized Persons inspect and hook-up the Self Retracting Lifelines (SRLs); however, the Competent Person will inspect the SRL housing on an annual basis due to inaccessibility. The manufacturer's instructions and recommendations must be followed for the inspection, use, maintenance, and storage of SRLs. The Authorized Persons will use the following procedure, at a minimum:
 - Pull down SRL lanyard with pole.
 - Visually inspect synthetic lanyard for burns, tears, fraying, etc.
 - Visually and physically inspect snap hook on SRL for smooth operating and complete locking mechanism.
 - Connect SRL snap hook to dorsal D-ring.
 - Perform buddy checks to check for proper connection of snap hook to D-ring.
6. Authorized Persons to climb-up railcar ladder and perform work activities. Keep away from edge of railcar whenever possible to minimize fall hazard potential.
7. Authorized Persons to climb-down railcar ladder after completing work activities.
8. Authorized Persons to disconnect from SRL, using the following procedure, at a minimum:
 - When removing SRL lanyard from D-ring to return to housing, do not allow instant release (may cause damage to retracting mechanism of SRL).
 - Use pole to release lanyard back to housing.
 - At no point allow SRL lanyard exposed and/or attached to any object.
 - Always return SRL lanyard to housing when not in use.
 - Do not remove SRL from horizontal rigid track system.
9. Authorized Persons to doff harness for maintenance and proper storage.
 - Remove harness while preventing twisting and knotting of straps.
 - Scan harness for radiological contamination/visually inspect for dirt, grease, chemical contamination.
 - Clean harness as necessary following manufacturer's recommendations.
 - Store harness (hang-up) in designated indoor location.
10. The following rescue procedure will be used in the event of a fall from the railcar:
 - Perform self-rescue: fallen worker climbs or pulls him/herself to safety.
 - Assist in self rescue: suspended worker to call out for assistance and then deploy suspension trauma safety straps; Authorized Rescuer to provide, hold, and stabilize ladder next to suspended worker to allow for climbing down to ground level.

10.28.2 Excavation/Leading Edge Fall Protection

Work performed near or adjacent to excavations greater than 6 ft in depth is an identified fall hazard. The Competent Person has made a determination that these activities require the use of at least one of the following controls:

- Construct guardrails or fencing around the perimeter of the excavations. Perimeter protection will be provided as required by EM 385-1-1 (USACE, 2008).
- Provide a Warning Line System meeting the requirements of EM 385-1-1 (USACE, 2008), as appropriate.
- Provide workers with travel restraint systems, when working between the Warning Line System and the edge of the excavation.
- Backfill excavations to grade as soon as possible to eliminate the fall hazard.

10.28.3 Water Treatment System Fall Protection

Working on top of the various water treatment system components may be an identified fall hazard at heights greater than 6 ft. The Competent Person has made a determination that these activities require the use of at least one of the following controls:

- Use the guardrails provided on stairs and top of the frac-tanks to prevent falls over the side.
- Provide workers with fall restraint systems when working on top of the frac-tanks to prevent falls into the man-way.
- Use the guardrails provided on the water treatment systems to prevent falls over the side of work platforms.

10.28.4 Fall Protection Rescue

The use of the personal fall arrest systems when working in or on top of railcars requires that rescue plans and procedures be in place prior to commencing work. When a fall occurs, potential rescuers in their panic can overlook important steps in their training. For this reason, it is crucial to keep rescue procedures as simple as possible, putting the fewest workers at risk. Competent Rescuers and Authorized Rescuers are trained in the “Hierarchy of a Rescue.” The preferred hierarchy of rescue is as follows; however, procedures one and two will primarily be used at FMSS:

1. Self-rescue (climbing or pulling oneself to safety back onto/into the railcar).
2. Assisted self-rescue (deployment of suspension trauma safety straps and ladders).
3. Mechanically aided rescue (man-lift).
4. Rescue pick-off (almost never).

Self Rescue

Most rescues will be carried out by a self-rescue. Depending on the type of equipment, the worker may fall anywhere between a few inches to a few ft. For example, the FallProof Rigid

Track System used for the FMSS railcar load-out activity includes 4.5 ft total fall distance while attached to the self-retracting lanyard; this distance includes a D-ring slide. The worker should be suspended high enough to pull themselves back onto the railcar.

Assisted Self Rescue

In the case of an assisted self-rescue, all fall arrest harnesses, by design, are equipped with suspension trauma safety straps. All Authorized Persons will be trained how to deploy and use the suspension trauma safety straps to reduce the potential of injury while assisted self-rescue is in progress. A ladder will be kept proximate to the fall arrest system where it will be readily available for an assisted self-rescue in the event of a fall. The rescue will be performed by an Authorized Rescuer positioning a ladder adjacent to the suspended worker to step on to. This ladder will be designated only for fall assisted rescue and for no other activities. The ladder will be inspected by the Railcar Load-out Lead Laborer as required by Cabrera OP 568, *Ladder Safety* (daily visual and documented monthly).

Mechanically Aided Rescue

If a ladder is not practical for an assisted rescue, a dedicated man-lift will be kept on site for the duration of the activity where the fall hazard is present. No work, involving the use of fall arrest systems, will be performed if these rescue procedures cannot be implemented.

10.29 STEEL ERECTION PLAN

This section is not applicable to the tasks being performed for this project.

10.30 NIGHT OPERATIONS LIGHTING PLAN

While night operations are not anticipated as part of the current SOW, supplemental lighting may be required on certain work areas within the MISS, and possibly the excavation areas, to meet the lm/ft² requirements in early morning and late evening hours of operation. Work schedules will be adjusted to ensure adequate daylight is present during operations, and in areas where operations are deemed critical, and are in need of the supplemental lighting, monitoring will be performed to determine the need, and verify adequacy.

All project lighting will adhere to the requirements set forth in Section 7 of EM 385-1-1, specifically in table 7-1. All interior work areas will be fully illuminated to the proper work requirements, including emergency exits. Lamps shall be protected from accidental contact or breakage by ensuring they are affixed/situated at an elevation above 7-ft from the normal working surface, and will be equipped with guard/cage.

10.31 SITE SANITATION PLAN

Smoking, Eating and Drinking

Personnel actively involved in the performance of activities within the Exclusion Zone (e.g., HAZWOPER Controlled work areas) will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks. Eating and drinking will be permitted only in designated areas at the project site. Smoking will be permitted only in designated areas giving primary consideration to those personnel who do not smoke.

Water Supply

Water supplies will be available for use on site and will comply with the following requirements.

Potable Water

Drinking water: An adequate supply of cool water will be supplied and will be kept in water coolers in the support zone on-site. The water cooler will be kept closed. Personnel will be instructed to wash their face and hands prior to drinking.

Potable water can be provided in the form of approved well or city water, bottled, or drinking fountains. Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.

Non-Potable Water

Non-potable water maintained at the project site and all outlets dispensing non-potable water should have posted the following: “CAUTION – WATER UNSAFE FOR DRINKING, WASHING, OR COOKING.” Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers/supplies of non-potable water used will be properly identified/labeled as such.

Toilet Facilities

Chemical toilet(s) will be available on-site. The toilet will be equipped with toilet paper, toilet paper holder, locking door, and adequate ventilation. Toilet facilities will be available for site personnel and visitors. Should subcontractor personnel be located on-site for extended periods, it may become necessary to obtain temporary toilet facilities.

Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

A minimum of one toilet will be provided for every 20 site personnel, with separate toilets maintained for each sex, except where there are less than five total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities (e.g., gas station, or rest stop), on site facilities are not required.

Washing Facilities

Site personnel will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday. Cleaning supplies at project sites will consist of soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacterial gels, wipes, etc.).

General Work Areas

At all times, work areas will be kept free of dirt and debris that may impact the safety of site personnel and visitors. All trash receptacles will be regularly emptied.

Break Areas and Lunchrooms

Site personnel will observe the following requirements when using break areas and lunchrooms at project sites:

- All food and drink items will be properly stored when not in use;
- Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation;
- Perishable foods will be refrigerated whenever possible;
- All waste food containers will be discarded in trash receptacles;
- All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times;
- Refrigerators used to store food items will be maintained at 45 °F and emptied of all unclaimed food items weekly; and
- Routine cleaning of refrigerators will also be performed on a regular basis.

10.32 FIRE PREVENTION AND PROTECTION PLAN

Fire prevention and protection procedures/resources at the project as follows:

- The Maywood, Lodi, or Rochelle Park Fire Departments are the available fire fighting services.
- Fire extinguishers (10 lbs ABC) will be securely mounted on all heavy equipment, as well as in Cabrera controlled office facilities. All project vehicles shall be equipped with fire extinguishers.
- The UMFL will be equipped with CO extinguishers only. Dry chemical extinguishers can cause severe chemical reactions with laboratory reagents.
- Hot Work Permits are required before flame or spark producing activity is to commence. Refer to Cabrera OP 594, *Hot Work*, and the task specific AHA, for additional information and safety precautions while performing these tasks.
- Flammable and oxidizing materials are to be stored in marked flammable storage cabinets in “No Smoking” areas with fire extinguishers available.
- Smoking will only be permitted in designated areas.
- Project personnel are only permitted to extinguish fires in their incipient stages and only if they have received fire extinguisher training within the last year. Fighting fires is prohibited by project personnel and will only be performed by the local fire department.

In the event of a fire or explosion at the site, the following actions will be implemented:

- Evacuate all personnel to a safe location upwind or crosswind of the incident. Contact the PM and SSHO.
- If personnel are present who have had training in the use of fire extinguishers, use available fire extinguishers to extinguish fires in their incipient stages.
- Alert the local fire department by calling 911.

- Document the incident in the field logbook and follow the procedures for incident reporting.

10.33 WILD LAND FIRE MANAGEMENT PLAN

This section is not applicable to the tasks being performed for this project.

10.34 PRE-CAST CONCRETE PLAN

This section is not applicable to the tasks being performed for this project.

10.35 HEAT/COLD STRESS MONITORING PLAN

It is anticipated that some form of either heat and/or cold stress monitoring will be conducted by the SSHO during the course of site activities. All Heat Stress Monitoring will be conducted per accordance with Cabrera OP 563, *Heat Stress* (Appendix C), using either the Wet Bulb Globe Thermometer (WBGT) or Adjusted Temperature methods. The WBGT Method has been described below.

10.35.1 Heat Stress

The SSHO will measure WBGT readings as well as monitor workers for physiological signs of heat stress. Workers will be trained on the symptoms of heat stress. Experience has shown that the following work/rest regimen (see Table 10-1) is appropriate for field workers performing various degrees of work while wearing Level D.

Heat stress is a general term used to describe one or more of the following heat-related disabilities and illnesses:

Heat Cramps - a condition characterized by painful, intermittent spasms of the voluntary muscles following hard physical work in a hot environment. Cramps usually occur after heavy sweating and often begin at the end of a work shift.

Heat Exhaustion - a condition characterized by profuse sweating, weakness, rapid pulse, dizziness, nausea, and headache. The skin is cool and sometimes pale and clammy with sweat. Body temperature is normal or subnormal. Nausea, vomiting, and unconsciousness may occur.

Heat Stroke - a condition in which sweating is diminished or absent. The skin is hot, dry, and flushed. Increased body temperature, if uncontrolled, may lead to delirium, convulsions, coma, and even death. Medical attention is needed immediately.

Work/Rest regiments will be established by the SSHO prior to the start of daily activities when WBGT exceeds 20 °C / 68 °F. This will involve limiting the work/rest regimen so that after one minute of rest, a person's heart rate does not exceed 110 beats per minute. If the heart rate is higher than 110 beats per minute after 1 minute of rest, the next work period will be shortened by 33%, while the length of the rest period stays the same. Work-rest regiments based on WBGT Temperatures are outlined below.

Table 10-1: Screening Criteria for Heat Stress Exposures
WBGT¹ values expressed in °C/°F², Source: ACGIH 2008 TLVs³ and BEIs⁴

(WBGT) TEMPERATURE FOR TYPE OF WORK LOAD (°C / °F)			
ACCLIMATIZED			
Work / Rest Ratio (per hour)	Light	Medium	High
60 / 0	31 / 88	28 / 82.5	26 / 79
45 / 15	31 / 88	29 / 84	27.5 / 81.5
30 / 30	32 / 89.5	30 / 86	29 / 84
15 / 45	32.5 / 90.5	31.5 / 89	30.5 / 87
NON-ACCLIMATIZED			
Work / Rest Ratio (per hour)	Light	Medium	High
60 / 0	28 / 82.5	25 / 77	22.5 / 72.5
46 / 15	28.5 / 83.5	29 / 79	24 / 75
30 / 30	29.5 / 85	27 / 80.5	25.5 / 78
15 / 45	30 / 86	29 / 84	28 / 82.5

¹Wet-Bulb Globe Temperature

² Degrees Centigrade/Degrees Fahrenheit

³Threshold Limit Values

⁴ BEI = Biological Exposure Index

⁵ACGIH = American Conference of Governmental Industrial Hygienists

Table 10-2 lists work demand categories in assessing heat strain in workers.

Table 10-2: Work Demand Categories
(Source: ACGIH 2002 TLVs and BEIs)

CATEGORIES	EXAMPLE ACTIVITIES
Resting	Sitting quietly
	Sitting with moderate arm movement
Light	Sitting with moderate arm movement
	Standing with light work at machine or bench while using arms
	Using table saw
Moderate	Standing with light or moderate work at machine or bench and some walking
	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
Heavy	Walking on level at 6 km/hr (3.7 mph) carrying 3 kg (6.6 lbs.) weight load
	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous basis
Very Heavy	Intermittent heavy lifting with pushing or pulling (e.g., pick and shovel work)
	Shoveling wet sand

km/hr=Kilometers per hour

mph=miles per hour

kg=kilograms

lbs=pounds

10.35.1.1 Heat Stress Prevention

Resting frequently in a shaded area and consuming large quantities of fresh, potable water can help to prevent heat stress. Dilute electrolytic beverages, such as Gatorade[®], may be used as a secondary source of fluid replacement. The following practices will help prevent heat stress:

- Acclimatize workers to hot working conditions.

- Provide plenty of liquids to replace the body fluids lost by perspiration. Fluid intake should be forced because, under conditions of heat stress, the normal thirst mechanism is not adequate to bring about a voluntary replacement of lost fluids.
- Provide personal cooling devices.
- Conduct strenuous field operations in the early morning and provide shade when possible.
- Train personnel to recognize the signs and symptoms of heat strain, its prevention, and treatment.
- Rotate personnel to various job duties and establish adequate work/rest cycles.
- Provide shade or shelter during rest periods.

10.35.1.2 Heat Stress Treatment

Individuals or coworkers showing the symptoms of heat strain shall notify the SSHO or FSM immediately. At the onset of heat-related illness, activities must be halted and treatment initiated. Early detection and treatment of heat strain helps to prevent further serious illness or injury. Individuals that have experienced heat-related illness can become more sensitive and predisposed to additional heat strain-related problems.

Heat exhaustion can be alleviated by having the affected person rest in a cool, shaded location and have them drink cool water. In a heat stroke situation, the body must be cooled immediately to prevent severe injury or death. *Medical attention must be immediately obtained.* To cool down the affected person's body,

- Remove impermeable PPE,
- Remove the worker from direct sunshine,
- Apply copious amounts of cool, not cold, water on them, and
- Have them drink cool water, not cold, if conscious.

10.35.1.3 Acclimatization

Physiologically adjusting or acclimatizing personnel to hot conditions is extremely important. NIOSH recommends a progressive six day acclimatization period for un-acclimatized workers before allowing them to work at their full capacity. Under this regimen, the first day of work in hot temperatures is completed at only 50% of the anticipated workload and exposure time, and 10% is added each day through day six. Six days should be considered the average time needed for worker acclimatization due to each individual's physical condition and their ability to adjust to hot and humid environments. It is important to note that employees can lose their acclimatization in a matter of days during time off from work and cooler weather.

10.35.1.4 Physiological Monitoring

In addition to use of a WBGT, the SSHO will monitor workers for physiological signs of heat stress. Workers will be encouraged to be aware of their own physiological responses after receiving proper training. Adequate work/rest periods shall be implemented as necessary to prevent heat strain on personnel. Cabrera will utilize physiological monitoring to determine the effectiveness of the work/rest regiment and aid in measuring each individual's response to heat

stress when ambient temperatures exceed 85 °F. One of two physiological parameters that individuals will monitor are:

- **Heart Rate.** Each individual will count their radial (wrist) pulse for 30 seconds (or use a heart rate wristwatch) to determine their heart rate as early as possible in the first rest period. If the heart rate of any individual exceeds 110 beats per minute at the beginning of the rest period, then the work cycle shall be decreased by one third. The rest period will remain the same.
- **Ear Temperature.** Each individual will measure their ear temperature with a thermometer as early as possible in the first rest period. If the ear temperature exceeds 99.6 °F at the beginning of the rest period, then the work cycle shall be decreased by one third. The rest period will remain the same.

Physiological information will be recorded on the Heat Stress Monitoring Log (Appendix D) by the crew leaders and turned into the SSHO on a daily basis (when required).

10.35.2 Cold Exposure

If fieldwork is conducted during the cold weather months, measures will be taken to protect against the cold. Exposure to cold temperatures increases the likelihood and potential for worker disorders that could result in injury or illness. Extremely low temperatures may not be the only element necessary to create the potential for cold exposure disorders or conditions; strong wind accompanied by cold temperatures can lead to these types of disorders or conditions.

The wind chill factor is the cooling effect of any combination of temperature and wind velocity or air movement. Consult the wind chill index (Table 10-3) when planning for exposure to low temperatures and wind. The wind chill index does not take into account the specific part of the body exposed to cold, the level of activity that affects body heat production, or the amount of clothing being worn.

The human body senses “cold” as a result of both the air temperature and wind velocity. Cooling of exposed flesh increases rapidly as the wind velocity goes up. Frostbite can occur at relatively mild temperatures if wind penetrates the body insulation. For example, when the actual air temperature of the wind is 40 °F (4.4 degrees centigrade [°C]) and the velocity is 30 miles per hour (48 kilometers per hour), the exposed skin would perceive this situation as equivalent to a still air temperature of 13 °F (-11 °C).

The generally recognized cold disorders or conditions are twofold.

Frostbite - The freezing of tissue, most commonly affects the toes, fingers, and face.

Hypothermia - Systemic hypothermia occurs when body heat loss exceeds body heat gain and the body core temperature falls below the normal 99 °F.

Contributing factors to these disorders or conditions are:

- Exposure to humidity
- High winds
- Contact with wetness
- Inadequate clothing

- Poor worker health

The presence of dead air space between the warm body and clothing and the outside air is essential. Many layers of relatively light clothing with an outer shell of windproof material maintains body temperature much better than a single heavy outer garment worn over ordinary indoor clothing. The more air cells each clothing layer has, the more efficiently it insulates against body heat loss. Clothing also needs to allow some venting of perspiration. In addition to adequate clothing, whenever possible, make full use of windbreaks and heat tents.

Table 10-3: Wind Chill Factors
(Source: National Weather Service 2012)

Temperature (°F)

	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45		
Wind Speed (miles per hour)	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63	5
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72	10
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77	15
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81	20
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84	25
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87	30
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89	35
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91	40
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93	45
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95	50
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97	55
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98	60

Wind Chill Formula: $T_{(wc)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Frost Bite Times	30 Minutes	10 Minutes	5 Minutes
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10.36 LABORATORY SAFETY

Refer to Section 3.8 of the SSHP for information regarding laboratory safety for the FMSS

11.0 RISK MANAGEMENT PROCESS

The primary means of managing risk on this project will be accomplished through the implementation of the hazard analysis process prior to the initiation of the specific task. The hazard analysis process has been completed for the five primary/major tasks, and a series of subtasks that occur under them, that have been deemed necessary to have individual AHAs developed. The AHAs can be found as Appendix A of the SSHP. An overall break-down of the task structure, and the AHAs developed for the work is as follows:

1. Mobilization/Demobilization (AHA 1.0)
 - 1.1 General Site Work (AHA 2.0)
2. Excavation of Impacted Soils
 - 2.1 Clearing & Grubbing (AHA 3.0)
 - 2.2 Excavation & Backfilling (AHA 4.0)
 - 2.3 Culvert & Road Bypass (AHA 5.0)
 - 2.4 Site Restoration (AHA 6.0)
3. Waste Management (Load-out and Waste Handling)
 - 3.1 Waste Soil/Debris Handling at MISS (AHA 7.0)
 - 3.2 Soil Load-out (AHA 8.0)
 - 3.3 Wastewater Management (AHA 9.0)
 - 3.3.1 Confined Space Entries (AHA 10.0)
4. Radiological Surveys & Sampling
 - 4.1 Radiological Surveys (AHA 11.0)
 - 4.2 Radon/Thoron Sampling (AHA 12.0)
 - 4.3 Groundwater Sampling (AHA 13.0)
 - 4.4 Surface Water & Sediment Sampling (AHA 14.0)
5. On-site Laboratory Operations (AHA 15.0)

Evaluation and management of potential risks is conducted through the preparation of AHAs. AHAs have been prepared for each of the above tasks. The AHAs, which are presented in Attachment A of the SSHP, describe the hazards associated with each step required to perform the task and define the appropriate safety controls.

Should revisions to an existing AHA or the creation of a new AHA be needed they will be prepared by a competent person familiar with the type of work to be conducted. Action levels for direct measurements are summarized in Table 4-5 of the SSHP.

12.0 REFERENCES

- American Conference of Governmental Industrial Hygienists (ACGIH), 2010, *Threshold Limit Values and Biological Exposure Indices*, Cincinnati, Ohio.
- American National Standards Institute (ANSI), 1992, *Standard Practice for Respiratory Protection*, Z88.2, New York, New York, May 19.
- American National Standards Institute (ANSI), 2006, *American National Standard-Construction and Demolition Operations- Safety Requirements for Powder-Actuated Fastening Systems*, ANSI/ASSE A10.3, New York, New York.
- American Society of Mechanical Engineers, 2007, *Boiler and Pressure Vessel Code – 2007 Edition*.
- Bechtel National, Incorporated, 1992, *Remedial Investigations Report for the Maywood Superfund Site, Maywood, New Jersey*, DOE/OR/21949-337, prepared for the U.S. Department of Energy, Oak Ridge Operations Office, under contract No. DE-ACO5-9OR21949, December.
- Bechtel National, Incorporated, 1993, *Health and Safety Plan for the Remedial Investigation/Feasibility Study - Environmental Impact Statement for the Maywood Superfund Site*
- Code of Federal Regulations (CFR), Title 10, Part 20, *Standards for Protection Against Radiation*, U.S. Government Printing Office, Washington, D.C., June 11, 2010, <http://www.access.gpo.gov/nara/cfr/waisidx_10/10cfr20_10.html> (December 2010).
- Code of Federal Regulations (CFR), Title 29, Part 1910, *Occupational Safety and Health Standards*, U.S. Government Printing Office, Washington, D.C., July 1, 2003, <<http://www.access.gpo.gov/nara/cfr/index.html>> (October 2010).
- Code of Federal Regulations (CFR), Title 29, Part 1926, *Safety and Health Regulations for Construction*, U.S. Government Printing Office, Washington, D.C., July 1, 2003, <<http://www.access.gpo.gov/nara/cfr/index.html>> (October 2010).
- Code of Federal Regulations (CFR), Title 40, Part 61, *National Emission Standards for Hazardous Air Pollutants*, U.S. Government Printing Office, Washington, D.C., August 17, 2010, <http://www.access.gpo.gov/nara/cfr/waisidx_10/40cfr61_10.html> (October 2010).
- Code of Federal Regulations (CFR), Title 49, Part 172, *Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans*, U.S. Government Printing Office, Washington, D.C., March 5, 2010, <http://www.access.gpo.gov/nara/cfr/waisidx_09/49cfr172_09.html> (October 2010).
- Code of Federal Regulations (CFR), Title 49, Part 178, *Specifications for Packagings*, U.S. Government Printing Office, Washington, D.C., March 5, 2010, <http://www.access.gpo.gov/nara/cfr/waisidx_09/49cfr178_09.html> (October 2010).
- McCully, R., 1992, Letter Correspondence from Ruth McCully, Director OSHA Office of Health Compliance Assistance to Richard Schreiber, Environmental Specialist, Georgia Radon Program, OSHA, October 6.

National Council on Radiation Protection and Measurements, 1987, Report No. 93, Ionizing Radiation Exposure of the Population of the United States.

National Institute for Occupational Safety and Health (NIOSH)/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard/U.S. Environmental Protection Agency (USEPA), 1985, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, October.

National Weather Service, 2012, Wind Chill Temperature Index Table, National Oceanic & Atmospheric Administration, www.nws.noaa.gov/om/windchill/index.shtml, November 2012.

Shaw Environmental, Inc. (Shaw), 1999, *Draft Background Data Summaries FUSRAP Maywood Superfund Site*, Maywood, New Jersey.

Shaw Environmental, Inc. (Shaw), 2003, *Chemical Data Quality Management Plan*, Revision 1, Maywood, New Jersey, September.

Stone & Webster, 1999, *FUSRAP Maywood Superfund Site General Environmental Protection Plan*, Revision 0, November.

U.S. Army Corps of Engineers (USACE), 2008, *Safety and Health Requirements Manual*, Safety, EM 385-1-1, Washington, D.C., September 15.

U.S. Army Corps of Engineers (USACE), 2010, *Ionizing Radiation Protection*, Safety, ER 385-1-80, Washington, D.C., June 30.

U.S. Department of Energy (DOE), 1995, *Engineering Evaluation/Cost Analysis for the Cleanup of Residential and Municipal Vicinity Properties at the Maywood Superfund Site*, Bergen County, New Jersey, September.

U.S. Environmental Protection Agency (USEPA), 1989, Letter Correspondence from the USEPA to the Stepan Company, *Presence of hazardous substances, pollutants, or contaminants in the groundwater and soil on the Stepan Company property*, Washington, D.C., January 6.

U.S. Environmental Protection Agency (USEPA), 1990, *The Clean Air Assessment Package-1988 (CAP-88) A Dose and Risk Assessment Methodology for Radionuclide Emissions to Air*, Volume 2, Appendices A – H, Washington, D.C., October.

**APPENDIX A
SITE-SPECIFIC HEALTH AND SAFETY PLAN**

SITE SAFETY & HEALTH PLAN

FUSRAP MAYWOOD SUPERFUND SITE MAYWOOD, NEW JERSEY

**SITE-SPECIFIC ENVIRONMENTAL RESTORATION
CONTRACT NO. W912DQ-13-D-3016 TASK ORDER 001**

Prepared for



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**December 2013
Revision 1**

APPROVALS

SITE-SPECIFIC SAFETY AND HEALTH PLAN

FUSRAP Maywood Superfund Site Maywood, New Jersey

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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 INTRODUCTION	1-1
1.1 General	1-1
1.2 Site Location and Description	1-1
2.0 SITE INFORMATION	2-1
2.1 Previous Investigations	2-1
2.2 Previously Collected Monitoring Data from Lab	2-6
3.0 GENERAL SAFTY RULES & PHYSICAL HAZARDS	3-1
3.1 General Safety Rules	3-1
3.1.1 <i>Housekeeping</i>	3-1
3.1.2 <i>Smoking, Eating, or Drinking</i>	3-1
3.1.3 <i>Personal Hygiene</i>	3-1
3.1.4 <i>Buddy System</i>	3-2
3.2 Stop Work Authority	3-2
3.3 Physical Hazards	3-2
3.3.1 <i>Slips, Trips, Falls, and Protruding Objects</i>	3-2
3.3.2 <i>Manual Lifting</i>	3-3
3.3.3 <i>Utility Hazards</i>	3-3
3.3.4 <i>Electrical hazards</i>	3-4
3.3.5 <i>Lock-Out/Tag-Out Procedures</i>	3-4
3.3.6 <i>Heavy Equipment and Vehicle Operations</i>	3-5
3.3.7 <i>Excavations and Trenches</i>	3-5
3.3.8 <i>Confined Space Entry</i>	3-6
3.3.9 <i>Working At Heights</i>	3-6
3.3.10 <i>Working Near Railroad Hazards</i>	3-7
3.3.11 <i>Dust and Odor Control</i>	3-8
3.3.12 <i>Spill Prevention</i>	3-9
3.3.13 <i>Noise Exposure Monitoring</i>	3-9
3.3.14 <i>Traffic Control</i>	3-10
3.4 Unexploded Ordnance	3-10
3.4.1 <i>Recognize, Retreat, Report</i>	3-10
3.5 Biological Hazards	3-10
3.5.1 <i>Small Mammals</i>	3-11
3.5.2 <i>Venomous Animals</i>	3-11
3.5.3 <i>Poisonous Plants</i>	3-11
3.5.4 <i>Insects</i>	3-12
3.6 Ultraviolet Hazards	3-13
3.7 Weather Hazards	3-13

TABLE OF CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
3.8	Laboratory Safety	3-14
3.8.1	<i>Laboratory Chemicals/Hazard Communication Program.....</i>	<i>3-14</i>
3.8.2	<i>Chemical and Radiological Hazards.....</i>	<i>3-14</i>
3.8.3	<i>Chemical and Radiological Hazard Controls</i>	<i>3-15</i>
3.8.4	<i>Additional Personal Protective Equipment</i>	<i>3-15</i>
3.8.5	<i>Engineering Controls</i>	<i>3-16</i>
3.8.6	<i>Emergency Shower and Eyewash.....</i>	<i>3-19</i>
3.8.7	<i>Laboratory Safe Work Practices</i>	<i>3-20</i>
4.0	CHEMICAL & RADIOLOGICAL HAZARDS	4-1
4.1	Chemical Exposure Hazards.....	4-1
4.1.1	<i>Heavy Metals</i>	<i>4-1</i>
4.1.2	<i>Organic Solvents</i>	<i>4-1</i>
4.2	Radiological Hazards.....	4-5
4.2.1	<i>Perspective on Occupational Radiation Exposure.....</i>	<i>4-6</i>
4.2.2	<i>Naturally Occurring Radioactive Material (NORM).....</i>	<i>4-8</i>
4.3	Exposure Monitoring.....	4-8
4.3.1	<i>Health and Safety Action Levels.....</i>	<i>4-9</i>
4.3.2	<i>Monitoring Equipment.....</i>	<i>4-9</i>
4.3.3	<i>Air Monitoring Procedures</i>	<i>4-10</i>
4.3.4	<i>Monitoring Equipment Calibration.....</i>	<i>4-14</i>
4.3.5	<i>Personal Sampling.....</i>	<i>4-14</i>
4.3.6	<i>Radiological Dosimetry.....</i>	<i>4-15</i>
4.3.7	<i>Expected Exposures to Public</i>	<i>4-15</i>
5.0	TRAINING & QUALIFICATION REQUIRMENTS.....	5-1
6.0	SITE CONTROLS	6-1
6.1	Site and Work Area Maps.....	6-1
6.2	Work Permitting.....	6-1
6.3	Site Access.....	6-1
6.4	Site Work Areas	6-2
6.4.1	<i>Radiological Contamination Controlled Work Areas</i>	<i>6-2</i>
6.4.2	<i>HAZWOPER Controlled Work Areas.....</i>	<i>6-6</i>
6.4.3	<i>Exclusion Zone</i>	<i>6-7</i>
6.4.4	<i>Contamination Reduction Zone.....</i>	<i>6-7</i>
6.4.5	<i>Support Zone</i>	<i>6-8</i>
6.5	Daily Safety Meetings	6-8
6.6	Site Postings.....	6-8

TABLE OF CONTENTS (Continued)

<u>Section</u>		<u>Page</u>
7.0	DECONTAMINATION.....	7-1
7.1	Personnel Decontamination Procedures.....	7-1
	7.1.1 <i>Decontamination Procedures for Level D Modified Personal Protective Equipment.....</i>	<i>7-2</i>
	7.1.2 <i>Decontamination Procedures for Level C Personal Protective Equipment.....</i>	<i>7-2</i>
	7.1.3 <i>Procedures for Emergency Decontamination</i>	<i>7-3</i>
7.2	Equipment Decontamination Procedures.....	7-3
	7.2.1 <i>Sampling Equipment.....</i>	<i>7-4</i>
	7.2.2 <i>Heavy Equipment.....</i>	<i>7-4</i>
	7.2.3 <i>Railcar & Transport Vehicles</i>	<i>7-5</i>
8.0	MEDICAL SURVEILLANCE PROGRAM.....	8-1
8.1	Site Medical Surveillance Program.....	8-1
8.2	Medical Recordkeeping Procedures.....	8-1
9.0	RECORDKEEPING	9-1
10.0	REFERENCES	10-1

LIST OF TABLES

Table 2-1: Potential Contaminants of Concern for Maywood Site Properties (Chemical and Radiological)..... 2-1

Table 3-1: Minimum Voltage-Safe Distances 3-4

Table 3-2: Hazardous Plant Identification Guide 3-12

Table 4-1: Chemical/Physical Agent Health and Safety Information 4-4

Table 4-2: FMSS Action Levels and Response 4-8

Table 4-3: Monitoring Equipment 4-10

Table 4-5: Effluent Concentration Values 4-14

Table 4-6: Summary of Air Monitoring Procedures and Action Levels 4-16

Table 4-6: Summary of Monitoring Procedures and Action Levels (Cont'd)..... 4-17

Table 6-1: Acceptable Surface Contamination Levels 6-4

LIST OF ATTACHMENTS

- Attachment A:** Activity Hazard Analysis
- Attachment B:** Radiation Protection Plan

LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists	µg/kg	micrograms per kilogram
AHA	Activity Hazard Analysis	MISS	Maywood Interim Storage Site
ALARA	As-Low-As-Reasonably Achievable	MSDS	Material Safety Data Sheet
ANSI	American National Standards Institute	MUTCD	Manual of Uniform Traffic Control Devices
APP	Accident Prevention Plan	NIOSH	National Institute of Occupational Safety and Health
APR	air purifying respirator	NJDEP	New Jersey Department of Environmental Protection
BEI	Biological Exposure Index	NOAA	National Oceanic and Atmospheric Administration
bgs	below ground surface	NORM	Naturally Occurring Radioactive Materials
°C	degrees Centigrade	NRC	Nuclear Regulatory Commission
Cabrera	Cabrera Services, Inc.	OHSMS	Occupational Health & Safety Management System
CFR	Code of Federal Regulation	OSHA	Occupational Safety and Health Administration
CIH	Certified Industrial Hygienist	PCHP	Project Certified Health Physicist
COC	Chain of Custody	PID	photoionization detector
CRZ	Contamination Reduction Zone	PM	Project Manager
CSP	Certified Safety Professional	PPE	Personal Protective Equipment
dBA	Decibels (A-weighted scale)	ppm	parts per million
DOE	Department of Energy	QAPP	Quality Assurance Project Plan
DOT	Department of Transportation	RSO	Radiation Safety Officer
EE/CA	Engineering Evaluation/Cost Analysis	SDS	Safety Data Sheet
EM	Engineering Manual	SOW	Statement of Work
EOD	Explosive Ordnance Disposal	SSHO	Site Safety and Health Officer
eV	electron volt	SSHP	Site Safety and Health Plan
EZ	Exclusion Zone	SVOC	Semi-Volatile Organic Compound
°F	degrees Fahrenheit	TEDE	total effective dose equivalent
FUSRAP	Formerly Utilized Sites Remedial Action Program	TLV	Threshold Limit Value
ft	feet	TSP	Total suspended particulate
FMSS	FUSRAP Maywood Superfund Site	UFML	USACE FUSRAP Maywood Laboratory
FSM	Field Site Manager	USACE	U.S. Army Corps of Engineers
GFCI	ground fault circuit interrupter	USEPA	U.S. Environmental Protection Agency
HAZWOPER	Hazardous Waste Operations and Emergency Response	UXO	Unexploded Ordnance
HS&E	Health Safety & Environment	VOCs	Volatile Organic Compounds
lbs	pounds	WP	Work Plan
kg	kilogram		
km/hr	kilometer per hour		
kV	kilovolts		
LOTO	Lockout/tag-out		
MEC	munitions and explosives of concern		

1.0 INTRODUCTION

The purpose of this document is to establish standard safety and health procedures for Cabrera Services Inc. (Cabrera) personnel and any contractors involved in the Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Sites (FMSS), located in Maywood, New Jersey. All project activities shall be performed in accordance with this Site Safety and Health Plan (SSHP). This SSHP is a working document and is subject to change based on review and the implementation of additional tasks. All changes will be reviewed and approved by the U.S. Army Corps of Engineers (USACE) prior to implementation in accordance with Engineering Manual (EM) 385-1-1.01A.11g.

1.1 GENERAL

This SSHP establishes the work practices necessary to ensure protection of personnel assigned to perform onsite activities, as well as the local community and the environment during project implementation. The objective of this SSHP is to anticipate, identify, evaluate, and control safety and health hazards, and, in addition to provide emergency response procedures relative to operations conducted at the site. Specific hazard control methodologies have been evaluated and selected in an effort to minimize the potential for accident or injury.

This SSHP presents Cabrera safety and health procedures used to control potential exposure hazards that project personnel and subcontractors will follow in performing site activities. The procedures presented herein are designed to reduce the risk of exposure to physical, chemical, radiological and biological hazards associated with the soil remediation field work performed at this site. The procedures in this SSHP are applicable to all Cabrera personnel as well as subcontractor personnel involved in site work. In the event of a conflict pertaining to health and safety between the contract requirements, the subcontract agreement between the subcontractors Health Safety & Environment (HS&E) procedures, and the Cabrera Accident Prevention Plan (APP)/SSHP, the most stringent requirement(s) will apply.

Field activities specified in the WP shall be performed in accordance with applicable policies and procedures from Cabrera's Occupational Health & Safety Management System (OHSMS) (Appendix C of APP), other applicable site HS&E regulations, Occupational Safety and Health Administration (OSHA) requirements, and other applicable Federal, State, and local statutes. Onsite personnel shall follow the HS&E guidelines specified in this SSHP, be alert to potential changes in site hazards, and exercise reasonable caution at all times.

1.2 SITE LOCATION AND DESCRIPTION

Refer to Sections 1.3 and 1.4 of the APP.

2.0 SITE INFORMATION

Cabrera will conduct environmental services at the FMSS site. Work will be performed in accordance with the applicable Statement of Work (SOW) and associated Project Work Plan (WP) developed for project site. Deviations from the listed SOW will require that a Safety Professional review any changes made to this SSHP, to ensure adequate protection of personnel and property.

The following is a summary of relevant data concerning the project site. The Project WP (including the Accident Prevention Plan –APP) is a companion document to this SSHP and provides more detail concerning both site history and planned work operations.

2.1 PREVIOUS INVESTIGATIONS

The FMSS include various properties that contain elevated levels of Naturally Occurring Radioactive Materials (NORM), generated from the chemical processing of Monazite sands containing elevated Thorium activities.

The U.S. Army Corps of Engineers (USACE) is presently overseeing the remediation of the Maywood properties. During remediation, soils with elevated levels of radionuclides are removed from the property and shipped to a waste disposal site. Occupational radiation workers and members of the public in the vicinity of the FMSS during remediation activities can receive internal radiation exposure from the inhalation of dust particles suspended in breathing air that contain NORM, and from the inhalation of radon gas and its particulate progeny that emanate from NORM. Occupational radiation workers and members of the public in the vicinity of the FMSS can also be exposed to external radiation from gamma ray emissions in NORM deposits in the ground and on surfaces.

Below is a table summarizing the potential contaminants of concern on the FMSS project, broken out by parcel. The COC levels are reported in mg/kg for metals and VOCs, and piC/g for radionuclides.

**Table 2-1: Potential Contaminants of Concern for Maywood Site Properties
(Chemical and Radiological)**

Property	Chemical Contaminant	Concentration Range in Soil (mg/kg unless otherwise stated)
New Jersey Vehicle Inspection Sta.	Diesel Fuel	Unknown
160/174 Essex Street (National Community Bank)	Coal Tar Volatiles	1-2
	Arsenic	3-25
	Barium	34-379
	Cadmium	3
	Chromium	12-251
	Lead	15-227
	Lithium	8-36
	Mercury	5
	Copper	19-180
	Zinc	27-263
	80 Industrial Road	None known
80 Hancock Street	Diesel Fuel	Unknown
100 Hancock Street	None known	

**Table 2-1: Potential Contaminants of Concern for Maywood Site Properties
(Chemical and Radiological) (Cont'd)**

Property	Chemical Contaminant	Concentration Range in Soil (mg/kg unless otherwise stated)
Sears	VOCs from Gasoline and Diesel	Unknown
	Antimony	Unknown
	Arsenic	Unknown
	Beryllium	Unknown
	Cadmium	Unknown
	Chromium	Unknown
	Copper	Unknown
	Lead	Unknown
	Mercury	Unknown
	Zinc	Unknown
	PAHs	Unknown
200 Route 17S (Sears Repair Center)	Arsenic	3
	Barium	94
	Chromium	11
	Copper	7
	Lead	5
	Lithium	6
	Nickel	8
	Zinc	21
239 Route 17N (Gulf Station)	Gasoline	Unknown
113 Essex Street (National Community Bank)	Arsenic	5
	Barium	106
	Chromium	28
	Copper	13
	Lead	34
	Lithium	22
	Nickel	17
	Zinc	56
Stepan Company	Benzene, ethylbenzene, toluene, xylene, methanol, sulfuric acid, sodium hydroxide, ethylene glycol, #4fuel oil, trichloroethene, xylene, diesel, gasoline.	Unknown
Formerly Utilized Sites Remedial Action Program Maywood Superfund Site (FMSS)	Arsenic	1-1,060
	Antimony	
	Barium	15-310
	Beryllium	
	Cadmium	
	Cerium	53-3,140
	Chromium	1-1,510
	Copper	3-224
	Lanthanum	40-1,560
	Lead	2-580
Lithium	17-2,290	

**Table 2-1: Potential Contaminants of Concern for Maywood Site Properties
(Chemical and Radiological) (Cont'd)**

Property	Chemical Contaminant	Concentration Range in Soil (mg/kg unless otherwise stated)
FMSS (continued)	Mercury	
	Neodymium	54-1,310
	Nickel	3-135
	Praseodymium	372
	Uranium	12-913
	Zinc	13-491
	Toluene	1-160 All organics in µg/kg
	2-butanone	3-170
	Carbon disulfide	1-29
	Xylenes (total)	2-4
	Chlordane	2-54
	Coal tar pitch volatiles	36-10,000
	DDE	
	DDD	
PAHs		
170 Gregg Street (Bergen Cable)	None known	
23 West Howcroft (DeSaussure)	Arsenic	Greater than NJDEP direct contact criteria (soil)
	Barium	Greater than NJDEP direct contact criteria (soil)
	Beryllium	Greater than NJDEP direct contact criteria (soil)
	Cadmium	Greater than NJDEP direct contact criteria (soil)
	Lead	Greater than NJDEP direct contact criteria (soil)
	Chromium	Greater than NJDEP direct contact criteria (soil)
	Cyanide	
	Antimony	Greater than NJDEP direct contact criteria (soil)
	Benzene	Greater than NJDEP direct contact criteria (soil)
	DDE	Greater than NJDEP direct contact criteria (soil)
	DDT	Greater than NJDEP direct contact criteria (soil)
	Ethylbenzene	Greater than NJDEP direct contact criteria (soil)
	Toluene	Greater than NJDEP direct contact criteria (soil)
205 Maywood/50 and 61 West Hunter (Myron Manufacturing)	None known	
137 Route 17 (AMP Realty)	VOCs and SVOCs	3-310 ppb
	Arsenic	Unknown conc. of metals
	Cadmium	
	Chromium	
	Lead	
	Beryllium	

**Table 2-1: Potential Contaminants of Concern for Maywood Site Properties
(Chemical and Radiological) (Cont'd)**

Property	Chemical Contaminant	Concentration Range in Soil (mg/kg unless otherwise stated)
167 Route 17 (Sunoco)	Cadmium	3 ppm
	Arsenic	14 ppm
	Chromium	223 ppm
	Lead	300 ppm
	Total VOC	849 ppb
	SVOC (bis[2-ethylhexyl]phthalate and di-n-butyl phthalate)	4,278 ppb
85-101 Route 17 (SWS Realty)	Benzene	1,000 ppm
	Toluene	1,000 ppm
	Cadmium	1 ppm
	Lead	204 ppm
Route 17 South and Essex Street (Mucarelle)	Arsenic	2
	Barium	32
	Chromium	12
	Copper	10
	Lead	9
	Lithium	4
	Nickel	13
	Zinc	17
NYS&W RR	None known	
I-80 West Right of Way	None known	
88 Money Street/72 Sidney Street	None known	
111 Essex Street (Scanel)	Coal tar pitch volatiles	< 16 mg/kg
NJ Route 17	None known	
29 Essex Street (Federal Express)	Lead	> 5ppb (water) NJDEP criteria
	Bis(2-ethylhexyl) phthalate	1 ppm (water)
01a: 88 Money Street, Lodi	Radium-226	8.43
	Thorium-232	18.43
	Uranium-238	37.53
02a: 100 Hancock Street, Lodi	Radium-226	60.77
	Thorium-232	132.59
	Uranium-238	133.10
02c: 80 Industrial Road, Lodi	Radium-226	2.35
	Thorium-232	32.30
	Uranium-238	11.16
02d: 8 Mill Street, Lodi	Radium-226	2.87
	Thorium-232	14.07
	Uranium-238	17.41
03a: 170 Gregg Street, Lodi	Radium-226	1.90
	Thorium-232	2.15
	Uranium-238	5.19
04a: 160/174 Essex Street	Radium-226	7.58
	Thorium-232	61.09
	Uranium-238	9.88
04b: I-80 Westbound Right of Way	Radium-226	2.32
	Thorium-232	7.99
	Uranium-238	8.53

**Table 2-1: Potential Contaminants of Concern for Maywood Site Properties
(Chemical and Radiological) (Cont'd)**

Property	Chemical Contaminant	Concentration Range in Soil (mg/kg unless otherwise stated)
05a: 99 Essex Street, Maywood	Radium-226	2.67
	Thorium-232	9.64
	Uranium-238	8.49
05b: 113 Essex Street, Maywood	Radium-226	3.52
	Thorium-232	7.84
	Uranium-238	4.14
05c: 200 NJ Route 17 South, Maywood	Radium-226	9.08
	Thorium-232	43.95
	Uranium-238	4.93
06a: 85-101NJ Route 17 North, Maywood	Radium-226	34.73
	Thorium-232	188.28
	Uranium-238	42.11
06b: 137 NJ Route 17 North, Maywood	Radium-226	116.08
	Thorium-232	624.70
	Uranium-238	90.38
06c: 167 NJ Route 17 North, Maywood	Radium-226	13.79
	Thorium-232	93.97
	Uranium-238	15.53
06d: 239 NJ Route 17 North, Maywood	Radium-226	32.55
	Thorium-232	102.66
	Uranium-238	19.16
06e: 29 Essex Street, Maywood	Radium-226	0.89
	Thorium-232	3.41
	Uranium-238	2.19
07a: 111 Essex Street, Maywood	Radium-226	45.52
	Thorium-232	540.00
	Uranium-238	190.81
07b: Hackensack and Lodi Railroad	Radium-226	4.79
	Thorium-232	2.30
	Uranium-238	109.68
08a :23 West Howcroft Road, Maywood	Radium-226	43.62
	Thorium-232	401.27
	Uranium-238	79.52
09a: 149-151 Maywood Avenue, Maywood	Radium-226	76.24
	Thorium-232	478.82
	Uranium-238	31.85
10a: 100 West Hunter Avenue (Stepan)	Radium-226	514.40
	Thorium-232	1,058.82
	Uranium-238	32.29
11a: 205 Maywood Avenue, Maywood	Radium-226	1.31
	Thorium-232	1.90
	Uranium-238	2.63
11b: 61 West Hunter Avenue, Maywood	Radium-226	1.43
	Thorium-232	3.01
	Uranium-238	3.06
12a: New York, Susquehanna and Western Railway	Radium-226	492.88
	Thorium-232	1,981.00
	Uranium-238	216.04

**Table 2-1: Potential Contaminants of Concern for Maywood Site Properties
 (Chemical and Radiological) (Cont'd)**

Property	Chemical Contaminant	Concentration Range in Soil (mg/kg unless otherwise stated)
12b: 100 West Hunter Avenue, Maywood (Maywood Interim Storage Site [MISS])	Radium-226	344.34
	Thorium-232	1,223.83
	Uranium-238	366.55

Unknown denotes not tested.

µg/kg denotes microgram(s) per kilogram.

DDD denotes dichlorodiphenyldichloroethane.

DDE denotes dichlorodiphenyldichloroethylene.

mg/kg denotes milligram(s) per kilogram.

NJDEP denotes New Jersey Department of Environmental Protection.

PAH denotes polycyclic aromatic hydrocarbon.

pCi/g denotes picoCuries per gram.

ppb denotes parts per billion.

ppm denotes parts per million.

SVOC denotes semivolatile organic compound.

VOC denotes volatile organic compound.

2.2 PREVIOUSLY COLLECTED MONITORING DATA FROM LAB

Previously collected monitoring data during laboratory operations indicates that the ventilation safety systems (i.e., fume hoods and high-efficiency particulate air filtered downdraft table) are effective in controlling chemical and radiological exposures to laboratory personnel. This assessment is based on the following information:

- Acid fume sorbent tube testing has been conducted during acid digestion procedures in lab hoods. No detectable readings were identified.
- Volatile Organic Chemical measurements are routinely obtained with a photoionization detector (PID) when samples with associated hazards are processed by the lab. While detectable volatile organic compound (VOC) readings have been identified in initial headspace measurements, all handling is performed in a hood or oven connected to the ventilation safety system. Furthermore, in no instance of high-VOC sample processing has a recordable reading above 5 ppm been detected in the breathing zone of a lab worker.
- Breathing zone particulate radionuclide air monitoring has been conducted continuously during sample pulverizing activities at the down-draft table. Results of soil pulverizing air monitoring are consistently below 10 percent of the applicable limit.
- Total suspended particulate (TSP) levels were determined for particulate air samples collected for radiological analysis during downdraft table sample pulverizer operations. The mean TSP concentration and associated standard deviation for the sample dataset (35 samples collected between 2006 and 2008) was 0.067 mg/m³ with a standard deviation of 0.092 mg/m³. At the 95 percent confidence level, the expected TSP concentration would be only 0.25 mg/m³, well below any threshold for concern given the blend of inorganic contaminants identified at FMSS properties.

3.0 GENERAL SAFETY RULES & PHYSICAL HAZARDS

3.1 GENERAL SAFETY RULES

All site personnel shall conduct themselves in a safe manner and maintain a working environment that is free of additional hazards, in adherence to all applicable safety rules/regulations and maintain proper housekeeping practices at all times.

3.1.1 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste Personal Protective Equipment (PPE) or contaminated materials. Refer to OP 518, *Housekeeping* (APP, Appendix C) for additional information.

3.1.2 Smoking, Eating, or Drinking

Smoking, eating and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any Cabrera site. Smoking, eating or drinking must be in an approved area.

3.1.3 Personal Hygiene

The following personal hygiene requirements will be observed:

Water Supply: A water supply meeting the following requirements will be utilized:

Potable Water - An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.

Non-Potable Water - Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

***Non-Potable Water
Not Intended for Consumption***

Toilet Facilities: A minimum of one toilet will be provided for every 20 personnel on site, with separate toilets maintained for each sex except where there are less than 5 total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.

Washing Facilities: Employees will be provided washing facilities (e.g., buckets with water and soap) at each work location. The use of water and hand soap (or similar substance) will be required by all employees following exit from the Exclusion Zone (EZ), prior to breaks, and at the end of daily work activities.

3.1.4 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Personnel belonging to another organization on site can serve as "buddies" for Cabrera personnel. Under no circumstances will any employee be present alone in a controlled work area. For areas not in controlled work areas, a remote check-in/check-out procedure will be established between the affected worker and the Field Site Manager (FSM) and/or Site Safety and Health Officer (SSHO). The established protocols (visual and/or verbal confirmations at established time intervals) will be followed at all times.

3.2 STOP WORK AUTHORITY

All employees have the right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions. Whenever any employee determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the employee is authorized and required to stop work, which shall be immediately binding on all affected Cabrera employees and subcontractors.

Upon issuing the stop work order, the employee shall consult with the FSM and/or SSHO who in-turn shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the HSM has concurred that workplace conditions meet acceptable safety standards. Refer to OP 511, *Safe Work Standards* (APP, Appendix C) for additional information on Stop Work authority and a copy of a Stop Work Order.

3.3 PHYSICAL HAZARDS

The following physical hazards are anticipated to be present on the site. Additional hazards may be noted on the Activity Hazard Analysis (AHA) developed for the individual tasks.

3.3.1 Slips, Trips, Falls, and Protruding Objects

A variety of conditions may exist that may result in injury from slips, trips, falls, and protruding objects. Slips and trips may occur as a result of wet, slippery, or uneven walking surfaces. To prevent injuries from slips and trips, always keep work areas clean; keep walkways free of objects and debris; and report/clean up liquid spills. Serious injuries may occur as a result of falls from elevated heights. Always wear fall protection while working at heights of 6 feet or greater above the next lower level. Protruding objects are any object that extends into the path of travel or working area that may cause injury when contacted by personnel. Always be aware of protruding objects and when feasible remove or label the protruding object with an appropriate warning.

Slippery, uneven footing and tripping hazards will likely be present at the site. Be vigilant, avoid puddles, and wear footwear with slip resistant soles.

Walk around, not over or on top of debris or trash piles. When carrying equipment, identify a path that is clear of any obstructions. It might be necessary to remove obstacles to create a smooth, unobstructed access point to the work areas on site.

During the winter months, snow shovels and salt crystals should be kept on site to keep work areas free of accumulated snow and ice. Furthermore, use sand or other aggregate material to help keep work surfaces from being slippery, especially where salt/calcium chloride cannot be used. In addition, make sure work boots have soles that provide good traction. When walking on ice is necessary crampons or Yaktrax® should be used.

Maintaining a work environment that is free from accumulated debris is the key to preventing slip, trip and fall hazards at construction sites. Essential elements of good housekeeping include:

- Orderly placement of materials, tools and equipment out of walkways;
- Placing trash receptacles at appropriate locations for the disposal of miscellaneous rubbish; and,
- Prompt removal and secure storage of items that are not needed to perform the immediate task at hand.

Refer to the AHA for the task/activity involving slip/trip/fall hazards for additional details.

3.3.2 Manual Lifting

Most materials associated with investigation and remedial activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use mechanical assistance to lift or move materials and at a minimum, use at least two people to lift, or roll/lift with your arms as close to the body as possible. Refer to the AHA for the task/activity involving manual lifting hazards for additional details. Refer to OP 518, Manual Lifting (APP, Appendix C) for additional information.

3.3.3 Utility Hazards

Various forms of underground and/or overhead utility lines may be encountered during site activities. Prior to the start of intrusive operations, utility clearance is mandated, as well as obtaining authorization from all concerned public utility department offices (refer to OP 589, *Utility Clearance and Isolation*). If necessary, a private locating service will be used in the event that the One Call service will not locate underground utilities within the property limits. If insufficient data is available to accurately determine the location of the utility lines, Cabrera will hand clear to a depth of at least 5 feet below ground surface in the proposed work area.

Should intrusive operations cause equipment to come into contact with utility lines, the SSSHO and the OH&S Manager will be notified immediately. Work will be suspended until the applicable utility agency is contacted and the appropriate actions for the particular situations can be taken.

Overhead power and utility lines may be present on, or adjacent to, the site and represent a potential hazard during the mob/demob of equipment and supplies. During site operations, ensure equipment operators, truck drivers, and signal person(s) are aware of overhead power lines and maintain a minimum of 10 feet between the lines and any equipment. Any deviation from the minimum safe distance noted in the table below must be approved by the SSSHO and OH&S Manager.

Table 3-1: Minimum Voltage-Safe Distances

Voltage	Distance
0 to 50 kV	10 feet
51 to 200 kV	15 feet
201 to 350 kV	20 feet
351 to 500 kV	25 feet
501 to 650 kV	30feet
651 to 800 kV	35 feet
801 to 950 kV	40 feet
951 to 1100 kV	45 feet

*kV = kilovolts

All temporary electric installations (site trailer, subpanels) will comply with OSHA (29 CFR 1926, Subpart K, and 29 CFR 1910, Subpart S) guidelines. Only qualified and competent individuals (licensed electrician) will provide electrical service/servicing.

Refer to OP 589, Utility Clearance and Isolation (Appendix C), and the AHA for the task/activity involving utility hazards for additional details.

3.3.4 Electrical hazards

Electrical and powered equipment may be used during a variety of site activities. Injuries associated with electrical and powered equipment include electric shock, cuts/lacerations, eye damage (from flying debris), and burns. To reduce the potential of injury from the hazards associated with electrical and powered equipment, always comply with the following:

- Use ground fault circuit interrupters (GFCIs) when using electrical powered tools/equipment. GFCIs prevent electrical shock by detecting the loss of electricity from a power cord and/or electrical device.
- Ensure generators are properly grounded, including the use of a grounding rod, driven to a depth of 3-feet.
- Wear American National Standards Institute (ANSI) approved (Z87.1) safety glasses. Face shields may be required to provide additional face protection from flying debris.
- Wear appropriate work gloves. Work gloves may reduce the severity of burns and cuts/lacerations.

All temporary electric installations (site trailer, subpanels) will comply with OSHA (29 CFR 1926, Subpart K, and 29 CFR 1910, Subpart S) guidelines. Only qualified and competent individuals (licensed electrician) will provide electrical service/servicing. Refer to OP 567, *Electrical Safety* (APP, Appendix C) as well as the AHA for the task/activity involving electrical hazards for additional details.

3.3.5 Lock-Out/Tag-Out Procedures

Use lockout/tagout (LOTO) procedures when performing maintenance or repairs on equipment.

It is the responsibility of the Competent Person in charge of the operation to verify that all remediation equipment is locked out before employees perform any maintenance or repair work

on the system. **The source must be locked out; it is not enough to push the power switch to off and disconnect the breaker. Anyone can re-engage power under these circumstances. Locking out the power source is the only way to guarantee that the power will not be inadvertently reactivated.**

A LOTO kit will be located in the safety office for the duration of the project. The kit includes standard locks, keys and lock-out notices.

The site specific LOTO information must be completed for the WWTP system. These forms will then be placed within the administration trailer so all field technicians performing operations and maintenance work on the system are familiar with how to lock-out the system when necessary.

Refer to OP 593, *Hazardous Energy Control* (APP, Appendix C) and the AHA for the task/activity involving the use of LOTO Procedures for additional details.

3.3.6 Heavy Equipment and Vehicle Operations

Heavy equipment and site vehicles present serious hazards site personnel. Blind spots, failure to yield, and other situations may cause heavy equipment/vehicles to come into contact with personnel. To reduce the possibility of contact between equipment/traffic and personnel, always adhere to the following:

- Personnel must wear a high visibility, reflective safety vest at all times when working near heavy equipment and/or other vehicle traffic.
- Personnel must always yield to equipment/vehicle traffic and stay as far as possible from all equipment/vehicle traffic. Always maintain eye contact with operators.
- When feasible, place barriers between work areas and equipment/vehicle traffic.
- Always ensure reverse warning alarms are working and louder than surrounding noise. Personnel must report inoperative reverse warning alarms.
- Ensure Daily Equipment Safety Inspections are being performed and documentation filed at the site.

Refer to OP 584, *Heavy Equipment* (APP, Appendix C) and the AHA for the task/activity involving the use of the specified Heavy Equipment for additional details.

The use of forklifts presents a unique set of hazards to employees using, and working around the equipment. Proper training on the safe usage of the specific type of forklift being utilized is essential to the safe execution of work tasks with the equipment. Besides the daily inspections and safe usage of the equipment, there are numerous other safety related issues that need to be assessed during their use, to include safe/level working surfaces, and overhead power lines.

Refer to OP 592, *Forklifts* (APP, Appendix C) and the AHA for the task/activity involving the use of the specified forklift for additional details.

3.3.7 Excavations and Trenches

Excavations and trenches present workers with a variety of hazards. If not properly sloped, shored, or boxed, trench walls may collapse and trap workers under the weight of the soil. Soil contaminants and other chemical hazards (e.g., carbon monoxide from equipment/vehicles) may

result in a hazardous atmosphere. Confined space entry procedures may need to be followed if the potential for a hazardous atmosphere exists. Buried utilities may exist where excavations/trenches will be placed. Always contact the local utility locator service prior to beginning excavations. Refer to OP 583, *Excavation & Trenching* (APP, Appendix C), the Excavation Inspection Form (APP, Appendix D) and the AHA for the task/activity for additional details.

3.3.8 Confined Space Entry

Confined space entry operations are among the most dangerous of tasks. Ordinary events, which elsewhere would not be serious, may become life threatening in confined spaces. Confined spaces can become unsafe as a result of: (1) possible atmospheric contamination by toxic or flammable vapors, or oxygen deficiency; (2) possible physical hazards when agitators or other moving parts are located therein; (3) the possibility of liquids, gases, or solids being admitted during occupancy; (4) Entrapment or engulfment; or (5) physical isolation of employees when in need of rescue.

Cabrera's Confined Space Entry Program is designed to comply with the requirements of the Occupational Safety and Health Administration's (OSHA) Permit Required Confined Spaces Standard (29 CFR 1910.146) The SSHO and/or FSM shall identify and inform all employees of the location of any potential confined spaces. Refer to OP 582, *Confined Spaces* (APP, Appendix C) and the AHA for confined space entry for additional details.

3.3.9 Working At Heights

Fall Protection - Fall Protection Systems shall comply with the Site Specific Fall Protection Plan, OSHA Regulations (Standards – 29 CFR) Standard # 1926.502 Fall Protection Systems Criteria and Practices and OSHA Standard # 1926.502(d) – 1926 Subpart M App C Personal Fall Arrest Systems.

Specifically, anyone working in an area exposed to a fall greater than 6 feet must use appropriate fall protection. Such protection includes: guardrail systems, safety net systems or personal fall arrest systems. Other protection methods include hole-covers, positioning devices, equipment guards, fences and barricades. Fall protection shall be provided as required in OSHA Regulations 29CFR1910 and 29CFR1926, reference: standard 1926.501 Duty to Have Fall Protection.

Work above a height of 6 feet requires a fall protection system. This project requires 100% tie off using full-body harness (Class III or IV) with dual shock-absorbing lanyard (shorter than fall distance and a maximum 6 ft. long) equipped with double-locking hooks connected to a proper tie-off attachment point capable of handling potential fall loads of 5,000 pounds.

Fall protection systems classified as “job made” (not purchased approved fall prevention devices from a fall protection supplier) shall be designed by a Registered Professional Engineer. Fall protection or restraining methods shall be in place when employees are within 6 feet of the leading or exposed edge, where a fall hazard exceeding 6 feet exists, such as during decking activities, inspecting structures, climbing, trenching, etc.

Refer to the Site Specific Fall Protection Plan (APP, Section 10.28), OP 585, *Fall Protection* (APP, Appendix C) and the AHA for the task/activity involving fall hazards for additional details.

3.3.10 Working Near Railroad Hazards

Project activities that require personnel to perform work near and within the railroad right of way will be conducted in conformance with the site specific procedures for railroad cars and New York, Susquehanna and Western Railroad Procedures, herein.

Personnel, whether in vehicles or on foot, will only cross railroads at designated crossing grades. When crossing at a crossing grade, personnel will stop and look both ways before proceeding. If a train is traveling toward the crossing grade, and is within visual sight, personnel will wait until the train has passed before proceeding. A signal man will be used to direct vehicular traffic at all crossing grades that are not equipped with lights and gates. A signal man will also be present when work must be performed within 25 feet of the railroad.

During soil load-out activities the following railroad safety procedures will be followed:

1. The Stepan spur will be locked out using the “blue” flag (Men Working) that will be placed on the track. The location of the flag must be visible to New York, Susquehanna and Western Railroad personnel so that locomotive and crew cannot operate on the same spur. If the entire spur is to be used for relocating railcars, the spur switch, located immediately off of the main line must be physically locked and the blue flag placed proximate to the switch. The blue flag shall be removed from the track at the end of each workday.
2. All personnel must wear level “D” PPE accessing the railroad spur, including use of high-visibility vest.
3. All railcar gondolas must have the manual brakes engaged and the wheels on the last railcar chocked. In addition, a “Red” flag shall be placed on the last railcar. This red flag shall remain in place during load-out activities. The flag shall be removed when the railcars need to be repositioned within the load-out area or at the end of the workday.
4. All personnel assigned to soil load-out activities must attend a training session to become familiar with railroad safety requirements, as well as soil load-out procedures and Department of Transportation (DOT) requirements.

When working on or near “live” tracks, follow these general rules:

- Hard hats (preferably orange), high visibility apparel, and safety footwear shall be worn on railroad right-of-way. All other owner/operator safety requirements and procedures, shall be followed.
- Red markers, flagging or lights shall not be used on railroad right-of-way. Red means “immediate danger”. Trains stop without exception. Red signals shall only be used when injured persons or disabled vehicles are on the tracks or at grade crossings and cannot be moved, or when any condition could cause derailment.
- Train schedules cannot be counted on. Passenger trains have published schedules, but are often off schedule.

- Freight trains have no schedules, and move “anyplace, anytime”.
- When tracks must be crossed, look in both directions every time. When crossing more than one set of tracks, stop after the first set, and look again each way before crossing the second set. Do not cross directly in front of, or lean on, a standing train. Do not crawl under stopped cars, or cross tracks between cars. Air build-up can cause a train to “jump” forward.
- Railroad equipment is not always heard, especially if there is other noise. Coasting, slow moving trains may give no warning.
- Notify the flagger each time it is necessary to “foul” the tracks, and then proceed only after “absolute protection” is received. Efforts to “clear” tracks must begin immediately anytime the flagger indicates to do so.
- For jobs longer than one day, the “flagger” and project supervisor shall discuss the day’s work and any need to “foul” the tracks at the start of each work day. Discuss job details with each new “flagger”.
- Be alert for buried electrical/utility lines on or near railroad right-of-way. Excavations on the right-of-way shall be filled at the end of each day.
- Access roads to and across tracks shall not be blocked or disrupted. Vehicles shall not be parked within 10 feet of the tracks. Materials, tools, or equipment shall not be stored on railroad right-of-way. Work areas shall be inspected after each day’s work to ensure nothing is left on or near the tracks
- Track ballast shall not be eroded or contaminated.
- Note that trains and cars in the hump yard area may be under remote operation. Exercise extreme caution when working in these areas as there may be no engineers aboard these trains and cars.

Refer to the AHA for the task/activity involving working near railroad right-of ways and tracks for additional details.

3.3.11 Dust and Odor Control

Specific controls will be in place to prevent dust generation. If dust is observed reaching or approaching the site boundary, activities causing the dust will be immediately stopped. Dust control measures (water spray, soil covers, slower work pace, or change in work activities) will be deployed prior to resuming work. Dust will be controlled by suppression with water or calcium chloride solution. Corrective measures will be documented in the daily report.

The primary dust control measure is the application of a water spray to exposed soils. Water will be delivered from a nearby hydrant, water wagon, or truck. Water will be sprayed on temporary soil piles, excavations, and re-vegetation areas. Only potable water obtained from a public water supply will be used for dust control. Work practices will be adjusted in a manner to minimize dust generation, such as lowering excavation rates and not letting soils free fall from equipment buckets.

Dry soils that are to be excavated will be preconditioned with water to keep them moist to a depth of at least 6 inches. Backfilled areas will be wet with the water immediately after backfilling. Re-vegetation of landscape will be completed as soon as practical to retain moisture and to minimize wind erosion. All soils, contaminated, uncontaminated, and clean backfill, will be covered during storage, wetted as required, and covered during transport to prevent windblown conditions.

It will be the responsibility of each worker to observe his or her work area for the potential and actual generation of dust. Areas that show potential release of dust will be reported to the SSHO and RSO, who will ensure that engineering controls will be used to eliminate the potential for dust problems. Engineering controls may include covering the material or using applications of water spray to stop dispersal of dust. Personnel will avoid working in dust by positioning themselves upwind of intrusive activities or demolition/concrete crushing activities. If necessary, the work area will be reduced or work stopped until the dust can be controlled. The presence of visible dust indicates a breakdown in dust control measures.

Due to the nature of the contaminant at the site, odors are not anticipated to be of concern. In the event that an odor complaint is received, the FSM and/or SSHO will immediately assess site conditions and determine the probable cause or causes. Appropriate odor mitigation measures will be deployed. These measures may include covering sediment piles, deploying odor suppressing foam, implementation of air monitoring or discontinuing activities that are generating the odor. Corrective measures will be documented in the daily report.

3.3.12 Spill Prevention

Work activities may involve the use of hazardous materials (i.e. fuels, solvents) or work involving drums or other containers. The following procedures will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (i.e. speedy dri) shall be available at each work site (more as needed).

- All hazardous commodities in use (i.e. fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.

3.3.13 Noise Exposure Monitoring

When heavy equipment is in operation, it will be necessary to ensure that each EZ fully encompasses all areas where hazardous noise levels are present (85dBA or greater). If the sound pressure level exceeds 85 dBA (est.) at any location along the site perimeter (using hand-held dosimeter), the EZ boundary will be adjusted to fully encompass this region. All personnel

working inside of the EZ will be required to wear hearing protection during the operation of heavy equipment. Refer to OP 565, *Hearing Conservation* (APP, Appendix C) and the AHA for the specific activity for appropriate PPE.

3.3.14 Traffic Control

During certain work tasks, the establishment of traffic control to adequately protect workers and the public may be required on-site. Site specific requirements will be determined by the FSM and/or SSHO on a case-by-case basis. Only approved traffic control devices per accordance with the Manual of Uniform Traffic Control Devices (MUTCD) will be used on public road ways per accordance with the applicable State regulatory guidance.

General traffic control precautions include placing a work vehicle between your worksite and oncoming traffic whenever possible. Not only is it a large, visible warning sign, but also if an oncoming car should fail to yield or deviate, the parked vehicle rather than your body would absorb the first impact of a crash. Turn the vehicle wheels so that if it was struck, it would swing away from the worksite. When using cones or other devices to modify traffic flow, ensure use of the proper taper length and device spacing to provide adequate warning distance to on-coming motor vehicles. In addition, proper PPE is to be worn during traffic operations, to include hardhat and high-visibility vests. Refer to AHA for the specific activity for appropriate traffic control measures.

3.4 UNEXPLODED ORDNANCE

Unexploded Ordnance (UXO)/Munitions and Explosives of Concern (MEC) hazards are not anticipated on the project site. If any items are observed, the following guidance should be observed:

3.4.1 Recognize, Retreat, Report

Recognize — Before entering a suspected UXO contaminated area, receive briefing from local Explosive Ordnance Disposal (EOD) or safety personnel. Maintain heightened awareness during field activities.

Retreat — If encountered, immediately stop, and leave the area the same way you entered. If possible, mark location with flagging or caution tape. Do not use stakes, pins, or anything else intrusive into the ground surface.

Report — Note the location, route, landmarks, or any other features that would aid in relocating the UXO item encountered. Report this information to the site manager, area supervisor, or the local EOD unit.

3.5 BIOLOGICAL HAZARDS

It is anticipated that numerous biological hazards will be present on the project site. Poisonous plants may be found along the tree lines, and adjacent to monitoring wells, along with ticks and other biting insects. Stinging insects, such as bees and wasps may build nests inside of monitoring wells or be within proximity of the work zone. Below is a discussion of the most

common biological hazards found on project sites, and those anticipated being of potential concern.

3.5.1 Small Mammals

Working in the field either directly or indirectly with small mammals have inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) that all field staff need to protect themselves against.

The risks are usually higher when there is direct contact with a wild animal, either through a break in the skin (blood), saliva, or excrement; however, there are also risks through air-borne diseases (e.g., Hantavirus).

Obviously, wildlife biologists directly handling wildlife, dead or alive, or working with wildlife feces or in enclosed habitats (such as caves), have an increased risk of exposure to a wider range of zoonotic diseases and should take extra precautions.

3.5.2 Venomous Animals

Some animals have the ability to inject venom. These include: various types of spiders, and snakes. The two more venomous spiders likely to be encountered are the Black Widow and Brown Recluse. Both spiders like dark conditions. The Black Widow prefers moist conditions, and the Brown Recluse dry. Other spiders possess venom but they are not harmful to humans. Snakes have limited distributions, and generally avoid humans, so in most areas you are unlikely to encounter them.

If bitten by any of these animals special care should be taken to treat the wound as it may lead to complications due to the toxin. A bite from a venomous snake, which may inject varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency. Bites from a Black Widow or Brown Recluse should be treated as medical emergencies. All other bites should be reported, proper first aid implemented, and the wound progression tracked.




3.5.3 Poisonous Plants

Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin, therefore it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can result in severe scarring, blindness or even death.

Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed (or Giant Cow Parsnip), Wild Parsnip, Devil's Club and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock; Water Parsnip) – do not eat anything that has not been identified.

A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying not to eat any berries or plants that you are not absolutely sure of their identity. Examples of common poisonous or irritating plant species, common to the United States, are shown in the table below.

Table 3-2: Hazardous Plant Identification Guide

<p>Poison Ivy</p> <ul style="list-style-type: none"> • Grows in West, Midwest, Texas, East • Several forms – vine, trailing shrub, or shrub • Three leaflets (can vary 3-9) • Leaves green in summer, red in fall • Yellow or green flowers • White berries 	
<p>Poison Oak</p> <ul style="list-style-type: none"> • Grows in the East (NJ to Texas), Pacific Coast • 6-foot tall shrubs or long vines • Oak-like leaves, clusters of three • Yellow berries 	
<p>Giant Hogweed</p> <ul style="list-style-type: none"> • Grows from MI to VA, found in western NY • 8- to 14-feet tall • Small, white flowers form a large flat-topped umbel • Leaves up to 5-feet across, lobed and deeply incised 	

3.5.4 Insects

Insects for which precautionary measures should be taken include: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, and ticks.

Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.

Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. Most serious concern is possibility of contracting Lyme disease which is spread by the Black-legged or Deer Tick. Occasionally a tick can cause Tick Paralysis if it is able to remain feeding for several days. Full recovery usually occurs shortly after the tick is removed.

Prompt and proper removal is essential to prevent the potential contraction of tick-borne diseases. Typically, if removed within 24-48 hours of the bite, the potential for disease drops significantly. Removal should be done by grabbing the tick as close to the base of the head as possible, and gently rolling fingers backwards to pull out. Avoid squeezing the body of the tick. Tick removal tools may also be used. All imbedded ticks must be reported to the SSHO and documents in an incident report.

3.6 ULTRAVIOLET HAZARDS

Workers performing field work outdoors may be susceptible to sunburn if not properly protected with sunscreen or protective clothing and hats. Skin can burn in minutes when the UV Index is VERY HIGH. Protective measures are advisable.

3.7 WEATHER HAZARDS

The SSHO will be attentive to daily weather forecasts for the project area each morning. Predicted weather conditions of potential field impact are to be included in safety briefings and the AHA for that day. Weather changes should initiate a review and updates as necessary. Weather-related hazards will directly correlate to the type of weather involved. Hot, dry weather may cause greater dust emissions, particularly during intrusive activities. Rain may increase slip/trip hazards, particularly for ground workers.

Severe weather can occur with little warning. Employees will be vigilant for the potentials for storms, lightning, high winds, and flash flood events. Additionally, lightning strikes during electrical storms could also be a potential hazard. The following procedures will be implemented once thunder is heard or lightning spotted:

- 1) If thunder is heard, all site personnel are to be alert of any visible lightning flashes. The SSHO will observe the storm front and track the direction it is moving. The SSHO will continue to observe the storm front until it passes or until the prevailing direction is determined to be away from the site.
- 2) If lightning is observed, the FSM or SSHO are to be notified. When the next lightning flash is observed, a “second” count shall be initiated from the time the lightning is observed until the thunder from the strike is heard.
- 3) The following action guidelines shall be implemented once the “second” count is ≤ 30 seconds:
 - a) “second” count > 30 , the FSM or SSHO will continually observe the storm front. If the front is moving away, work will continue. If the front is moving towards the site, the FSM will initially place workers on alert for potential evacuation.
 - b) “second” count ≤ 30 , the FSM will issue the evacuation command and all workers are to report to the break/lunch trailer. Work can be re-initiated once the front has passed by and thunder has not been heard for 30 minutes.
- 4) If lightning is observed and the storm front is moving away from or around the site and is > 20 miles away, work will be permitted to continue. The location of the storm can be

confirmed via internet access to a local weather website that has a Doppler radar tracking system.

3.8 LABORATORY SAFETY

This Section of the SSHP defines the operational requirements specific to the USACE FUSRAP Maywood Laboratory (UFML). These procedures apply to all employees engaged in the laboratory use of hazardous chemicals and serves as a management plan to protect employees from the health hazards presented by hazardous chemicals in use or in storage at the UFML laboratory. Visitors and contractors must comply with specific elements so defined.

The on-site laboratory performs analysis of environmental samples from the FMSS. The laboratory analyzes these samples for the presence of radioactive constituents, that is, radium-226, thorium-232, and uranium-238 using a variety of radioanalytical techniques. Other radionuclides may be encountered during the processing and analysis of samples. Unique radiological conditions, identified by the Laboratory Manager, shall be immediately brought to the attention of the SRSO. The anticipated hazards in the laboratory and the recommended control measures are presented in this section.

3.8.1 Laboratory Chemicals/Hazard Communication Program

Hazardous chemicals are used in the laboratory to analyze the samples obtained from the FMSS. These laboratory chemicals consist of acids, bases, salts, solvents, compressed gases, and cryogenic liquids. The use of laboratory chemicals is regulated by OSHA under the Hazard Communication Standard (29 CFR 1910.1200) and the OSHA standard for Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450). Cabrera OP 517, *Hazard Communication* (Appendix C, APP), provides requirements for the safe use of operational chemicals.

Air monitoring will be performed as needed to assess exposures resulting from their use. Both a Hazardous Substances Inventory List (Appendix E, APP) and a Safety Data Sheet (SDS) for each laboratory chemical must be maintained by the Laboratory Manager. If any additional chemicals are necessary for future laboratory activities, SDSs for these chemicals will be obtained at the time of procurement. The Laboratory Manager will evaluate each chemical used in the on-site laboratory for hazardous characteristics. This evaluation will be used by the Laboratory Manager and SSHO to verify that the engineering controls, PPE, and safety equipment are in place to control the hazards and protect the health and safety of laboratory personnel. Copies of the SDSs shall be provided to the fire department, upon their request.

3.8.2 Chemical and Radiological Hazards

There is potential for personnel exposures to hazards from site contaminants brought into the laboratory via samples. There are also hazards in using laboratory chemicals to analyze the samples.

The laboratory typically analyzes samples of air (as air filters containing trapped particulates), soil, and water obtained from the FMSS. Some of these samples will contain chemical contamination. Many of the samples will also contain radioactive contamination.

3.8.3 Chemical and Radiological Hazard Controls

The chemical and radiological hazards associated from both the contamination in the samples and the laboratory chemicals used in the analytical processes can and will be controlled.

Hazardous chemicals new to the laboratory will be reviewed and approved by the Lab Manager and SSHO before the order is placed. It may be determined that the new chemical does not need to be brought into the facility. No chemical may be released for use until the SDS is available and the employees have been informed of the hazards and trained in the safe use of the chemical.

For carcinogenic or other particularly hazardous chemicals, the Lab Manager and SSHO will prepare a written evaluation for the chemical. This written evaluation will summarize the hazardous characteristics, its interactions with other laboratory chemicals, the planned conditions of use, additional or augmented hazards that might arise from the proposed use, instructions for storing the chemical, and any special requirements for using the chemical (i.e., a laboratory hood, monitoring, etc.) will also be included. The required PPE to be worn when handling the material will also be specified.

The hazard evaluation will be conveyed to employees in a training session.

The following chemical hazard controls are in effect and mandatory:

- All laboratory personnel shall be trained on the information presented in this this section of the SSHP.
- All non-laboratory personnel shall be trained on the information presented in this herein to the extent necessary for them to safely complete their business in the laboratory.
- All laboratory personnel shall participate in a medical surveillance program as specified.
- All personnel entering and/or performing work in the laboratory shall wear the PPE specified within the AHA.
- All personnel entering and/or performing work in the laboratory shall adhere to the safe laboratory practices and laboratory rules specified herein.
- Engineering controls shall be implemented and maintained as specified.
- Chemical and radiological monitoring shall be performed as specified.
- All personnel entering and/or performing work in the laboratory shall be informed about and follow the emergency procedures.

3.8.4 Additional Personal Protective Equipment

For certain procedures, additional hazards may require the use of specialized PPE in addition to the minimum equipment specified in the APP and AHA for Laboratory Operations.

Eye and Face Protection

Chemical splash goggles meeting ANSI Z87.1 specifications will be worn when carrying out operations in which there is reasonable danger from splashing chemicals, flying particles, etc. Goggles will be required when working with concentrated acids, when performing laboratory operations that produce corrosive vapors, or when working with cryogenic liquids. Goggles will also be required when working with glassware under reduced or elevated pressure and when

employing glass apparatus in high-temperature operations. Since goggles offer little protection to the face and neck, full-face shields meeting ANSI Z87.1 specifications shall also be worn when conducting laboratory operations that require goggles.

Dermal Protection

The PPE selection for hands and dermal protection should be made on the basis of the chemicals that will be handled and the task to be carried out. In some instances the need for dexterity may result in the use of thin gloves that will not afford mechanical protection.

Gloves must be worn when handling samples and hazardous materials; double gloving may be required. Glove material selection shall be made in conjunction with the SSHO. Examples of glove types and their applications are:

- Nitrile, vinyl, or latex disposable surgical gloves. Latex surgical gloves do not afford protection from solvents and other laboratory chemicals.
- Rubber gloves for handling acids, aqueous liquids, and solids.
- Vinyl rubber gloves for laboratory operations with a low possibility of solvent contact.
- Nitrile rubber gloves for handling organic liquids with high likelihood of extensive solvent contact.
- Viton rubber, Silver Shield, 4H, or other approved gloves for handling organic liquids with high likelihood of extensive solvent contact.
- Kevlar gloves for handling materials and equipment that have very sharp edges.
- Non-asbestos heat resistant gloves for handling hot crucibles or other items subject to high temperatures.
- Insulated gloves for operations involving cryogenics such as dry ice, liquid nitrogen, etc.

The following PPE will be provided by the laboratory and made available to all laboratory personnel as necessary:

- Gloves
- Chemical-resistant aprons
- Disposable Tyvek® coveralls (coated as necessary)
- Other protective equipment as specified by the Laboratory Manager, SRSO, SSHO, or OH&S Manager.

3.8.5 Engineering Controls

Chemical safety is accomplished by developing an awareness of the chemical hazards and by keeping chemical exposure under control through use of a variety of engineered safeguards, administrative controls, and PPE. Laboratory personnel shall be familiar with the proper use of those safeguards. Laboratory personnel and supervisors should be able to detect if those safeguards are malfunctioning. Engineering controls will be properly maintained, inspected regularly, and not used beyond their design limits. No modification of engineering controls will

occur unless justified to the Laboratory Manager and SSHO and/or testing by the Laboratory Manager and/or SSHO indicates that employee protection will continue to be adequate.

Several different engineered controls that are used to dilute, capture, or contain hazardous chemicals are implemented within the lab. Specifically, ventilation systems, both general and exhaust hoods, approved storage containers, and storage cabinets for flammable and corrosive chemicals are suitable engineering controls to reduce personnel exposure to volatile hazardous chemicals.

The risk of fire can be reduced by limiting the quantity of chemicals stored in the laboratory and by reducing the use of ignition sources, or open flames. The proper and compatible storage of chemicals minimizes the risk of hazardous chemical reactions.

3.8.5.1 Ventilation

General ventilation with air intakes properly located will reduce the intake of contaminated air into the building. Laboratory ventilation supply air should:

- Continually replace the laboratory air, preventing an increase in the concentration of volatile chemicals in air over the workday. Generally 4 to 12 changes of room air per hour are considered to provide adequate ventilation.
- Introduce the conditioned, fresh air uniformly throughout the laboratory with minimum turbulence.
- Since the air in laboratories can become contaminated with fumes and vapors that have been released during work with chemicals, heating, ventilation, and air conditioning air must not be recycled from those laboratory areas where work with chemicals is performed.

General ventilation should not be relied on to provide adequate protection by diluting the vapors of volatile chemicals used within the laboratory. An inadequate ventilation system can prove to be worse than none at all since it could give laboratory workers a false sense of security that they are protected from airborne toxic substances. Improper function of engineering controls must be reported to the Laboratory Manager and SSHO immediately. The system shall be taken out of service until proper repairs have been executed.

Hoods and downdraft tables will be provided for all laboratory operations that are likely to produce airborne respiratory hazards. These hazards can include dust from grinding samples and chemical fumes or vapors from sample preparation activities. Laboratory operations that can produce airborne hazards **MUST** be performed in an operating laboratory hood. Laboratory fume hoods protect employees working with hazardous chemicals by removing toxic materials from the workers' breathing zone. They are the primary engineering control for reducing employee exposure to volatile chemicals.

All employees shall follow proper work practices when using the engineering controls. As a general rule, the hood shall be used for all chemical procedures involving substances which are appreciably volatile and have a permissible exposure limit (PEL) less than 50 ppm. As a result, fume hoods shall be used when employees are working with hazardous materials or substances with unknown toxicity. This includes the initial receipt and processing of samples, which can then be moved out of the hood if there is no apparent need for ventilation. Fume hoods:

- Will have an average face velocity of at least 100 feet per minute with a minimum of 80 feet per minute at any one point. A face velocity of 125 feet per minute with a minimum of 100 feet per minute at any one point, is required if carcinogens and highly toxic materials are being used. An average face velocity of 100 feet per minute is required for work with radioactive materials. Fume hood operation will be evaluated by the Lab Manager and SSHO. The sash position shall be marked to indicate the acceptable position for achieving the desired air flow rate.
- Face velocities will be posted on the face of each hood. Documentation on face velocity measurements will be maintained by the Lab Manager and SSHO for at least five years.
- All laboratory hoods will be inspected a minimum of once every three months for face airflow velocity and containment characteristics. These tests will be performed by or at the direction of the SSHO. A record of each inspection shall be maintained by the SSHO. A label will be placed on each laboratory hood that has passed this inspection. Only laboratory hoods with a current inspection label may be used for laboratory operations that can produce airborne hazards. Additional velocity testing will be performed if fume hoods are altered, after maintenance activities, after any modification to building ventilation systems, and as directed by the SSHO.
- Will have a device attached that indicates the hood is working correctly. Such devices include, but are not limited to, a slant manometer or a magnehelic gauge. They should allow the lab worker to determine that the hood is working regardless of the position of the sash.
- Hood sashes will be maintained at the recommended height established during velocity testing and marked on the hood. Hood sashes may be adjusted for brief periods to facilitate placing items in or removing items from the hoods. If the face velocity is such that the sash must be lowered so that the operator cannot use the hood effectively the hood will be taken out of service.
- A sign shall be posted on the hood to inform employees when a hood is not working correctly. It is the responsibility of the Lab Manager to verify that repairs are promptly made. The face velocity will be measured after repairs are complete in order to ensure that the hood is working correctly before it is returned to service. This is not necessary after routine maintenance.

The following general rules apply to the use of laboratory hoods:

- Fume hoods are work areas and should not be used for storage. Materials in the hoods will be kept to a minimum and placed where they will not block vents or reduce air flow.
- Never put your head inside an operating laboratory hood.
- The plane of the sash is the barrier between contaminated and uncontaminated air.
- Minimize interference with the inward flow of air into the hood.
- Vent ducts and fans must be kept clean and clear of obstructions.
- Hoods and sashes shall be periodically cleaned, as directed by the Lab Manager, to ensure chemical buildup is minimized and a high level of visibility is maintained.

- Storage of chemicals and equipment inside the hood shall be kept to a minimum.
- Avoid cluttering hoods with bottles or equipment; keep it clean and clear. Only materials actively in use should be in the hood. This will provide optimal containment and reduce the risk of extraneous chemicals being involved in any fire or explosion that may occur in the hood.
- Always try to keep hazardous chemicals at least 6 inches behind the plane of the sash.
- The hood must remain “on” when chemicals are contained inside the hood or if it is uncertain whether adequate general laboratory ventilation will be maintained when the hood is nonoperational.
- Hoods must be operating prior to opening chemical containers inside the hood. An inward flow of air can be confirmed by holding a piece of tissue or paper at the face of the hood and observing the movement of the paper. If the hood is not operational, contact the Lab Manager and SSHO and post an out of service sign. The sign should be clearly visible to all users of the hood and state that the hood is not operational.
- After using hoods, operate the fan for a minimum of 15 minutes to clear residual contaminants from the ductwork.
- The hood shall not be used as a means of disposal for volatile chemicals.
- Promptly report power failure or any suspected hood malfunctions to the CHO.

Maintenance

Good equipment maintenance is important for safe, efficient operations. Equipment failure may create an unacceptable hazard level within the laboratory. If the operation cannot be performed safely, the preparation or analysis of the samples will not continue.

Fume hoods and ventilation systems shall be given preventive maintenance at least every 6 months. The maintenance should be scheduled and performed when the unit can be taken out of production. Equipment repair and maintenance shall be performed by trained individuals. Maintenance of and repairs on engineered controls shall be documented.

3.8.6 Emergency Shower and Eyewash

The laboratory is equipped with a combination deluge type safety shower and face/eyewash facility. The pathway to this eyewash and shower facility must be kept clear at all times and identified with highly visible signage.

Personnel using the eyewash or shower to deluge corrosive materials shall continue the procedure for a 15 minute period while emergency personnel are en route to provide medical care.

It is the responsibility of the Lab Manager and SSHO to inspect and test the safety shower and face/eyewash facility in the laboratory weekly. The safety shower and face/eyewash facility must be activated to verify proper operation. The Lab Manager will document that the inspection was performed and initial and tag the inspection tag. Safety showers and eyewash facilities shall also receive an annual inspection in accordance with ANSI Z358.1, Sections 4 and 7.

3.8.7 Laboratory Safe Work Practices

The key factor in working safely with chemical, physical, radiological, and biological hazards is preventing, or minimizing any exposure. The level of exposure to these hazards can be greatly reduced or eliminated through the use of engineering controls, administrative controls, and PPE. Laboratory safety requires all employees to accept their responsibilities and to participate collectively.

3.8.7.1 Laboratory Rules

The following minimum requirements will be followed by anyone handling chemicals or samples in the laboratory:

- The employees should understand, and will implement the requirements of the safety provisions of this section of the SSHP.
- All accidents, incidents, injuries, work-related illnesses and chemical releases will be reported to the Lab Manager and SSHO immediately following the event, or as soon as it is discovered.
- The Lab Manager and SSHO shall be notified immediately of any unsafe condition, or safety equipment that is broken, damaged, or missing.
- Good housekeeping is of paramount importance. Employees will keep floors, working surfaces clean, dry, and free from clutter. Spills will be cleaned up immediately. Glassware and other equipment will be stored in designated areas when not in use.
- Eating, drinking, chewing gum or tobacco products, or applying cosmetics or lip balm in the laboratory is not permitted.
- Hands, arms, and other areas of the body that may have been in contact with chemicals will be washed before eating, drinking, or smoking.
- All facility personnel and visitors will wear safety glasses with side shields while in laboratory areas, except where posted otherwise.
- Avoid use of contact lenses in the laboratory unless necessary. If they are used, inform the Lab Manager and SSHO so precautions, if necessary, can be taken.
- Chemical goggles or face shields over safety glasses will be worn while large quantities (5 gallons or more) of hazardous liquids are being handled, concentrated acids or bases are used, or where there is a potential for chemicals to be splashed during transfer.
- Laboratory coats will be worn by all employees and visitors when working directly with, or in close proximity to chemicals and samples, or contaminated equipment. Lab coats may not be taken home for laundering. Lab coats must be removed before entering areas where food consumption is permitted.
- Gloves must be worn when chemicals and samples are handled. The gloves will be selected on the basis of the materials handled, procedure, the temperature conditions, and the dexterity required.
- Employees will inspect gloves before use and make sure that the gloves provide adequate protection from the hazardous chemicals being used.

- PPE listed in the standard operating procedure for the task.
- Enclosed shoes will be worn in a laboratory. Protective footwear (i.e., safety shoes or shoe caps) will be worn for activities that have the potential to result in foot injuries (e.g., moving heavy equipment or materials).
- Long pants will be worn when handling hazardous chemicals in the laboratory.
- Any safety equipment, such as a laboratory coat, that is suspected of being contaminated will be removed immediately and a new laboratory coat or replacement safety equipment will be obtained.
- Clear access will be maintained to all emergency equipment, such as fire extinguishers, eye washes, safety showers, etc., and to electrical panels and other control equipment.
- Employees shall be trained in the selection, location, and operation of emergency equipment for use in the event of an accident or spill.
- The use of respiratory protective equipment requires SSHO approval and training.
- A neoprene rubber or polyethylene carrier will be used to transport single bottles of hazardous chemicals from stockroom/storeroom and within the laboratory. Bottles shall not be carried unprotected.
- A cart with a leak proof top to provide secondary containment of chemicals will be used to transport multiple containers of chemicals from stock/storeroom and within the laboratory.
- Mouth pipetting is prohibited. Mechanical pipettes will be used.
- Chemicals or samples will not be smelled or tasted.
- Chemicals must be stored in safe locations according to compatibility.

3.8.7.2 Hygiene Practices

The following good hygiene practices must be adhered to:

- Hands will be washed before eating, drinking, smoking, or using restrooms.
- Food and drink will be stored, handled, or consumed in an area free from hazardous chemicals.
- Glassware or utensils that could be used for laboratory operations must never be used to prepare or contain food or beverages.
- Laboratory refrigerators, ice chests, cold rooms, and such are for samples and will not be used for storing food and beverages. These refrigerators shall be marked that they will not be used for food storage.

3.8.7.3 Housekeeping

There is a definite relationship between safety performance and orderliness in the laboratory. When high housekeeping standards are not maintained, safety performance and productivity inevitably deteriorates. Hazardous materials are present in laboratory and storage areas, thus it is

of paramount importance that good housekeeping practices be implemented to prevent unnecessary exposure or injury. The following steps are required:

- Chemicals must be labeled clearly and properly.
- Equipment/materials must be stored in their proper location.
- All safety equipment shall be readily accessible.
- Aisles will be clear of items that could cause trips or block someone's exit.
- Floors will be cleaned regularly.
- Trash will be placed in appropriate, labeled containers; and prohibited from accumulating on the floor, on the benches, etc.
- Clean-up should occur at the end of the operation, or the end of the day.
- Report and clean up spilled chemicals immediately using the appropriate spill control procedures. Spill clean-up materials shall be properly packaged and labeled for subsequent disposal. The SSHO should be contacted if additional information is needed.
- Access to exits, emergency equipment, electrical control panels, etc. will be kept clear at all times.
- Electrical cords, cables, etc., must not present a tripping hazard. They should be kept tidy, preferably off the floors.
- Chemical wastes will be disposed of promptly using appropriate procedures.
- Materials and chemicals that are no longer needed must not be allowed to accumulate in the laboratory.

3.8.7.4 *Equipment Guarding*

All mechanical equipment shall be equipped with guards that prevent access to moving parts (i.e., the belts and pulleys). Each laboratory worker will inspect equipment before using it to verify that the guards are in place and functioning.

Personnel shall be instructed on the location and operation of emergency shut-off devices.

3.8.7.5 *Glassware*

Accidents involving glassware are a leading cause of all laboratory injuries; therefore, the following guidelines must be adhered to closely:

- Glassware will be inspected carefully before use.
- Careful handling and storage procedures must be used to avoid damaging glassware. Chipped, cracked, or stressed items shall be disposed of, or if appropriate, repaired.
- Adequate hand protection must be used when inserting glass tubing into rubber stoppers or corks, or when placing rubber or plastic tubing on glass hose connections. Glass tubing should be fire polished or rounded and will be lubricated. Hands should be held close together to limit movement of glass if fracture occurs. The use of plastic or metal connectors should be considered.

- Heavy gloves must be used when picking up broken glass. (Small pieces should be swept into a dustpan with a brush.)
- Proper instruction should be provided for first-time users of glass equipment designed for specialized tasks that may represent unusual risks. For example, separatory funnels containing volatile solvents can develop considerable pressure during use; these must be vented frequently into a hood.

3.8.7.6 *Electrical*

Electrical hazards in the laboratory shall be controlled. The following electrical safety procedures are in effect:

- Only qualified persons are permitted to work on electrical equipment and systems.
- Electrical outlets will have a grounding connection (three-pronged plug).
- Ground-fault circuit interrupters will be used within six feet of water supplies or in areas where water may be present.
- Outlets will be located so as to minimize the possibility of water or chemicals being accidentally spilled on them.
- The condition of wiring and cords attached to equipment will be frequently inspected, including regular monthly inspections and before use. All wiring that is worn or frayed will be eliminated.
- Extension cords should be considered to be a temporary solution for lack of power at a location within a laboratory. Their use shall be limited and the installation of a permanent solution, such as additional electric circuits, should be implemented as soon as practical. When they are used, they must be of sufficient gauge for the anticipated load and must be secured to prevent a tripping hazard.
- Outlets should be identified by control panel and circuit so they can quickly be turned off from outside the work area.
- Electrical control panels must not be obstructed; a clearance of at least 3 feet must be maintained in front.
- Electrical control panel circuits shall be labeled identifying rated amperage, room, and equipment and/or outlets.
- Electrical circuits in the laboratories will have overload protection.
- New or existing laboratory equipment will contain overload protection.
- Electric strips equipped with overload protection may be used; “octopus” or similar multiple outlets are prohibited.

3.8.7.8 *Refrigerators and Freezers*

The following rules pertain to the use of refrigeration equipment:

- Only aqueous solutions may be stored in domestic (home-type) refrigerators and freezers because the various control switches and defroster heaters can spark and ignite flammable mixtures.
- Explosion-proof, or flammable storage refrigerators and freezers shall be used when flammable or reactive chemicals must be refrigerated. These refrigerators have modified internal wiring eliminating ignition sources and sealed external motors and switches.
- Laboratory refrigerators and freezers shall be appropriately posted to prohibit food and drink storage.

3.8.7.9 Portable Heaters

Laboratory use of portable heaters is not permitted because of the presence of flammable materials.

3.8.7.10 Cryogenic Hazards

Cryogenic materials (i.e., liquefied gases) are extremely cold and, therefore, extremely hazardous. They and the surfaces they cool can cause severe burns if allowed to contact the skin.

While transfers are being made protective equipment will include laboratory coat, insulated gloves, and face shield when working with liquefied gases or dry ice baths. Safety glasses may be substituted when transfers are not being made. Gloves will be loose enough so that they can easily be cast aside.

Neither liquid nitrogen nor any other cryogenic liquid may be used to cool a flammable mixture in the presence of air because oxygen can condense from air and cause a fire or explosion.

3.8.7.11 Containers under Vacuum

In an evacuated system, the higher pressure is on the outside, rather than on the inside, thus a break causes an implosion that results in flying glass, spattered chemicals, and possibly fire. Glass will be inspected for star cracks, scratches or etching before use. Repaired glass should not be used for vacuum or pressure work. Apparatus such as desiccators, cold traps, and Dewar flasks will be wrapped in friction tape or contained behind an explosion shield. Employees will use a face shield and safety glasses when working with containers under vacuum. Water aspirators use specially designed glassware – substitution is not allowed.

3.8.7.12 Compressed Gas Cylinders

Compressed gases pose both physical and chemical hazards. Handling compressed gases exposes the employee both to the weight of the cylinder and to chemical hazards, which are the contents of the cylinder. Flammable gases under pressure may diffuse throughout a laboratory presenting a fire or explosion threat. Compressed gases frequently are at 1,500 to 2,000 pounds per square inch making the cylinder a potential rocket or fragmentation bomb. Unlabeled cylinders or cylinders with dents, scratches, or gouges will not be accepted at time of delivery. Cylinders must be legibly marked, identifying the gas by a chemical or trade name.

Storage and Handling

The following rules pertain to the storage and handling of compressed gas cylinders:

- Persons handling and moving compressed gas cylinders will wear safety glasses and steel-toed shoes or shoe caps.
- Cylinders of compressed gases should be handled as high energy sources.
- All gas cylinders must be stored in a well-ventilated location at least 20 feet, where possible, away from all hazardous substances. Oxygen and oxidizing gases will be separated by at least 20 feet from flammable gases, or by a fire barrier meeting NFPA requirements.
- Cylinders of all sizes (empty or full) will be firmly restrained by chains, straps, stands or in racks.
- Valve caps will be securely in place during cylinder storage and transfer. Never lift a cylinder by the valve cap.
- Cylinders will be moved by strapping into a specially designed wheeled cart to ensure stability. Do not allow cylinders to knock together.
- Some rupture devices on cylinders will release at about 65 degrees Celsius ($^{\circ}\text{C}$). Do not expose cylinders to temperatures higher than 50°C . Some small cylinders, such as lecture bottles, are not fitted with rupture devices and may explode if exposed to high temperatures.
- Cylinders must not be used as rollers.

Operation and Use

The following rules pertain to the operation and use of compressed gas cylinders:

- Use the appropriate regulator on each gas cylinder. Adapters or homemade modifications can be dangerous and are prohibited.
- Oxygen shall not be used in place of air.
- Cylinders must be secured before being put into service.
- Do not put oil or grease on cylinder systems that contain oxygen, chlorine, or other oxidizing agents. An explosion can result.
- Use SNOOPTM or a soap solution to test for leaks, do not use a flame.
- Toxic, flammable, or reactive gases will be used only in fume hoods.
- Never direct high pressure gases at anyone.
- Compressed gas or compressed air should not be used to blow away dust or dirt; the resultant flying particles are dangerous.
- Flash arrestors will be used on cylinders containing hydrogen or other flammable gases.
- Be aware that rapid release of a compressed gas will cause an unsecured gas hose to whip dangerously and also may build up a static charge that could ignite a combustible gas.
- Do not extinguish a flame involving a highly combustible gas until the source of gas has been shut off; otherwise, it can re-ignite causing an explosion.

- Close the main cylinder valves securely when the cylinder is not in use.
- Never bleed cylinders completely empty. Leave a slight pressure to keep contaminants out.
- Cylinders must never be opened, even to determine if they are empty, without a regulator being firmly attached.
- Promptly remove the regulators from empty cylinders, and replace the protective valve cap at once. Mark the cylinder empty and move it to storage.

Acetylene

The following rules pertain to the operation and use of compressed acetylene cylinders:

- Acetylene cylinders are partially filled with acetone; they shall be stored and used in an upright position.
- Do not use an acetylene cylinder that has been stored or handled in a non-upright position until it has remained upright for at least 30 minutes.
- Ensure that the outlet line of an acetylene cylinder is protected with a flash arrester.
- Never exceed the pressure limit indicated by the warning red line of an acetylene pressure gauge.
- Use the correct kind of tubing to transfer gaseous acetylene. Tubing materials such as copper and some brass alloys form explosive acetylides and must not be used.
- Always close the cylinder valve before closing off the regulator.

3.8.7.13 Warning Signs and Labels

Signs, labels, and postings are integral parts of a hazard communication program. These postings, signs, markings, and labels shall be properly positioned and all employees shall be trained to recognize the significance of these communications.

Laboratory areas will be posted with the appropriate warning signs. Standard signs and symbols have been established for a number of special situations, such as radiation hazards, biological hazards, fire hazards, and laser operations. Areas designated for use of carcinogens, or other high hazard or regulated materials will be identified and posted.

Signs providing information will be posted to show the location of safety items such as:

- Eye wash stations
- Safety showers
- Fire extinguishers

Labels on containers of chemicals will contain information on the hazards involved with the chemical. They will not be removed as long as the chemical remains in the container. Shelf life dates will be provided for sensitive chemicals such as peroxide forming chemicals.

Waste containers shall be labeled for the type of waste that can be safely deposited in them.

3.8.7.14 Acutely Hazardous Substances

Some acutely hazardous substances are present in the laboratory. The following hazardous substances warrant special precaution:

- Tracers and standards for uranium, thorium, and radium analysis may be considered acutely hazardous substances because of their radioactivity.
- Hydrofluoric acid is used to digest soil samples. Hydrofluoric acid is acutely toxic as well as corrosive.

Special precautions for handling and using these chemicals are included in the individual OPs for operations involving their use. Additional eye, face, and dermal protection are specified for using these chemicals.

Digesting soil and air filter samples requires destructive digestion using hydrofluoric acid at elevated temperature and pressure. These digestions will be performed in either a specially designed and vented microwave oven or an operating laboratory hood.

Special instructions for prompt medical treatment of hydrofluoric acid exposure must be followed and reviewed with all laboratory personnel.

3.8.7.15 Laboratory Wastes

All wastes must be properly labeled, stored, accumulated in approved areas subject to routine inspection, and offered for disposal under the control of applicable regulations. All waste materials will be disposed of in compliance with local, state, and federal regulations in a manner that prevents contamination of non-designated areas.

Laboratory aqueous liquid waste will be poured into designated sinks for disposal to the liquid aqueous waste tank. Aqueous wastes should be tested for pH prior to disposal. Wastes should be adjusted to a pH between 5.5 and 9.5 before disposing to the waste tank.

All wastes shall be segregated, containerized, and properly disposed of as specified by the Project Transportation and Disposal Coordinator.

Conventional solid waste will be disposed of as ordinary trash in the facility dumpster.

4.0 CHEMICAL & RADIOLOGICAL HAZARDS

4.1 CHEMICAL EXPOSURE HAZARDS

The following is a discussion of the hazards presented to worker personnel during this project from on-site chemical and radiological hazards known, suspected or anticipated to be present on site. Cabrera has based its evaluation on available data and maximum concentrations reported for the project site. The contaminants identified in Table 2-1 (Section 2) have been evaluated for exposure potential and those contaminants of concern (COC) that have the potential to exceed will be discussed in this SSHP. The COCs that have the potential to exceed their PEL/REL/TLV have been listed below in Table 4-1. If there is any information that is contrary to Cabrera's conclusions in this SSHP, it is anticipated that the client will provide this information prior to the initiation of site activities.

Exposure symptoms and applicable first aid information for each suspected site contaminant identified in the Scope of Work are located in the following subsections.

4.1.1 Heavy Metals

As a group, the heavy metals (including lead, arsenic, chromium, nickel, cadmium, and selenium) are toxic to a number of organs and organ systems in the body, including the liver, kidneys, blood-forming organs (primarily located in the bones), and the CNS (especially lead). Acute exposure to metals can produce such symptoms as stomach distress and vomiting, mental confusion and sluggishness, heart palpitations, breathing difficulties, and renal (kidney) failure. Chronic exposures can be characterized by deterioration in function of the liver and kidneys, CNS degradation, and abnormal changes in blood cell counts (especially white blood cells). Exposure to chromium may also lead to formation of lung and gastric cancers.

The primary route of exposure to heavy metals of concern during this project is contact with contaminated soil and water, which can lead to entry through open wounds or ingestion of food or inhalation of dust from on-site activities when dealing with impacted media. Preventing potential exposure necessitates the use of dust control measures, administrative controls (e.g., no consumption of food/beverages in the work area or smoking/chewing tobacco), chemically-protective gloves, and decontamination procedures.

4.1.2 Organic Solvents

Organic solvents are toxic because of the physical characteristics which permit them to solubilize fats, lipids, and grease. At some concentration, all organic solvents are asphyxiates. Acute exposure risks are depressive and narcotic effects on the central nervous system.

Neurotoxic effects of organic solvents have been known for a long time. Neurasthenic syndromes, including fatigue, concentration difficulty, loss of memory, general irritability, and alcohol intolerance have been described as well as several cases in which chronic symptoms revealed more or less permanent injuries to the nervous system. However, it may be assumed that the amount of exposure was higher in the past than it is now, due to awareness of the work environment and control of health risks.

The mechanisms by which the effects on the nervous system are produced remain largely unclear. Mutagenic activity in the various test systems has been demonstrated for benzene,

styrene, trichloroethylene and certain chlorinated ethanes. Chromosome changes have been noted in workers exposed to benzene, benzene-toluene mixture, trichloroethylene, styrene, and in cases where there has been a mixed exposure to solvents, etc., in laboratories. Trichloroethylene, perchloroethylene, dichloroethane, carbon tetrachloride, methylene chloride and chloroform have all proved carcinogenic in conventional tumor induction tests on mice and rats.

Epidemiological studies of tumors have been done on persons exposed at work to trichloroethylene, benzene, and styrene. Benzene has long been known as a leukomogenic substance. Fetal damage and spontaneous abortions are suspected to be related to exposure to solvents.

Effects on other organs include the acute cardiac rhythm disturbances which have been described in connection with high exposure to certain solvents. The effects of benzene on the blood-forming bone-marrow is well known. Similar effects have been reported with other aromatic solvents; however, benzene contamination may have been the cause. Carbon disulfide has been reported to cause an increased incidence of chronic heart disease.

Exposure to carbon tetrachloride and certain chlorinated ethanes produce acute effects on the liver, as also does consumption of ethyl alcohol. These substances may also cause chronic liver damage. A slight or moderate increase in liver values in groups exposed to solvents is sometimes noted in health examinations, but is hard to evaluate.

Exposure to solvents has also been shown to be more common in cases of chronic glomerulonephritis than in control groups. Exposure to high concentrations of organic solvents in the air causes localized eye irritation. Certain lens changes have also occurred.

The drying effect of solvents on the skin is a very common occurrence. As stated previously, solvents remove fats and lipids from cellular membranes causing them to dry out and give a cracked appearance.

CNS depressant properties:

As a practical concern, as size increases beyond 5 carbons for any of the functional classes (i.e., amines, alcohols, etc.) the vapor pressure decreases, therefore, the likelihood of exposure also decreases.

Central nervous system depression is usually enhanced by halogenation, and to a lesser extent, by the addition of alcoholic functional groups.

Anesthetic Properties

Methane & Ethane	Little if any
Methanol & Ethanol	Potent
Methylene chloride	Appreciable
Chloroform	Strong
Carbon tetrachloride	Stronger

Irritation of membranes and tissues:

- 1) Aromatics are more irritating than aliphatics.

2) Functional groups increase the irritant properties:

Level of Irritant Activity

Amines	Higher
Organic acids	Higher
Aldehydes & Keytones	Same
Alcohols	Lower
Alkanes	Lower

Other toxic properties of organic solvents include:

hepatotoxicity nephrotoxicity
cardiac arrhythmias chemical pneumonitis (if aspirated)
(induced by sensitizing the heart to catecholamines),

Saturated aliphatic solvents:

Saturated aliphatic solvents are the least potent of all classes. Aliphatics with 1 to 4 carbons are low in toxicity, with their primary hazard being flammability and explosion potential. Chronic exposure (particularly hexane and heptane) can cause polyneuropathy characterized by a lower nerve conduction velocity and a degenerative change “drying back” in the distal axons. Also, may include muscle pain, spasm, weakness and parathesias. Metabolites such as di-keytones have been implicated.

Aromatic solvents:

Aromatic solvents are more irritating than the aliphatics. They typically are primary irritants causing severe defatting of the skin and may result in tissue injury or burns with repeated exposure. If systemically absorbed, they are considerably more toxic than the aliphatics of similar carbon number. Addition of functional groups increases CNS depressant activity.

Benzene is a CNS depressant and an irritant. Benzene is myelotoxic with chronic exposure initially stimulating RBC, WBC, and thrombocyte counts, followed by aplastic anemia (pancytopenia). Benzene is leukemogenic and causes myocardial sensitization to epinephrine.

Information derived from Organic Solvents, written by Roy T. McKay, Ph.D., Toxicologist, Occupational Health Clinic, Cincinnati, OH 45267.

Table 4-1: Chemical/Physical Agent Health and Safety Information

Compound	PEL/TLV (ppm)	Exposure Route	Health Effects	Ionization Potential (eV)	IDLH (ppm)
Benzene	1/0.1, 5.0 STEL	Inhalation, skin, absorption	Cancer, CNS	9.24	500 Carcinogen
1,1dichloroethene	none/5, 20 STEL	Inhalation, skin, absorption	CNS, Skin-eye irritant	10	Not determined
Ethyl benzene	100/100, 125 STEL	Inhalation, skin, absorption	CNS, dermatitis	8.76	800
Toluene	100, 150 STEL	Inhalation, skin, absorption	CNS, Skin-eye irritant	8.82	500
Trichloroethene	100, 200 C/25 (10-hour TWA)	Inhalation, skin, absorption	CNS, dermatitis	9.45	1,000
Xylene	100/100, 150 STEL	Inhalation, skin, absorption	CNS, dermatitis	8.56	900
Arsenic (Inorganic)	10 µg/m ³ /2.0 µg/m ³ (15-min)	Inhalation, skin, absorption	Cancer, GI	NA	5 mg/m ³
Barium	0.5 µg/m ³ /0.5 mg/m ³	Inhalation, skin, absorption	CNS, Skin-eye irritation	NA	5 mg/m ³
Cadmium	5 µg/m ³	Inhalation, skin, absorption	Cancer, respiratory	NA	9 mg/m ³
Chromium Chromium VI	1.0 mg/m ³ /0.5 mg/m ³ C 0.1 mg/m ³ /0.001 mg/m ³	Inhalation, skin, absorption	Eye and skin irritation, respiratory	NA	250 mg/m ³
Trivalent chromium	0.5/0.5 mg/m ³	Inhalation, skin, absorption	Irritant, dermatitis	NA	25 mg/m ³
Hexavalent chromium	C= 0.1 mg/m ³ /0.001 mg/m ³	Inhalation, skin, absorption	Cancer, respiratory irritant	NA	15 mg/m ³
Lead	0.05/0.05 mg/m ³	Inhalation, skin, absorption	CNS, Blood, GI	NA	100 mg/m ³
Uranium	0.25/0.2 mg/m ³ 0.6 mg/m ³ STEL	Inhalation, contact, absorption	Cancer, respiratory, kidney	NA	10 mg/m ³
Antimony	0.05/0.5 mg/m ³	Inhalation, contact, absorption	Irritation, CVS, lung	NA	50 mg/m ³
Beryllium	0.002 mg/m ³ /0.0005 mg/m ³ (not to exceed)	Inhalation, contact, absorption	Berylliosis, lung cancer	NA	Carcinogen (4 mg/m ³ as Be)
Copper	1/1 mg/m ³	Inhalation, contact absorption	Irritation, metal fume fever	NA	100 mg/m ³
Mercury	0.1 C/0.025 mg/m ³ Skin	Inhalation, contact absorption	CNS, kidney	NA	10 mg/m ³
Nickel	1.0/0.015 mg/m ³	Inhalation, contact absorption	Dermatitis, kidney	NA	Carcinogen (10 mg/m ³ as Nickel)
Zinc	5 mg/m ³ (resp dust) 10 mg/m ³ STEL	Inhalation, contact absorption	Lung	NA	500 mg/m ³

Table 4-1: Chemical/Physical Agent Health and Safety Information (Cont'd)

Compound	PEL/TLV (ppm)	Exposure Route	Health Effects	Ionization Potential (eV)	IDLH (ppm)
Lithium	0.025/0.025 mg/m ³ Lithium hydride	Inhalation, contact absorption	Irritation	NA	0.5 mg/m ³
Gasoline	NA/300, 500 STEL	Inhalation, contact absorption	Cancer, CNS, irritant	Mixture	Carcinogen
2-butanone	200/200, 300 STEL	Inhalation ingestion	Irritation, CNS	9.54	3,000
Carbon disulfide	20, 30 C/1, 10 STEL (skin)	Inhalation,	CVS, CNS, neuropathy	10.08	500
Chlordane	0.5/0.5 mg/m ³ skin	Contact, ingestion	CNS, liver	Not known	Carcinogen (100 mg/m ³)
Coal tar pitch Volatiles	0.2/0.2 mg/m ³	Inhalation	Cancer	NA	Carcinogen (80 mg/m ³)
Dibutyl phthalate	5/5 mg/m ³	Inhalation, ingestion	Irritant, reproductive	NA	4,000 mg/m ³
Methanol	200/200, 250 STEL (skin)	Skin, inhalation	Neuropathy, CNS	10.84	6,000
Sulfuric acid	1/1 mg/m ³	Skin, inhalation	Irritation, cancer	NA	15 mg/m ³
Ethylene glycol	NA/50 mg/m ³ C	Skin, inhalation	Irritation, CNS		NA
Sodium hydroxide	2/2 mg/m ³ C	Skin, inhalation	Irritation	NA	10 mg/m ³
Noise	8 hours = 90 dB 4 hours = 95 dB	Ears, bone conduction	Hearing loss	NA	NA
Heat Stress			Heat stress Heat stroke	NA	104°F Body core temperature
Cold Stress	98.6°F Body Temperature		Frost bite	NA	95°F Body Temp.

Note(s):

°F denotes degrees Fahrenheit.

µg/m³ denotes microgram(s) per cubic meter.

C denotes ceiling.

CNS denotes central nervous system.

CVS denotes cardio vascular system.

dB denotes decibels.

eV denotes electron volts.

GI denotes gastrointestinal.

IDLH denotes Immediately Dangerous to Life and Health.

NA denotes not applicable.

PEL denotes permissible exposure limit.

ppm denotes parts per million.

STEL denotes short term exposure limit.

TLV denotes threshold limit value.

TWA denotes time-weighted average.

4.2 RADIOLOGICAL HAZARDS

Contamination at the FMSS by radioactive materials resulted from processing operations conducted at the site from 1916 through 1956. The main process was extraction of thorium and

other rare metals, which in turn were used to manufacture other products such as mantles for gas lanterns. Waste generated from manufacturing has been dispersed and the wastes are buried at various locations on the site.

Review of various site characterization studies indicates the presence of thorium-232, radium 226, and uranium 238 contamination in surface and subsurface soil that are above the New Jersey clean up requirements. Refer to Table 2-1, "Potential Contaminants of Concern for Maywood Site Properties (Chemical and Radiological)," for maximum found radionuclide concentrations in soil at FMSS properties.

Elevated radon and thoron levels have also been detected on and around the site. Radon and thoron gas monitors were maintained on and around the site during the 1984 through 1988 period. Radon and thoron concentrations above the New Jersey regulatory requirements were detected.

Radiological hazards may be present during remediation activities. Internal and/or external exposure to alpha, beta, and gamma radiation from the decay of thorium-232, radium 226, uranium 238, radon, thoron, and their decay products may occur. The potential hazard is directly related to the concentration of radioactive materials in soil being remediated. Internal exposure occurs when radioactive materials are taken into the body following inhalation, absorption, or ingestion. External exposure results from exposure to radiation from a radioactive source outside the body. Radiation effects occur on a cellular level. Energy from radioactive particles (alpha and beta) and ray (gamma and x rays) can cause a range of damage to cells, from no effect to cell death or cancer.

Alpha particles deliver an internal radiation dose when emitted from a radionuclide that has gained entrance into the body. Alpha particles are not normally considered an external dose hazard for workers, as they are shielded by the dead layer of skin. Alpha particles may be taken internally by inhalation (the primary pathway at Maywood), ingestion, and injection.

Radiation dose can be received by external exposure to gamma rays emanating from various Maywood radionuclides of concern. Gamma rays are short wavelength rays that have no mass. Gamma rays deposit their energy in the whole body because gamma rays readily penetrate and pass through human tissues.

Although less of a concern than gamma or alpha radiation at Maywood, the dose is also received from beta particles emitted from several of the radionuclides of concern at Maywood. Beta particles are a potential internal and external hazard. The energy of beta particles can be deposited externally in the skin or in an internal organ if an intake occurs.

4.2.1 Perspective on Occupational Radiation Exposure

Radiation is all around us. It is naturally present in our environment and has been since the birth of this planet. Consequently, life has evolved in an environment that has significant levels of ionizing radiation. It comes from outer space (cosmic), the ground (terrestrial), and even from within our own bodies. It is present in the air we breathe, the food we eat, the water we drink, and in the construction materials used to build our homes. Certain foods such as bananas and Brazil nuts naturally contain higher levels of radiation than other foods. Brick and stone homes have higher natural radiation levels than homes made of other building materials such as wood. Our nation's capitol, which is largely constructed of granite, contains higher levels of natural

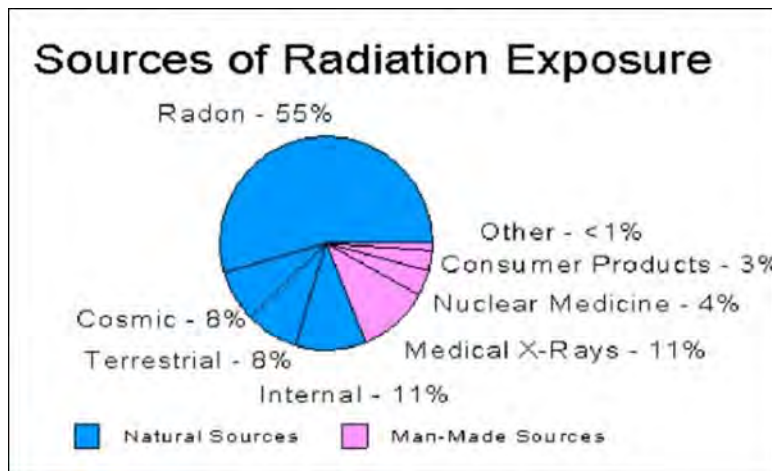
radiation than most homes. Furthermore, a lot of our natural exposure is due to radon, a gas from the earth's crust that is present in the air we breathe.

Levels of natural or background radiation can vary greatly from one location to the next. For example, people residing in Colorado are exposed to more natural radiation than residents of the east or west coast because Colorado has more cosmic radiation at a higher altitude and more terrestrial radiation from soils enriched in naturally occurring uranium.

The average annual radiation exposure from natural sources to a member of the general public in the United States is about 0.3 rem. Radon gas accounts for two thirds of this exposure, while cosmic, terrestrial, and internal radiation account for the remainder. No adverse health effects have been discerned from doses arising from these levels of natural radiation exposure.

In addition, man-made sources of radiation from medical, commercial, and industrial activities contribute another 0.06 rem to our annual radiation exposure. One of the largest of these sources of exposure is medical x-rays. Diagnostic medical procedures account for about 0.04 rem each year. In addition, some consumer products such as tobacco, fertilizer, welding rods, gas mantles, luminous watch dials, and smoke detectors contribute another 0.01 rem to our annual radiation exposure.

A typical breakdown between natural background radiation and artificial sources of radiation is shown in the pie chart below, "Sources of Radiation Exposure" (National Council on Radiation Protection and Measurements, 1987). It shows natural radiation contributes about 82 percent of the annual dose to the population while medical procedures contribute most of the remaining 18 percent. Both natural and artificial radiation affect us in the same way.



Above background levels of radiation exposure, the Nuclear Regulatory Commission (NRC) requires that its licensees limit maximum radiation exposure to individual members of the public to 0.1 rem per year, and limit occupational radiation exposure to adults working with radioactive material to 5 rem per year.

In 1999, almost 130,000 workers were monitored for radiation exposure at NRC licensed facilities. The average total effective dose equivalent (TEDE) for all workers at these facilities was 0.13 rem. A little over 113,000 workers were monitored for radiation exposure at DOE facilities in 1999. The average TEDE for all these workers was slightly above 0.01 rem. For the sake of comparison, the average TEDE for all monitored workers at the FMSS in 2001 was less

than 0.01 rem. This shows that the average worker exposure at the FMSS is lower than other nuclear industry workers, and is a small fraction of what the average person receives every year from background radiation.

4.2.2 Naturally Occurring Radioactive Material (NORM)

NORM consists of isotopes that are naturally occurring. The sources of ionizing radiation in NORM are from Uranium-238 and Thorium-232 and their decay products, which are naturally present in many oil, gas and water producing formations. Radon gas is produced during the decay of these sources.

NORM presents a potential hazard due to overexposure to naturally occurring ionizing radiation that have been concentrated through processing or manufacturing operations as is the case at the FMSS. Exposure to the hazards associated with these sources at the FMSS project occurs when employees contact the solid material (scale, sludge, cuttings, etc.).

Table 4-2: FMSS Action Levels and Response

Parameter	Monitor	Action Level*	Response Activity
Low Level Gamma	Measured at waist level	< 200 μ R/hr	Continue working in designated PPE ensemble
Low Level Gamma	Measured at waist level	200 μ R/hr -2mR/hr	If not addressed in activity-specific work permit, cease activities, contact Site RSO, investigate readings
Low Level Gamma	Measured at waist level	>2mR/hr	If not addressed in activity-specific work permit, cease activities, exit immediate area and contact Site RSO

*Action Level is twice background normally (one must identify a background prior to entering an area where equipment may cause elevated readings).

A project As-Low-As-Reasonably Achievable (ALARA) goal of 500 millirem (mrem) per year TEDE has been set at 10 percent of the USACE and NRC occupational dose based limits. This ALARA goal may not be exceeded without the written approval of the USACE Radiation Safety Staff Officer.

4.3 EXPOSURE MONITORING

The following section discusses the monitoring procedures and action levels to be implemented on-site during activities that involve potential exposure to the above listed COCs. The derived action levels are intended to provide maximum protection to employees by allowing adequate warning time to upgrade PPE, in an effort to avoid exposure.

Air monitoring data will primarily be used to verify that administrative controls, engineering controls, and PPE are effectively preventing harmful exposures (within allowed regulatory limits) to chemicals and/or are controlling internal exposures of radiation to project personnel and the public. Air monitoring data will also be used to document fugitive emissions and to indicate when site activities or work practices need modification. Air monitoring results will be conveyed to project personnel.

Real time air monitoring will be periodically conducted during routine laboratory operations and during periods when field monitoring indicates the samples being submitted for analysis may contain elevated contaminant concentrations. This type of monitoring may also be performed in

special circumstances, such as when odors are observed, employee complaints are registered, and prior to and during spill clean-up activities.

4.3.1 Health and Safety Action Levels

An action level is a point at which increased protection is required due to the concentration of contaminants in the work area or other environmental conditions. The concentration level (above background level) and the ability of the PPE to protect against that specific contaminant determine each action level. The action levels are based on concentrations in the breathing zone.

If ambient levels are measured which exceed the action levels in areas accessible to unprotected personnel, necessary control measures (barricades, warning signs, and mitigative actions to limit, etc.) must be implemented prior to commencing activities at the specific work area.

Personnel should also be able to upgrade or downgrade their level of protection with the concurrence of SSHO, SRSO and/or OH&S Manager.

Reasons to upgrade:

- Known or suspected presence of dermal hazards.
- Occurrence or likely occurrence of gas, vapor, or dust emission.
- Change in work task that will increase the exposure or potential exposure to hazardous materials.

Reasons to downgrade:

- New information indicating that the situation is less hazardous than was originally suspected.
- Change in site conditions that decrease the potential hazard.
- Change in work task that will reduce exposure to hazardous materials.

4.3.2 Monitoring Equipment

Monitoring shall be performed within the work area on site in order to detect the presence and relative levels of toxic substances. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE.

Radiation detection instruments will be used at the site to monitor for radioactivity. Portable instruments will be used to monitor or “frisk” personnel upon exiting ACPs and used for releasing equipment from radiological controls equipment will typically consist of an alpha sensitive zinc sulfide scintillation detector coupled to an appropriate rate-meter. All field personnel will be trained in the use of these instruments.

Similar instruments with either an alpha sensitive zinc sulfide scintillation detector or a gas flow proportional detector are configured with a sample holder and used to count smears for assessing removable contamination and air samples.

Instruments used to measure dose rates are ionization chamber detectors and scintillation detectors. Dose rate instrument will have adequate range and energy sensitivity to measure dose rates from background levels of a few microrem per hour to high levels of several rem per hour.

Daily quality control maintenance on all in service radiation detectors will be performed by an RPT. These include background, voltage, battery, and source checks. Data will be recorded on a quality control data sheet and initialed. Background and source count rates will be compared to average count rates. Any instrument that fails to meet the performance criteria will be tagged out of service and sent for repair or recalibration.

Each instrument shall be calibrated and operated per accordance with the manufacturer's instructions. Employees shall refer to the instrument specific instructional guidance that comes with the individual unit. The project QAPP contains a comprehensive listing of all project specific Operating Procedures. Project specific Operating Procedures for the use of several of the instruments may be referenced here.

Table 4-3 specifies the real-time monitoring equipment, which will be used for this project.

Table 4-3: Monitoring Equipment

INSTRUMENT	MANUFACTURER/MODEL*	SUBSTANCES DETECTED
VOC Monitoring Equipment		
Photo Ionization Detector (PID)	RAE Systems Mini-RAE or Multi-RAE (min. 10.6 eV bulb)	Petroleum hydrocarbons Organic Solvents
CGI Monitoring Equipment		
Combustible Gas Indicator (CGI) or Multi-gas Detector May be combined with individual or multi-gas detectors.	RAE Systems Multi-RAE	Explosively Oxygen (O ₂) Carbon Monoxide (CO) Hydrogen Sulfide (H ₂ S)
Respirable Dust Monitoring		
Particulate Monitor For respirable dust	MIE Model PDR Thermo Scientific Model PDR 1500	Aerosols, mist, dust, and fumes including Respirable dust
Perimeter Dust Monitoring		
Particulate Monitor For total dust	Dust Trak, MIE Model PDM-3 mini-RAM	Aerosols, mist, dust, and fumes
Radiological Air Monitoring		
Radiation Meter	Refer to the RPP for specific instrumentation	Radiation
Radiological Perimeter Monitoring		
Radiation Meter	Refer to the RPP for specific instrumentation	Radiation

*Or similar unit, as approved by the HSM

4.3.3 Air Monitoring Procedures

The air monitoring procedures shown below will be used on the project site during the various stages of work activities. A summary table for the following air monitoring procedures and action levels for the project has been provided in Table 4-6.

4.3.3.1 VOC Monitoring

During all intrusive work activities where radiological and chemical contamination is suspected, real time air monitoring will be conducted using the instrumentation noted above per the AHA for the task, and discretion of the SSHO.

4.3.3.2 CGI Monitoring

During specialty work, like hot work, confined space entries, and spill response clean-up, real-time air monitoring will be conducted using the instrumentation noted above (Combustible gas indicator) per the AHA for the task, and discretion of the SSHO.

4.3.3.3 Respirable Dust Monitoring

General area sampling for respirable dust particles is used primarily to verify the adequacy of radiological postings in changing airborne radiological conditions. Respirable dust monitoring provides dust equivalency levels for employee protection in case of a failure to obtain adequate breathing zone samples. The SSHO, in conjunction with the SRSO, will determine the sampling frequency, and sampler location(s), based on the stability of airborne radiological conditions, and work activities in progress.

4.3.3.4 Perimeter Dust Monitoring

Perimeter dust monitoring is used as an indicator that engineering controls are adequate for protection of the public on a real time and continuous basis.

Intermittent dust monitoring will be conducted using a Dust Trak or equivalent aerosol monitor during work activities that may result in hazardous particulates becoming airborne. Monitoring locations will be chosen based upon the anticipated tasks as well as wind and weather conditions. The action level for dust concentration at the perimeter is 50 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) ($0.05 \text{ mg}/\text{m}^3$).

The SSHO and/or SRSO may make adjustments to the $50 \mu\text{g}/\text{m}^3$ guideline using the following formula:

$$C = \text{AEL} \times (1/A) \times (8,760 \text{ hours}/t) \times (1018 \mu\text{g pCi mL}/\text{g } \mu\text{Ci m}^3)$$

Where:

- C = the dust concentration at the perimeter
- AEL = the adjusted effluent level
- A = the average soil activity on the surface
- t = the number of work hours that take place during the entire year
- $\mu\text{g pCi mL}/\text{g } \mu\text{Ci m}^3$ = is micrograms per picoCuries per milliliter/gram per microCuries per cubic meter

The $50 \mu\text{g}/\text{m}^3$ guideline was based on the following assumptions:

- A = 100 picoCuries per gram
- AEL = 1.2 (representing $1.2\text{E}-15 \mu\text{Ci}/\text{mL}$ for project-adjusted thorium-232, the E-15 is accounted for in the $\mu\text{g pCi mL}/\text{g } \mu\text{Ci m}^3$ conversion)
- T = 2,000 hours per year

With USACE concurrence, the Project Certified Health Physicist (PCHP) may eliminate the requirement for perimeter dust monitoring if air particulate data indicates that dust monitoring is unwarranted (based on sample data collected at the MISS) and unduly burdensome.

4.3.3.5 Radiological Air Monitoring

At a minimum, radiological air monitoring will be performed as follows:

- In areas where an individual working at the FMSS project is likely to receive an annual intake in excess of 10 percent of the specified limits (10 CFR 20)
- When airborne effluents or migration of airborne radioactive materials from the site exceeds 10 percent of allowable limits
- During activities with a reasonable potential to generate airborne radioactivity
- For characterization of airborne background, as needed

The SRSO will evaluate activities and work area conditions to determine if monitoring is necessary in accordance with this section. Deviations from established air monitoring protocols require PCHP and USACE concurrence.

Techniques used to quantify airborne radioactivity will include personal air samplers – also called breathing zone air samplers or lapel samplers – and general area air sampling. Breathing zone air sampling will be used to estimate routine intakes of inhaled radionuclides for assessing individual doses.

The use of breathing zone air samplers is the primary method for assessing routine intakes of thorium and uranium. Additionally, breathing zone sample results can be used to identify large, non-routine intakes. Radiation protection personnel providing job coverage, in consultation with the SRSO, select individuals (minimum of one during activities with a reasonable potential for intake of airborne radioactive materials) to wear breathing zone air lapel samplers based on the ongoing evaluation of worker activities, variability of work area radiological conditions, and individual exposure potential. Breathing zone air samples will be collected and analyzed on-site.

Radiological air monitoring will be performed for radon and radon daughters (working level) as required when an individual is likely to receive 10 percent or more of an annual limit of Intake of radon and its progeny (equal to 0.4 working level month). To assess radon exposure, it is necessary to measure the radon concentration in the air above background and to track individual exposure times. Detection methods for radon include alpha track etch detectors, electrets, continuous radon monitors, continuous working level meters, and particulate grab samples. Refer to the RPP for more specific information on radiological monitoring. The project occupational derived air concentration (DAC) values are presented in Table 4-4, “FMSS ROC DAC Values”.

Table 4-4: FMSS ROC DAC Values

Radionuclide	10 CFR 20 Appendix B, Table 1, Column 3 (μCi/mL)	Project DAC (10% of 10CFR20) (μCi/mL)
Thorium-232	1×10^{-12}	1×10^{-13}
Radium-226	3×10^{-10}	3×10^{-11}
Uranium-238	2×10^{-11}	2×10^{-12}

SOURCE: Code of Federal Regulations (CFR), Title 10, Part 20, Standards for Protection Against Radiation, U.S. Government Printing Office, Washington, D.C., June 11, 2010
 <http://www.access.gpo.gov/nara/cfr/waisidx_10/10cfr20_10.html> (December 2010).

Note(s): μCi/mL denotes microCuries per milliliter.

4.3.3.6 Radiological Perimeter Monitoring

Perimeter air monitoring is performed at the Controlled Area fence of the MISS and vicinity properties to support compliance with 10 CFR 20 Subpart D and USEPA 40 CFR 61.102

(National Emissions Standards for Hazardous Air Pollutants [NESHAP]). Perimeter air monitoring data is reviewed by the SRSO to evaluate the adequacy of engineering controls during remedial activities.

A background monitoring station has been established in downtown Maywood to determine average background air concentrations. Background is subtracted from perimeter monitoring results to determine airborne effluent concentrations resulting from remediation operations at FMSS.

Perimeter air sampling is normally performed at fixed locations 24 hours per day, 7 days a week. At vicinity properties, perimeter monitoring may be performed during active remediation activities. Low volume air samplers will be placed at strategic locations at the vicinity property Controlled Area boundaries to collect air samples.

It is expected that dust concentrations at the perimeter during work activities will be greater than during non-work hours due to heavy equipment operation and material handling activities. Perimeter monitoring may be suspended by the SRSO during non-work hours, provided dust suppression measures (i.e., wetting or covering exposed contamination in the excavation or in soil storage areas) are taken during non-work hours to prevent wind-blown movement of radioactive material to areas outside the Controlled Areas. When perimeter monitoring is suspended during non-work hours, the airborne effluent concentrations will be estimated using the same value as for similar site and meteorological conditions during work hours. Perimeter monitoring may be terminated once Restricted Area postings have been removed.

Filter change out of perimeter air samplers will be performed at a frequency long enough to ensure acceptable counting statistics and short enough to maintain consistent sampler flow rates.

Passive detectors will be used at Controlled Area perimeters to provide long term radon monitoring. The USEPA recommended action level for radon is 4 picoCuries per liter (40 CFR 61).

The controlling limit for airborne effluent is 10 mrem per year to the maximum exposed member of the general public (NESHAP [40 CFR 61]). Doses to the public are assessed using the Clean Air Assessment Package 1988 (CAP-88) PC model per NESHAP (USEPA, 1990). Effluent limits for the radionuclides of concern at the FMSS are found in 10 CFR 20, Appendix B, Table 2, Column 1. These nuclide specific values are those concentrations that, if inhaled for a period of one year, would deliver a 50 mrem TEDE. Inhalation of an air concentration reduced by a factor of five for 1 year would therefore result in a 10 mrem annual dose equivalent limit as stipulated in the radionuclide NESHAP and ALARA per 10 CFR 20.1101.

The relevant values are given in Table 4-5, "Effluent Concentration Values." If the action levels in Table 10 are exceeded a review of dust control and material handling procedures will be conducted. The levels may be exceeded for short periods of time without reaching the 10 mrem dose limit. Note that NESHAP dose limits are for any member of the public and are not boundary dose limits unless a member of the public is likely to receive the dose at a Controlled Area boundary. Appropriate modifications will be implemented to reduce the potential for exceedances in the future. Refer to the RPP for more specific information on radiological monitoring.

Table 4-5: Effluent Concentration Values

Radionuclide	10 CFR 20 Appendix B, Table 2, Column 1 ($\mu\text{Ci/mL}$)	Adjusted Effluent Level ($\mu\text{Ci/mL}$)
Thorium-232	6×10^{-15}	1.2×10^{-15}
Radium-226	9×10^{-13}	1.8×10^{-13}
Uranium-238	6×10^{-14}	1.2×10^{-14}
Uranium-234	5×10^{-14}	1×10^{-14}

SOURCE: Code of Federal Regulations (CFR), Title 10, Part 20, Standards for Protection Against Radiation, U.S. Government Printing Office, Washington, D.C., June 11, 2010
http://www.access.gpo.gov/nara/cfr/waisidx_10/10cfr20_10.html (December 2010).

Note(s): $\mu\text{Ci/mL}$ denotes microCuries per milliliter.

4.3.4 Monitoring Equipment Calibration

All instruments used will be calibrated at the beginning and end of each work shift, in accordance with the manufacturer's recommendations. If the owner's manual is not available, the personnel operating the equipment will contact the applicable office representative, rental agency or manufacturer for technical guidance for proper calibration. If equipment cannot be pre-calibrated to specifications, site operations requiring monitoring for worker exposure or off-site migration of contaminants will be postponed or temporarily ceased until this requirement is completed.

4.3.5 Personal Sampling

Should site activities warrant performing personal sampling (breathing zone) to better assess chemical exposures experienced by Cabrera employees, the SSHO, under the direction of a Certified Industrial Hygienist (CIH) will be responsible for specifying the monitoring required. Within five working days after the receipt of monitoring results, the SSHO will notify each employee, in writing, of the results that represent that employee's exposure. Copies of air sampling results will be maintained in the project files.

If the site activities warrant, the subcontractor will ensure its employees' exposures are quantified via the use of appropriate sampling techniques. The subcontractor shall notify the employees sampled in accordance with health and safety regulations, and provide the results to the SSHO for use in determining the potential for other employees' exposure.

Time integrated air sampling may be performed during activities when site characterization data and real time instrumentation indicate that chemical and/or dust exposures to personnel are suspected to be approaching established limits (permissible exposure limit/threshold limit value) for target compounds, such as arsenic, uranium, chromium, cadmium, or lead.

Initially, personal air samples will be collected for each craft job classification to determine if an employee may be exposed to these chemicals/materials at or above the action levels. Additional periodic monitoring may be performed based on the results of the initial monitoring. Samples will be collected and analyzed following OSHA or National Institute of Occupational Safety and Health (NIOSH) methods. All time integrated, personal air samples for chemical constituents will be analyzed using a laboratory accredited by the American Industrial Hygiene Association. Employees who are subject to time-integrated air sampling will be informed of the results.

For activities within the UFML, time-integrated personal air sampling will primarily be performed to determine the acid vapor concentrations for the acids commonly used in the laboratory. Acid vapor testing will be performed at least once per calendar year to verify hood ventilation safety system performance. The air samples will be collected using Gilian GilAir-5® (or equivalent) personal air sampling pumps. Each personal sampling pump shall be calibrated (airflow rate) and documented each day before use and again at the conclusion of the sample collection period.

Full-shift (at least seven hours) personal air samples will be collected in the worker's breathing zone and will include the workers who have the highest potential for exposure for each job classification. All time-integrated air samples will be analyzed for by a laboratory accredited by the American Industrial Hygiene Association. The analytical results shall be reported as a TWA concentration for comparison against the OSHA PEL or American Conference of Governmental Industrial Hygienists (ACGIH) TLV, whichever is lower.

4.3.6 Radiological Dosimetry

For personnel internal and external exposure monitoring, refer to the RPP.

4.3.7 Expected Exposures to Public

Under the scope of the General Environmental Protection Plan (Stone & Webster, 1999), an Annual Environmental Monitoring Report will be prepared for submission to the USACE. The USACE will submit the report to the USEPA and to the New Jersey Department of Environmental Quality. The report will include results from measurements external radiation measurements, radon gas measurements, surface water and sediment measurements, and groundwater measurements. The report includes doses from radioactive emissions.

Air particulate emissions are estimated for purposes of the report using an USEPA approved computer model, the CAP 88 (USEPA, 1990). The CAP 88 is the USEPA preferred approach to demonstrate compliance, as it is not practical to install samplers at all off-site receptor locations to capture the worst case impact and because of interferences with natural radioactivity present in the air.

The SRSO may perform CAP 88 modeling prior to the start-up of new activities that may result in potential exposures to the public.

Table 4-6: Summary of Air Monitoring Procedures and Action Levels

PARAMETER	LOCATION AND INTERVAL	RESPONSE LEVEL (Meter units/ppm above background)	RESPONSE
VOC Monitoring			
Hydrocarbons, VOCs, SVOCs (Total by PID)	Continuous in the worker's breathing zone or in the immediate work area for sustained reading of 2 minutes in duration.	< 5 ppm	Level D work and continue monitoring (not applicable for initial assessment of unknown drums or containers).
		≥ 5 ppm	Contact the SSHO, and if no potential for change in conditions exist (drum/container activities increasing airborne levels), don Level C (GME/P100 cartridges or equivalent chemical cartridge combined with P100) and continue monitoring..
	Confined spaces will require initial and continuous monitoring.	Initial entry or opening/sampling unknown drums/containers	Stop Work. Not consistent with chemical contamination and concentrations identified in the specifications. Based upon the inconsistency, additional chemical specific monitoring may be required. Consult with FSM, SSHO, and OH&S Manager.
		≥ 10 ppm	
CGI Monitoring			
Oxygen Levels (multi-gas detector or O ₂ meter)	In the breathing zone/work area within the confined space prior to and continuously during entry or in the immediate work area during intrusive activities involving impacted materials.	19.5 – 23.5 percent (%) O ₂	Continue work and monitoring. If significant changes exist in this acceptable range, contact the SSHO to investigate the potential for contributing factors.
		< 19.5 or > 23.5 percent (%) O ₂	Cease work, exit the work area or confined space and contact the SSHO.
Carbon Monoxide	In the breathing zone/work area prior to and during operation of equipment with combustion motors.	< 25 ppm	Continue work and monitoring. If significant changes exist in this acceptable range, contact the SSHO to investigate the potential for contributing factors.
		≥ 25 ppm	Cease work, exit the work area or confined space and contact the SSHO.
Hydrogen Sulfide (multi-gas detector or individual H ₂ S meter)	In the breathing zone/work area within the confined space prior to and continuously during entry or in the immediate work area during intrusive activities involving impacted materials.	< 10 ppm	Continue work activities. If significant changes exist in this acceptable range, contact the SSHO to investigate the potential for contributing factors.
		≥ 10 ppm	Cease work, exit the area or confined space, and contact the SSHO.
Explosive Atmospheres (multi-gas detector or CGI)	In the breathing zone/work area prior to and during entry in to container/drum, impacted work area or confined space.	< 10% LEL	Continue work activities. If significant changes exist in this acceptable range, contact the SSHO to investigate the potential for contributing factors.
		≥ 10% LEL	Cease work, exit the area or confined space, and contact the SSHO.

Table 4-6: Summary of Monitoring Procedures and Action Levels (Cont'd)

PARAMETER	LOCATION AND INTERVAL	RESPONSE LEVEL (Meter units/ppm above background)	RESPONSE
Respirable Dust Monitoring			
Dust, Mist, Aerosols (Respirable)	Continuous during intrusive activities involving impacted materials. In addition, site perimeter monitoring may be initiated by the SSO based on elevated air monitoring results.	< 1 mg/m ³ (Sustained for more than 2 minutes)	Continue Level D work and continue monitoring.
		≥ 1 mg/m ³ (Sustained for more than 2 minutes)	Upgrade to Level C PPE. Contact the FSM and SSHO, implement mitigation measures, and continue Level C (minimum GME/P100 cartridges or equivalent chemical cartridge combined with P100) and continue monitoring.
		≥ 5 mg/m ³ (Sustained for more than 2 minutes)	Temporarily cease work operations, contact the FSM, SSHO, and OH&S Manager to discuss improving site mitigation measures.
Perimeter Dust Monitoring			
Dust, Mist, Aerosols (Total by PDM 3 mini-RAM or Dust Track 4, Perimeter Monitoring)	Continuous during intrusive activities involving impacted materials in two locations (One upwind and one down-wind).	< 0.05 mg/m ³	Work activities to continue with routine dust control measures. Continue to monitor and prepare to increase mitigation measures.
		≥ 0.05 mg/m ³	Improvement of site mitigation measures required. Temporarily cease operations, apply dust control measures and wait for levels to subside. Work may resume once levels drop below the action level.
Radiological Air Monitoring			
Radiological Air Monitoring	Refer to the RPP for specifics regarding monitoring.	< 1 mg/m ³	Work activities to continue with routine dust control measures. Continue to monitor and prepare to increase mitigation measures.
		≥ 1 mg/m ³	Improvement of site mitigation measures required. Temporarily cease operations, apply dust control measures and wait for levels to subside. Work may resume once levels drop below the action level.
Radiological Perimeter Monitoring			
Radiological Perimeter Monitoring (Passive Radon)	Refer to the RPP for specifics regarding monitoring.	< 4 pCi/l	Work activities to continue with routine dust control measures. Continue to monitor and prepare to increase mitigation measures.
		≥ 4 pCi/l	Improvement of site mitigation measures required. Temporarily cease operations, apply dust control measures and wait for levels to subside. Work may resume once levels drop below the action level.

5.0 TRAINING & QUALIFICATION REQUIREMENTS

The project training program is in compliance with 29 CFR 1910.120(e), and is designed to ensure that workers receive the training they need to work safely on field assignments. Site safety and health training requirements are based on the job hazard assessments contained in this SSHP and relevant OSHA requirements. The SSHO and OH&S Manager oversee the implementation of this training program and are responsible for ensuring that personnel are adequately and currently trained for tasks they are asked to perform. Personnel who have not been trained to a level required by their job function and responsibility are not permitted to participate in or supervise field activities. Refer to Section 5.0 of the APP for additional details.

6.0 SITE CONTROLS

The site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of each site, to facilitate emergency evacuation and medical care, and to prevent unauthorized entry to the site. The general site control requirements are discussed in this section. The general requirements will be implemented by the SSHO in order to ensure proper controls for each site.

The site control program includes the following site-specific information:

- Site and Work Area Maps
- Work Permitting
- Site Access
- Site Work Zones
- Daily Site Meetings
- Site Postings

The SSHO is responsible for evaluating site conditions, informing site personnel of site control requirements, and for verifying that the site control program functions effectively. The site control program is updated regularly and reflects current site conditions, work operations, and procedures.

6.1 SITE AND WORK AREA MAPS

Section 1.3 of the APP provides the location of the proposed work areas. Maps of specific work areas and work zones within these areas are included in the WP. These maps will be reviewed in detail with project personnel prior to the start of activities and posted in the project field office.

6.2 WORK PERMITTING

Required work permits (e.g., Dig Safe, Hot-Work) will be secured by the FSM and/or SSHO prior to beginning any tasks associated with project activities.

6.3 SITE ACCESS

Site access during project activities will be through the main entrance gate on Hunter Avenue. Cabrera will have primary control and responsibility for work area access during investigation activities. This control will be coordinated with the USACE and property owners prior to mobilization. Site access control will include:

- Allowing only authorized personnel to enter the work areas while the investigation is being performed;
- Ensuring that the site physical barriers (such as the fences, gates, and locks) are maintained;
- Proper posting of the site and individual work areas;
- Implementing sign-in and sign-out protocols for personnel moving on and off site; and

- Ensuring that personnel are properly trained and qualified to be onsite or in specific work areas.

Evaluations of general site access and controls will be coordinated between Cabrera, USACE, and the property owners.

All visitors will be required to notify the FSM upon their arrival at the site. Once on site, all visitors are required to first report to the FSM and sign the site entry and exit log. All visitors will receive a brief site safety briefing by the SSHO or his designee on their first visit. Access to work areas is contingent on the training requirements summarized in Section 5.0 of the APP. However, site visitors may be granted access to administrative areas without the requisite training if escorted by Cabrera's SSHO.

6.4 SITE WORK AREAS

The overall objective of the site control component of the SSHP is to specify procedures to minimize employee exposure and protect the public from hazardous substances and to prevent unauthorized access to the site. In general, most work areas will be controlled through the use of temporary barricades, such as traffic cones or barricade tape in accordance with EM 385-1-1.25.B.01 for Excavation & Trenching, as a best practice. The FSM or SSHO will determine the appropriate method for each location in the field.

Procedures to meet the objectives of the site control program must include the following:

- Coordination with property owner's representatives in the establishment of site boundaries,
- Development of a map of the work locations,
- Establishment of work areas to prevent unauthorized personnel from entering controlled work areas,
- Reducing accidental spread of hazardous substances from equipment in the contaminated area(s) by workers,
- Confining work activities to the appropriate areas,
- Facilitating the location and evacuation of personnel in case of an emergency,
- Establishment of the "buddy system,"
- Establishment of appropriate communication systems, and
- Implementation of worker safety procedures.

6.4.1 Radiological Contamination Controlled Work Areas

Site controls are established to minimize potential radiological exposures to workers and to protect the public from the hazards of site activities. Access to work areas that pose radiological hazards to personnel are restricted in order to minimize exposure and limit the migration of contamination. When hazards are identified or anticipated, the work area will be clearly delineated and posted. These areas will be secured, to the extent practicable, to minimize the potential for unauthorized access. Posting and labeling requirements will meet 10 CFR 20

Subpart J, specifically 1901, Caution Signs, 1902, Posting Requirements, and 1904, Labeling of Containers requirements.

Work zones at the Maywood project are defined in this section. The implementation procedure for establishing controlled work zones for radiological contamination is discussed further in the RPP.

Appropriate postings will be strategically placed where people enter Restricted Areas and at other locations where personnel may approach the area. Signs should be placed so that the postings are visible from all normal avenues of approach. Signs will be consistent with the potential radiological hazards and will use the colors magenta and yellow or black and yellow. The universal trefoil symbol for radioactivity or radiation will be used on all postings and labels. The words “Caution” or “Danger” will appear on all radiological posting signs.

Yellow and magenta rope, chain, or ribbon may be used to delineate radiological boundaries. This is required around any area posted Contamination Area or Airborne Radioactivity Area (ARA).

6.4.1.1 Controlled Area

A Controlled Area is an area outside of a Restricted Area but inside the site boundary where access is limited due to project work activities. Controlled Area postings are established to identify those areas owned by or under the control of the project. The Controlled Area may be used for staging materials, parking vehicles, office facilities, sanitation facilities, and deliveries. To the extent practicable, Controlled Area postings will be established and maintained along site perimeters and at all gates and normal access points. Controlled Area postings for U.S. Government owned properties shall read as shown below, “U.S. Government Property Posting.” Properties under temporary control of the U.S. Government during remediation activities shall be posted as shown below, “U.S. Government Controlled Area Posting.”

<p style="text-align: center;">WARNING</p> <p style="text-align: center;">U.S. Government Property Potentially Hazardous Material Present</p> <p style="text-align: center;">NO TRESPASSING</p> <p style="text-align: center;">U.S. Army Corps of Engineers</p>	<p style="text-align: center;">WARNING</p> <p style="text-align: center;">U.S. Government Controlled Area Potentially Hazardous Material Present</p> <p style="text-align: center;">NO TRESPASSING</p> <p style="text-align: center;">U.S. Army Corps of Engineers</p>
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Proposed changes to Controlled Area posting language require specific consent of the USACE Maywood Program Manager.

6.4.1.2 Restricted Area

Restricted Areas are established within Controlled Areas to which access is limited to protect individuals against undue risks from exposure to radiation or radioactive materials. All posted radiological areas are Restricted Areas. Eating, drinking and smoking is prohibited within Restricted Areas. Oversight (i.e., job coverage) of personnel accessing Restricted Areas will be performed by radiation protection personnel at a frequency (i.e., start of job, intermittent, or continuous) determined by the SRSO or as specified in the RPP.

6.4.1.3 Radioactive Materials Area

An RMA is any area/room where quantities of radioactive materials in excess of 10 times the 10 CFR 20, Standards for Protection Against Radiation, Appendix C, quantities are used or stored. All RMAs are established at the Maywood Project to identify storage areas for containerized radioactive material. This includes items such as waste drums, sample containers, Rad bags, and wrapped or fixed contaminated equipment. Areas posted “Contamination Area” or “High Contamination Area” do not require separate posting as an RMA. “Underground RMAs” where in situ contaminated soils are located are understood to be present throughout the FMSS and are not specifically posted, unless surface conditions warrant personnel protection. Personal frisking is typically not required upon exiting an RMA unless the RMA is also a Contamination Area or ARA.

6.4.1.4 Contamination Area

Contamination Areas are posted when the following conditions are identified or anticipated:

- Radioactively contaminated soils are being excavated, stored, or loaded for disposal.
- Removable surface contamination levels exceed the values specified in the table below (6-1), “Acceptable Surface Contamination Levels.” The acceptable surface contamination levels for thrium 232 will be used unless subsequent sampling indicates the presence radium 226, radium 228, thorium-230, protactinium 231, or actinium 227 in concentrations greater than that of the parent nuclide. The RSO will determine if contamination limits should be modified for a specific activity or location based on available data.
- The SRSO determines that a potential for the spread of contamination exists in an area.

If removable contamination levels exceed 100 times the applicable limits, the area will be reposted as a High Contamination Area (HCA). Visitors will not access HCAs. Personal frisking is typically required upon exiting a Contamination Area or HCA.

All Contamination Areas are also posted as Restricted Areas.

Table 6-1: Acceptable Surface Contamination Levels

Nuclide ^a	Average ^{b c} dpm/100 cm ²	Maximum ^{b d} dpm/100 cm ²	Removable ^{b e} dpm/100 cm ²
Uranium-nat, Uranium-235, Uranium-238 and associated decay products	5,000	15,000	1,000
Transuranics, Radium-226, Radium-228, Thorium-230, Thorium-228, Pa-231, Ac-227, Iodine-125, Iodine-129	100	300	20
Thorium-nat, Thorium-232, Strontium-90, Radium-223, Radium-224, Uranium-232, Iodine-126, Iodine-131, Iodine-133	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Strontium-90 and others noted above.	5,000	15,000	1,000

Source: U.S. Army Corps of Engineers (USACE), 2010, Ionizing Radiation Protection, Safety, ER 385-1-80, Washington, D.C., June 30.

Notes:

- a Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.
 - b As used in this table, dpm means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
 - c Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.
 - d The maximum contaminated level applies to an area of not more than 100 cm².
 - e The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
- cm² denotes square centimeters.
dpm denotes disintegrations per minute.

6.4.1.5 Radiation Area

A Radiation Area is an area accessible to individuals in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates. Radiation Areas are not anticipated to be encountered during this project. If encountered, external whole body exposure monitoring devices will be issued and worn in accordance with the RPP for access to Radiation Areas. Additional dosimetry (i.e., self-reading dosimeter [SRD], alarming dosimeter or extremity device) may be required by the SRSO to access a Radiation Area.

6.4.1.6 Airborne Radioactivity Area

An ARA is any room enclosure or area in which airborne radioactive materials exist in concentrations:

1. In excess of the derived air concentrations (DACs) specified in appendix B, to 10 CFR 20.1001–20.2401, or
2. To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

Radiological air monitoring is required to access an ARA. Engineering controls will be used as necessary in radiological contaminated areas reduce the possibility of material becoming airborne in accordance with the RPP and/or per instructions of the SRSO or designee.

6.4.1.7 Access Control Points

Access Control Points (ACP) are established to facilitate entry/exit from posted radiological contaminated areas. Access control radiological procedures are provided in the RPP. Contamination Areas and Airborne Radioactivity Areas. The purpose of the ACP is to minimize the potential for cross contamination by limiting the points where radiological boundaries are crossed. However, radiation protection personnel may direct personnel and/or equipment to an alternate entry/exit point along the radiological boundary, as necessary.

All PPE removal, segregation, and waste disposal, as well as personnel monitoring, are normally performed at the ACP. Equipment is typically decontaminated and monitored as close to the ACP or decontamination pad as practicable. Radiological areas in close proximity may share a common ACP. In the event that personnel frisking cannot be performed at the ACP (e.g., high background, wet conditions, etc.) radiation protection personnel may establish an alternate monitoring location as close as possible to the ACP. If an alternative egress location is used, radiation protection personnel shall routinely survey the path outside the Contamination Area or ARA that personnel and equipment have traveled prior to personnel or equipment monitoring.

A fixed ACP is typically a shed or other covered structure with sufficient integrity to protect occupants, stored PPE, and monitoring equipment from inclement weather (e.g., rain, snow, or cold temperatures). An emergency eyewash station, first aid kits, and fire extinguisher shall be placed at each fixed ACP. The SRSO may authorize establishment of a temporary ACP for short duration tasks. All active ACPs will have suitable personnel contamination monitors and waste/PPE receptacles.

Water coolers and rest areas may be established on the contaminated side of the ACP boundary for worker comfort and safety. At a minimum, potentially contaminated workers will remove outer gloves and monitor hands and facial areas prior to drinking water at the ACP. Except in the case of an emergency, contaminated personnel shall contact radiation protection personnel and remain at the ACP until radiation protection personnel perform the necessary decontamination under the direction of the SRSO.

In the event of an emergency, contaminated personnel are to proceed to the designated assembly point, avoid contact with coworkers, and notify radiation protection personnel of their contaminated status.

6.4.1.8 Emergency Entry and Exit

In the event that an emergency entry is required, emergency responders will be escorted. Training is not required unless the responder makes frequent site visits to perform or attend training or other nonemergency events. If a serious illness or injury is involved, emergency response takes precedence over decontamination.

An emergency may be declared at the discretion of the SSHO, SRSO, or site PM. The SSHO or the RSO shall suspend all dust generating activities during an emergency and shall escort (as appropriate) any untrained workers requiring access to the site during the declared emergency.

During an emergency, personnel will assemble at a predetermined location at the site. If conditions such as wind direction or physical hazards do not allow access to the prescribed evacuation routes, personnel are to evacuate by the safest routes available. If possible, personnel should doff their PPE at the ACP when leaving the area. However, if this is not possible, personnel should remove their foot protection (e.g., shoe covers or booties) and exit to the assembly area. At the assembly area, the remaining PPE can be doffed and personnel can be frisked for contamination.

6.4.2 HAZWOPER Controlled Work Areas

Each Hazardous Waste Operations and Emergency Response (HAZWOPER) controlled work area will consist of the following three zones:

- Exclusion Zone: Contaminated work area.
- Contamination Reduction Zone: Decontamination area.
- Support Zone: Uncontaminated or “clean area” where personnel should not be exposed to hazardous conditions.

Each zone will be periodically monitored in accordance with the air monitoring requirements established in this SSHP. The EZ and the Contamination Reduction Zone (CRZ) are considered work areas. The Support Zone is accessible to the public (e.g., vendors, inspectors). All personnel should be alert to prevent unauthorized, accidental entrance into controlled-access areas (the EZ and CRZ). If such an entry should occur, the trespasser should be immediately escorted outside the area, or all HAZWOPER-related work must cease. All personnel, equipment, and supplies that enter controlled-access areas must be decontaminated or containerized as waste prior to leaving (through the CRZ only).

6.4.3 Exclusion Zone

The EZ is the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc. This area must be clearly marked with hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements specified in the applicable AHA and this SSHP will be allowed in an EZ.

The extent of each area will be sufficient to ensure that personnel located at/beyond its boundaries will not be affected in any substantial way by hazards associated with sample collection activities.

- **Excavation & Heavy Equipment Activities**. A distance of 50 feet plus the maximum swing radius of the equipment (minimum) will be cleared in all directions from the equipment and the location where the excavated soil is deposited. The cleared area will be sufficient to accommodate movement of necessary equipment and the stockpiling of spoils piles. Vehicles and other hard barriers should be used where applicable to protect employees and public.
- **GW/Sediment/Surface Water Sampling**. A distance of 10 feet (minimum) will be cleared in all directions from the sampling location in order to accommodate additional sampling equipment. Vehicles and other hard barriers should be used where applicable to protect employees and public.
- **Radiological Surveys & Sampling**. A distance of 50 feet plus the maximum swing radius of the equipment (minimum) will be kept by the survey crew while performing this task. The cleared area will be sufficient to accommodate movement of necessary equipment and the stockpiling of debris. Vehicles and other hard barriers should be used where applicable to protect employees and public.

6.4.4 Contamination Reduction Zone

The Contamination Reduction Zone is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The decontamination of workers and equipment limits the physical transfer of hazardous substances into the clean area. This area must

also be clearly marked with hazard tape and access limited to personnel involved in decontamination.

6.4.5 Support Zone

The Support Zone is an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located. The Support Zone shall have minimal potential for significant exposure to contaminants (i.e., background levels).

Employees will establish a Support Zone (if necessary) at the site before the commencement of site activities. The Support Zone would also serve as the entry point for controlling site access.

6.5 DAILY SAFETY MEETINGS

In addition to the information outline in Section 6.1 of the APP, additional pre-entry briefings will be conducted for the work crews performing specific tasks on the site (if more than one). The SSHO and/or the FSM will conduct daily safety toolbox meetings for reviewing the day's tasks, the associated hazards, and the controls to be used. This daily orientation will be required for personnel working that day. An example of a daily safety meeting form is contained in Appendix D of the APP.

6.6 SITE POSTINGS

All remedial construction work areas will have their access points posted with the appropriate safety signage identifying the potential hazard(s) and/or appropriate personnel protective equipment required before entering the site. Safety signage will be implemented in accordance with 29 CFR 1926.200 and EM 385-1-1.08.A.06. At a minimum, the control boundary will be posted "Caution: Authorized Personnel Only."

7.0 DECONTAMINATION

This process is critical to health and safety at hazardous material response sites. Decontamination protects end users from hazardous substances that may contaminate and eventually permeate the protective clothing, respiratory equipment, tools, vehicles, and other equipment used in the vicinity of the chemical hazard; it protects all site personnel by minimizing the transfer of harmful materials into clean areas; it helps prevent mixing of incompatible chemicals; and it protects the community by preventing uncontrolled transportation of chemicals from the site.

Decontamination involves physically removing contaminants from personnel and equipment and/or chemically converting them into innocuous substances. The extent of decontamination depends on a number of factors, the most important of which is the types of contaminants involved; the more harmful the contaminant, the more extensive and thorough the decontamination. The combination of decontamination, correct donning of protective clothing, and delineation of site work areas minimizes cross-contamination from the protective clothing to wearer, from equipment to personnel, and from one area to another. When decontamination is required in such areas, procedures must be developed which will accommodate both contamination types and minimize the amount of mixed waste.

The overall objectives of the decontamination section are to:

- Determine and implement the decontamination methods for personnel and equipment that are effective for the specific hazardous/radioactive substance(s) present,
- Ensure the decontamination procedure itself does not pose any additional safety or health hazards,
- Provide pertinent information on the locations and layouts of decontamination stations and equipment,
- Establish procedures for the collection, storage and disposal of clothing and equipment that has not been completely decontaminated, and
- Provide for the periodic evaluation of the plan against the existing site hazards.

7.1 PERSONNEL DECONTAMINATION PROCEDURES

Contamination control for personnel consists of wearing PPE properly, discarding disposable PPE, cleaning reusable PPE, proper frisking for contamination, and personal hygiene. If during the course of wear PPE integrity has been compromised, personnel shall notify radiation protection personnel. The RPT will perform any necessary monitoring, and repair or replace the PPE as appropriate. Sections 7.3.1 and 7.3.2 address appropriate PPE decontamination and doffing sequences to maximize contamination control.

After doffing PPE, personnel will frisk themselves for radioactive contaminants with an appropriate survey instrument to determine if personnel decontamination is warranted. Monitoring is required upon exiting a Contamination Area or Airborne Radioactivity Area, and as directed by the SRSO. If skin contamination is suspected, workers are required to stay in the area and contact radiation protection personnel for assistance. Radiation protection personnel

under direction of the SRSO or SSHO, and in accordance with procedures in the RPP, shall perform skin decontamination and subsequent monitoring. Upon release from the ACP workers are directed to wash hands and face to remove any potential chemical contaminants.

Any employee suspected of experiencing skin contact with hazardous chemical materials will remove all clothing, which may have absorbed the chemical contaminant (as modesty permits and exposure warrants); thoroughly wash the affected area(s); and don clean clothes. Following this, he/she must report the incident to the SSHO.

7.1.1 Decontamination Procedures for Level D Modified Personal Protective Equipment

The general decontamination sequence for activities conducted in modified Level D PPE are as follows:

- Drop off equipment for cleaning
- Rinse outer gloves and boots (if disposable outer gloves and/or boot covers are used, this step may be omitted – disposable articles are only used once)
- Remove tape at wrists and boot interface
- Remove outer gloves and boot covers
- Remove coveralls, if worn
- Remove and rinse goggles, face shield, and hard hat
- Remove inner gloves
- Wash hands and face with water or baby wipes
- Proceed to frisking station

7.1.2 Decontamination Procedures for Level C Personal Protective Equipment

The general decontamination sequence for activities conducted in Level C PPE is as follows:

- Drop off equipment for cleaning
- Wash outer gloves and boots (cartridges on respirators may be changed at this point if this is the only purpose for leaving the Restricted Area/EZ)
- Rinse outer gloves and boots (if disposable outer gloves and/or boot covers are used, the first two steps may be omitted)
- Remove tape at wrist, boot, and hood interface
- Remove outer gloves and boot cover
- Remove and rinse hard hat
- Remove coveralls
- Remove air purifying respirator (APR), discard cartridges (if necessary), clean APR
- Remove inner gloves

- Wash hands and face
- Proceed to frisking station

Disposable gloves and coveralls will be removed by turning them inside out as they are removed. Ground cloths, gloves, disposable coveralls, and APR cartridges will be placed into plastic trash bags and stored at an RMA for disposal. Respirators will be cleaned with potable water in the field after each use and will be washed at the end of the day using a soap and water wash, and will then be disinfected. Respirators will be inspected daily for damage, missing parts, and proper function.

Other reusable protective equipment worn by personnel performing field activities will be rinsed with potable water after each use and will be cleaned at the end of each day in the manner described by the manufacturer. Reusable items may be air dried and placed in plastic bag lined, DOT-approved, 55 gallon drums for storage.

7.1.3 Procedures for Emergency Decontamination

In an emergency, the primary concern is to prevent the loss of life or additional injury to personnel. If immediate medical treatment is required to save a life, decontamination should be delayed until the victim is stabilized. Proceed with decontamination if it can be performed without interfering with essential life saving techniques or first aid.

If a worker has been exposed to corrosive materials, decontamination must be performed immediately. If an emergency from a heat related illness develops, protective clothing should be removed from the victim as soon as possible to reduce further stress. During an emergency, provisions must be made for protecting rescue, first aid, or medical personnel from hazardous materials and for disposing of contaminated clothing and equipment.

If decontamination can be done, wash, rinse, and/or remove protective clothing and equipment (corrosive materials in the eyes or on the skin use water for 15 minutes).

If decontamination cannot be done:

- Alert medical personnel to potential contamination and instruct them about specific methods to reduce spread of contamination and about decontamination procedures, if necessary.
- The SRSO or designee (RPT) will accompany the victim to the medical facility to assist with any facility radiological decontamination and/or surveys, if necessary.
- Provide site personnel familiar with the incident at the medical facility.

7.2 EQUIPMENT DECONTAMINATION PROCEDURES

Upon completion of an excavation at a vicinity property remote from the MISS, decontamination of small tools and equipment shall be performed under the direction of the SSHO and SRSO. Heavy equipment will initially be decontaminated at the vicinity property by removing all loose soil from bucket, tracks, and undercarriage prior to leaving the vicinity property. All decontamination water and loose soil will be contained, as necessary to avoid cross contamination of clean areas during decontamination procedures, and will be returned to the MISS. When gross cleaning is complete, equipment may be transported to the MISS for a final

decontamination and exit survey or transported to the next work site in accordance with instructions of the SRSO. If contaminated equipment is transported to the next work site, the next site must be appropriately secured and posted prior to the transfer.

7.2.1 Sampling Equipment

Disposable sampling equipment will be used wherever possible to minimize decontamination requirements. When reusable equipment is used, such equipment will be decontaminated both prior to sampling in the field and between uses. The following decontamination steps will be performed for reusable equipment, in the following order:

- 1) Potable water rinse
- 2) Wash with laboratory-grade detergent (Alconox[®], Liquinox[®], or equivalent)
- 3) Distilled water rinse
- 4) Air drying

A field nitric acid rinse and an additional distilled water rinse will be performed between steps three and four (above) for samples submitted for metals analysis. If air drying is not possible following the acid rinse, a final deionized water rinse will be included to minimize the possibility of having trace organics adhering to the sampling equipment.

Following decontamination, all equipment will be surveyed by an RPT. Radioactivity levels on equipment leaving the site for free release must not exceed the limits in Table 6-1. Results of contamination surveys will be documented and retained in project files.

7.2.2 Heavy Equipment

Equipment, rail car, and vehicle decontamination generally consists of the removal of excess solids (e.g., mud) and equipment washing. Equipment will be disassembled as necessary to ensure all potentially contaminated surfaces are adequately decontaminated. High pressure washers can be used for final decontamination. Safety procedures outlined in the applicable AHA will be followed for cleaning or decontaminating equipment or vehicles. Small equipment may be pressure washed or scrubbed/wiped with soap and water.

All wash waters will be collected for treatment and disposal. Equipment requiring maintenance or repair will generally be decontaminated prior to servicing. Following decontamination, all equipment will be surveyed by an RPT. Radioactivity levels on equipment leaving the site for free release must not exceed the limits in Table 6-1. Results of contamination surveys will be documented and retained in project files.

Vehicles and equipment may be transferred between Restricted Areas within the Controlled Area provided that adequate control measures are in place to prevent the spread of removable contamination into clean areas, and with SRSO authorization.

At the conclusion of the project, all equipment will be thoroughly cleaned. All equipment will meet the contamination limits found in Table 6-1. The SRSO or designee will verify the adequacy of decontamination prior to performing an unrestricted release survey. Release surveys will be documented and retained in project files.

The equipment required to perform decontamination may vary based on site-specific conditions and the nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Wood and polyethylene sheeting to create a decontamination pad.
- Alternatively, a butyl rubber pre-formed decontamination pad may be used as well.
- Soft-bristle scrub brushes or long-handled brushes to remove contaminants;
- Hoses, buckets of water or garden sprayers for rinsing;
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions;
- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment;
- Sump pumps and hand tools (shovels) for containerizing decontamination water and solids;
- Metal or plastic cans or drums for the temporary storage of contaminated liquids.

For HAZWOPER controlled work sites, gross contamination should be removed prior to the equipment leaving the EZ and handled appropriately, as residual contamination (pending location of equipment to EZ and COCs).

For larger equipment, a high-pressure washer may need to be used. Care must be taken to avoid over-splash and walls, or other temporary barriers, may need to be erected along the edges of the decontamination pad to adequate capture material/spray. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination.

Equipment will be checked with the appropriate monitoring devices prior to demobilization and further decontaminated if necessary. Equipment decontamination procedures are further detailed in the RPP.

7.2.3 Railcar & Transport Vehicles

Railcar equipment and transport vehicles will be surveyed for contamination prior to use in Restricted Areas, at the discretion of the SRSO, in order to establish whether the Maywood FUSRAP project is responsible for the contamination. Additionally, this is to protect against the expenditure of funds to decontaminate prior contaminated equipment.

Soil will be loaded into appropriate containers/vehicles in designated areas that have adequate spill control measures, including equipment to catch and contain spillage, and equipment necessary to recover spillage and clean the area. Disposable sheeting will normally be placed on the ground around trucks to catch any incidental spillage during loading.

All vehicles will be surveyed for radioactive contamination after loading prior to exiting Restricted Areas (i.e., Contamination Areas, etc.). The extent of the survey will be determined by the SRSO in consideration of the potential for contamination. Vehicles and rail cars must be visually clean prior to survey. Any vehicles exceeding applicable contamination criteria will be

decontaminated before going onto public roads or rails outside the posted areas so as to not spread contamination off site.

8.0 MEDICAL SURVEILLANCE PROGRAM

This section describes how worker health status will be monitored for this project. Medical surveillance is used when there is the potential for worker exposure to substances at levels above permissible exposure limits. The purpose of a medical surveillance program is to medically monitor workers health and ensure that personnel are not adversely affected by site hazards and that they are physically able to perform their specific job functions.

8.1 SITE MEDICAL SURVEILLANCE PROGRAM

Medical surveillance, in accordance with OSHA requirements presented in 29 CFR 1910.120 (f), is required for personnel involved in project field activities. The SSHO and OH&S Manager will ensure that project personnel are medically cleared for their anticipated duties. Personnel assigned onsite work shall provide documentation that demonstrates compliance with the medical surveillance requirements of 1910.120. Documents that shall be made available include the employee's most recent medical clearance and respirator clearance forms.

8.2 MEDICAL RECORDKEEPING PROCEDURES

The following items will be maintained in project personnel records:

- Fitness for duty
- Exposure monitoring results

9.0 RECORDKEEPING

Each site worker is responsible for providing the following recordkeeping information; the FSM is responsible for ensuring that these records are filed onsite and available and become part of the project file.

- Accident Prevention Plan Acknowledgment Form (Section 13.0 of APP)
- AHA Acknowledgements (Attachment A)
- 40-hour HAZWOPER training certificates and current eight-hour refresher
- Medical Approval for site work and respirator clearance, if required
- Accident Investigation Reports: a written accident report is forwarded to the OH&S Manager within 24 hours if an accident or employee injury occurs onsite.

The SSO, in consultation with the OH&S Manager, will document recommended changes to the SSHP. Revisions approved by the required signatories on the Approval Page of the SSHP will be made part of the SSHP and will be distributed to essential personnel. Retraining of employees for SSHP changes will be provided by site supervisors; acknowledgement of retraining by employees will be documented and filed.

10.0 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH), 2010, *Threshold Limit Values and Biological Exposure Indices*, Cincinnati, Ohio.

American National Standards Institute (ANSI), 1992, *Standard Practice for Respiratory Protection*, Z88.2, New York, New York, May 19.

American National Standards Institute (ANSI), 2006, *American National Standard-Construction and Demolition Operations- Safety Requirements for Powder-Actuated Fastening Systems*, ANSI/ASSE A10.3, New York, New York.

American Society of Mechanical Engineers, 2007, *Boiler and Pressure Vessel Code – 2007 Edition*.

Bechtel National, Incorporated, 1992, *Remedial Investigations Report for the Maywood Superfund Site, Maywood, New Jersey*, DOE/OR/21949-337, prepared for the U.S. Department of Energy, Oak Ridge Operations Office, under contract No. DE-ACO5-90R21949, December.

Bechtel National, Incorporated, 1993, *Health and Safety Plan for the Remedial Investigation/Feasibility Study - Environmental Impact Statement for the Maywood Superfund Site*

Code of Federal Regulations (CFR), Title 10, Part 20, *Standards for Protection Against Radiation*, U.S. Government Printing Office, Washington, D.C., June 11, 2010 <http://www.access.gpo.gov/nara/cfr/waisidx_10/10cfr20_10.html> (December 2010).

Code of Federal Regulations (CFR), Title 29, Part 1910, *Occupational Safety and Health Standards*, U.S. Government Printing Office, Washington, D.C., July 1, 2003, <<http://www.access.gpo.gov/nara/cfr/index.html>> (October 2010).

Code of Federal Regulations (CFR), Title 29, Part 1926, *Safety and Health Regulations for Construction*, U.S. Government Printing Office, Washington, D.C., July 1, 2003, <<http://www.access.gpo.gov/nara/cfr/index.html>> (October 2010).

Code of Federal Regulations (CFR), Title 40, Part 61, *National Emission Standards for Hazardous Air Pollutants*, U.S. Government Printing Office, Washington, D.C., August 17, 2010, <http://www.access.gpo.gov/nara/cfr/waisidx_10/40cfr61_10.html> (October 2010).

Code of Federal Regulations (CFR), Title 49, Part 172, *Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans*, U.S. Government Printing Office, Washington, D.C., March 5, 2010, <http://www.access.gpo.gov/nara/cfr/waisidx_09/49cfr172_09.html> (October 2010).

Code of Federal Regulations (CFR), Title 49, Part 178, *Specifications for Packagings*, U.S. Government Printing Office, Washington, D.C., March 5, 2010, <http://www.access.gpo.gov/nara/cfr/waisidx_09/49cfr178_09.html> (October 2010).

McCully, R., 1992, Letter Correspondence from Ruth McCully, Director OSHA Office of Health Compliance Assistance to Richard Schreiber, Environmental Specialist, Georgia Radon Program, OSHA, October 6.

National Council on Radiation Protection and Measurements, 1987, Report No. 93, Ionizing Radiation Exposure of the Population of the United States.

National Institute for Occupational Safety and Health (NIOSH)/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard/U.S. Environmental Protection Agency (USEPA), 1985, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, October.

Shaw Environmental, Inc. (Shaw), 1999, *Draft Background Data Summaries FUSRAP Maywood Superfund Site*, Maywood, New Jersey.

Shaw Environmental, Inc. (Shaw), 2003, *Chemical Data Quality Management Plan*, Revision 1, Maywood, New Jersey, September.

Stone & Webster, 1999, *FUSRAP Maywood Superfund Site General Environmental Protection Plan*, Revision 0, November.

U.S. Army Corps of Engineers (USACE), 2008, with 2010 Errata #1, *Safety and Health Requirements Manual*, Safety, EM 385-1-1, Washington, D.C.

U.S. Army Corps of Engineers (USACE), 2010, *Ionizing Radiation Protection*, Safety, ER 385-1-80, Washington, D.C., June 30.

U.S. Department of Energy (DOE), 1995, *Engineering Evaluation/Cost Analysis for the Cleanup of Residential and Municipal Vicinity Properties at the Maywood Superfund Site*, Bergen County, New Jersey, September.

U.S. Environmental Protection Agency (USEPA), 1989, Letter Correspondence from the USEPA to the Stepan Company, *Presence of hazardous substances, pollutants, or contaminants in the groundwater and soil on the Stepan Company property*, Washington, D.C., January 6.

U.S. Environmental Protection Agency (USEPA), 1990, *The Clean Air Assessment Package-1988 (CAP-88) A Dose and Risk Assessment Methodology for Radionuclide Emissions to Air*, Volume 2, Appendices A – H, Washington, D.C., October.

**ATTACHMENT A
ACTIVITY HAZARD ANALYSES**

OP 551 - Project Planning



Activity Hazard Analysis – 1.0

Activity/Work Task: Mobilization/Demobilization	Overall Risk Assessment Code (RAC) (Use highest code)	L						
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix							
Contract Number: W912DQ-13-D-3016	Severity	Probability						
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely						
Prepared by (Name/Title): Al Craig	Catastrophic	E	E	H	H	M		
Reviewed by: Sean Liddy, CSP	Critical	E	H	H	M	L		
	Marginal	H	M	M	L	L		
Competent Person (if applicable):	Negligible	M	L	L	L	L		
	Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)					RAC Chart		
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved APP for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.					E = Extremely High Risk			
“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.					H = High Risk			
“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible					M = Moderate Risk			
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.					L = Low Risk			
Personal Protective Equipment (PPE): <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input type="checkbox"/> Coveralls (coated) <input type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Level D PPE								
Safety Equipment: <input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:								
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP): <input type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input type="checkbox"/> PDR (Respirable Dust) <input type="checkbox"/> PDM (Total Dust) <input type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): None.								
Job Steps	Hazards	Controls				RAC		
Pre-trip Planning	Traffic delays, weather	-Plan your route, research construction delays, weather impacts				L		
Complete Vehicle Inspection	Unserviceable vehicles	-Inspect vehicle for deficiencies, report and correct prior to use. Complete vehicle inspection log each day prior to use.				L		
Safety Equipment	Unsecured driver, passenger, or gear and equipment	-Always use seatbelts while vehicle is in motion, lock doors. Always secure the load with a cargo net or rope. Secure all loose equipment in cab.				L		

Job Steps	Hazards	Controls	RAC
Backing	Blind spots; unseen objects	-Always use a spotter when backing, check mirrors and over shoulder Back into parking spaces upon arrival, whenever possible. When preparing to move or back vehicles, walk around the vehicle 360 degrees before entering vehicle to identify any new conditions or obstructions. Use a spotter when backing whenever possible. Determine and agree upon hand signals (between spotter and driver) before attempting to back vehicle. Check the rear-view and side mirrors prior to backing (Note: All vehicles, other than automobiles, must have small convex mirrors attached to the side mirrors.) Back slowly in areas of obstructed vision. Anticipate others who may be backing out into your pathway and adjust accordingly.	L
Driving	Rough road surface (potholes), sleepiness, Blind corners, reduced visibility due to dust, fog, snow, rain. Mobile devices Crossing Rail road tracks.	-Keep eyes moving, use mirrors, follow posted signs, avoid distractions -Aim high in steering, -Maintain 15 sec eye lead time -Leave yourself an out, maintain cushion around vehicle Get the big picture; -Avoid being boxed in, adjust speed to traffic, focus on driving, -Refrain from emotional discussions/NO CELL PHONE. -When approaching a blind corner slow down to 10 mph at least 250 feet from the corner, proceed around the corner at no greater than 10 mph. -During periods of reduced visibility, reduce speeds, pull over and stop until visibility improves, increase following distance during periods of decreased visibility. - Hand held phone use prohibited. No texting. Car on, phone off. - Stop, look, and listen before crossing railroad tracks. Be aware that multiple tracks may have more than one train using them, and the trains may be traveling in opposite directions. Look for direction from track spotter (if present).	L
Parking	Collision, injury to others, possible grass or brush fire from hot vehicle parts (catalytic converter) in contact with dry vegetation.	-Park away from other cars, set brake, park on level terrain, use wheel chocks and turn wheels if parked on sloped terrain. -Park only in cleared areas or where vegetation beneath vehicle is less than 6 inches tall.	L
Backing	Collision with stationary objects, backing into ditch	-Get out and look around vehicle before backing, use a spotter. -When parking, pull through or back in when possible.	L
Driving larger trucks/vans	Blind spots; unseen objects; longer stopping, distance; wider turning radius	-Driver should be familiar with the vehicle they are driving set sideview mirrors to r-reduce blind spots	L
Heavy equipment operations adjacent to and on site roadways	Collisions with heavy equipment, heavy equipment backing out into roadway from side roads or work areas along the roadways.	-Know the increased turning radius of the vehicle vs. a small compact	L
Heavy equipment cutting roads or clearing vegetation adjacent to roadways or at locations above roadways.	Falling rocks/debris	-Slow speeds when approaching heavy equipment activities along or adjacent to roads. -Stop and make contact with operator or spotter to ensure it is safe to pass. -Pass only when given permission by the operator or spotter.	L

Additional Safety Considerations

1. All employees must receive site specific safety orientation prior to beginning work on the project site. Review APP and sign acknowledgment form.
2. No Chemical Hazards anticipated.
3. Use caution around delivery trucks and stay clear if not involved in spotting operation. Use one person to communicate with driver via hand signals to avoid unnecessary confusion. Watch for overhead utilities. Wear high visibility vest or shirt at all times.
4. Maintain eye contact with equipment operator during stone installation and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator.
5. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed or the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
6. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
7. Keep clear area around work area, maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
8. Avoid the use of chains for lifting. If necessary, ensure chain is equipped with annual load rating cert and proper hooks being used. For synthetic slings, ensure red warning line is not showing and item is in good condition. For wire ropes, inspect for broken wires (6 in a lay, 3 in a strand).
9. Keep line of site with co-worker and ensure regular verbal contact. If out of the line of site, ensure radio or cell phone contact is established and maintained.

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, CABRERA employees agree that:

- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.
- I will ensure compliance with my company's policies on health and safety.

Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 2.0

Activity/Work Task: Site Preparation (General Site Activities)	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix					
Contract Number: W912DQ-13-D-3016	Severity	Probability				
Date Prepared: 11/22/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E	E	H	H	M
Reviewed by: Sean Liddy, CSP	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
Competent Person (if applicable): Operator for heavy equipment operations.	Negligible	M	L	L	L	L
	Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)					RAC Chart
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.						
“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.						
“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible						
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.					E = Extremely High Risk	
					H = High Risk	
					M = Moderate Risk	
					L = Low Risk	
Personal Protective Equipment (PPE):						
<input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input type="checkbox"/> Coveralls (coated) <input type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Use Level D PPE for all site prep activities where n potential exposure to impacted materials.						
Safety Equipment:						
<input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:						
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP):						
<input type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input type="checkbox"/> PDR (Respirable Dust) <input type="checkbox"/> PDM (Total Dust) <input type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): None.						

Job Steps	Hazards	Controls	RAC
Arrival of new personnel	Newly hired personnel and visitors. Unfamiliarity with: site, general (radiological chemical, physical, environmental) site hazards, project safety rules and hazard control procedures, chain of command, and emergency procedures.	Submission of required training certifications to SSHO. Receive site specific safety briefing, to include review of APP/SSHP/ and applicable AHAs. Attend Preparatory meeting when necessary. Review of emergency procedures (hospital and clinic route maps/directions, and emergency contact numbers). Copies to be place inside every site vehicle, and located at office.	L

Job Steps	Hazards	Controls	RAC
Set-up and maintenance of site Trailers/offices (delivery/tie-down, electrical connection by certified electrician)	<ul style="list-style-type: none"> -Vehicular traffic -Slips, trips, falls and protruding objects -Cuts/laceration hazards from sharp edges of equipment and supplies -Overhead utilities -Sprains/Strains -Electrical Hazards -Confined Spaces (present on-site) 	<ul style="list-style-type: none"> -Wear high vis safety vest and maintain eye contact with truck driver -Ensure work surface clear of encumbrances and ensure proper footing Walk with special care over wet floors. On rainy or snowy days, wipe your shoe soles as soon as you enter the office area. Wipe up spilled liquid immediately. Use handrails on the steps. Do not carry stacks of materials on steps. Step over carpet edges, rather than stepping on them. Remove excess debris from the work areas. Keep telephone and electrical cords out of aisles and walkways. -Use leather gloves and avoid sharp metal and protruding objects. Use only approved cutting devices. Pass scissors handle first, with blades closed together. Use approved safety cutting devices instead of knives or open blades. Never use a double-edged or unprotected razor blades. -Watch for overhead lines and ensure minimum safe distance (10 ft) maintained -Use proper lifting techniques and do not over extend (field ergonomics). Get necessary assistance when lifting heavy objects. - Connections of trailers should only be done by licensed electrician. All electrical equipment shall be grounded. Worn or frayed electrical cables must be replaced and destroyed. Ground-fault circuit interrupters shall be used on all power tools and extension cords. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas. Keep extension cords off of ground surface. -No one will be permitted to enter any confined space without proper training, proper PPE, notifying the SSHO, and having a Permit-Confined Space Permit issued. CSE covered under separate AHA for task. 	L
Fueling Operations	<ul style="list-style-type: none"> Exposure to fuels Fire hazards Spills 	<ul style="list-style-type: none"> -Review SDS for products. Use in well ventilated areas and avoid direct inhalation of fumes. Avoid skin contact and wash hands with soap/water. -Turn off all equipment prior to refueling. Eliminate all possible ignition sources prior to fueling. NO SMOKING. -Minimize/eliminate static sources by maintain contact of nozzle with fuel port. Do not re-enter vehicle while fuelling. Place cans on ground before fueling. Do not refuel in back of truck. -Cans will be stored in fire cabinets. Cabinets will be properly grounded, labeled, and extinguisher present. -A 2-A: 40-B:C fire extinguisher shall be readily available when fueling equipment at any location on site. Trucks with flammable/combustible fuels must be equipped with a 20-B:C fire extinguisher. - All portable saddle tanks shall be manufactured to meet DOT specifications and be properly marked (see 49 Code of Federal Regulation 172.101) with the proper shipping name and labeled for “No Smoking.” No more than 110 gallons of diesel fuel may be transported. 	L

Job Steps	Hazards	Controls	RAC
Installation and maintenance of driveway and parking area (skid steer, loader)	<ul style="list-style-type: none"> -Moving Equipment -Slips, trips, falls and protruding objects -Cuts/laceration hazards from sharp edges of equipment and supplies (geo-textile) -Rigging and lifting with hydraulic equipment -Overhead Utilities 	<ul style="list-style-type: none"> -Wear high vis safety vest and maintain eye contact with equipment operator. Ensure back-up alarms are working properly and equipment equipped with fire extinguisher (min 5 lbs B:C) and seat belts. -Ensure work surface clear of encumbrances and ensure proper footing -Use leather gloves and avoid sharp metal and protruding objects. Use only approved cutting devices for geo-textile. Gauntlet gloves with Kevlar to be used for fence maintenance when exposed to barbed wire. -Perform work in accordance with EM 385-1-1, Section 16.S. Calculate lift/load capacities using manuals and load capacity charts and hold pre-lift meeting prior to attempting lift. Assign operator, rigger, tagline, and signal man responsibilities as necessary. Use proper hand signals. Inspect rigging prior to use and remove damaged items from service. Use tag lines for controlling load. - Before equipment is moved, the travel route shall be surveyed for overhead and terrain hazards. Masts must be lowered before transporting equipment. The minimum distances from electrical lines must be observed (EM 385-1-1, Table 11-1). 	L
Unloading supplies (using forklift and manual lifting)	<ul style="list-style-type: none"> -Moving Equipment -Slips, trips, falls and protruding objects -Cuts/laceration hazards from sharp edges of equipment, tools, and supplies (geo-textile) -Sprains/Strains -Rigging and lifting with hydraulic equipment -Overhead Utilities 	<ul style="list-style-type: none"> -Wear high vis safety vest and maintain eye contact with equipment operator. Ensure back-up alarms are working properly and equipment equipped with fire extinguisher (min 5 lbs B:C) and seat belts. -Ensure work surface clear of encumbrances and ensure proper footing -Use leather gloves and avoid sharp metal and protruding objects. Use only approved cutting devices for opening containers/boxes. -Use proper lifting techniques and do not over extend (field ergonomics). Get necessary assistance when lifting heavy objects. -Perform work in accordance with EM 385-1-1, Section 16.S. Calculate lift/load capacities using manuals and load capacity charts and hold pre-lift meeting prior to attempting lift. Assign operator, rigger, tagline, and signal man responsibilities as necessary. Use proper hand signals. Inspect rigging prior to use and remove damaged items from service. Use tag lines for controlling load. - Before equipment is moved, the travel route shall be surveyed for overhead and terrain hazards. Masts must be lowered before transporting equipment. The minimum distances from electrical lines must be observed (EM 385-1-1, Table 11-1). 	M
Vegetation maintenance	<ul style="list-style-type: none"> Noise. Flying Debris. Biological Hazards. Slips, trips and falls other personnel in the area. Inadvertent contact with other equipment. Personnel injury/ equipment damage during start-up. 	<ul style="list-style-type: none"> -Use hearing protection during the weed eating process. - Be aware of and avoid agitating loose debris. Stay 50 ft. away from other personnel and vehicles. Use face shields in addition to safety glasses. -Be aware if poisonous plants (oak/ivy). -Use leather steel-toe work boots with defined heel. If conditions are wet and muddy use rubber steel toe boots with defined heel. Inspect for holes and changing conditions while working. Stay alert for holes and changing conditions while working. Stay alert for loose material, potholes, uneven surfaces, etc. -Use caution when using the weed eater around the silt fence, etc. -Make sure weed eater are clear of all obstructions prior to start up. 	L

Additional Safety Considerations

1. Use caution around delivery trucks and stay clear if not involved in spotting operation. Use one person to communicate with driver via hand signals to avoid unnecessary confusion. Watch for overhead utilities.
2. Maintain eye contact with equipment operator during stone installation and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator.
3. Use proper hand tools for silt fence install/repair and remove defective equipment from use.
4. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed or the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
5. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
6. Keep clear area around work area, maintain good housekeeping practices.
7. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
8. Avoid the use of chains for lifting. If necessary, ensure chain is equipped with annual load rating cert and proper hooks being used. For synthetic slings, ensure red warning line is not showing and item is in good condition. For wire ropes, inspect for broken wires (6 in a lay, 3 in a strand).

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Skid Steer/Loader	Daily Preventative Maintenance Checks	Certified heavy equipment operator Familiarity with the vehicle being operated.
Forklift	Daily Preventative Maintenance Checks	Certified Forklift Driver Familiarity with the vehicle being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

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- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.
- I will ensure compliance with my company's policies on health and safety.

Name (Print)	Date	Company	Signature

OP 551 - Project Planning

Activity Hazard Analysis – 3.0

Activity/Work Task: Clearing & Grubbing	Overall Risk Assessment Code (RAC) (Use highest code)	M
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix	
Contract Number: W912DQ-13-D-3016	Severity	Probability
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M
Reviewed by: Sean Liddy, CSP	Critical	E H H M L
	Marginal	H M M L L
	Negligible	M L L L L
Competent Person (if applicable): Operator for heavy equipment operations.	RAC Chart	
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.		
Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)		
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.		
Personal Protective Equipment (PPE): <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input checked="" type="checkbox"/> Coveralls (coated) <input type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Use Modified Level D (tyvek an overbooties) if potential exposure to soils exist.		
Safety Equipment: <input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:		
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP): <input type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input checked="" type="checkbox"/> PDR (Respirable Dust) <input checked="" type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium). Concern during root removal (grubbing) where potential to generate dust exists.		
Job Steps	Hazards	Controls
Stage tools and equipment	-Slips, trips, and uneven surfaces -Cuts/laceration hazards from sharp edges of rusted pipes and valves. -Unsafe Equipment. -Biological Hazards	-Inspect equipment to assure that all operational and safety systems are functional. -Keep work area clear of surface encumbrances -Use leather gloves and avoid sharp metal and protruding objects. -Perform thorough inspection of equipment and note any missing/damaged components. Ensure guards are intact, and kill switches working. -Be aware of potential presence of poisonous plants (ivy/oak). Avoid contact. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Immediately notify the SSHO if you suspect you contacted. Defective equipment or safety systems
		L

Job Steps	Hazards	Controls	RAC
Inspecting equipment.	Pinch points. Biological hazards. Cuts/lacerations.	Identify pinch points before beginning any task. If possible, use hand safety stickers to remind everyone that may come into contact with the equipment where pinch points are located. Check immediate area for potential hazards such as poison ivy, spiders, wasps, snakes, etc. Use bug repellent and sunscreen as necessary. Use snake chaps or shin guards. Use a bar to clear out objects and/or vegetation from spiders and/or snakes (do not use your hands or feet). Use leather gloves when touching equipment to help grip and prevent cuts or slips on the material.	
Establish EZ and install perimeter controls (Perimeter protection and sediment & erosion control devices)	-Exposure to COCs	-Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified in the SSHP. Use Class 2 or 3 perimeter protection with stop logs and clear distances to maintain safe distances with equipment and trucks. -Avoid contact with contaminated materials. Wear Modified Level D PPE. - RPTs will perform radiological surveillance. Radiological surveillance may include: 1. Personnel working in Restricted Areas may be issued Lapel Samplers (also called Breathing Zone (BZ) Air Samplers). 2. General Area Air Monitors may be used to sample work areas. 3. Perimeter Air Monitors may be used to sample Control Area boundary locations. 4. Real-time dust monitoring may be used to sample boundary areas. 5. Monitoring of radon, thoron, or Working Level (WL) may be used to sample work and boundary areas in accordance with the SSHP.	L
	-Slips, trips, and uneven surfaces -Cuts/laceration hazards from sharp edges of tools/equipment -Crush hazards on fingers/hands during fence install	-Keep work area clear of surface encumbrances. Be aware of vines and other natural debris on ground surface, including holes and tree stumps. -Use leather gloves and avoid sharp metal and protruding objects. -Use dedicated fence post driver. Avoid over exertion. Do not place hands near post while someone is driving with hammer. Use extension rod to hold.	L
Clearing and grubbing of brush and grass and shrubs.	-Noise. -Flying Debris. -Biological Hazards. -Chainsaw hazards -Slips, trips and falls other personnel in the area. -Inadvertent contact with other equipment. -Personnel injury/ equipment damage during start-up.	-Use hearing protection during the weed eating process and while working adjacent to heavy equipment. -Be aware of and avoid agitating loose debris. Stay 50 ft. away from other personnel and vehicles. Use face shields in addition to safety glasses. -Consult applicable equipment safety card for chainsaw operations. Use proper PPE (chaps, facesheild, gloves) and follow manufacturer’s instructions for proper usage. -Use leather steel-toe work boots with defined heel. If conditions are wet and muddy use rubber steel toe boots with defined heel. -Stay alert for loose material, potholes, uneven surfaces, etc. -Use caution when using the weed eater around the silt fence, etc. -Make sure weed eater are clear of all obstructions prior to start up. -If using skid steer, ensure all motion alarms are functional, personnel wear high-vis safety vest, and maintain clear distance from around machine (50 feet). -Use hand signals, keep clear of moving equipment, ensure eye contact with operator prior to approaching.	M

Job Steps	Hazards	Controls	RAC
Dust suppression	Exposure to COCs during operations with potential to generate dust (grubbing).	-Control dust by maintaining equipment operation rates. -Control dust by applying water and/or calcium chloride. -Personnel shall stay out of dust and work from upwind when possible. -Perform dust and rad monitoring per accordance with SSHP to verify dust control is effective. -Read and follow SDS for each chemical used. Do not use any chemical that you have not been trained to safely use. Wear proper PPE. Properly label all containers.	M
Police area and remove all tools and equipment	-Sprains/Strains from lifting -Hand tool use	-Use proper lifting techniques and mechanical assistance -Inspect hand tools and ensure in proper operating condition. Remove defective tools from use.	L

Additional Safety Considerations	
1.	See attached equipment safety card for chainsaw operations.
2.	Maintain eye contact with equipment operator and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator.
3.	Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed or the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
4.	When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
5.	Keep clear area around work area, maintain good housekeeping practices.
6.	When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
7.	Avoid the use of chains for lifting. If necessary, ensure chain is equipped with annual load rating cert and proper hooks being used. For synthetic slings, ensure red warning line is not showing and item is in good condition. For wire ropes, inspect for broken wires (6 in a lay, 3 in a strand).

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Skid Steer	Daily Preventative Maintenance Checks	Certified heavy equipment operator Familiarity with the vehicle being operated.
Power Tools: Chainsaw and chipper	Daily Preventative Maintenance Checks	Training and experience using equipment required. Familiarity with tools being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

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Name (Print)	Date	Company	Signature



OP 551 - Project Planning



Activity Hazard Analysis – 4.0

Activity/Work Task: Excavation	Overall Risk Assessment Code (RAC) (Use highest code)				M	
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix					
Contract Number: W912DQ-13-D-3016	Severity	Probability				
Date Prepared: 11/22/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by: Sean Liddy, CSP	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
Competent Person (if applicable): Operator for heavy equipment operations. Field engineer for excavation.	Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)				RAC Chart	
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.	“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.					
	“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible					
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.					
Personal Protective Equipment (PPE):						
<input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input checked="" type="checkbox"/> Coveralls (coated) <input type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Use modified Level D PPE (to include tyvek and over booties or dedicated rubber boots).						
Safety Equipment:						
<input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:						
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP):						
<input checked="" type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input checked="" type="checkbox"/> PDR (Respirable Dust) <input checked="" type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs. Monitor for dust, VOC and radiological COCs per accordance with SSHP and RPP at direction of SSHO/SRSO.						
Job Steps	Hazards	Controls			RAC	
Utility Locate call, Review site drawings. Mark known subsurface lines	Overhead or underground utilities that can be encountered during excavation activities causing injury to personnel and/or damage to equipment and property	-Obtain all necessary utility clearance permits and maintain copies at site. Use site drawings to assist with utility location. Clearly mark and refresh lines/markings as needed. Hand dig or air knife within 5-feet of suspected lines to positively ID and avoid. -Ensure minimum safe distances from overhead utilities. Unmarked lines suspected, or observed evidence of potential presence.			L	

Job Steps	Hazards	Controls	RAC
Stage tools and equipment	<ul style="list-style-type: none"> -Slips, trips, and uneven surfaces -Cuts/laceration hazards from sharp edges of tools. -Unsafe Equipment. -Biological Hazards 	<ul style="list-style-type: none"> -Inspect equipment to assure that all operational and safety systems are functional. -Keep work area clear of surface encumbrances -Use leather gloves and avoid sharp metal and protruding objects. -Operator must perform thorough inspection of equipment and note any missing/damaged components. Ensure motion alarms are functional (at proper audible levels), horn functional, mirrors and windows intact (no cracking). -Be aware of potential presence of poisonous plants (ivy/oak). Avoid contact. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Immediately notify the SSHO if you suspect you contacted.  Defective equipment or safety systems 	L
Establish EZ and install perimeter controls (Perimeter protection and sediment & erosion control devices)	<ul style="list-style-type: none"> -Exposure to COCs 	<ul style="list-style-type: none"> -Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified in the SSHP. Use Class 2 or 3 perimeter protection with stop logs and clear distances to maintain safe distances with equipment and trucks. -Avoid contact with contaminated materials. Wear Modified Level D PPE. - RPTs will perform radiological surveillance. Radiological surveillance may include: <ol style="list-style-type: none"> 1. Personnel working in Restricted Areas may be issued Lapel Samplers (also called Breathing Zone (BZ) Air Samplers). 2. General Area Air Monitors may be used to sample work areas. 3. Perimeter Air Monitors may be used to sample Control Area boundary locations. 4. Real-time dust monitoring may be used to sample boundary areas. 5. Monitoring of radon, thoron, or Working Level (WL) may be used to sample work and boundary areas in accordance with the SSHP. 	L
	<ul style="list-style-type: none"> -Slips, trips, and uneven surfaces -Cuts/laceration hazards from sharp edges of tools/equipment -Crush hazards on fingers/hands during fence install 	<ul style="list-style-type: none"> -Keep work area clear of surface encumbrances. Be aware of vines and other natural debris on ground surface, including holes and tree stumps. -Use leather gloves and avoid sharp metal and protruding objects. -Use dedicated fence post driver. Avoid over exertion. Do not place hands near post while someone is driving with hammer. Use extension rod to hold. 	L
Excavation of soils Hand dig around subsurface lines	<ul style="list-style-type: none"> -Excavation/trench side walls can collapse. -Heavy equipment hazards from pinch points on equipment, swinging arms of backhoes, and moving. -Noise Building wall cracks, bulges or breaks. -Underground and overhead utilities -Fall into excavation/trench by personnel and/or equipment -Hand tool use during fence install, and manual digging. 	<ul style="list-style-type: none"> -Ensure proper sloping/shoring of excavation. Assume Class C soils to start. Place spoils at least 2-3 ft back from edge of trench. CP must inspect daily and after each rain event. Shoring systems to be installed per engineered design. Exposed edges properly sloped and/or benched. -All unessential personnel stay back 50 feet plus max swing radius of equipment. Do not stand between equipment and other fixed objects. -Use hearing protection while working adjacent to heavy equipment. -Use hand signals, keep clear of moving equipment, ensure eye contact with operator prior to approaching. -Unsure utility locations in facility are clearly demarcated and verified with CP and/or engineer prior to intrusive work. -Excavation edges must be properly demarcated with orange fencing at sufficient distance from edge (≥ 6 ft where possible) and curb stops if equipment is operating adjacent (Minimum Class 2 or 3 perimeter protection). -Inspect hand tools and ensure in proper operating condition. Remove defective tools from use. 	M

Job Steps	Hazards	Controls	RAC
Excavation (cont.)	Trench collapse	-Competent person for excavation has inspected and documented the excavation conditions prior to the start of work (daily) and ensures trench box assembled per engineered drawing. Exposed edges properly sloped/benched. -Appropriate means of egress used to enter/exit from excavation  Exposing subsurface lines or structures not previously identified. Excavation fills with water or product. Adjacent road or structure cracks, bulges or breaks.	M
Dust suppression	Exposure to COCs via dust generation during excavation	-Control dust by maintaining equipment operation rates. -Control dust by applying water and/or calcium chloride. -Personnel shall stay out of dust and work from upwind when possible. -Perform dust and rad monitoring per accordance with SSHP/RPP and per SSHO/SRSO to verify dust control is effective. -Read and follow SDS for each chemical used. Do not use any chemical that you have not been trained to safely use. Wear proper PPE. Properly label all containers.	M
Excavation (cont.) Water accumulation in the excavation	-Stability -Dust (with potential COCs)	-Pump out water to expose bottom of excavation. Designated CP to inspect and document conditions. -Use dust suppression as necessary to avoid airborne dust in work zone.  Inability to control water level.	M
Use of pumps and generators	-COC exposure -Electrical Hazards -Fire Hazards -Sprains/Strains during lifting	- Wear proper PPE (modified D) and avoid splashing water. - All extension cords should be inspected daily. Use GFCI protected outlets. Ensure grounding plug intact. Keep connections and cord out of water. Dry hands prior to connecting/disconnecting. -Turn equipment off and let cool prior to refueling. Ensure fire extinguisher present. -Use proper lifting techniques and mechanical assistance where necessary. Wear gloves.	M
Soil Load-out	Heavy equipment hazards from pinch points on equipment, swinging arms of backhoes, and moving. Noise Vehicle hazards Traffic hazards Overhead utilities	-All workers except the excavator operator shall remain outside the swing radius of the equipment. -Workers shall not approach the excavator unless the bucket is on the ground and the operator signals that it is OK to approach -Drivers to remain inside of truck cab. Equipment shall not swing over top of cab. -Hard Hat, Safety Glasses or Goggles, Leather Gloves, Hearing Protection used within EZ. Wear high vis vests and stay out to truck travel lanes. -Truck drivers to pay attention to spotters when working in tight spaces due to blind spots. -Truck drivers to be aware of traffic on roadways. Come to complete stop before pulling on to road way. Use flaggers when necessary to facilitate safe entrance/exit . -Be aware of location of overhead power lines. Do not raise/lift bed within 10 ft of lines. Fully lower beds prior to movement to avoid accidental snag/entangle with lines.	M

Job Steps	Hazards	Controls	RAC
Decontamination of trucks	-Off-Site spread of Contamination -Power/steam washing hazards	-Trucks shall use dedicated site entrance/exit. -Trucks will be decontaminated (dry brush and/or wet techniques) prior to departure from the EZ. -If using wet methods (power or steam) spray shall be directed at surfaces to be cleaned only, and never at body parts or other personnel. Personnel in the immediate area shall use face shields and metatarsal/shin guards. Personnel shall keep firm grip on wand and not point it at anything that is not being washed. Pressure washer operators must maintain good footing. The trigger on the wand shall never be wired/fixed open. Operators are to take adequate breaks to avoid fatigue. Personnel shall be trained in the use of the washing equipment including emergency shut-off procedures for the equipment being used.	M
Back fill excavation	-Heavy equipment hazards from pinch points on equipment, swinging arms of backhoes, and moving. -Rigging hazards -Sprains/stains from manual lifting and use of compaction equipment. Noise	-All workers except the excavator operator shall remain outside the swing radius of the equipment. Workers shall not approach the excavator unless the bucket is on the ground and the operator signals that it is OK to approach. -Use proper rigging for lifting compaction equipment into/out of excavation. -Use mechanical assistance whenever possible. Use proper lifting techniques. Use remote control on compaction roller and do not stand directly adjacent to machine. -Hard Hat, Safety Glasses or Goggles, Leather Gloves, Hearing Protection	M
Backing trucks up to excavation.	-Trucks/equipment falling into excavation.	-Ensure stop logs set a distance from edge to prevent truck from getting too close. Use spotters where necessary. Spotters to stay in line of sight of drivers mirrors and/or cab.	M
Police area and remove all tools and equipment	-Sprains/Strains from lifting -Hand tool use	-Use proper lifting techniques and mechanical assistance -Inspect hand tools and ensure in proper operating condition. Remove defective tools from use.	L

Additional Safety Considerations

1. Air monitoring procedures to be used to ensure controls effective in prevention of exposure and off-site migration of COCs from work area.
2. Use one person to communicate with driver via hand signals to avoid unnecessary confusion. Watch for overhead utilities.
3. Maintain eye contact with equipment operator and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator. Unessential personnel must stay back 50-feet plus maximum swing radius of equipment.
4. Keep clear area around work area, maintain good housekeeping practices.
5. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
6. Avoid the use of chains for lifting. If necessary, ensure chain is equipped with annual load rating cert and proper hooks being used. For synthetic slings, ensure red warning line is not showing and item is in good condition. For wire ropes, inspect for broken wires (6 in a lay, 3 in a strand).

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including dump trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Excavator/Dozer	Daily Preventative Maintenance Checks	Certified heavy equipment operator Familiarity with the equipment being operated.
Compaction equipment	Daily Preventative Maintenance Checks	Trained laborer/operator Familiarity with the equipment being operated.

Equipment to be Used	Inspection Requirements	Training Requirements
Power/Steam Washer	Daily Preventative Maintenance Checks	Trained laborer/operator Familiarity with the equipment being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

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Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 5.0

Activity/Work Task: Culvert & Road Bypass Installation	Overall Risk Assessment Code (RAC) (Use highest code)	M																					
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix																						
Contract Number: W912DQ-13-D-3016	Severity	Probability																					
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely																					
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M																					
Reviewed by: Sean Liddy, CSP	Critical	E H H M L																					
	Marginal	H M M L L																					
Competent Person (if applicable): Operator for heavy equipment operations. Field engineer for excavation.	Negligible	M L L L L																					
	RAC Chart																						
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Job Steps	Hazards	Controls	RAC																				
Utility Locate call, Review site drawings. Mark known subsurface lines	Overhead or underground utilities that can be encountered during excavation activities causing injury to personnel and/or damage to equipment and property	-Obtain all necessary utility clearance permits and maintain copies at site. Use site drawings to assist with utility location. Clearly mark and refresh lines/markings as needed. Hand dig or air knife within 5-feet of suspected lines to positively ID and avoid. -Ensure minimum safe distances from overhead utilities. Unmarked lines suspected, or observed evidence of potential presence.	L																				

Job Steps	Hazards	Controls	RAC
Stage tools and equipment	<ul style="list-style-type: none"> -Slips, trips, and uneven surfaces -Cuts/laceration hazards from sharp edges of tools. -Unsafe Equipment. -Biological Hazards 	<ul style="list-style-type: none"> -Inspect equipment to assure that all operational and safety systems are functional. -Keep work area clear of surface encumbrances -Use leather gloves and avoid sharp metal and protruding objects. -Operator must perform thorough inspection of equipment and note any missing/damaged components. Ensure motion alarms are functional (at proper audible levels), horn functional, mirrors and windows intact (no cracking). -Be aware of potential presence of poisonous plants (ivy/oak). Avoid contact. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Immediately notify the SSHO if you suspect you contacted.  Defective equipment or safety systems 	L
Dust suppression	<ul style="list-style-type: none"> -Exposure to COCs via dust generated during excavation and soil load-out activities 	<ul style="list-style-type: none"> -Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified in the SSHP. Use Class 2 or 3 perimeter protection with stop logs and clear distances to maintain safe distances with equipment and trucks. -Avoid contact with contaminated materials. Wear Modified Level D PPE. - RPTs will perform radiological surveillance. Radiological surveillance may include: <ol style="list-style-type: none"> 1. Personnel working in Restricted Areas may be issued Lapel Samplers (also called Breathing Zone (BZ) Air Samplers). 2. General Area Air Monitors may be used to sample work areas. 3. Perimeter Air Monitors may be used to sample Control Area boundary locations. 4. Real-time dust monitoring may be used to sample boundary areas. 5. Monitoring of radon, thoron, or Working Level (WL) may be used to sample work and boundary areas in accordance with the SSHP. 	L
Installation of bypass culvert	<ul style="list-style-type: none"> -Excavation Safety -Heavy equipment hazards from pinch points on equipment, swinging arms of backhoes, and moving. Noise Vehicle hazards Traffic hazards Overhead utilities 	<ul style="list-style-type: none"> -Refer to Excavation and Backfilling AHA for safe excavation techniques -All workers except the excavator operator shall remain outside the swing radius of the equipment. -Workers shall not approach the excavator unless the bucket is on the ground and the operator signals that it is OK to approach -Drivers to remain inside of truck cab. Equipment shall not swing over top of cab. -Hard Hat, Safety Glasses or Goggles, Leather Gloves, Hearing Protection used within EZ. Wear high vis vests and stay out to truck travel lanes. -Truck drivers to pay attention to spotters when working in tight spaces due to blind spots. -Truck drivers to be aware of traffic on roadways. Come to complete stop before pulling on to road way. Use flaggers when necessary to facilitate safe entrance/exit . -Be aware of location of overhead power lines. Do not raise/lift bed within 10 ft of lines. Fully lower beds prior to movement to avoid accidental snag/entangle with lines. 	M
Installation of temporary road	<ul style="list-style-type: none"> -Traffic hazards 	<ul style="list-style-type: none"> -Obtain necessary temporary road closure permits (if required). -Establish temporary traffic control measures as required. -All personnel required to wear high visibility clothing during all phases of task. 	M
Backing trucks up to excavation.	<ul style="list-style-type: none"> -Trucks/equipment falling into excavation. 	<ul style="list-style-type: none"> -Ensure stop logs set a distance from edge to prevent truck from getting too close. Use spotters where necessary. Spotters to stay in line of sight of drivers mirrors and/or cab. 	M

Job Steps	Hazards	Controls	RAC
Use of pumps and generators	-COC exposure -Electrical Hazards -Fire Hazards -Sprains/Strains during lifting	- Wear proper PPE (modified D) and avoid splashing water. - All extension cords should be inspected daily. Use GFCI protected outlets. Ensure grounding plug intact. Keep connections and cord out of water. Dry hands prior to connecting/disconnecting. -Turn equipment off and let cool prior to refueling. Ensure fire extinguisher present. -Use proper lifting techniques and mechanical assistance where necessary. Wear gloves.	M
Police area and remove all tools and equipment	-Sprains/Strains from lifting -Hand tool use	-Use proper lifting techniques and mechanical assistance -Inspect hand tools and ensure in proper operating condition. Remove defective tools from use.	L

Additional Safety Considerations	
1.	Air monitoring procedures to be used to ensure controls effective in prevention of exposure and off-site migration of COCs from work area.
2.	Use one person to communicate with driver via hand signals to avoid unnecessary confusion. Watch for overhead utilities.
3.	Maintain eye contact with equipment operator and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator. Unessential personnel must stay back 50-feet plus maximum swing radius of equipment.
4.	Keep clear area around work area, maintain good housekeeping practices.
5.	When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
6.	Avoid the use of chains for lifting. If necessary, ensure chain is equipped with annual load rating cert and proper hooks being used. For synthetic slings, ensure red warning line is not showing and item is in good condition. For wire ropes, inspect for broken wires (6 in a lay, 3 in a strand).

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including dump trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Excavator/Dozer	Daily Preventative Maintenance Checks	Certified heavy equipment operator Familiarity with the equipment being operated.
Compaction equipment	Daily Preventative Maintenance Checks	Trained laborer/operator Familiarity with the equipment being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, CABRERA employees agree that:

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- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.
- I will ensure compliance with my company's policies on health and safety.

Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 6.0

Activity/Work Task: Site Restoration Activities	Overall Risk Assessment Code (RAC) (Use highest code)	M		
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix			
Contract Number: W912DQ-13-D-3016	Severity	Probability		
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely		
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M		
Reviewed by: Sean Liddy, CSP	Critical	E H H M L		
	Marginal	H M M L L		
	Negligible	M L L L L		
Competent Person (if applicable): Operator for heavy equipment operations	RAC Chart E = Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk			
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.			Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)	
			“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.	
			“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.			
Personal Protective Equipment (PPE): <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input checked="" type="checkbox"/> Coveralls (coated) <input type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Use Level D PPE for site restoration.				
Safety Equipment: <input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:				
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP): <input type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input type="checkbox"/> PDR (Respirable Dust) <input type="checkbox"/> PDM (Total Dust) <input type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): None.				
Job Steps	Hazards	Controls		
Stage tools and equipment	-Slips, trips, and uneven surfaces -Cuts/laceration hazards from sharp edges of tools. -Unsafe Equipment.	-Inspect equipment to assure that all operational and safety systems are functional. -Keep work area clear of surface encumbrances -Use leather gloves and avoid sharp metal and protruding objects. -Operator must perform thorough inspection of equipment and note any missing/damaged components. Ensure motion alarms are functional (at proper audible levels), horn functional, mirrors and windows intact (no cracking). Defective equipment or safety systems		
		L		

Job Steps	Hazards	Controls	RAC
Establishment of construction zone safety requirements.	-Traffic hazards	-Obtain necessary temporary road closure permits (if required). -Establish temporary traffic control measures as required. Place cones, barrels and advance warning sigs at proper distances per NJ DOT requirements. -All personnel required to wear high visibility clothing during all phases of task.	
Concrete curb/gutter construction	-Excavation Safety -Heavy equipment hazards from pinch points on equipment, swinging schutes. -Cuts/laceration hazards from sharp edges of tools. -Concrete hazards (burns) Noise Vehicle hazards Traffic hazards Impalement hazards.	-Refer to Excavation and Backfilling AHA for safe excavation techniques during fine grading where required. -Concrete Truck Drivers to remain adjacent to truck. Washout-s to be performed as designated location within the MISS. -Use leather gloves and avoid sharp metal and protruding objects. -Use gloves, and avoid direct dermal contact with wet concrete. If exposed, promptly wash off. Avoid getting concrete in boots. -Hard Hat, Safety Glasses or Goggles, Leather Gloves, Hearing Protection used within EZ. - Wear high vis vests and stay out to truck travel lanes. Truck drivers to pay attention to spotters when working in tight spaces due to blind spots. -Truck drivers to be aware of traffic on roadways. Come to complete stop before pulling on to road way. Use flaggers when necessary to facilitate safe entrance/exit . -Place rebar caps on any exposed rebar that presents potential impalement hazard.	M
Asphalt Road Installation	-Excavation Safety -Heavy equipment hazards from pinch points on equipment, swinging schutes. -Cuts/laceration hazards from sharp edges of tools. -Noise -Vehicle hazards -Traffic hazards -Burns from asphalt/tar	-Refer to Excavation and Backfilling AHA for safe excavation techniques during fine grading where required. -Asphalt Truck Drivers to remain inside to truck. -Use leather gloves and avoid sharp metal and protruding objects. -Hard Hat, Safety Glasses or Goggles, Leather Gloves, Hearing Protection used within EZ. - Wear high vis vests and stay out to truck travel lanes. Truck drivers to pay attention to spotters when working in tight spaces due to blind spots. -Truck drivers to be aware of traffic on roadways. Come to complete stop before pulling on to road way. Use flaggers when necessary to facilitate safe entrance/exit -Proper work gloves and clothing shall be used by personnel working with paver and/or asphalt - proper clothing includes: un-cuffed, long pants, long sleeve shirts with closed necks. Personnel shall be reminded of the potential for hot surfaces on paver. Tyvek® and/or polyester shall not be worn by personnel working on or near paver. Personnel working with liquid tack shall also wear a face shield.	M
Topsoil and seeding (including re-vegetation)	-Heavy equipment hazards from pinch points on equipment, swinging arms of backhoes, and moving. Noise Vehicle hazards Traffic hazards	-All workers except the excavator operator shall remain outside the swing radius of the equipment. -Workers shall not approach the excavator unless the bucket is on the ground and the operator signals that it is OK to approach -Drivers to remain inside of truck cab. Equipment shall not swing over top of cab. -Hard Hat, Safety Glasses or Goggles, Leather Gloves, Hearing Protection used within EZ. Wear high vis vests and stay out to truck travel lanes. -Truck drivers to pay attention to spotters when working in tight spaces due to blind spots. -Truck drivers to be aware of traffic on roadways. Come to complete stop before pulling on to road way. Use flaggers when necessary to facilitate safe entrance/exit .	M

Job Steps	Hazards	Controls	RAC
Trucking of materials.	-Trucks/equipment falling into excavation. -Overhead utilities -Traffic hazards	-Ensure stop logs set a distance from edge to prevent truck from getting too close. Use spotters where necessary. Spotters to stay in line of sight of drivers mirrors and/or cab. -Be aware of location of overhead power lines. Do not raise/lift bed within 10 ft of lines. Fully lower beds prior to movement to avoid accidental snag/entangle with lines. -Truck drivers to be aware of traffic on roadways. Come to complete stop before pulling on to road way. Use flaggers when necessary to facilitate safe entrance/exit .	M
Police area and remove all tools and equipment	-Sprains/Strains from lifting -Hand tool use	-Use proper lifting techniques and mechanical assistance -Inspect hand tools and ensure in proper operating condition. Remove defective tools from use.	L

Additional Safety Considerations	
1.	Use one person to communicate with driver via hand signals to avoid unnecessary confusion. Watch for overhead utilities.
2.	Maintain eye contact with equipment operator and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator. Unessential personnel must stay back 50-feet plus maximum swing radius of equipment.
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Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including dump trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Heavy Equipment	Daily Preventative Maintenance Checks	Certified heavy equipment operator Familiarity with the equipment being operated.
Compaction equipment	Daily Preventative Maintenance Checks	Trained laborer/operator Familiarity with the equipment being operated.
Asphalt placement equipment.	Daily Preventative Maintenance Checks	Trained laborer/operator Familiarity with the equipment being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Familiarity with the equipment.
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Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 7.0

Activity/Work Task: MISS Activities (Waste stockpile management)	Overall Risk Assessment Code (RAC) (Use highest code)	M
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix	
Contract Number: W912DQ-13-D-3016	Severity	Probability
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M
Reviewed by: Sean Liddy, CSP	Critical	E H H M L
	Marginal	H M M L L
	Negligible	M L L L L
Competent Person (if applicable): Operator for heavy equipment operations	RAC Chart	
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.		
Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)		
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Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP): <input checked="" type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input checked="" type="checkbox"/> PDR (Respirable Dust) <input checked="" type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs Monitor for dust, VOC and radiological COCs per accordance with SSHP and RPP at direction of SSHO/SRSO.		
Job Steps	Hazards	Controls
Trucking of materials.	-Trucks/equipment -Overhead utilities -Traffic hazards	-Use spotters where necessary when backing up trucks to stockpile. Spotters to stay in line of sight of drivers mirrors and/or cab. -Be aware of location of overhead power lines. Do not raise/lift bed within 10 ft of lines. Fully lower beds prior to movement to avoid accidental snag/entangle with lines. -Truck drivers to be aware of traffic on roadways. Come to complete stop before pulling on to road way. Use flaggers when necessary to facilitate safe entrance/exit . -Follow posted speed limits on site. -All personnel required to wear high-vis clothing in MISS.
		L

Job Steps	Hazards	Controls	RAC
Maintenance of Soil stockpile	<ul style="list-style-type: none"> -Vehicular traffic -Slips, trips, falls and protruding objects -Cuts/laceration hazards from sharp edges of equipment and supplies -Overhead utilities -Sprains/Strains -Electrical Hazards -Confined Spaces (present on-site) 	<ul style="list-style-type: none"> -Wear high vis safety vest and maintain eye contact with truck driver -Ensure work surface clear of encumbrances and ensure proper footing. Do not walk on liners or other potentially slippery/wet surface. -Use leather gloves and avoid sharp metal and protruding objects. Use only approved cutting devices. Pass scissors handle first, with blades closed together. Use approved safety cutting devices instead of knives or open blades. Never use a double-edged or unprotected razor blades. -Watch for overhead lines and ensure minimum safe distance (10 ft) maintained -Use proper lifting techniques and do not over extend (field ergonomics). Get necessary assistance when lifting heavy objects. -All electrical equipment shall be grounded. Worn or frayed electrical cables must be replaced and destroyed. Ground-fault circuit interrupters shall be used on all power tools and extension cords. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas. Keep extension cords off of ground surface. -No one will be permitted to enter any confined space without proper training, proper PPE, notifying the SSHO, and having a Permit-Confined Space Permit issued. CSE covered under separate AHA for task. 	M
Maintenance of waste piles for overburden (asphalt, concrete).	<ul style="list-style-type: none"> -Vehicular traffic -Slips, trips, falls and protruding objects -Cuts/laceration hazards from sharp edges of equipment and supplies -Overhead utilities -Sprains/Strains -Electrical Hazards 	<ul style="list-style-type: none"> -Wear high vis safety vest and maintain eye contact with truck driver -Ensure work surface clear of encumbrances and ensure proper footing. Do not walk on liners or other potentially slippery/wet surface. -Use leather gloves and avoid sharp metal and protruding objects. Use only approved cutting devices. Pass scissors handle first, with blades closed together. Use approved safety cutting devices instead of knives or open blades. Never use a double-edged or unprotected razor blades. -Watch for overhead lines and ensure minimum safe distance (10 ft) maintained -Use proper lifting techniques and do not over extend (field ergonomics). Get necessary assistance when lifting heavy objects. -All electrical equipment shall be grounded. Worn or frayed electrical cables must be replaced and destroyed. Ground-fault circuit interrupters shall be used on all power tools and extension cords. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas. Keep extension cords off of ground surface. 	L
	<ul style="list-style-type: none"> -Exposure to COCs via dust during operations. 	<ul style="list-style-type: none"> -Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified in the SSHP. Use Class 2 or 3 perimeter protection with stop logs and clear distances to maintain safe distances with equipment and trucks. -Avoid contact with contaminated materials. Wear Modified Level D PPE. - RPTs will perform radiological surveillance. Radiological surveillance may include: <ol style="list-style-type: none"> 1. Personnel working in Restricted Areas may be issued Lapel Samplers (also called Breathing Zone (BZ) Air Samplers). 2. General Area Air Monitors may be used to sample work areas. 3. Perimeter Air Monitors may be used to sample Control Area boundary locations. 4. Real-time dust monitoring may be used to sample boundary areas. 5. Monitoring of radon, thoron, or Working Level (WL) may be used to sample work and boundary areas in accordance with the SSHP. 	L

Job Steps	Hazards	Controls	RAC
Dust Control	Exposure to COCs	-Control dust by maintaining equipment operation rates. -Control dust by applying water and/or calcium chloride. -Personnel shall stay out of dust and work from upwind when possible. -Perform dust monitoring to verify dust control is effective. -Read and follow SDS for each chemical used. Do not use any chemical that you have not been trained to safely use. Wear proper PPE. Properly label all containers.	L
Use of pumps and generators	-COC exposure -Electrical Hazards -Fire Hazards -Sprains/Strains during lifting	- Wear proper PPE (modified D) and avoid splashing water. - All extension cords should be inspected daily. Use GFCI protected outlets. Ensure grounding plug intact. Keep connections and cord out of water. Dry hands prior to connecting/disconnecting. -Turn equipment off and let cool prior to refueling. Ensure fire extinguisher present. -Use proper lifting techniques and mechanical assistance where necessary. Wear gloves.	L
Decontamination of trucks	-Off-Site spread of Contamination -Power/steam washing hazards	-Trucks shall use dedicated site entrance/exit. -Trucks will be decontaminated (dry brush and/or wet techniques) prior to departure from the EZ. -If using wet methods (power or steam) spray shall be directed at surfaces to be cleaned only, and never at body parts or other personnel. Personnel in the immediate area shall use face shields and metatarsal/shin guards. Personnel shall keep firm grip on wand and not point it at anything that is not being washed. Pressure washer operators must maintain good footing. The trigger on the wand shall never be wired/fixed open. Operators are to take adequate breaks to avoid fatigue. Personnel shall be trained in the use of the washing equipment including emergency shut-off procedures for the equipment being used.	L

Additional Safety Considerations

1. Air monitoring procedures to be used to ensure controls effective in prevention of exposure and off-site migration of COCs from work area.
2. Use caution around delivery trucks and stay clear if not involved in spotting operation. Use one person to communicate with driver via hand signals to avoid unnecessary confusion. Watch for overhead utilities.
3. Maintain eye contact with equipment operator during stone installation and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator.
4. Maintain eye contact with equipment operator and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator. Unessential personnel must stay back 50-feet plus maximum swing radius of equipment.
5. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed or the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
6. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
7. Keep clear area around work area, maintain good housekeeping practices.
8. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
9. Avoid the use of chains for lifting. If necessary, ensure chain is equipped with annual load rating cert and proper hooks being used. For synthetic slings, ensure red warning line is not showing and item is in good condition. For wire ropes, inspect for broken wires (6 in a lay, 3 in a strand).

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Skid Steer/Loader	Daily Preventative Maintenance Checks	Certified heavy equipment operator Familiarity with the vehicle being operated.
Forklift	Daily Preventative Maintenance Checks	Certified Forklift Driver Familiarity with the vehicle being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, CABRERA employees agree that:

- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.
- I will ensure compliance with my company's policies on health and safety.

Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 8.0

Activity/Work Task: Railcar Load-out	Overall Risk Assessment Code (RAC) (Use highest code)	H				
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix					
Contract Number: W912DQ-13-D-3016	Severity	Probability				
Date Prepared: 11/22/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E	E	H	H	M
Reviewed by: Sean Liddy, CSP	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
Competent Person (if applicable): Lead laborer responsible for track clearances. Operator for heavy equipment	Negligible	M	L	L	L	L
	Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)					RAC Chart
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.						
“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.						
“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible						
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.					E = Extremely High Risk	
					H = High Risk	
					M = Moderate Risk	
					L = Low Risk	
Personal Protective Equipment (PPE):						
<input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input checked="" type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input checked="" type="checkbox"/> Coveralls (coated) <input checked="" type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Use modified Level D PPE (to include tyvek and over booties or dedicated rubber boots). Upgrade to Level C dependent upon air monitoring.						
Safety Equipment:						
<input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:						
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP):						
<input checked="" type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input checked="" type="checkbox"/> PDR (Respirable Dust) <input checked="" type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs. Monitor for dust, VOC and radiological COCs per accordance with SSHP and RPP at direction of SSHO/SRSO.						
Job Steps	Hazards	Controls				RAC
Secure the rail spurs and position rail cars with Track Mobile.	Rail safety Struck by/crushed by	- The operator and the Lead laborer will ensure that the Sears track switch has been locked and a “Blue” signal is displayed at the switch. A “Red” flag will be placed on the last railcar by the Lead laborer. This flag signifies that personnel are on the rail and rail car movement is prohibited. - Coupling and de-coupling of rail cars shall be completed by competent trained individual(s), and all other personnel shall not participate and are prohibited from all de-coupling activities.				H

Job Steps	Hazards	Controls	RAC
		<ul style="list-style-type: none"> -Personnel shall not position themselves between equipment and stationary objects and shall only approach equipment after receiving approval from the operator. - Rail car movement equipment load capacities shall not be exceeded. -Once railcars are in position the lead laborer will engage the manual brake on the first railcar (attached to the Track Mobile) and insert a wheel chock on the last railcar farthest from Track Mobile. - No one shall be permitted to ride inside or on rail car while in motion 	H
Use of track fall protection system	Falls from height during railcar preparation, loading, and securing processes.	<ul style="list-style-type: none"> - Follow Site-Specific Fall Protection and Prevention Plan. - Do not use horizontal rigid track system and personal fall protection unless Competent Person for Fall Protection is on-site. - Verify training was provided for Authorized Users/Authorized Rescuer on the use of horizontal rigid track system, personal fall protection, and fall rescue procedures. - Personal fall protection equipment shall be inspected by the Authorized User prior to each use to determine that is in a safe working condition. Verify fall arrest systems are properly functioning before use. - A competent person shall inspect the equipment at least once semi-annually and whenever subjected to severe use. - Defective or damaged equipment shall not be used, immediately removed from service, and replaced before use of system. - Verify self-retracting lifelines (SRLs) are established for each individual. - Verify all personal fall protection is matched by manufacturer and meets ANSI Z359.1 (2007). - The attachment point for body harnesses shall be located in the center of the wearer's back near shoulder level, or above the wearer's head. - SRLs shall never be attached to the railcars. Only attach to the engineered track system. - Always use the buddy system when using horizontal rigid track system and personal fall protection. - Verify rescue equipment is readily accessible and in good condition for immediate use. Periodically practice rescues with rescue drills. 	H
Prepare rail cars for loading Installing liner	<ul style="list-style-type: none"> -Injuries caused by improper lifting techniques. -Hand hazards from metal cages and ladders. -Use of hand tools -Ladder Stability -Falls from ladders and railcars -Walking/Working Surfaces (slips) -Sprains/strains -Uneven terrain 	<ul style="list-style-type: none"> - Use proper bending/lifting techniques by bending and lifting with legs and not with back. Use buddy system to lift heavy objects. - Watch for sharp edges and wear leather work gloves. - Select proper tool for task performed and follow correct procedures for use. - Check each ladder thoroughly, ensuring it is structurally sound, and properly anchored. Complete ladder inspection forms. - Use ladders to climb, ensuring 3-points of contact at all times. - Use dedicated fall protection system during activities that require work 6 feet above ground surface. -Use ropes to lift/lower supplies over truck if necessary. - Avoid wet locations (standing water) and dry feet sufficiently prior to climbing. Do not attempt to climb ladders with wet feet. Avoid stepping on liner. - Do not over-exert pulling on liner to unfold. Unfold in sections and lay-out using assistance. Do not over extend attempting to secure liner to sidewall. - Grab handrails and turn to back down ladder. Maintain three points of contact at all times. 	M

Job Steps	Hazards	Controls	RAC
		<ul style="list-style-type: none"> - Inspect ground surface below ladder prior to descending, to ensure area is clear of debris (stones, cobbles, etc). - When stepping off ladder, do not jump, and place one foot on ground at time, ensuring proper footing, prior to placing all of weight on foot. 	
Load rail cars.	<ul style="list-style-type: none"> -Heavy equipment hazards from pinch points on equipment, swinging arms of backhoes, and moving. -Noise - Overhead utilities 	<ul style="list-style-type: none"> - All unessential personnel stay back 50 feet plus max swing radius of equipment. Do not stand between equipment and other fixed objects. - Use hand signals, keep clear of moving equipment, ensure eye contact with operator prior to approaching. - Use hearing protection while working adjacent to heavy equipment. -Be aware of location of overhead power lines. Do not raise/lift bed within 10 ft of lines. Fully lower beds prior to movement to avoid accidental snag/entangle with lines. 	L
	-Exposure to COCs via dust generated during load-out	<ul style="list-style-type: none"> -Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified in the SSHP. Use Class 2 or 3 perimeter protection with stop logs and clear distances to maintain safe distances with equipment and trucks. -Avoid contact with contaminated materials. Wear Modified Level D PPE. - RPTs will perform radiological surveillance. Radiological surveillance may include: <ol style="list-style-type: none"> 1. Personnel working in Restricted Areas may be issued Lapel Samplers (also called Breathing Zone (BZ) Air Samplers). 2. General Area Air Monitors may be used to sample work areas. 3. Perimeter Air Monitors may be used to sample Control Area boundary locations. 4. Real-time dust monitoring may be used to sample boundary areas. 5. Monitoring of radon, thoron, or Working Level (WL) may be used to sample work and boundary areas in accordance with the SSHP. 	L
Implementation of Dust Control	- Exposure to COCs thru dust	<ul style="list-style-type: none"> -Control dust by maintaining equipment operation rates. -Control dust by applying water and/or calcium chloride. -Personnel shall stay out of dust and work from upwind when possible. -Perform dust monitoring to verify dust control is effective. -Read and follow SDS for each chemical used. Do not use any chemical that you have not been trained to safely use. Wear proper PPE. Properly label all containers. 	L
Prepare loaded rail cars for shipment. (Securing liner)	<ul style="list-style-type: none"> -Injuries caused by improper lifting techniques. -Hand hazards from metal cages and ladders. -Use of hand tools -Ladder Stability -Falls from ladders and railcars -Walking/Working Surfaces (slips) Sprains/strains -Uneven terrain 	<ul style="list-style-type: none"> - Use proper bending/lifting techniques by bending and lifting with legs and not with back. Use buddy system to lift heavy objects. - Watch for sharp edges and wear leather work gloves. - Select proper tool for task performed and follow correct procedures for use. - Check each ladder thoroughly, ensuring it is structurally sound, and properly anchored. Complete ladder inspection forms. - Use ladders to climb, ensuring 3-points of contact at all times. - Use dedicated fall protection system during activities that require work 6 feet above ground surface. -Use ropes to lift/lower supplies over truck if necessary. - Avoid wet locations (standing water) and dry feet sufficiently prior to climbing. Do not attempt to climb ladders with wet feet. - Do not over-exert pulling on liner to unfold. Unfold in sections and lay-out using assistance. Do not over extend attempting to secure liner to sidewall. - Grab handrails and turn to back down ladder. Maintain three points of contact at all times. 	M

Job Steps	Hazards	Controls	RAC
		<ul style="list-style-type: none"> - Inspect ground surface below ladder prior to descending, to ensure area is clear of debris (stones, cobbles, etc). - When stepping off ladder, do not jump, and place one foot on ground at time, ensuring proper footing, prior to placing all of weight on foot. 	
Re-position rail cars with Track Mobile.	<ul style="list-style-type: none"> -Rail Safety -Struck-by/crushed-by 	<ul style="list-style-type: none"> -The "Red" flag can only be removed by the Lead laborer after a visual inspection is performed to confirm that track is clear of personnel. Lead laborer will also communicate directly to the operator that track is clear. - Rail car movement equipment load capacities shall not be exceeded. -Once railcars are in position the lead laborer will engage the manual brake on the first railcar (attached to the Track Mobile) and insert a wheel chock on the last railcar farthest from Track Mobile. - No one shall be permitted to ride inside or on rail car while in motion 	H
Perform final inspections.	<ul style="list-style-type: none"> -Use of hand tools -Ladder Stability -Falls from ladders and railcars -Walking/Working Surfaces (slips) Sprains/strains -Uneven terrain 	<ul style="list-style-type: none"> - Check each ladder thoroughly, ensuring it is structurally sound, and properly anchored. Complete ladder inspection forms. - Use ladders to climb, ensuring 3-points of contact at all times. - Use dedicated fall protection system during activities that require work 6 feet above ground surface. - Avoid wet locations (standing water) and dry feet sufficiently prior to climbing. Do not attempt to climb ladders with wet feet. - Grab handrails and turn to back down ladder. Maintain three points of contact at all times. - Inspect ground surface below ladder prior to descending, to ensure area is clear of debris (stones, cobbles, etc). - When stepping off ladder, do not jump, and place one foot on ground at time, ensuring proper footing, prior to placing all of weight on foot. 	M

Additional Safety Considerations	
1.	Air monitoring procedures to be used to ensure controls effective in prevention of exposure and off-site migration of COCs from work area.
2.	Ensure all personnel have read and acknowledged the AHA.
3.	Keep line of site with co-worker and ensure regular verbal contact. If out of the line of site, ensure radio or cell phone contact is established and maintained.
4.	Wear sunscreen and wide brim hat to avoid sun exposure.

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Excavator/Loader	Daily Preventative Maintenance Checks	Certified heavy equipment operator Familiarity with the vehicle being operated.
Forklift	Daily Preventative Maintenance Checks	Certified Forklift Driver Familiarity with the vehicle being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.

Equipment to be Used	Inspection Requirements	Training Requirements
Fall protection equipment – Harnesses and self-retracting lanyards hooked to engineered track system.	Daily Visual Inspections Monthly documented inspection (OP 585) Annual documented inspection (OP 585)	Performance based training on use of engineered track system and retractable lanyards. Familiarity with the equipment being used.
Ladders	Daily Visual Inspections Quarterly Ladder Inspection (OP 568)	Ladder safety Familiarity with the equipment being used.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

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- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.
- I will ensure compliance with my company's policies on health and safety.

Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 9.0

Activity/Work Task: WWTP Operations & Maintenance	Overall Risk Assessment Code (RAC) (Use highest code)	L
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix	
Contract Number: W912DQ-13-D-3016	Severity	Probability
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M
Reviewed by: Sean Liddy, CSP	Critical	E H H M L
	Marginal	H M M L L
Competent Person (if applicable): Authorized WWTP Operator	Negligible	M L L L L
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.	RAC Chart	
	Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)	
	“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.	
	“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.	
Personal Protective Equipment (PPE): <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input checked="" type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input checked="" type="checkbox"/> Coveralls (coated) <input checked="" type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Modified Level D for splash protection measures		
Safety Equipment: <input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:		
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP): <input checked="" type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input type="checkbox"/> PDR (Respirable Dust) <input type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs. Monitoring performed for precautionary purposes per accordance with SSHO/SROS.		
Job Steps	Hazards	Controls
System start-up/shutdown	-Hazardous noise -Cuts/lacerations and abrasions	-Use hearing protection during start-up/shut-down operations. -Watch hand placement and avoid pinch points
		L

Job Steps	Hazards	Controls	RAC
Assembling system components, connecting removing piping, component replacement (i.e. gaskets, filters, and fittings), installing/removing pumps and meters.	<ul style="list-style-type: none"> -Release of hazardous energy -Exposure potential -Manual Lifting (sprains, strains) 	<ul style="list-style-type: none"> - When disconnecting cords or tubing from equipment or removing pipe fittings, be aware that it may be difficult to twist off. When possible, ask for assistance. - Wear leather gloves to help protect your hands. - All hoses pumps and piping have the potential or kinetic energy in the form of moving water present. Ensure that approved LOTO procedures (if applicable) have been conducted prior to disconnecting any piping or removing any piece of equipment. - Before disassembling, look around and ensure proper clearances. 	L
Daily inspections and maintenance.	<ul style="list-style-type: none"> -Unplanned Activities -Electrical Shock -Chemical Hazards -Off-gas Exposure -Space Constraints -Slips, Trips, Falls 	<ul style="list-style-type: none"> - Discuss unplanned activities with site supervisor and/or project manager before proceeding. Confirm what processes are currently taking place and ensure safe to proceed with current PPE level. - Only trained personnel should be accessing electrical or mechanical equipment within the WWTP area. Proper LOTO procedures shall be followed (if applicable). Personnel will not complete this work without the proper training. All electrical hazards should be identified and mitigated prior to accessing or working near electrical systems. - Review SDS for chemicals used during treatment process. PPE as indicated above should be donned at all times. - The WWTP is to remain properly vented at all times. - The WWTP is complete with tanks, pumps, conveyance pipes, and multiple other pieces of equipment. When accessing the area to perform daily activities, personnel should always be aware of their surroundings, and ensure that they are standing in an open area that allows them to view the work, but not interfere with or be obstructed from the view of other site workers. - Stay on designated walk ways. Be observant for piping, and other potential trip hazards. 	L
System measurements	<ul style="list-style-type: none"> -Contaminants -Releases -Pinch Points -Slips trips and Falls -Fall to below -Striking others 	<ul style="list-style-type: none"> - Always wear nitrile gloves when performing work. Double glove if you know you are prone to glove breakage. - When using turning valves by hand, ensure that the loose clothing or hands are not caught in between valve body and valve handle. - It will be necessary to access the top of the frac tank by climbing the tank stairway. Ensure that the stairway is clean and free of debris and ice or snow during winter conditions. Also, if there is piping, cords, or other obstacles in the area of the tank, be aware and select access routes that will avoid contact with these obstacles. Ensure fall protection railings are installed. - When collecting measurements, employees should remain on the OSHA approved walkways and ensure that only the measurement device enters the tank. At no point should the technicians waist level be located higher than the tank railing or the opening to the tank. - Personnel will collect regular readings from the totalizer and other system components. Before readings are recorded, the technician will ensure that they are not obstructed from the view of other site workers. 	L

Job Steps	Hazards	Controls	RAC
Entering secondary containment areas	Slips, trips, falls. Liner damage	<ul style="list-style-type: none"> - Enter secondary containment areas at designated access points only. - Inspect access area (visually) before entering. Identify possible hazards such as scattered debris, standing water, or ice. Contact site supervisor immediately and do not proceed if any conditions are observed that could make entering the secondary containment area unsafe and that cannot be fixed with the equipment or personnel onsite. - Stay on designated walkways and clear of debris/ice during winter months. - Do not enter secondary containment area wearing traction aids. These, and other similar devices, will pierce the liner and compromise its integrity. Stay on designated walkways (mats) and use designated stairway access points. 	L
Equipment maintenance (Frac tank and respective piping assemblies inspection and cleaning)	Contaminants Slips, trips, falls. Fall to Below Cuts and lacerations Cross contamination Pinch points Releases Striking other Hazmat contact	<ul style="list-style-type: none"> - Always wear nitrile gloves when handling equipment. Double glove if you know you are prone to glove breakage. - It will be necessary to access the top of the frac tank by climbing the tank stairway. Ensure that the stairway is clean and free of debris and ice or snow during winter conditions. Also, if there is piping, cords, or other obstacles in the area of the tank, be aware and select access routes that will avoid contact with these obstacles. - When collecting measurements, employees should remain on the OSHA approved walkways and ensure that only the measurement device enters the frac tank. At no point should the technician's waist level be located higher than the tank railing or the opening to the tank. There should not be any maintenance activities requiring employees to have their waist above the top edge of the frac tank. - Use leather gloves over your nitrile gloves to breakdown equipment to help grip and prevent cuts or slips on the equipment. Note: The edges of the modular tanks and respective supports have sharp edges and direct contact should be avoided when possible. - Triple rinse using distilled or deionized water andalconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment out of the designated work area without proper decontamination. - When disconnecting cords or tubing from equipment or removing pipe fittings, be aware that it may be difficult to twist off. When possible, ask for assistance. - Wear leather gloves to help protect your hands. - All hoses pumps and piping have the potential or kinetic energy in the form of moving water present. Ensure that approved LOTO procedures (if applicable) have been conducted prior to disconnecting any piping or removing any piece of equipment. - Before disassembling tools, look around and ensure proper clearance. Identify and communicate to other workers within striking distance. - Wear proper PPE when working with potentially hazardous materials. 	L
Trouble Shooting/Spill Response	<ul style="list-style-type: none"> - General - Electrical Shock/chemical hazards - Environmental Releases 	<ul style="list-style-type: none"> - If site personnel note any issues through general observation that require the system to be disabled, then they should immediately notify the WWTP operator. Upon notification, the system operator will respond accordingly to resolve the issue. - Provide secondary containment as necessary. Drain all pumps and hoses prior to movement. - Any releases must be immediately reported to the SSHO per the incident reporting procedures in the APP/SSHP. 	L

Job Steps	Hazards	Controls	RAC
	-Exposure to COCs	- Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified. - Avoid contact with contaminated materials. Wear Modified Level D PPE to avoid splash hazards. - RPTs will perform radiological surveillance.	L
Entry into tanks for cleaning and maintenance	Confined Space Hazards	Refer to AH 10.0 for Confined Space Entry Operations	L

Additional Safety Considerations	
1.	LOTO of item being repaired/replaced on must be verified prior work by all parties. Use caution when re-energizing system.
2.	Use caution around delivery trucks and stay clear if not involved in spotting operation. Use one person to communicate with driver via hand signals to avoid unnecessary confusion. Watch for overhead utilities.
3.	Maintain eye contact with equipment operator during stone installation and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator.
4.	Maintain eye contact with equipment operator and use proper hand signals. Do not approach running equipment unless eye contact is made, and acknowledgment is received from operator. Unessential personnel must stay back 50-feet plus maximum swing radius of equipment.
5.	Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed or the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
6.	When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
7.	Keep clear area around work area, maintain good housekeeping practices.
8.	When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
9.	Avoid the use of chains for lifting. If necessary, ensure chain is equipped with annual load rating cert and proper hooks being used. For synthetic slings, ensure red warning line is not showing and item is in good condition. For wire ropes, inspect for broken wires (6 in a lay, 3 in a strand).

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Skid Steer/Loader	Daily Preventative Maintenance Checks	Certified heavy equipment operator Familiarity with the vehicle being operated.
Forklift	Daily Preventative Maintenance Checks	Certified Forklift Driver Familiarity with the vehicle being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Ladders	Daily Visual Inspections Quarterly Ladder Inspection (OP 568)	Ladder safety Familiarity with the equipment being used.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.

Equipment to be Used	Inspection Requirements	Training Requirements
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, CABRERA employees agree that:

- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.
- I will ensure compliance with my company's policies on health and safety.

Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 10.0

Activity/Work Task: WWTP O&M - Confined Space Entries	Overall Risk Assessment Code (RAC) (Use highest code)	M
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix	
Contract Number: W912DQ-13-D-3016	Severity	Probability
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M
Reviewed by: Sean Liddy, CSP	Critical	E H H M L
	Marginal	H M M L L
	Negligible	M L L L L
Competent Person (if applicable): CSE Supervisor	RAC Chart	
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.		
Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)		
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.		
Personal Protective Equipment (PPE): <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input checked="" type="checkbox"/> Coveralls (coated) <input checked="" type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Modified Level D to avoid potential splash hazards, and those present inside of tanks while performing cleaning.		
Safety Equipment: <input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment: Retrieval equipment for CSE to include tri-pod, harness, and ventilation equipment (if necessary).		
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP): <input type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input checked="" type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input type="checkbox"/> PDR (Respirable Dust) <input type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs. Monitoring for CSE parameters, VOCs, and rad.		
Job Steps	Hazards	Controls
Competent Person to complete Confined Space Entry Permit.	- Insufficient atmosphere. - Proper isolation of energy sources in space. - Rescue capabilities.	- Perform air monitoring with Multi-Rae device and ensure atmospheric levels within acceptable ranges. - Assess space of all potential sources of energy (kinetic from water, electrical, etc) and ensure properly isolated. - Ensure all personnel properly trained for task. Consult with SSHO to verify training. - Oversee set-up of self-rescue equipment (tripod and retrieval device) and ensure functionality.
		L

Job Steps	Hazards	Controls	RAC
Isolating system from plant flows	<ul style="list-style-type: none"> - Entrapment by flow within space - Uncontrolled release of energy 	<ul style="list-style-type: none"> - Ensure LOTO efforts coordinated with client and contractor performing work. - All hoses pumps and piping have the potential or kinetic energy in the form of moving water present. Ensure that approved LOTO procedures (if applicable) have been conducted prior to disconnecting any piping or removing any piece of equipment. 	L
Opening man way door and testing of atmosphere.	<ul style="list-style-type: none"> - Manual lifting of temporary cover - Cuts/lacerations - Hazardous atmosphere 	<ul style="list-style-type: none"> - Use proper lifting techniques and do not over-extend. Use proper lifting device and get assistance if necessary. - Watch for spurs and sharp edges on tools and equipment and remove. - Allow space to ventilate and monitor with Multi-Rae to determine atmospheric quality. Record readings on permit. 	L
Entry into conduit and perform work.	<ul style="list-style-type: none"> - Hazardous atmosphere - Exposure potential - Entrapment or incapacitation during entry - Slips and Falls - Nuisance Contamination - Manual lifting of tools and supplies - Loss of contact with entrant 	<ul style="list-style-type: none"> - Allow space to ventilate and monitor with Multi-Rae to determine atmospheric quality continually during entry. Record readings on permit. Acceptable parameters outlined below. - Maintain awareness of fluid level within space, if changes noted exit - Use self-rescue device with tripod and harness. - Use of Modified Level D PPE - Use proper lifting techniques and ergonomics awareness. - Maintain direct verbal communications with entrant or use radios to supplement 	M
	<ul style="list-style-type: none"> - Exposure to COCs 	<ul style="list-style-type: none"> - Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified. - Avoid contact with contaminated materials. Wear Modified Level D PPE to avoid splash hazards. - RPTs will perform radiological surveillance. 	L
	<ul style="list-style-type: none"> - Slips, trips, and uneven surfaces - Cuts/laceration hazards from sharp edges of tools/equipment - Hand tool use 	<ul style="list-style-type: none"> - Keep work area clear of surface encumbrances. Use caution when entering/exiting tanks to avoid catching feet on lip of entrance. . - Use leather gloves and avoid sharp metal and protruding objects. - Inspect hand tools and ensure in proper operating condition. Remove defective tools from use. 	L
Exit conduit and close.	<ul style="list-style-type: none"> - Manual lifting of tools and supplies - Cuts/lacerations and abrasions 	<ul style="list-style-type: none"> - Use proper lifting techniques and ergonomics awareness. - Use proper lifting techniques and ergonomics awareness. Watch hand placement and avoid pinch points 	L

Additional Safety Considerations

1. Approach every confined space as it were a permit required confined space. Test the atmosphere prior to entry and continuously during using Multi-Rae (or other approved multi-gas meter).
2. Rescue services must be verified with local fire department prior to performing entry. Not all municipal locations are capable of responding to such emergencies.
3. All personnel entering confined spaces or performing duties directly associated with confined spaces (i.e., attendant) must be trained in accordance with 29 CFR 1910.146, Permit-Required Confined Spaces. In additional site-specific training will include the hazards associated with the space, entry procedures, LOTO procedures, and emergency procedures.
4. Communications will be maintained visually and verbally between the entry members and attendant.
5. All equipment will be disconnected completely and isolated from the primary source. Confirm disconnection of equipment or lock-out/tag-out with project management and client each day. Each employee entering space must have their own lock placed on the isolation device(s). If equipment is not disconnected, contact safety department for lock out / tag out procedures. Supervisor must perform visual check of lock-out/tag-out prior to entry.

Additional Safety Considerations (cont)

6. If any new hazards (e.g., exceeding action levels, introduction of new hazards) are identified during entry, the entry will cease until the condition(s) is eliminated. If condition cannot be eliminated, contact the SSHO for permit entry procedures.
7. Monitor the work area with Multi-gas meter prior to entry to ensure the atmosphere is safe. If any of the parameters being tested are outside the action level, do not enter the space. While working, place the monitoring equipment in a location that will not interfere with the work to allow for continual monitoring of the work area.
8. Acceptable entry levels.
 - 19.5 – 23.5 percent (%) O₂
 - < 25 ppm CO
 - < 10 ppm H₂S
 - < 10% LEL
9. Refer to the CSE permit for additional information.

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Tripod, harness and ventilation equipment for CSE	Daily Preventative Maintenance Checks Annual inspection and maintenance	Entrant, Attendant, and Supervisor CSE Training Familiarity with the equipment being used.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

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Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 11.0

Activity/Work Task: Radiological Surveys	Overall Risk Assessment Code (RAC) (Use highest code)	L																					
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix																						
Contract Number: W912DQ-13-D-3016	Severity	Probability																					
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely																					
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M																					
Reviewed by: Sean Liddy, CSP	Critical	E H H M L																					
Competent Person (if applicable): Radiation Technician	Marginal	H M M L L																					
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.	Negligible	M L L L L																					
<p>Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)</p> <p>“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.</p> <p>“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible</p> <p>Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.</p>		<p>RAC Chart</p> <p>E = Extremely High Risk</p> <p>H = High Risk</p> <p>M = Moderate Risk</p> <p>L = Low Risk</p>																					
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Job Steps	Hazards	Controls	RAC																				
Site walk/survey to perform inspections and collect measurements and data.	Twisting ankles/feet due to surface/subsurface obstructions. Biologic hazards such as insects, poison ivy, spiders, and snakes.	- Inspect area before driving and/or walking. Identify possible hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground. Contact site manager immediately and do not proceed if any conditions are observed that could make driving/walk in the area unsafe and that cannot be fixed with the equipment or personnel onsite. - Check immediate area for potential hazards such as poison ivy, spiders, wasps, snakes, etc. Use bug repellent and sunscreen as necessary.	L																				

Job Steps	Hazards	Controls	RAC
	<p>Injuries caused by improper lifting techniques.</p> <p>Trips/Falls</p> <p>Vehicular Traffic</p>	<p>- Use proper bending/lifting techniques by bending and lifting with legs and not with back. Use buddy system to lift heavy objects.</p> <p>- Watch footing and observe ground surface for breaks in elevation, uneven surfaces, loose debris, or other obstructions to cause improper footing.</p> <p>- Wear high visibility work vest when working. Watch for moving vehicles. Avoid walking on road and stay out of travel lanes.</p>	L
	<p>Falls from ladders</p> <p>Falls from height</p> <p>Confined Spaces</p>	<p>Ensure proper type of ladder selected for application. Fully extend and lock spreaders on step ladders. Maintain 3 points of contact when ascending/descending.</p> <p>Avoid areas in which potential fall hazards (≥ 6 ft to lower level) are present.. Use fall protection if exposed to fall ≥ 6 ft to lower level. Use full body harness and self-retracting lanyard on engineered rail system. Only trained personnel may use.</p> <p>Be aware of presence of confined spaces on project site and do not enter.</p>	L
	<p>-Exposure to COCs via dust generation for specific task.</p>	<p>-Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified in the SSHP. Use Class 2 or 3 perimeter protection with stop logs and clear distances to maintain safe distances with equipment and trucks.</p> <p>-Avoid contact with contaminated materials. Wear Modified Level D PPE.</p> <p>- RPTs will perform radiological surveillance. Radiological surveillance may include:</p> <ol style="list-style-type: none"> 1. Personnel working in Restricted Areas may be issued Lapel Samplers (also called Breathing Zone (BZ) Air Samplers). 2. General Area Air Monitors may be used to sample work areas. 3. Perimeter Air Monitors may be used to sample Control Area boundary locations. 4. Real-time dust monitoring may be used to sample boundary areas. 5. Monitoring of radon, thoron, or Working Level (WL) may be used to sample work and boundary areas in accordance with the SSHP. 	L
Data collection.	<p>Injuries caused by improper lifting techniques or stretching.</p> <p>Twisting ankles/feet due to surface/subsurface obstructions.</p> <p>Slips, trips, falls.</p> <p>Biologic hazards such as insects, poison ivy, spiders, and snakes.</p>	<p>Use proper bending/lifting techniques by bending and lifting with legs and not with back. Use buddy system to lift heavy objects.</p> <p>Inspect area before driving and/or walking. Identify possible hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground. Contact the SSHO immediately and do not proceed if any conditions are observed that could make driving/walk in the area unsafe and that cannot be fixed with the equipment or personnel onsite.</p> <p>Be observant for tripping hazards, holes, stickups, vines, old fence lines.</p> <p>Check immediate area for potential hazards such as poison ivy, spiders, wasps, snakes, etc. Use bug repellent and sunscreen as necessary. Use a bar to clear out objects and/or vegetation from spiders and/or snakes (don't use your hands or feet).</p>	L

Job Steps	Hazards	Controls	RAC
Secure equipment in vehicle.	Damage to equipment/tools and/or accidents with loose objects. Pinch points. Communications	- Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed or the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle. - When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible. - Maintain contact with site workers and advise of location of survey, and status. Confirm when complete prior to departure.	L

Additional Safety Considerations
<ol style="list-style-type: none"> 1. Be aware of equipment being used in work zones and maintain adequate safe distances (50 ft plus max swing radius). Make eye contact with equipment operators and receive confirmation prior to approaching. 2. Ensure all personnel have read and acknowledged the AHA. 3. Keep line of site with co-worker and ensure regular verbal contact. If out of the line of site, ensure radio or cell phone contact is established and maintained. 4. Wear sunscreen and wide brim hat to avoid sun exposure.

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Fall protection equipment – Harnesses and self-retracting lanyards hooked to engineered track system.	Daily Visual Inspections Monthly documented inspection (OP 585) Annual documented inspection (OP 585)	Performance based training on use of engineered track system and retractable lanyards. Familiarity with the equipment being used.
Ladders	Daily Visual Inspections Quarterly Ladder Inspection (OP 568)	Ladder safety Familiarity with the equipment being used.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

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- I will conduct work at this site in accordance with the requirements of the AHA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
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Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 12.0

Activity/Work Task: Radon/Thoron Sampling	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix					
Contract Number: W912DQ-13-D-3016	Severity	Probability				
Date Prepared: 11/22/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E	E	H	H	M
Reviewed by: Sean Liddy, CSP	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
Competent Person (if applicable):	Negligible	M	L	L	L	L
	Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)					RAC Chart
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.						
“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.					E = Extremely High Risk	
“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible					H = High Risk	
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.					M = Moderate Risk	
					L = Low Risk	
Personal Protective Equipment (PPE): <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input type="checkbox"/> Coveralls (coated) <input checked="" type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Level D. Upgrade to modified Level D is potential for contact with impacted media exists.						
Safety Equipment: <input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:						
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP): <input type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input type="checkbox"/> PDR (Respirable Dust) <input type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs. Monitoring being performed per accordance with the requirements set forth in SSHP/RPP and AHAs for specific tasks. Consult with SSHP/SRSO for specific requirements. No additional monitoring anticipated for this task if conducted as stand-alone operation.						
Job Steps	Hazards	Controls				RAC
Stage tools and equipment	Malfunctioning or damaged equipment could cause an incident if the equipment were to malfunction during work activities -Slips, trips, and uneven surfaces -Cuts/laceration hazards from sharp edges of rusted pipes and valves.	- Inspect equipment to assure that all operational and safety systems are functional. - Delineate exclusion zone boundary. Establish minimum 10-ft clear distance around sample point. Keep work area clear of surface encumbrances - Use leather gloves and avoid sharp metal and protruding objects. Defective equipment or safety systems				L

Job Steps	Hazards	Controls	RAC
Utility Locate call. Review site drawings. Mark known subsurface lines	- Overhead or underground utilities that can be encountered during vapor point installation, causing injury to personnel and/or damage to equipment and property	-Use site drawings to assist with utility location. De-energize and lockout electrical utilities in the vicinity of the work area. -Ensure utility locations in facility are clearly demarcated and verified with facility prior to intrusive work.  Exposing subsurface lines or structures not previously identified.	L
Visually clear proposed sample location locations.	- Damage to equipment or vehicles due to surface/subsurface obstructions. - Slips, trips, falls.	- Identify possible slip, trip, and fall hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground. Contact site manager immediately and do not proceed if any conditions are observed that could make sampling location area unsafe.	L
Drilling sampling implants in concrete slab	- Contact with and exposure to utilities. - Shock from electrical supply. - Entanglement in power extension cords. - Back strain or other personal injury.	- Contact NJ One Call, property managers, and get utility clearance prior to sample collection. - Wear leather gloves to avoid sharp edges. - Check integrity of all equipment power supply cords. Use GFCI on outlets. - Maintain housekeeping around work area. - Use proper tools and follow manufacturer's instructions. - Use proper bending/lifting techniques by bending and lifting with legs and not with back. - Wear all appropriate PPE, including hearing protection. .	L
	-Exposure to COCs	-Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified in the SSHP. -Avoid contact with contaminated materials. Wear Modified Level D PPE. - RPTs will perform radiological surveillance. Radiological surveillance may include: 1. Personnel working in Restricted Areas may be issued Lapel Samplers (also called Breathing Zone (BZ) Air Samplers). 2. General Area Air Monitors may be used to sample work areas. 3. Perimeter Air Monitors may be used to sample Control Area boundary locations. 4. Real-time dust monitoring may be used to sample boundary areas. 5. Monitoring of radon, thoron, or Working Level (WL) may be used to sample work and boundary areas in accordance with the SSHP.	L
Sample Collection	Back strain or other personal injury. Slips, trips and falls.	- Use proper ergonomic lifting technique. Get help in lifting heavy or awkward objects. Establish and maintain clear work area/path. Make sure equipment is in good condition.	L
Sampling Point Abandonment	Back strain or other personal injury. Slips, trips and falls.	- Use proper ergonomic lifting technique. Get help in lifting heavy or awkward objects such as (e.g., concrete mixture). - Establish and maintain clear work area/path. - Use proper tools and avoid pinch points. Wear proper PPE.	L
Packing samples	Back strain or other personal injury. Slips, trips and falls.	- Use proper ergonomic lifting technique. Get help in lifting heavy or awkward objects. Establish and maintain clear work area/path. Utilize mechanical methods when possible (e.g., drum dolly, hydraulic equipment, etc.).	L
Police area and remove all tools and equipment	Sprains/Strains from lifting	Use proper lifting techniques and mechanical assistance	L

Additional Safety Considerations

1. Be aware of equipment being used in work zones and maintain adequate safe distances (50 ft plus max swing radius). Make eye contact with equipment operators and receive confirmation prior to approaching.
2. Ensure all personnel have read and acknowledged the AHA.
3. Keep line of site with co-worker and ensure regular verbal contact. If out of the line of site, ensure radio or cell phone contact is established and maintained.
4. Wear sunscreen and wide brim hat to avoid sun exposure.

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

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Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 13.0

Activity/Work Task: Groundwater Sampling	Overall Risk Assessment Code (RAC) (Use highest code)	L
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix	
Contract Number: W912DQ-13-D-3016	Severity	Probability
Date Prepared: 11/22/2013		Frequent Likely Occasional Seldom Unlikely
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M
Reviewed by: Sean Liddy, CSP	Critical	E H H M L
Competent Person (if applicable):	Marginal	H M M L L
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.	Negligible	M L L L L
	Step 1: Review each “ Hazard ” with identified safety “ Controls ” and determine RAC (See above)	
	“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.	
	“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “ Hazard ” on AHA. Annotate the overall highest RAC at the top of AHA.	
RAC Chart		
E = Extremely High Risk		
H = High Risk		
M = Moderate Risk		
L = Low Risk		
Personal Protective Equipment (PPE):		
<input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input type="checkbox"/> Coveralls (coated) <input checked="" type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Modified Level D for use in avoiding potential splash hazards.		
Safety Equipment:		
<input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:		
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP):		
<input checked="" type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input type="checkbox"/> PDR (Respirable Dust) <input type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs. VOC and Rad in groundwater primary concern. No dust anticipated.		
Job Steps	Hazards	Controls
General Physical Hazards	– Slip/Trip/Fall – Cold/Heat Stress – Biological Hazards –	– Level D PPE required. – Maintain a clean and organized work area. – Watch your step and ensure proper footing. – Provide drinking water and first aid kit. – Wear appropriate clothing for weather conditions. – Assess work area for poisonous plants and animals and communicate observations to avoid them.
		L

Job Steps	Hazards	Controls	RAC
	<ul style="list-style-type: none"> - Cuts/Scrapes/Bruises - Manual lifting - Climbing into back of truck - Adverse Weather 	<ul style="list-style-type: none"> - Wear appropriate work gloves for task. - Maintain 3 points of contact when climbing into truck - Use proper lifting techniques by bending and lifting with legs, do not over extend or twist (item >49lb. require assistance) - Be aware of changing weather conditions and provide appropriate weather gear. - When work is halted due to inclement weather, personnel are to seek shelter in vehicles and buildings. 	L
Establish EZ around well and unload/set-up equipment	<ul style="list-style-type: none"> - Traffic in roadways and parking lots - Cuts/scrape - Stacking heights - Manual lifting - Cuts from tools 	<ul style="list-style-type: none"> - Use combination of vehicles, cones, traffic barriers and caution tape. - Wear leather gloves. - Avoid stacking equipment and boxes. - A traffic plan may be necessary depending on location. - Fixed Blade Open Knives (FBOK) prohibited. Use proper cutting devices (tubing cutter and/or safety knives). 	L
Open well and take water level measurement.	<ul style="list-style-type: none"> - Cuts/scrapes - Biological Hazards - Exposure potential 	<ul style="list-style-type: none"> - Wear leather gloves when un-bolting well lid - Look for spiders, scorpions, etc. in the well head. - Use ventilation procedures on each well, monitoring at well head and breathing zone. - Wear nitrile gloves to remove plug and taking measurement. 	L
Sample/develop purge using a bladder pump, bailer or whale pump Well will be purged prior to sampling.	<ul style="list-style-type: none"> - Exposure potential - Cuts/scrapes - Electrical - Manual lifting 	<ul style="list-style-type: none"> - Wear nitrile gloves while taking flow rates - Monitor breathing zone continuously during sampling event. - Ensure employees are properly trained in the use of the compressors, i.e., use correct contacts for 12volt batteries and avoid arcing situations - Use proper lifting techniques and ergonomics awareness. - Use only approved cutting devices for tubing boxes and proper tools for pump repairs/maintenance. 	L
	-Exposure to COCs	<ul style="list-style-type: none"> - Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified. - Avoid contact with contaminated materials. Wear Modified Level D PPE to avoid splash hazards. - RPTs will perform radiological surveillance. 	L
IDW handling	<ul style="list-style-type: none"> - Chemical Exposure - Manual lifting - Splash Hazard - Spills 	<ul style="list-style-type: none"> - Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) - Have portable eyewash on site - Inspect Drums/Containers prior to use for integrity and contaminants - Pour water from buckets into drums/containers as soon as practicable. - Place used PPE and disposable sampling equipment in garbage bags to be disposed of properly. 	L
Sample collection and packaging	<ul style="list-style-type: none"> - Chemical exposure potential - Cuts/Scrapes - Manual lifting of equipment 	<ul style="list-style-type: none"> - Inspect glassware for breakage and avoid sharp edges and where gloves. - Use proper lifting techniques and do not over-extend. - Follow proper decontamination procedures. 	L
Decontamination	<ul style="list-style-type: none"> - Chemical exposure potential - Cuts/Scrapes - Manual lifting of equipment 	<ul style="list-style-type: none"> - Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) - Have portable eyewash on site - Pour water from buckets into drums/containers as soon as practicable and lifting with legs. 	L

Additional Safety Considerations

1. Watch for traffic. Wear high-vis vests and ensure exclusion zone around work area is clearly marked and delineated at adequate distance to protect employees and public (min 10 ft).
2. Ensure use of proper cutting devices and other tool selection during pump assembly/disassembly. Use of FBOs prohibited. Self-retracting cutting devices (safety knives or tubing cutters) are only to be used.
3. Evaluate surrounding work area for additional hazards that may be present. Stand upwind to avoid exposure whenever possible.
4. Sample bottles for VO+10 analysis are 40-ml glass – do not over-tighten. Confirm no acid preservative is outside bottle before use. Wrap in paper towels as needed.
5. Check sample location for potential hazards such as poison ivy, surface obstructions such as rubble, old foundations or rebar. Identify possible slip, trip, and fall hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground.
6. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate AHAs or OPs.
7. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
8. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
9. For equipment decontamination, triple rinse using distilled or deionized water and alconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment back to the office without proper decontamination.

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

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- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
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Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 14.0

Activity/Work Task: Surface Water & Sediment Sampling	Overall Risk Assessment Code (RAC) (Use highest code)	L	
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix		
Contract Number: W912DQ-13-D-3016	Severity	Probability	
Date Prepared: 11/15/2013		Frequent Likely Occasional Seldom Unlikely	
Prepared by (Name/Title): Al Craig	Catastrophic	E E H H M	
Reviewed by: Sean Liddy, CSP	Critical	E H H M L	
Competent Person (if applicable):	Marginal	H M M L L	
Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.	Negligible	M L L L L	
Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)		RAC Chart	
"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.			
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible			
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.			
Personal Protective Equipment (PPE):			
<input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Ear Muffs <input checked="" type="checkbox"/> Long Pants/Sleeves <input type="checkbox"/> Inner Glove <input type="checkbox"/> Fall Protection <input type="checkbox"/> Wide Brim Hat <input checked="" type="checkbox"/> Leather Glove <input type="checkbox"/> Safety Goggles <input checked="" type="checkbox"/> Ear Plugs <input checked="" type="checkbox"/> Coveralls (coated) <input checked="" type="checkbox"/> Outer Glove <input type="checkbox"/> Cooling Vest <input type="checkbox"/> Half/Full Face Respirator <input type="checkbox"/> Kevlar Glove <input checked="" type="checkbox"/> Safety Toe Boots <input checked="" type="checkbox"/> Traffic Vest <input type="checkbox"/> Flame Resistant Clothing <input type="checkbox"/> Face Shield <input type="checkbox"/> Welding PPE <input type="checkbox"/> Cartridge/Filter Type: Other PPE: Modified Level D for splash and dermal protection.			
Safety Equipment:			
<input checked="" type="checkbox"/> First Aid Kit <input type="checkbox"/> Eyewash Station <input checked="" type="checkbox"/> Eyewash Bottles <input checked="" type="checkbox"/> Fire Extinguisher (A-B-C) <input type="checkbox"/> Pop-up Shade <input checked="" type="checkbox"/> Sunscreen <input checked="" type="checkbox"/> Drinking Water <input type="checkbox"/> Air Horn <input type="checkbox"/> Trekking Poles <input checked="" type="checkbox"/> Insect Repellent <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Cargo Net <input type="checkbox"/> Stretch First Safety First Other Safety Equipment:			
Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP):			
<input checked="" type="checkbox"/> PID (10.6eV) <input type="checkbox"/> PID (11.7eV) <input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL) <input type="checkbox"/> PDR (Respirable Dust) <input type="checkbox"/> PDM (Total Dust) <input checked="" type="checkbox"/> Radiological Meter <input type="checkbox"/> Personal Air Pump Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs. Monitoring being performed per accordance with the requirements set forth in SSHP/RPP and AHAs for specific tasks. Consult with SSHP/SRSO for specific requirements.			
Job Steps	Hazards	Controls	RAC
General Physical Hazards	– Slip/Trip/Fall – Cold/Heat Stress – Biological Hazards –	– Level D PPE required. – Maintain a clean and organized work area. – Watch your step and ensure proper footing. – Provide drinking water and first aid kit. – Wear appropriate clothing for weather conditions. – Assess work area for poisonous plants and animals and communicate observations to avoid them.	L

Job Steps	Hazards	Controls	RAC
	<ul style="list-style-type: none"> - Cuts/Scrapes/Bruises - Manual lifting - Climbing into back of truck - Adverse Weather 	<ul style="list-style-type: none"> - Wear appropriate work gloves for task - Maintain 3 points of contact when climbing into truck - Use proper lifting techniques by bending and lifting with legs, do not over extend or twist (item >49lb. require assistance) - Be aware of changing weather conditions and provide appropriate weather gear. - When work is halted due to inclement weather, personnel are to seek shelter in vehicles and buildings. 	L
Establish EZ around sampling location and unload/set-up equipment	<ul style="list-style-type: none"> - Traffic in roadways and parking lots - Cuts/scrape - Stacking heights - Manual lifting - Cuts from tools 	<ul style="list-style-type: none"> - Use combination of vehicles, cones, traffic barriers and caution tape. - Wear leather gloves. - Avoid stacking equipment and boxes. - A traffic plan may be necessary depending on location. - Fixed Blade Open Knives (FBOK) prohibited. Use proper cutting devices (tubing cutter and/or safety knives). 	L
Surface water samples will be collected using a bailer, or other suitable mechanical means. Sediment samples collected using a clam-shell dredge.	<ul style="list-style-type: none"> -Manual lifting of bailers and clamshell -Cuts/lacerations -Slips, Trips on uneven surfaces and streambank (rocks) 	<ul style="list-style-type: none"> -Use proper lifting techniques and ergonomics awareness. -Use only approved cutting devices for cutting tubing and proper tools for equip repairs/maintenance -Visually survey work area for slip, trips and fall hazards and maintain solid footing. Avoid clay banks and rocks with moisture and/or biological growth. 	L
	<ul style="list-style-type: none"> -Exposure to COCs 	<ul style="list-style-type: none"> - Barriers such as fences and ropes will be put in place to limit the access to Controlled and Restricted Areas as specified. - Avoid contact with contaminated materials. Wear Modified Level D PPE to avoid splash hazards. - RPTs will perform radiological surveillance. 	
IDW handling	<ul style="list-style-type: none"> - Chemical Exposure - Manual lifting - Splash Hazard - Spills 	<ul style="list-style-type: none"> - Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) - Have portable eyewash on site - Inspect Drums/Containers prior to use for integrity and contaminants - Place used PPE and disposable sampling equipment in garbage bags to be disposed of properly. 	L
Sample collection and packaging	<ul style="list-style-type: none"> - Chemical exposure potential - Cuts/Scrapes - Manual lifting of equipment 	<ul style="list-style-type: none"> - Inspect glassware for breakage and avoid sharp edges and where gloves. - Use proper lifting techniques and do not over-extend. - Follow proper decontamination procedures. 	L
Decontamination	<ul style="list-style-type: none"> - Chemical exposure potential - Cuts/Scrapes - Manual lifting of equipment 	<ul style="list-style-type: none"> - Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) - Pour water from buckets into drums/containers as soon as practicable and lifting with legs. 	L

Additional Safety Considerations

1. Watch for traffic. Wear high-vis vests and ensure exclusion zone around work area is clearly marked and delineated at adequate distance to protect employees and public (min 10 ft).
2. Ensure use of proper cutting devices Use of FBOKs prohibited. Self-retracting cutting devices (safety knives or tubing cutters) are only to be used.
3. Evaluate surrounding work area for additional hazards that may be present. Stand upwind to avoid exposure whenever possible.
4. Sample bottles for VO+10 analysis are 40-ml glass – do not over-tighten. Confirm no acid preservative is outside bottle before use. Wrap in paper towels as needed.
5. Check sample location for potential hazards such as poison ivy, surface obstructions such as rubble, old foundations or rebar. Identify possible slip, trip, and fall hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground.
6. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate AHAs or OPs.
7. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle.
8. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
9. For equipment decontamination, triple rinse using distilled or deionized water and alconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment back to the office without proper decontamination.

Equipment to be Used	Inspection Requirements	Training Requirements
Utility Vehicles, including trucks	Daily Preventative Maintenance Checks	Vehicle & Driver Safety Awareness Familiarity with the vehicle being operated.
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, CABRERA employees agree that:

- I have read this Activity Hazard Analysis and I understand the requirements of the AHA.
- I will conduct work at this site in accordance with the requirements of the AHA.

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- I will conduct work at this site in accordance with the requirements of the AHA.
- I will ensure compliance with my company's policies on health and safety.

Name (Print)	Date	Company	Signature

OP 551 - Project Planning



Activity Hazard Analysis – 15.0

Activity/Work Task: Laboratory Operations	Overall Risk Assessment Code (RAC) (Use highest code)	M																									
Project Location: FUSRAP Maywood Superfund Site	Risk Assessment Code (RAC) Matrix																										
Contract Number: W912DQ-13-D-3016	Severity	Probability																									
Date Prepared: 11/22/2013		Frequent	Likely	Occasional	Seldom	Unlikely																					
Prepared by (Name/Title): Al Craig	Catastrophic	E	E	H	H	M																					
Reviewed by: Sean Liddy, CSP	Critical	E	H	H	M	L																					
	Marginal	H	M	M	L	L																					
Competent Person (if applicable): Laboratory Technicians	Negligible	M	L	L	L	L																					
	<p>Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)</p> <p>“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.</p> <p>“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible</p> <p>Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.</p>					RAC Chart																					
<p>Notes: (Field Notes, Review Comments, etc.) The following outlines minimum requirements per accordance with the approved Accident Prevention Plan for the project site. Subcontractors are responsible for performing tasks in accordance with the minimum requirements established for the site and in accordance with their own HS&E policies and procedures. Subcontractors shall review and supplement the AHA with company specific HS&E guidance. Modifications or changes to the AHA should be forwarded to the PM/SSHO and reviewed by all project staff prior to performing the task.</p>						E = Extremely High Risk																					
						H = High Risk																					
						M = Moderate Risk																					
						L = Low Risk																					
<p>Personal Protective Equipment (PPE):</p> <table style="width:100%; border:none;"> <tr> <td><input checked="" type="checkbox"/> Hard Hat</td> <td><input checked="" type="checkbox"/> Safety Glasses</td> <td><input type="checkbox"/> Ear Muffs</td> <td><input checked="" type="checkbox"/> Long Pants/Sleeves</td> <td><input type="checkbox"/> Inner Glove</td> <td><input type="checkbox"/> Fall Protection</td> <td><input type="checkbox"/> Wide Brim Hat</td> </tr> <tr> <td><input checked="" type="checkbox"/> Leather Glove</td> <td><input type="checkbox"/> Safety Goggles</td> <td><input checked="" type="checkbox"/> Ear Plugs</td> <td><input type="checkbox"/> Coveralls (coated)</td> <td><input checked="" type="checkbox"/> Outer Glove</td> <td><input type="checkbox"/> Cooling Vest</td> <td><input type="checkbox"/> Half/Full Face Respirator</td> </tr> <tr> <td><input checked="" type="checkbox"/> Kevlar Glove</td> <td><input checked="" type="checkbox"/> Safety Toe Boots</td> <td><input checked="" type="checkbox"/> Traffic Vest</td> <td><input type="checkbox"/> Flame Resistant Clothing</td> <td><input type="checkbox"/> Face Shield</td> <td><input type="checkbox"/> Welding PPE</td> <td><input type="checkbox"/> Cartridge/Filter Type:</td> </tr> </table> <p>Other PPE: Modified Level D for splash/dermal protection during sample handling activities. Additional PPE to be used during specific chemical handling procedures.</p>							<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety Glasses	<input type="checkbox"/> Ear Muffs	<input checked="" type="checkbox"/> Long Pants/Sleeves	<input type="checkbox"/> Inner Glove	<input type="checkbox"/> Fall Protection	<input type="checkbox"/> Wide Brim Hat	<input checked="" type="checkbox"/> Leather Glove	<input type="checkbox"/> Safety Goggles	<input checked="" type="checkbox"/> Ear Plugs	<input type="checkbox"/> Coveralls (coated)	<input checked="" type="checkbox"/> Outer Glove	<input type="checkbox"/> Cooling Vest	<input type="checkbox"/> Half/Full Face Respirator	<input checked="" type="checkbox"/> Kevlar Glove	<input checked="" type="checkbox"/> Safety Toe Boots	<input checked="" type="checkbox"/> Traffic Vest	<input type="checkbox"/> Flame Resistant Clothing	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Welding PPE	<input type="checkbox"/> Cartridge/Filter Type:
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<p>Monitoring Procedures and Action Levels (Refer to Section 3.0 of SSHP):</p> <table style="width:100%; border:none;"> <tr> <td><input checked="" type="checkbox"/> PID (10.6eV)</td> <td><input type="checkbox"/> PID (11.7eV)</td> <td><input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL)</td> <td><input checked="" type="checkbox"/> PDR (Respirable Dust)</td> <td><input type="checkbox"/> PDM (Total Dust)</td> <td><input checked="" type="checkbox"/> Radiological Meter</td> <td><input type="checkbox"/> Personal Air Pump</td> </tr> </table> <p>Chemicals of Concern (COC): Radium, Thorium, Uranium, Heavy Metals (lead, arsenic, chromium), low level VOCs. Monitoring to occur during various operations to confirm adequacy of fume hood ventilation, and other chemical specific exposures. Consult with SSHO/SRSO for specific monitoring requirements.</p>							<input checked="" type="checkbox"/> PID (10.6eV)	<input type="checkbox"/> PID (11.7eV)	<input type="checkbox"/> Multi-Rae (PID+O2, H2S, CO, LEL)	<input checked="" type="checkbox"/> PDR (Respirable Dust)	<input type="checkbox"/> PDM (Total Dust)	<input checked="" type="checkbox"/> Radiological Meter	<input type="checkbox"/> Personal Air Pump														
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Job Steps	Hazards	Controls				RAC																					
General Lab Safety	-Slips trips and Falls - Electrical hazards. - Chemical storage/compatibility	- Keep floors in work area clear or encumbrances. Ensure cords not routed in travel paths. Immediately clean-up any spills with appropriate absorbent materials. - Equipment should be plugged into GFCI protected outlets. Ensure grounding plug intact (exception for double insulated tools/equipment) and inspect routinely. - Ensure chemicals being used are stored appropriately with like materials. Refer to site specific HazCom plan. Ensure SDS for all chemicals use on-site and readily available.				L																					

Job Steps	Hazards	Controls	RAC
Work with or around hazardous chemicals, including generating wastes	<p>Exposure (inhalation, skin or eye contact) or other hazards due to use of or proximity to hazardous chemicals</p> <p>Fire from flammable materials</p> <p>Exposure, injury, fire or property damage caused by uncontrolled reactive or explosive materials (e.g., pyrophorics, water reactive, chemicals with explosive properties)</p>	<ul style="list-style-type: none"> - Know the hazards of the materials you are working with. Consult SDS or other sources for properties of materials including incompatibilities. - Label containers of stock, in-process and waste chemicals properly per the Hazard Communication Plan requirements. - Assure that all hazardous liquids are stored within secondary containment. Perform Hazard Assessment and utilize controls specified. - Use properly functioning fume hood or other containment for any procedure that liberates hazardous particulate, vapor or mist - Wear lab coat, closed toed shoes, safety eyewear (e.g., safety glasses with side shields, goggles, and face shield) as appropriate. - Wear gloves appropriate for the material being handled (consult SDS for materials being handled). Always wear nitrile gloves when performing work. Double glove if you know you are prone to glove breakage. - Assure that emergency eyewash and/or safety shower are available for any use that poses an eye, face or body exposure hazard. - Store and use all materials to avoid incompatibility reactions. - Dispose of unwanted or out-of-date chemicals regularly - Clean up spills immediately. - Lab equipped with CO extinguishers. Do not use ABC dry chem. - Regular inspections and functional tests of eyewash and shower stations to be performed by Lab Manager. Refer to first aid procedures for hydrofluoric acid 	L
Using tools with exposed sharp points	<ul style="list-style-type: none"> -Lacerations from sharps -Lacerations from glass 	<ul style="list-style-type: none"> - FBOs prohibited. Use proper cutting device (safety knife). - If the point is present on a machine, evaluate the machine for the necessity of Point-of-Operation guarding - Wear cut resistant gloves. - Use caution when working with glassware. Do not use excessive force with glassware (pipets or other tubing) as breakage would result in shards - Use plastic or metal tube extenders on glass pipets and tubing to make connections. - Inspect glassware for signs of visible stress (cracks, cuts, chips) prior to use and dispose of properly. - If breakage occurs, immediately clean-up using dust pan and broom. Avoid using hands directly. If necessary, ensure use of cut resistant gloves. 	M
General monitoring	-Exposure to COCs	<ul style="list-style-type: none"> -Samples shall not be opened unless contained within lab hood. -Avoid contact with contaminated materials. Wear Modified Level D PPE. - RPTs will perform radiological surveillance. Radiological surveillance may include: <ol style="list-style-type: none"> 1. Personnel working in Restricted Areas may be issued Lapel Samplers (also called Breathing Zone (BZ) Air Samplers). 2. General Area Air Monitors may be used to sample work areas. 3. Perimeter Air Monitors may be used to sample Control Area boundary locations. 4. Real-time dust monitoring may be used to sample boundary areas. 5. Monitoring of radon, thoron, or Working Level (WL) may be used to sample work and boundary areas in accordance with the SSHP. 	L
Dust generation during sample preparation	-Exposure to COCs	<ul style="list-style-type: none"> -Control dust by opening samples in fume hoods. -Control dust by misting with water where necessary. -Perform dust monitoring to verify dust control is effective. 	L

Job Steps	Hazards	Controls	RAC
IDW handling	<ul style="list-style-type: none"> - Chemical Exposure - Manual lifting - Splash Hazard - Spills 	<ul style="list-style-type: none"> - Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) - Have portable eyewash on site - Inspect Drums/Containers prior to use for integrity and contaminants. - Place used PPE and disposable sampling equipment in garbage bags to be disposed of properly. 	L
Decontamination	<ul style="list-style-type: none"> - Chemical exposure potential - Cuts/Scrapes - Manual lifting of equipment 	<ul style="list-style-type: none"> - Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) - Have portable eyewash on site - Use proper lifting techniques. Do not over extend/reach. - Triple rinse using distilled or deionized water and alconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment out of the designated work area without proper decontamination. 	L
Sample collection and packaging	<ul style="list-style-type: none"> - Chemical exposure potential - Cuts/Scrapes - Manual lifting of equipment 	<ul style="list-style-type: none"> - Inspect glassware for breakage and avoid sharp edges and where gloves. - Use proper lifting techniques and do not over-extend. - Follow proper decontamination procedures. 	L

Additional Safety Considerations	
1.	Exposure monitoring or various chemicals and COCs during sample preparation to occur per accordance with SSHO/SRSO.
2.	Ensure use of proper cutting devices and other tool selection during pump assembly/disassembly. Use of FBOKs prohibited. Self-retracting cutting devices (safety knives or tubing cutters) are only to be used.
3.	Evaluate surrounding work area for additional hazards that may be present. Stand upwind to avoid exposure whenever possible.
4.	Sample bottles for VO+10 analysis are 40-ml glass – do not over-tighten. Confirm no acid preservative is outside bottle before use. Wrap in paper towels as needed.
5.	Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate AHAs or OPs.
6.	Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.

Equipment to be Used	Inspection Requirements	Training Requirements
Fume hoods and other dedicated lab equipment	Daily Preventative Maintenance Checks	Laboratory Technicians Familiarity with the equipment being used.
Hazardous Chemicals	Regular checks of eye wash and shower stations and first aid kits	Hydrofluoric Acid First Aid response procedures
Communications Equipment	Daily communications Checks	Familiarity with the equipment. Knowledge of Emergency Response Procedures.
Hand/Power Tools	Inspect hand tools for serviceability	Use hand tools for their intended purposes. Use gas powered tools only for intended purposes. Review manufactures instructions. Familiarity with the equipment.

Equipment to be Used	Inspection Requirements	Training Requirements
		<u>Other Training:</u> -Evacuation, Emergency Response & Notification Procedures IAW APP/SSHP. -Safe work practices and precautions IAW APP/SSHP. -OSHA qualifications and training as required IAW APP/SSHP.

Acknowledgement

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Name (Print)	Date	Company	Signature

**ATTACHMENT B
RADIATION PROTECTION PLAN**



TITLE: Radiation Protection Program (RPP)
INTRODUCTION / TABLE OF CONTENTS

NO.: PP-8-100-5

PAGE: 1 of 2

DATE: December, 2013

APPROVED:

Dennis Whitlock

Digitally signed by Dennis Whitlock
DN: cn=Dennis Whitlock, o=Cabrera, ou=Health Physics,
email=dwhitlock@cabreraservices.com, c=US
Date: 2014.02.11 06:35:42 -0500

Dennis Whitlock - FMSS Project RSO

DN: cn=Michael S. Winters, o=Cabrera Services, ou=HPCX
Operations, email=mwinters@cabreraservices.com, c=US
Location: Spring Hill, Florida
Date: 2014.02.10 17:23:09 -0500

Mike Winters – FMSS Project CHP

The Cabrera Services, Inc. FUSRAP Maywood Superfund Site (FMSS) Radiation Protection Program (RPP) establishes policy and project procedures to be implemented at the FMSS project during remediation activities. This RPP is an appendix to the Cabrera Services, Inc. FMSS "Site Safety and Health Plan" (SSHP). The SSHP is Appendix A of the FMSS "Accident Prevention Plan" (APP).

The FMSS RPP complies with applicable federal, state and local laws and regulatory requirements for the establishment of a Radiological Safety Program for an organization engaged in the safe handling of radioactive materials.

The general elements of the RPP are established in the FMSS SSHP. Specific Project Procedures (PPs) contained in, and supporting the implementation of, the RPP at the FMSS are listed as follows:

PROCEDURE NUMBER	TITLE	REV.	REVISION EFFECTIVE DATE	LAST REVIEW DATE
100 Series – Introduction / Table of Contents				
PP-8-100	Introduction / Table of Contents	5	12/2013	12/2013
200 Series - Radiation Protection Program				
PP-8-200	Radiation Protection Program	2	12/2013	12/2013
300 Series - ALARA				
PP-8-301	Embryo-Fetus Protection Program	1	12/2013	12/2013
400 Series – Reserved for Future Use				
500 Series - Dosimetry Program				
PP-8-500	Technical Basis for the External and Internal Dosimetry and Air Sampling Programs	4	12/2013	12/2013
PP-8-501	Issue and Use of Standard Dosimetry Devices	2	12/2013	12/2013
600 Series - Radiation Protection Instrumentation				
PP-8-600	Issue, Control, and Accountability of Radiation Protection Instrumentation	2	12/2013	12/2013

**FMISS RADIATION PROTECTION PROGRAM
INTRODUCTION / TABLE OF CONTENTS**

NO.: PP-8-100-5
(12/2013)

PAGE: 2 of 2

PROCEDURE NUMBER	TITLE	REV.	REVISION EFFECTIVE DATE	LAST REVIEW DATE
PP-8-601	Portable Count Rate Survey Instruments	2	12/2013	12/2013
PP-8-602	Calibration and Operation of the Gilian GilAir-3 Air Sampling Pump	1	12/2013	12/2013
PP-8-603	Calibration and Operation of HI-Q Model HVP-3800AFC High Volume Air Sampler	3	12/2013	12/2013
PP-8-604	Calibration and Operation of the SKC AirChek® 2000 Sampling Pump	1	12/2013	12/2013
PP-8-605	Calibration and Operation of Low Volume Air Samplers	1	12/2013	12/2013
PP-8-606	Fixed Counting Systems	1	12/2013	12/2013
PP-8-607	Set-Up and Operation of the Thermo-Scientific Model RO-20 Ion Chamber	1	12/2013	12/2013
PP-8-608	Set-Up and Use of Portable Gamma Scintillation Dose Rate Instruments	1	12/2013	12/2013
PP-8-609	Calibration and Operation of HI-Q Model HVP-4300AFC High Volume Air Sampler	2	12/2013	12/2013
PP-8-610	Calibration and Operation of the SKC Leland Legacy Sampling Pump	1	12/2013	12/2013
700 Series – Access Control				
PP-8-701	Access Control	2	12/2013	12/2013
PP-8-702	Radiological Posting Requirements	1	12/2013	12/2013
800 Series - Radiation Protection Surveillance				
PP-8-803	Measurement of Airborne Radioactivity	2	12/2013	12/2013
PP-8-805	Radiological Surveys	3	12/2013	12/2013
PP-8-807	Survey Documentation and Review	1	12/2013	12/2013
PP-8-810	Conveyance Survey	3	12/2013	12/2013
PP-8-811	Vegetation Surveys	1	12/2013	12/2013
PP-8-815	Personnel Survey and Decontamination	2	12/2013	12/2013
900 Series - Radioactive Materials Control				
PP-8-900	Radioactive Material Control Program	2	12/2013	12/2013
PP-8-902	Unrestricted Release Requirements	1	12/2013	12/2013
1000 Series – Reserved for Future Use				
1100 Series - Radiation Protection Training				
PP-8-1101	General Employee Radiation Training	1	12/2013	12/2013
PP-8-1102	Radiation Worker Training (RWT)	1	12/2013	12/2013
PP-8-1103	Radiation Protection Technician Qualification	2	12/2013	12/2013
1200 Series - Radiation Protection Records				
PP-8-1200	Control of Radiation Protection Records	2	12/2013	12/2013
PP-8-1201	Radiological Occurrence Reports	2	12/2013	12/2013

<p align="center">FMSS RADIATION PROTECTION PROGRAM</p> <p align="center">RADIATION PROTECTION PROGRAM</p>	<p align="center">NO.: PP-8-200-2 (12/2013)</p>
	<p align="center">PAGE: 1 of 8</p>

1.0 PURPOSE

This administrative procedure describes the Cabrera Services, Inc. (Cabrera) Radiation Protection Program (RPP) for the FUSRAP Maywood Superfund Site (FMSS) and the major elements. As applicable, this administrative procedure references sections in this RPP containing Project Procedures (PPs) which describe the program in more detail.

2.0 APPLICABILITY

These program descriptions apply to personnel who plan, review, supervise, or perform work involving radiation protection activities for remediation support, final status surveys, and additional radiological investigation activities (as requested and approved).

3.0 REFERENCES

References are listed in the specific PPs that comprise this RPP.

4.0 DEFINITIONS

Activity Hazard Analysis (AHA): A document or series of documents prepared by OH&S and Radiation Protection (RP) to inform workers of the OH&S and/or radiological conditions that exist in the work area, work scope limitations, specific protective requirements, ALARA considerations, and instructions to workers.

Radioactive Material: Materials containing or capable of emitting alpha particles, beta particles, gamma rays, X-rays, neutrons and/or other ionizing radiations.

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

5.0 RESPONSIBILITIES

5.1 Project Manager (PM)

The PM, as Cabrera's senior on-site representative, is the primary safety official on the project, and the project's focal point of contact with the U.S. Army Corps of Engineers (USACE).

- The PM will maintain functional lines of communication with the USACE New York District and contractual communication with the USACE Kansas City District.
- The PM has ultimate authority and responsibility for the establishment and maintenance of program administration control programs and procedures.
- The PM issues communications to the USACE on the overall program status. Specifically, the PM is ultimately responsible for the development, implementation, and enforcement of the comprehensive health and safety program for all Cabrera Contract work.
- The PM is responsible for coordinating the development, implementation, and enforcement of this RPP.
- The PM is also responsible for ensuring that the necessary resources are available for this project to be completed safely and in compliance with this RPP, USACE requirements, and OSHA regulations.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-200-2 (12/2013)
RADIATION PROTECTION PROGRAM	PAGE: 2 of 8

5.2 Occupational Health and Safety Manager (OHSM)

The OHSM is the Cabrera individual responsible for project occupational health and safety performance and reports to Cabrera's President. The OHSM will approve all aspects of Cabrera's Occupational Health and Safety (OH&S) Program including the FMSS "Accident Prevention Plan" (APP). Any deviations from the approved "Site Safety and Health Plan" (SSHP) which is Appendix A of the APP or changes in expected site conditions will be presented to the OHSM for consideration / approval. The OHSMH and the Project Certified Health Physicist (PCHP) are responsible for audits and will be present for the start of major work events, as requested by the PM.

5.3 Project Certified Health Physicist (PCHP)

The PCHP is the Cabrera individual responsible for project radiological safety performance, reports to Cabrera's President, and provides guidance to the OHSM and Radiation Safety Officer (RSO), as required. The PCHP is responsible for:

- Approving Health Physics-related work plans, the RPPs policies and procedures.
- Reviewing and approving Activity Hazard Analyses (AHAs) for matters related to radiological protection.
- Evaluation of the dosimetry program, including the assignment of internal dose, dose assessments, and applicable monitoring.
- Performing or coordinating regular external audits of the RPP.
- Providing technical oversight in the areas of radiological engineering, respiratory protection, radiation protection instrumentation, analytical services and other areas of radiation protection.

5.4 Site Safety and Health Officer (SSHO)

The SSHO is responsible for field aspects of OH&S at FMSS. The SSHO will conduct inspections to determine if operations are being conducted in accordance with the SSHP, USACE requirements, Cabrera's OH&S Policies and Procedures, and applicable federal regulations. The SSHO, or designee, will perform OH&S portions of the FMSS orientation training, coordinate all safety training activities, and maintain the training records and certifications. The SSHO will perform and/or provide oversight to all OH&S air monitoring performed during the course of FMSS work. The SSHO reports directly to the PM for execution of project activities and indirectly to the OHSM with functional issues. An open dialogue is kept between the SSHO, RSO, and project supervisory personnel to ensure that safety issues are quickly addressed and corrective actions are taken.

The SSHO has the authority to suspend operations and/or restrict personnel access at the project as a result of nonconformance to the SSHP, or other applicable regulations, and when OH&S conditions change beyond the scope of an AHA.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-200-2 (12/2013)
RADIATION PROTECTION PROGRAM	PAGE: 3 of 8

5.5 Radiation Safety Officer (RSO)

The FMSS Project RSO is responsible for field aspects of radiological safety at FMSS and advises project management on all aspects of Radiation Protection (RP). The RSO reports directly to the PM for execution of project activities and indirectly to the PCHP with functional issues and Health Physics-related matters. An open dialogue is maintained among the RSO, SSHO, and Project Management to ensure that RPP issues are quickly addressed and corrective actions are taken. The RSO directs all radiological safety activities on the project. The RSO has the authority to suspend operations and /or restrict personnel access at the project as a result of nonconformance to this RPP, or other applicable regulations, and when radiological conditions change beyond the scope of an AHA. The RSO is responsible for:

- Implementing and ensuring compliance with RPP's policies and procedures.
- Inspect work activities to ensure operations, including off-normal activities, are being conducted according to the RPP, USACE requirements, applicable federal regulations, and industry accepted ALARA principles.
- Reviewing and approving work plans, AHAs, and RPP procedures.
- Trending radiation work performance of project personnel including contamination and radiation exposure control.
- Identifying, reviewing, and documenting nonconformance, their causes and corrective actions for incidents associated with radiation protection.
- Ensuring an effective ALARA Program, including conducting onsite radiation safety and health briefings and coordinating ALARA committee meetings.
- Performing periodic safety and quality reviews including weekly inspections and monitoring activities of project operations to ensure compliance with this RPP and any property-specific RPP.
- Ensuring documentation of any RPP deficiency.
- Reviewing survey data.
- Conducting briefings concerning radiological work activities.
- Ensuring that radiological records are complete, clear and legible, meet the intended purpose, and are regularly transmitted to document control for archive.
- Ensuring Restricted Areas are correctly identified, posted and marked.
- Performing or coordinating regular internal audits of the RPP.

5.6 Radiation Protection Technician (RPT)

RPTs report directly to the RSO. RPTs are assigned by the RSO to provide support to field activities for implementation of RPP requirements. RPTs provide guidance in RPP matters to field personnel. RPTs have stop-work authority for radiological safety matters and activities that could result in an unsafe condition being present. RPTs are responsible for the following:

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-200-2 (12/2013)
RADIATION PROTECTION PROGRAM	PAGE: 4 of 8

- Conducting routine and job-specific radiological surveys (i.e., radiation, contamination, and airborne radioactivity).
- Establishing radiological postings.
- Implementing the personal protective equipment (PPE) and respiratory protection programs for the purpose of keeping radiation exposures ALARA.
- Maintaining and operating portable survey instrumentation used in the performance of RP activities.
- Performing unconditional release surveys of material from the restricted area.
- Performing transportation radiological surveys according to applicable U.S. Department of Transportation (DOT) regulations.
- Assisting the SSHO with OH&S monitoring and inspections to a level commensurate with training and experience.

5.7 Project Supervisor

All Project Supervisors are responsible for:

- Ensuring personnel under their direction comply with RPP requirements.
- Providing information on projected work activities to the RPP organization.
- Notifying RP personnel of any radiological problems encountered.
- Ensuring workers are prepared for tasks with tools, equipment and training to minimize time spent in radiological areas.

5.8 Project Radiation Worker

All Project Radiation Workers and individuals entering radiologically controlled areas are responsible for:

- Obeying promptly “stop-work” and “evacuate” orders from RP personnel and the SSHO.
- Obeying posted, oral and written radiological control instructions and procedures, including instructions on AHAs and those in the SSHP.
- Immediately reporting unexpected exposure and lost or off-scale dosimetry devices to RP personnel.
- Reporting medical radiation treatments to the RSO and supervisor.
- Keeping track of personal radiation exposure status to ensure that administrative dose limits are not exceeded.
- Notifying RP personnel of faulty or alarming radiation protection equipment, and unsafe radiological conditions.

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

None

<p align="center">FMSS RADIATION PROTECTION PROGRAM</p>	<p align="right">NO.: PP-8-200-2 (12/2013)</p>
<p align="center">RADIATION PROTECTION PROGRAM</p>	<p align="right">PAGE: 5 of 8</p>

8.0 APPARATUS

None

9.0 RECORDS

None

10.0 PROCEDURE

10.1 Radiation Protection Program Organization

- The RPP Organization will provide appropriate personnel and resources to verify and maintain a radiologically safe working environment.
- RPP staffing levels will be periodically reviewed to ensure that adequate staffing levels are maintained consistent with current and planned remediation activities.
- The Project RPP Organization will have access to engineering and other personnel needed to support the RPP.
- The development and control of RPP Project Procedures will be in accordance with the following guidelines:
 - Clearly defined scope, tasks, applicability, limiting conditions, precautions, consideration of special controls, reference to acceptance criteria and quality requirements.
 - Clearly understood text, using standard grammar, nomenclature and punctuation, concise instruction steps in a logical sequence, and references.
 - Review, approval, issuance, and control of changes and permanent revisions.
- New procedures and revisions to existing procedures shall be submitted to USACE on a Field Change Request for concurrence and be incorporated into the next revision of the RPP.

10.2 ALARA Program

All activities involving radiation and radioactive materials shall be conducted in such a manner that radiation exposure to workers and the general public are maintained As-Low-As-Reasonably-Achievable (ALARA), taking into account current technology and the economics of radiation exposure reduction in relationship to the benefits of health and safety. ALARA concepts are implemented throughout the entire RPP. ALARA-specific procedures are defined by the 300 series Project Procedures (PP-8-300s).

- Administrative controls and procedures endeavor to reduce individual and collective radiation exposures ALARA. Minimizing radiation exposure is accomplished by preliminary planning and scheduling, using proven and innovative engineering techniques and performing engineering reviews of proposed work plan changes.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-200-2 (12/2013)
RADIATION PROTECTION PROGRAM	PAGE: 6 of 8

- Worker involvement and acceptance in minimizing radiation exposure is a key component of the ALARA Program. Workers are responsible to incorporate ALARA principles into work performance.
- Work shall be planned in accordance with ALARA principles, involving input from discipline engineers, the project RPP staff and implementing supervisors.
- A FMSS project ALARA committee will be formed and hold meetings on at least an annual basis. Meeting minutes will be documented. The committee will include a representative from each department (i.e., Project Management, Engineering, Construction, and Safety). The RSO shall chair ALARA committee meetings.
- An Embryo-Fetus Protection Program (EFPP) has been established for the Project and is specified in PP-8-301, Embryo-Fetus Protection Program.”

10.3 Radiation Protection Audit Program

- Internal / External Audits of the RPP should be performed, documented, and be of sufficient scope, depth, and frequency to identify and resolve actual or potential performance deficiencies before significant quality problems are encountered. Audit frequency and criteria are determined by the PCHP.
- The RSO and / or PCHP shall perform an annual review of RPP content and implementation as specified in 10 CFR 20.1101(c).

10.4 External and Internal Dosimetry Program

This program provides requirements for project radiation workers, individuals entering Restricted Areas, and RP personnel responsible for implementation of dosimetry procedures. The Dosimetry Program is defined by the 500 series Project Procedures (PP-8-500s) which describes:

- A discussion of applicable regulatory limits for occupational workers and members of the public.
- ALARA goals.
- Monitoring requirements.
- Recordkeeping requirements.
- Reporting requirements for both normal operations and incidents.
- Bioassay methods and routine dose calculations.
- The air sampling program, including: Routine dose calculation methods, minimum detectable activities and minimum counting times, guidelines as to when follow-up bioassay should be performed, and generation, distribution, and archiving of dosimetry exposure records and periodic reports.
- The external dosimetry program, including a description of standard dosimetry and their use to demonstrate compliance with regulatory standards and ALARA goals.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-200-2 (12/2013)
RADIATION PROTECTION PROGRAM	PAGE: 7 of 8

10.5 Radiation Protection Instrumentation Program

This Program describes the radiation protection instrumentation and requirements to implement the Program. This includes establishing criteria and requirements for the operation, calibration, response testing, maintenance, inventory and control of radiation protection instrumentation and equipment to comply with applicable regulations and conform with applicable ANSI standards. The Instrumentation Program is detailed by the "Radiation Protection Instrumentation Program" in the 600 Series of the Project Procedures (PP-8-600s).

10.6 Access Control Program

This program describes the administrative and physical measures used to control access to Restricted Areas, the requirements for entry into Restricted Areas, the posting of Restricted Areas, and the use of AHAs. The Access Control Program is administered through the "Access Control Program" in the 700 Series of the Project Procedures (PP-8-700s).

10.7 Radiation Protection Surveillance Program

The Radiation Protection Surveillance Program provides for the conduct of radiological surveys in all areas undergoing remediation. Its purpose is to identify radiological sources, to determine radiological conditions in the work environments, to ensure remediation equipment and materials are verified acceptable for unconditional release, and to comply with applicable regulations throughout the remediation effort. The Program encompasses both routine and non-routine surveys to be performed within buildings and yard areas subject to or in proximity to remediation activities. The Radiation Protection Surveillance Program is detailed in the "Radiation Protection Surveillance" in the 800 Series of the Project Procedures (PP-8-800s).

10.8 Radioactive Material Control Program

This Program provides guidance and requirements for control of radioactive materials. The Radioactive Material Control Program includes receipt, inventory, handling, and release of materials. It also provides for radioactive sealed source control, control of materials entering Restricted Areas and control of contaminated tools and equipment in accordance with the "Radioactive Material Control Program" in the 900 Series of the Project Procedures (PP-8-900s).

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-200-2 (12/2013)
RADIATION PROTECTION PROGRAM	PAGE: 8 of 8

10.9 Respiratory Protection Program

It is not expected that respirators will be widely used for radiation protection purposes at FMSS, due to the low activity levels present at FMSS and the constraint of 29 CFR 1910.1096 (c)(e), which does not allow credit to be taken for the use of respirators. The Respiratory Protection Program will be administered by the SSHO in accordance with Cabrera's OH&S Policies & Procedures and the SSHP. The SSHO will consult with the RSO when respiratory protection is required for radiological purposes.

10.10 Radiation Protection Training Program

The RP Training Program identifies the Program's organization structure and staff responsibilities, objectives, general course content, and ongoing training requirements. The Program consists of three basic levels of training: General Employee Radiation Training for visitors and non-radiation workers, Radiation Worker Training for workers who access Restricted Areas and Radiation Protection Technician Training. The RP Training Program is detailed in the 1100 Series of the Project Procedures (PP-8-1100s).

10.11 Radiation Protection Records

Radiation Protection Records are routinely developed to document all aspects of the RPP. Records are generated using clear concise text using standard grammar and punctuation. Records are reviewed for adequacy and completeness and transmitted to the Document Control organization for long-term retention. Radiological Occurrence Reports are generated to document abnormal events and are to be used as tools to identify adverse trends and program weaknesses. The RP Reporting Program is detailed in the in the 1200 Series of the Project Procedures (PP-8-1200s).

11.0 ATTACHMENTS

None

FMSS RADIATION PROTECTION PROGRAM EMBRYO-FETUS PROTECTION PROGRAM	NO.: PP-8-301-1 (12/2013)
	PAGE: 1 of 4

1.0 PURPOSE

This procedure describes the preferred method by which a pregnant worker can request participation in the FUSRAP Maywood Superfund Site (FMSS) Embryo-Fetus Protection Program (EFPP).

2.0 APPLICABILITY

This procedure applies to radiation workers who request participation in the EFPP, contractors and sub-contractors who support FMSS radiological work activities, and the Radiation Protection Group, who implements the EFPP.

3.0 REFERENCES

- NRC Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure"
- NRC 10 CFR 20, "Standards for Protection Against Radiation"
- USACE EM-385-1-80, "Radiation Protection" Manual

4.0 DEFINITIONS

Controlled Area: A Controlled Area is an area outside of a Restricted Area but inside the site boundary, for which access is limited. Controlled Area postings are established to identify those areas owned by or under the control of the FMSS Project. The Controlled Area is used for staging materials, parking vehicles, office facilities, sanitation facilities, and deliveries.

Radiation Worker: An individual who accesses any Restricted Area unescorted. Radiation Workers shall have successfully completed all requisite medical and training requirements for performing work in Restricted Areas as specified in Project Procedures PP 8-1101-0, "General Employee Radiation Training" and PP 8-1102-0, "Radiation Worker Training (RWT)," and in this procedure.

Restricted Area: Restricted Areas are established within Controlled Areas to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials. All posted radiological areas are Restricted Areas

Declared Pregnant Woman (DPW): A female radiation worker who has voluntarily submitted a written Declaration of Pregnancy declaration to the FMSS Radiation Safety Officer (RSO) requesting participation in the EFPP.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Overseeing implementation of this procedure.
- Evaluates potential radiation exposure to a DPW based on employee work activities, work area radiation levels, and work area airborne radionuclide concentrations.

5.2 Radiation Protection Technician (RPT)

- Performs radiological surveys in support of the EFPP.

FMSS RADIATION PROTECTION PROGRAM EMBRYO-FETUS PROTECTION PROGRAM	NO.: PP-8-301-1 (12/2013)
	PAGE: 2 of 4

5.3 DPW's Supervisor

- Maintains awareness of the EFPP and the process by which a female employee can submit/revoke a pregnancy declaration.
- Implements modification(s) to DPW work assignment or work location based on exposure risk evaluation performed by the RSO.
- Ensures that pregnant workers who choose to not participate in the EFPP are not discriminated against in any way with regards to exposure to radiation or radioactive materials

5.4 Declared Pregnant Woman (DPW)

- Complies with radiological work and access restrictions implemented by the RSO for the duration of the pregnancy, or until a revocation of DPW status is submitted in writing to the RSO.

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

- The EFPP is limited to those female radiation workers who choose to participate. Other female project employees (non-radiation workers) are limited to an annual exposure of 100 mrem/yr, and are therefore not subject to additional dose restrictions implemented as a DPW.
- No special action(s) will be taken to limit radiation exposure to a pregnant radiation worker until she submits a written declaration of pregnancy to the RSO.

8.0 APPARATUS

None

9.0 RECORDS

- Declaration of Pregnancy
- RSO Evaluation of Radiological Exposure Risks (includes surveys)

10.0 PROCEDURE

- 10.1 A pregnant female radiation worker who chooses to participate in the EFPP shall submit a written Declaration of Pregnancy to the RSO. An example declaration is included in Attachment 1.
- 10.2 Upon receipt of the written Declaration of Pregnancy, the RSO will inform the DPW's Supervisor and initiate an evaluation of employee radiological exposure to-date. This evaluation typically includes a review or collection of the following information:
 - Work area air sample results
 - Work area radiation survey results
 - DPW's previous/current job descriptions and responsibilities

FMSS RADIATION PROTECTION PROGRAM EMBRYO-FETUS PROTECTION PROGRAM	NO.: PP-8-301-1 (12/2013)
	PAGE: 3 of 4

- DPW's year-to-date exposure
- 10.3 Using collected information, the RSO shall prepare an Evaluation of Radiological Exposure Risks with necessary future job assignment(s) and/or work area modification(s). The evaluation shall adhere to the following parameters:
- Total Effective Dose Equivalence (TEDE) to the fetus during the entire gestation period shall be limited to 0.5 rem. This includes exposure received between the estimated date of conception and acceptance into the EFPP.
 - If the dose to the embryo/fetus exceeds or is within 0.05 rem of 0.5 rem at the time of declaration, then dose to the embryo/fetus is limited to 0.05 rem for the remainder of gestation, and access to Restricted Areas will be prohibited.
 - The TEDE in any one-month of the gestation period shall not exceed 0.1 rem. This is to avoid substantial variation above a uniform monthly exposure rate to a DPW (e.g., receiving all available dose during the first trimester).
- 10.4 The RSO shall notify the Project Certified Health Physicist of the employee's DPW status and the results of the exposure risk evaluation. The Project Certified Health Physicist may provide further direction to the RSO, as necessary.
- 10.5 The RSO shall discuss the results of the evaluation with the DPW and her Supervisor.
- 10.6 The DPW and Supervisor shall ensure necessary job assignment and/or work area modifications are implemented and maintained for the duration of participation in the EFPP.
- 10.7 The RSO shall attach the Declaration of Pregnancy and available surveys and backup identified in 10.2, above, to the Evaluation of Radiological Exposure Risks and submit them to be retained as quality records in accordance with project procedures for the control of RP records.
- 10.8 DPW participation in the EFPP shall remain in effect until conclusion of the pregnancy, or until the employee submits a written revocation. This can be done at any time and should be of similar format to the Declaration of Pregnancy (Attachment 1).

11.0 ATTACHMENTS

Attachment 1 Declaration of Pregnancy (Example)

FMSS RADIATION PROTECTION PROGRAM EMBRYO-FETUS PROTECTION PROGRAM	NO.: PP-8-301-1 (12/2013)
	PAGE: 4 of 4

ATTACHMENT 1
DECLARATION OF PREGNANCY

TO: FUSRAP Maywood Radiation Safety Officer

In accordance with the NRC's regulations at 10 CFR 20.1208, "Dose to an Embryo/Fetus," I am declaring that I am pregnant. I believe I became pregnant on or about:

_____ (Month/Year).

I understand that the radiation dose to my embryo/fetus during my entire pregnancy will not be allowed to exceed 0.5 rem (5 millisieverts) unless that dose limit has already been exceeded between the time of conception and submitting this letter.

I also understand that meeting the lower dose limit may require a change in job or job responsibilities during my pregnancy.

_____/_____
(Employee Full Name / Signature)

(Date)

_____/_____
(RSO Signature / Date)

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 1 of 95

Final
Technical Basis for the External and Internal Dosimetry
and Air Sampling Programs
FUSRAP Maywood Superfund Site
Maywood, New Jersey

Soils Operable Unit (OU)-1 Remedial Action
Cabrera Services, Inc. (Cabrera)
Contract Number: W912DQ-13-D-3016
Task Order: 001

Revision 4, December 2013

Michael Winters, CHP
Project Certified Health Physicist
Cabrera

Date

Roy Racino, RRPT
Radiation Safety Officer
Cabrera

Date

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 2 of 95

Document Version History/Revision Record

Rev. 2 (06/2002). Original document release coordinated with issuance of Rev. 2 of the Maywood Site Safety & Health Plan. Primary authors/approvers of the original document version were Barbara Reider, Certified Health Physicist (CHP) (Maywood Project CHP) and Brian Keele, CHP (Maywood Project HPJ). Mike Winters, RRPT (Maywood Project RSO) contributed to document development and conducted a comprehensive content review prior to issuance. (Stone & Webster (Reider & Keele) / Safety & Ecology Corp (Winters))

Rev. 3 (06/2006)

1. Added paragraph to Section 5.1 discussing the technical basis for solubility classes of Maywood airborne particulates based upon a study provided by Dave Hays (USACE) titled *Lung Fluid Solubility Studies for Samples from FUSRAP Sites*, prepared by M.J. Laudeman (Oak Ridge Institute for Science and Education) for DOE-FUSRAP, April 1996 and referencing the Groundwater Remedial Investigation Report (Rev. 4). The lung fluid solubility study was previously referenced generically in Section 4.0 of Stone & Webster Calculation titled *DAC Values and Dose Conversion Factors for use at the Maywood Superfund Site* (Appendix B).
2. Added note block to Section 5.9 establishing that the use of alternative occupational dose assignment strategies are acceptable provided they are captured under separate technical basis and are reviewed by the Project CHP and Project RSO
3. All remaining changes were editorial in nature, not related to technical content.
4. Document content review and revision by Mike Winters, RRPT (Maywood Project HP & RSO, Shaw Environmental, Inc.) and, Barbara Reider, CHP (Maywood Project CHP, Shaw Environmental, Inc.)

Rev. 4 (12/2013)

1. Throughout – provide Cabrera Service’s information, contract, approvals, and Cabrera-specific references.
2. Incorporated as a new Project Procedure (PP-8-500-4) in the FMSS Radiation Protection Program
3. *At the time of publishing, Cabrera accepts the existing technical bases subject to future assessment.*

Table of Contents

Document Version History/Revision Record	2
List of Tables	5
List of Attachments.....	5
Acronyms and Abbreviations	6
1.0 Introduction.....	7
1.1 Document Purpose.....	7
1.2 Contract Requirements for Internal Dosimetry and Air Sampling Programs.....	7
2.0 Regulations.....	8
2.1 Overall Program	8
2.2 Dose Limits and Related Requirements	8
2.2.1 Occupational Dose Limits	8
2.2.2 Occupational As-Low-As-Reasonably-Achievable Goals	10
2.2.3 Occupational Dosimetry Monitoring Requirements	10
2.2.4 Dose to the Fetus	11
2.2.5 Occupational Medical Monitoring Requirements	11
2.3 Dose Limits for Members of the Public	12
2.4 Record-keeping Requirements, Occupational Dose	12
2.5 Reporting Requirements.....	14
2.5.1 Disclosure to Former Employee.....	14
2.5.2 Disclosure to Regulator.....	14
2.5.2.1 Normal Operations Reporting.....	15
2.5.2.2 Incident Reporting.....	15
3.0 Site Characterization Data	17
3.1 Soil Sampling Data.....	17
3.2 On-Site Radon progeny Data	17
3.3 Radionuclides of Concern for Offsite Doses	18
4.0 Internal Dosimetry Program – Bioassay.....	19
4.1 In Vivo (Whole Body and Lung) Counting.....	19
4.2 In Vitro Counting - Urinalysis	20
4.3 In Vitro Counting - Fecal Analysis.....	22
5.0 Internal Dosimetry Program – Breathing Zone Air Particulate	
 Sampling	24
5.1 Dose Calculated from Individual Air Filters Analyzed by Gross Alpha	
Activity.....	25
5.1.1 Effective Derived Airborne Concentration Based on Soil Sample	
Data.....	25
5.1.2 Derived Airborne Concentration Fraction Based on Gross Count	
Data of Breathing Zone Air Filter.....	26
5.1.3 Dose Assignment to Individuals Based on Gross Count Data of Breathing	
Zone Air Filter	26
5.1.4 Example Dose Calculation from an Individual Air Filter Analyzed	
by Gross Alpha Activity	27

Table of Contents (continued)

5.2	Dose Calculated from Individual or Batched Air Filters Analyzed by Isotopic Activity.....	28
5.2.1	Derived Airborne Concentration Fraction Based On Isotopic Analysis of a Breathing Zone Air Filter	28
5.2.2	Dose Assignment to Individuals Based On Isotopic Analysis of Breathing Zone Air Filter(s)	29
5.2.3	Example Dose Calculation from an Air Filter Analyzed by Isotopic Analysis	29
5.3	Count Times and Minimum Detectable Activities for Gross Alpha Counting of Breathing Zone Air Samples.....	30
5.4	Use of Negative Numbers	32
5.5	Gross Alpha Analysis	32
5.6	Occupational Safety and Health Administration Compliance	32
5.7	Identifying Abnormally High Intakes and Follow-Up Bioassay.....	33
5.8	Breathing Zone Air Sampling Frequency	35
5.9	Dose Assignment Strategy	35
5.10	Reporting Internal Doses.....	36
6.0	Area and Perimeter Air Particulate Sampling	37
6.1	General Area Air Samples.....	37
6.2	Perimeter Air Samples.....	37
6.2.1	Minimum Volumes and Minimum Detectable Activities	39
6.2.2	Gross Alpha Analysis.....	39
7.0	Occupational Radon Exposure	41
8.0	External Dosimetry	43
8.1	Reporting External Exposures.....	44
9.0	References	45

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 5 of 95

List of Tables

Table 1	Activity in Soil Samples
Table 2	Radon Progeny Working Level Concentration in Building 76
Table 3	Estimated Relative Doses from Maywood Radionuclides
Table 4	Fraction Retained in Lung at 3 Days and 30 Days Post Inhalation Intake per 10 Code of Federal Regulation 20/International Commission on Radiological Protection 30
Table 5	Minimum Detectable Activities Expressed as Percent Annual Limit on Intake ¹
Table 6	Derived Investigation Levels Corresponding to 10 Percent Annual Limit on Intake
Table 7	Calculation Example Soil Data
Table 8	Example of Isotopic Data from Air Filter
Table 9	Example Calculation of Derived Airborne Concentration Fraction for Radionuclide Mixture on Air Filter
Table 10	Collection Volumes for Perimeter Samples to Meet Required Minimum Detectable Activity on the Gross Alpha Count as a Function of Count Time

List of Attachments

Attachment 1	Derived Air Concentrations, Annual Limits on Intake, and Maximum Permissible Concentrations
Attachment 2	Mean Soil Activity Values and Recommended Surface Contamination Levels for use at the Maywood Superfund Site
Attachment 3	Thermoluminescent Dosimeter Description
Attachment 4	Derived Air Concentrations Values and Dose Conversion Factors for use at the Maywood Superfund Site

Acronyms and Abbreviations

ALARA	As-Low-As-Reasonably-Achievable
ALI	annual limit on intake
AMAD	activity median aerodynamic diameter
ANSI	American National Standards Institute
BZA	breathing zone air
Cabrera	Cabrera Services, Inc.
CDE	committed dose equivalent
CEDE	committed effective dose equivalent
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
DAC	derived airborne concentration
DDE	deep dose equivalent
DIL	derived investigation level
DOE	U.S. Department of Energy
FGR	Federal Guidance Report
FMSS	FUSRAP Maywood Superfund Site
FUSRAP	Formerly Utilized Sites Remedial Action Program
ICRP	International Commission on Radiological Protection
lpm	liters per minute
MDA	Minimum Detectable Activity
MDD	Minimum Detectable Dose
MeV	megaelectron volt
MISS	Maywood Interim Storage Site
mL	milliliter
MPC	Minimum Permissible Concentration
mrem	millirem
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NORM	Naturally Occurring Radioactive Material
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
pCi	picoCurie
ROC	Radionuclide of Concern
RSO	Radiation Safety Officer
RSSO	USACE Radiation Safety Staff Officer
SDE	shallow dose equivalent
SSHP	Site Safety and Health Plan
TEDE	total effective dose equivalent
TLD	thermoluminescent dosimeter
USACE	U.S. Army Corps of Engineers
WB	Whole Body
WL, WLM	working level, working level month
μCi	microCurie

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 7 of 95

1.0 INTRODUCTION

The Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS) includes various properties that contain elevated levels of Naturally Occurring Radioactive Materials (NORM), generated from the chemical processing of Monazite sands containing elevated Thorium activities.

The U.S. Army Corps of Engineers (USACE) is presently overseeing the remedial action at the FMSS properties. During remediation, soils with elevated levels of radionuclides are removed from the property and shipped to a waste disposal site. Occupational radiation workers and members of the public in the vicinity of the FMSS during remediation activities can receive internal radiation exposure from the inhalation of dust particles suspended in breathing air that contain NORM, and from the inhalation of radon gas and its particulate progeny that emanate from NORM. Occupational radiation workers and members of the public in the vicinity of the FMSS can also be exposed to external radiation from gamma-ray emissions in NORM deposits in the ground and on surfaces.

1.1 Document Purpose

This document provides the technical basis and background information to support the external dosimetry, internal dosimetry and air monitoring programs for the remediation activities at the FMSS, including vicinity properties.

Internal exposures resulting from injection or ingestion of NORM are beyond the scope of this document. Such exposures should be evaluated individually.

1.2 Contract Requirements for Internal Dosimetry and Air Sampling Programs

Section 3.3 of the PERFORMANCE WORK STATEMENT, Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS) Maywood, New Jersey, New Task Order for Soils Operable Unit (OU)-1 Remedial Action requires that the Contractor's APP/SSHP comply with the following radiological regulations:

- Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OEW) Activities, ER 385-1-92
- Ionizing Radiation Protection, ER 385-1-80 (30 June 2010)
- Other applicable Federal, State, and local regulations

Radiation Protection Program Project Procedure, PP-8-200 requires the Project Certified Health Physicist to be responsible for the "Evaluation of the dosimetry program, including the assignment of internal dose, dose assessments, and applicable monitoring."

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 8 of 95

2.0 REGULATIONS

2.1 Overall Program

The Site Safety and Health Plan (SSHP), Section 1.1 states that, “Field activities specified in the WP shall be performed in accordance with applicable policies and procedures from Cabrera’s Occupational Health & Safety Management System (OHSMS) (Appendix C of APP), other applicable site HS&E regulations, Occupational Safety and Health Administration (OSHA) requirements, and other applicable Federal, State, and local statutes.”

2.2 Dose Limits and Related Requirements

2.2.1 Occupational Dose Limits

The USACE occupational dose limits with the written approval of the USACE Radiation Safety Staff Officer (RSSO), from all employers within a calendar year, per EM-385-1-1, 06.E.04 Table 6-1 and 10 CFR 20.1201 are:

- 5 rem total effective dose equivalent (TEDE) to the whole body
- 50 rem sum of deep dose equivalent (DDE) and committed dose equivalent (CDE) to any individual organ other than the lens of the eye
- 15 rem to the lens of the eye
- 50 rem shallow dose equivalent (SDE) to the skin or to any extremity

EM-385-1-1 Section 06.E.04 states that no employee under 18 years of age shall receive occupational exposure to ionizing radiation, and the dose to an embryo/fetus shall not exceed 0.5 rem during the entire gestation period.

Occupational Safety and Health Administration (OSHA) Regulation 29 CFR 1910.1096(b)(1) occupational limits are in rem per calendar quarter and as follows:

- Whole body; Head and trunk; active blood forming organs; lens of eye; or gonads: 1.25
- Hands and forearms; feet and ankles: 18.75
- Skin of whole body: 7.5

OSHA Regulation 29 CFR 1910.1096(b)(2) further states that:

“An employer may permit an individual in a restricted area to receive doses to the whole body greater than those..” above “ so long as:

- (i) During any calendar quarter the dose to the whole body shall not exceed 3 rems; and

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 9 of 95

(ii) The dose to the whole body, when added to the occupational dose to the whole body, shall not exceed 5 (N-18) rems, where “N” equals the individual’s age in years at his last birthday; and

(iii) The employer maintains adequate past and current records...”

NOTE: 5(N-18) should not be used as an annual limit, since this is in conflict with EM 385-1-1 and 10 CFR 20, since these regulations are conservative, and are based on later dosimetry models than are the OSHA regulations.

OSHA Regulation 19 CFR 1910.1096(c) further states that:

“(1) No employer shall possess, use or transport radioactive material in such a manner as to cause any employee, within a restricted area, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table 1 of Appendix B to 10 CFR part 20. The limits given in Table 1 are for exposure to the concentrations specified for 40 hours in any workweek of 7 consecutive days. In any such period where the number of hours of exposure is less than 40, the limits specified in the table may be increased proportionately. In any such period where the number of hours of exposure is greater than 40, the limits specified in the table shall be decreased proportionately.

(2) No employer shall possess, use, or transfer radioactive material in such a manner as to cause any individual within a restricted area, who is under 18 years of age, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table II of Appendix B to 10 CFR 20. For purposes of this paragraph, concentrations may be averaged over periods not greater than 1 week.

(3) Exposed as used in this paragraph means that the individual is present in an airborne concentration. No allowance shall be made for the use of protective clothing or equipment, or particle size.”

NOTE: The referenced tables are of Appendix B in the 1971 revision of 10 CFR 20 (McCulley, 1992). These tables were in use by the NRC prior to 1993.

NOTE: Although OSHA allows persons under the age of 18 to receive a reduced occupational dose & exposure to airborne concentrations of radionuclides, EM 385-1-1 prohibits any individual under the age of 18 from receiving an occupational exposure. The FMSS project shall therefore not employ any individuals under the age of 18 as radiation workers.

NOTE: 29 CFR 1910.1096 requires that workers be informed of their doses, however does not provide guidance specifically for calculating internal dose (i.e., as per TEDE summing). In the 1971 when the OSHA regulation was written, dose from internal sources and external sources were not summed, however International Commission on Radiological Protection's (ICRP) 2 (the base document for the older version of 10 CFR 20) does recommend summing.

It is acceptable to report external dose and Maximum Permissible Concentration hours (MPC-hrs) separately for quarterly dose reporting in accordance with OSHA regulations provided that it is established that the total dose does not exceed OSHA dose limits. Per Section

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 10 of 95

5.6, it is unlikely that the OSHA dose limit will be exceeded. TEDE should also be calculated using present 10 CFR 20 methods (summed, annual dose, particle sizes & other modeling methods), because workers leaving this site and going to work at licensed sites or U.S. Department of Energy (DOE) facilities need a dose record consistent with methods used at those facilities in order to determine annual dose. An explanation should be provided when dose for an individual is reported. Additionally, the results of both dose methods where dose records are required should be maintained. Per USACE direction, the FMSS project may not use ICRP 60 methods to calculate dose at this time.

2.2.2 Occupational As-Low-As-Reasonably-Achievable Goals

EM-385-1-1 Section 06.E.04 states that, in order to keep the doses As-Low-As-Reasonably-Achievable (ALARA), the user shall set administrative dose limits. ALARA goals recommended by the USACE are:

- 0.1 rem TEDE to the whole body
- 0.5 rem sum of DDE and CDE to any individual organ other than the lens of the eye
- 0.15 rem to the lens of the eye
- 0.5 rem SDE to the skin or to any extremity

Because of the restrictive derived airborne concentration (DAC) of Th-232, the ALARA goals at the FMSS will be one tenth of the annual dose limit, or 500 millirem (mrem) per year to the whole body. This is also one tenth of the USACE EM-385-1-1 and 10 CFR 20 dose limits. The 500 mrem ALARA annual goal may only be exceeded with written permission from the RSSO.

2.2.3 Occupational Dosimetry Monitoring Requirements

Part 10 CFR 20 and EM 385-1-1 require monitoring when the dose from internally deposited radioactive materials or the external dose is likely to be in excess of 10 percent of the dose limit in one year. Additionally, 10 CFR 20.1502 requires individual monitoring of external and internal occupational dose in order to demonstrate compliance with the occupational dose limits.

USACE EM385-1-1 06.E.05 states that:

“Users of unsealed radioactive material sources shall institute an internal dosimetry program:

- (1) when there is a potential for a worker to receive an internal dose of greater than 0.5 rem (5 mSv) per year;
- (2) that is reviewed and approved by a qualified health physicist, and
- (3) that contains provisions for a pre-exposure bioassay, a bioassay method capable of detecting internal radioactive materials, at a level below 10 percent of the Annual Limit of Intake listed in Appendix B of 10 CFR 20 for each radionuclide used, appropriate action levels for requiring additional bioassay, actions for individuals found to have internally

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 11 of 95

deposited radioactive materials, and provisions for post-exposure bioassay.”

OSHA Regulation 29 CFR 1910.1096(d)2 states that:

“Every employer shall supply appropriate personnel monitoring equipment... and shall require the use of such equipment by: (i) Each employee who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value ...”

NOTE: This OSHA Action Level for requiring personnel monitoring is equivalent to a dose of 312 mrem per quarter.

Additionally, OSHA’s airborne concentration limit of 40 MPC-hrs in a 7-day workweek implies the need for monitoring the airborne concentrations of radionuclides to which workers are exposed.

Internal dosimetry action levels are based on 1 micrometer (micron) particle sizes and take no allowance for the use of protective clothing or equipment per 29 CFR 1910.1096 (c)(3). Attachment 1, “Derived Air Concentrations, Annual Limits on Intake, and Maximum Permissible Concentrations,” contains a listing of annual limit on intake (ALI) and DAC values for use at FMSS.

2.2.4 Dose to the Fetus

10 CFR 20.1208 and EM 385-1-1.06.E.04.d state:

- that the dose to an embryo / fetus of a declared pregnant woman/employee shall not exceed 0.5 rem (0.005 Sv, or 5 mSv) during the entire gestation period.
- That efforts shall be made to avoid variations above a uniform monthly exposure rate,
- If the dose to the embryo/fetus exceeds or is within 0.05 rem of 0.5 rem at the time of declaration, then dose to the embryo/fetus is limited to 0.05 rem for the remainder of gestation.

OSHA has no guidance regarding the embryo/fetus.

Note: For the FMSS Program, the 10 CFR 20 and EM 385-1-1 dose limit to the embryo / fetus shall be applied to the embryo / fetus of a declared pregnant woman.

2.2.5 Occupational Medical Monitoring Requirements

EM 385 1 1 06.E.13 requires that medical examinations shall be conducted:

“...when deemed necessary by a physician or referred by the RSO.” “All cases of overexposure and suggested ingestion or inhalation of radioactive materials shall be referred to a physician for examination.”

Additionally, the Cabrera Health and Safety Manual, Medical Surveillance Program (MSP) states that: “The MSP serves three (3) purposes: first, it is designed to determine if employees are capable of performing operations without adverse health effects to the employee; second, it

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 12 of 95

assures the continued health of employees through medical examinations; and third, it documents the health status of employees, both present and former.

The Medical Surveillance Program requires a medical examination “Annually, at least once every twelve months.”

2.3 Dose Limits for Members of the Public

The EPA sets an offsite dose limit of 10 mrem per year for DOE and non-DOE government facilities, as stated in the following excerpt from 40 CFR 61.92 and .102:

“Emissions of radionuclides... to the ambient air... shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.”

Per 40 CFR 61, the doses caused by radon-222 emission and decay products are not included. Additionally, the ICRP Publication No. 26 must be used to calculate doses to the public. ICRP 26 is the basis for EPA’s Federal Guidance Report (FGR) No. 11 as well as for 10 CFR 20 Appendix B values. The FMSS complies with the DOE regulations.

40 CFR 61.222 states that, “Radon-222 emissions to the ambient air from uranium mill tailings pile that are no longer operational shall not exceed 20 pCi/(m²-sec) (1.9 pCi/(ft²-sec)) of radon-222.”

10 CFR 20.1301 states that “the total dose to individual members of the public from the licensed operation does not exceed 0.1 rem ... in a year...”

Guidelines for demonstrating compliance with dose limits for members of the public are given in 40 CFR 61.93 and .103 and specify use of computer models such as CAP-88, AIRDOS-PC or COMPLY, or other procedures for which EPA has granted prior approval.

10 CFR 20.1302 states that a licensee shall show compliance with the annual dose limit by demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose does not exceed the annual dose limit.

NOTE: Compliance with the above regulations is demonstrated using computer-generated results for remediation related activities at the FMSS. The FMSS will perform perimeter monitoring support compliance with 10 CFR 20 and EM 385-1-1 dose limits to the public, and to assure that engineering controls are effective as used during remediation related activities.

2.4 Record-keeping Requirements, Occupational Dose

29 CFR 1910.1096 (n)(1) requires that every employer shall maintain records of the radiation exposure of all employees for whom personnel monitoring is required....and advise each of his employees of his individual exposure on at least an annual basis.

10 CFR 20.2110 All records must remain legible throughout the specific retention period.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 13 of 95

EM 385-1-1 06.E.10 gives the following record-keeping requirement:

- "All users of radioactive material...shall prepare and maintain records of the Radiation Safety Program for three years after termination of the license permit.
- "For any individual who frequents a controlled area, and may potentially be exposed to 100mrem (1mSv) per year or more, the licensee shall prepare and maintain records to determine that person's:
 - Occupational dose during the current year
 - Attempt to obtain records of cumulative occupational radiation exposure, and
 - Dose received, both internal and external.
- "All users of radioactive material...shall prepare and maintain records of all calculated or monitored radiation dose to individual members of the public so as to document compliance with paragraph 06.E.05."

10 CFR 20 requires that the following records be kept for 3 years after the record is generated:

- Records of the radiation protection program, relating to audits and other reviews of program content and implementation
- Records showing the results of surveys and calibrations, except for surveys used for dosimetry purposes
- Records used in preparing NRC Form 4

10 CFR 20 requires that the following records be kept until the license is terminated:

- NRC Form 4.
- Records of the provisions of the radiation protection program.
- Records of the results of surveys to determine the dose from external sources and used, in the absence of or in combination with individual monitoring data, in the assessment of individual dose equivalents.
- Records of the results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose.
- Records showing the results of air sampling, surveys, and bioassays.
- Records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment.

American National Standards Institute (ANSI) standard ANSI/HPS N13.6-1999, Practice for Occupational Exposure Records System recommends the below listed records be kept for 75 years after generation. The lengthy retention time in excess of regulatory requirements is because symptoms of radiation caused injuries and diseases may not be evident for many years after an exposure event has occurred and that the symptoms may be pathologically similar to the injuries and disease not caused by radiation exposure. Long retention of records is recommended

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 14 of 95

by ANSI to account for possible future needs for worker compensation programs or for conduct of future litigation.

- Prior employment occupational radiological exposure histories
- Assessments of radiological exposure
- Records describing unusual occurrences or incidents
- Programmatic records describing the technical basis for radiological protection
- Procedural records, including implementing and operating records.
- Control and calibration records
- Data summary records.

ANSI/HPS N13.6-1999 also suggests that radiation work permits and radiological surveys, and other unspecified records may be valuable in establishing the exposure of an individual and should be considered for long-term retention. It suggests that a shorter retention time may be appropriate for raw data and other unspecified types of records.

Interpretation: Cabrera will follow the guidance of ANSI/HPS N13.6-1999, for the reasons indicated in the standard.

2.5 Reporting Requirements

2.5.1 Disclosure to Former Employee

29 CFR 1910.1096 (o)(1) At the request of a former employee an employer shall furnish to the employee a report of the employee's exposure to radiation as shown in records maintained by the employer. Such report is to be furnished within 30 days from the time the request is made. The report shall cover each calendar quarter of the individual's employment or such lesser period as may be requested by the employee and shall include internal analyses as appropriate.

Note: Doses should be subtotaled quarterly to verify that the OSHA quarterly dose limits are met, and totaled annually to verify that the USACE annual dose limits are met. Since isotopic data is often not available for NORM radionuclides within 30 days of receipt of a request for dose information, the FMSS project Radiation Safety Officer (RSO) may choose to release to the employee preliminary dose results based upon gross count results. If preliminary data is used, the RSO shall provide a final report to the former employee when more accurate data becomes available. An explanation of the dose information including whether the dose information is preliminary or finalized should accompany the data.

2.5.2 Disclosure to Regulator

OSHA and USACE reporting regulations are given below. The USACE shall be notified and briefed prior to notification to other regulatory agencies.

10 CFR 20 reporting regulations do not apply because the FMSS is not an NRC licensee, therefore the USACE shall replace the NRC as the regulatory body to which the project reports.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 15 of 95

2.5.2.1 Normal Operations Reporting

EM385-1-1 06.E.11 requires that “Annual reports shall be issued by the RSO for each individual USACE radiation worker with the recorded or calculated dose assigned to the USACE individual for the year or specific work project. These shall be maintained in such a manner that accumulated exposure can be determined at a future date.”

2.5.2.2 Incident Reporting

29 CFR 1910.1096 (l) requires immediate notification by telephone or telegraph of Assistant Secretary of Labor for incidents that cause or threaten to cause

- Greater than 25 rem Whole Body (WB)
- Greater than 150 rem skin of WB
- Greater than 375 rem extremities (forearms, hands, feet, ankles)
- Greater than 5,000 Appendix B Table II concentration limit averaged in 24 hours

29 CFR 1910.1096 (l) also requires 24-hour notification by telephone or telegraph of Assistant Secretary of Labor for incidents that cause or threaten to cause

- Greater than 5 rem WB
- Greater than 30 rem skin of WB
- Greater than 75 rem extremities (forearms, hands, feet, ankles)

29 CFR 1910.1096 (m) requires 30-day notification in writing of Assistant Secretary of Labor for incidents that cause exposure to radiation or concentrations of radioactive material in excess of any applicable limit.

29 CFR 1910.1096 (m) also requires that the individual be notified in writing in the case where an employer is required to report to the US Department of Labor any exposure to radiation or to concentrations of radioactive material. The notification shall include the wording: “You should preserve this report for future reference.”

EM 385-1-1 06.E.11 requires that “Any loss, theft, damage or overexposure shall immediately upon discovery be reported to the RSO who will then file a report with the NRC (if required) in accordance with the requirements of 10 CFR 20.” In lieu of notifying the Commission, notifications are to be made to USACE.

10 CFR 20.2203 specifies that any overexposure of the limits in 10 CFR 20 be reported to the Commission within 30 days of learning of the occurrence. The report is to contain an estimate of the individual’s dose, the levels of radiation and concentrations of radioactive material involved, the cause of the elevated exposure, and corrective actions taken or planned. 10 CFR 20.2205 specifies transmitting a copy of the report to the exposed individual or identified member of the public at a time no later than transmitted to the Commission. In lieu of reporting to the Commission, reports are to be made to USACE.

10 CFR 20.2202 specifies immediate notification to the Commission of any event that may have caused, or threatens to cause, an overexposure that is greater than 5 times the limits of 10 CFR

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 16 of 95

20. Immediate notification is also required for any release of radioactive material into any area so an individual present for 24 hours could have received an intake five times the ALI. 10 CFR 20.2202 specifies 24 hour notification to the Commission of any event which may have caused, or threatens to cause, an overexposure that is greater than the limits of 10 CFR 20. 24 hour notification is also required for any release of radioactive material into any area so an individual present for 24 hours could have received an intake equal to the ALI. In lieu of notifying the Commission, notifications are to be made to USACE.

NOTE: There is a realistic possibility that, during remediation activities, the airborne concentrations at the FMSS will exceed the 29 CFR 1910.1096 limit of 40 MPC-hrs in a contiguous 7-day time period. This would require a 30-day notification in writing to the Labor Dept. It is advised that, prior to notification, the RSO consider all possible data to verify that airborne concentrations did indeed exceed limits. This would include obtaining the isotopic results of the appropriate air filters.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 17 of 95

3.0 SITE CHARACTERIZATION DATA

The radionuclides of concern (ROC) for air sampling and internal dose at the FMSS include Th-232, U-238, U-235, and their radioactive progeny.

Reports of data often list only Th-232, U-238 and Ra-226; it is assumed that if any of these radionuclides are found to be elevated in soil samples, some or all of their progeny will also be present in elevated amounts. Additionally, since no enrichment is expected to have occurred, U-235 and progeny are expected to be present in concentrations proportional to the natural abundance of U-235 in nature.

It is also generally expected that all Th-232 progeny are expected to be present at the same concentration as the concentration of the Th-232 parent due to secular equilibrium. The radioactive progeny of Th-232 with the longest half-life is Ra-228 (5.75 years) and over 7 half-lives have passed since the last year of active processing of NORM at the site in 1957. The activities of radioactive progeny are greater than 99 percent of that of the parent after seven half-lives. Additionally, any purified Ra-228 that was in the tailings in 1957 would have decayed to less than 1 percent of its original activity in this time period.

Data summarizing the radionuclides anticipated during activities at the FMSS is presented below.

3.1 Soil Sampling Data

Soil sampling has been used to characterize contaminated material at the various FMSS properties. Soil has been analyzed for Ra-226, Th-232 and U-238. Table 1, "Activity in Soil Samples," shows mean activities at each property and the ratios of mean activities of other nuclides with respect to Thorium-232, at the FMSS and vicinity properties. Attachment 2, "Mean Soil Activity Values and Recommended Surface Contamination Levels for use at the Maywood Superfund Site," shows the mean soil activity values and recommended surface contamination levels for use at the FMSS.

There is a large amount of variability in the activities of samples, which range from what appear to be background levels of radionuclides (approximately 1 pCi/g each for Ra-226 and Th-232 and 2 pCi/g for U-238) up to activities of a few thousand pCi/g.

Although the measured activities are Th-232, U-238 and Ra-226, a mixture of radionuclides including progeny from these and other radionuclides is present.

3.2 On-Site Radon progeny Data

A study of radon progeny working level concentrations in air in Building 76 at FMSS was conducted for approximately 2 months, primarily during the winter of 2000.

The mean and maximum radon progeny working level concentrations are given in Table 2, "Radon Progeny Working Level Concentration in Building 76," (Stone & Webster, 2001).

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 18 of 95

3.3 Radionuclides of Concern for Offsite Doses

The doses reported in the Annual Environmental Monitoring Report-2000 are used to give an indication of the radionuclides that are likely to be responsible for internal dose to offsite persons. The radionuclides responsible for the greater than 99 percent of the dose as calculated for the Annual Environmental Monitoring Report are listed in Table 3, "Estimated Relative Doses from Maywood Radionuclides," and sorted in accordance to the magnitude of the dose expected. Note that doses to the public calculated in National Emissions Standards for Hazardous Air Pollutants (NESHAP) are very small compared to the 40 CFR 61 dose limit of 10 mrem/y.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 19 of 95

4.0 INTERNAL DOSIMETRY PROGRAM – BIOASSAY

Note: OSHA 19 CFR 1910.1096 uses concentration in air (MPC-hrs) rather than internal dose. Since OSHA does not discuss internal dosimetry methods, calculations at FMSS reflect USACE (EM 385-1-1) and NRC (10 CFR 20) based methodologies. This is conservative for Th-232, which is the primary ROC at the FMSS.

4.1 In Vivo (Whole Body and Lung) Counting

Lung counting and whole body counting are direct bioassay methods that are used to assess the isotopes and quantity of radionuclides that are in the body at the time the measurement is being taken. This information can be used to calculate the quantities of radionuclides that have been inhaled, ingested, or otherwise taken into the body in the initial intake. Additionally, multiple measurements can be used to determine the retention and excretion specific to the individual, and can indicate the size of the particles in the intake.

Lung counters are the optimum instruments commonly used for detection of low energy gamma emitters in workers. Lung counters use large, high efficiency, low energy germanium detectors, and are placed in low background shielded rooms.

Whole body counters (WBC) with large, high efficiency, low energy germanium detectors are less expensive than lung counters, however, WBC are not as sensitive as lung counters because they have only partial shields, and therefore background is greater.

The best expected sensitivities of optimized lung counters for U-238, U-235, and Th-232 are given in Table 4, “Fraction Retained in Lung at 3 Days and 30 Days Post Inhalation Intake per 10 Code of Federal Regulation 20/ International Commission on Radiological Protection 30.”

The minimum sensitivity desired in routine bioassay measurements is that which corresponds to 10 percent of the dose limit to workers (500 mrem) summed for intakes of all radionuclides. As is indicated in Table 5, “MDAs Expressed as percent ALI per 10 CFR 20¹,” the sensitivity of lung counting does not go down as low as 10 percent ALI for U-238 or Th-232, whether the subject is counted 3 or 30 days after an intake. Routine operations are expected to result in multiple, smaller intakes that would be even more difficult to detect than acute intakes.

Lung counting and WBC are, based on the above discussion, not suitable for use for routine bioassay at the FMSS. Lung counting should be considered for assessing intakes and doses for incidents resulting in large intakes.

A lung counter would cost approximately \$500,000 and would require a trained staff and a building to support the equipment. Since lung counting would be used only in those rare cases

¹ Per phone conversation with Dave Groff, Canberra Industries, June 2001. Minimum detectable activities (MDA) are expressed in terms of %ALI. Note: MDAs are for an 1800 second count time, 1 activity median aerodynamic diameter (AMAD) Class Y uranium and thorium, a single large intake, and a Livermore Realistic Phantom with a chest wall thickness of 2.25 cm). %ALI values were calculated using information supplied by D. Groff.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 20 of 95

when intakes of about 20 to 30 percent ALI were suspected it is not financially feasible for the FMSS to purchase a lung counter. Various facilities can be contacted to provide services on an as-needed contract basis.

4.2 In Vitro Counting - Urinalysis

Urinalysis is often the method of choice for routine bioassay where in vivo methods of counting are not feasible. Urine samples are often taken and analyzed for radioisotope concentrations in order to determine the intake of radionuclides based on retention and excretion function models. Urinalysis, when used for routine bioassay, typically involves taking 24-hour samples on monthly or quarterly basis.

The feasibility of using a urinalysis program to determine occupational dose depends upon the ability of the analysis method to detect the ROCs down to desired levels in the samples within the given sampling time period. Alpha spectroscopy is typically used for urinalysis of the ROCs at FMSS. The upper bound of the desired detection level is 10 percent of the dose limits, which is the regulatory limit for requiring monitoring for internal dose per 10 CFR 20.1502 and EM385-1-1 06.E.05. Derived investigation levels (DILs) based upon intakes of 10 percent of the ALI are compared with minimum detectable activities of radionuclides in urine to determine whether urinalysis is feasible for the radionuclides found at FMSS.

DILs depend upon the fraction of radionuclides in the intake that would be excreted in the urine at the time of sample collection after the intake². The fraction of a radionuclide taken into the body that is excreted through urine is dependent upon a number of factors affecting the deposition of particles and the retention and movement throughout the body. These factors include the time after the intake, the chemical form – and therefore solubility – of the element, the type of intake (ingestion, inhalation, absorption, etc.), the particle size, and physiological parameters related to the individual.

At FMSS, the primary method of intake of radionuclides is expected to be inhalation of particulates in the air. A 1 AMAD particle size is assumed. Thorium and uranium are assumed to be Class Y and radium is assumed to be Class W. ALIs are from 10 CFR 20, Appendix B (based on ICRP 30). Excretion fractions (E_t) from NUREG/CR-4884 3 are used to estimate the accumulated fraction of the radionuclide excreted at various times post intake. These excretion fractions assume that a single intake is responsible for the fraction of radionuclide excreted.

² ICRP 54 calculates DILs for the midpoint of a monitoring interval, based on 30% of an ALI, as well as for individual intakes; additionally, chronic intake data is displayed. The conclusion reached in ICRP 54 is the same as that below, that urine monitoring for routine intakes does not have adequate sensitivity for these radionuclides (thorium and uranium isotopes).

³ 10CFR20 and NUREG/CR-4884 values are based on ICRP 26 & 30 retention and excretion models; ICRP has since replaced these with ICRP-54. The conclusions of this technical basis are not affected by use of the older models.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 21 of 95

$$DIL(10 \text{ percent ALI}) = \frac{(0.1 \times ALI \times E_t)}{1.4}$$

Where:

- ALI = the stochastic Annual Limit on Intake from 10 CFR 20, Appendix B Table A.
- E_t = the accumulated fraction of the radionuclide excreted in a 24-hour duration sample taken at time t after the intake.
- 1.4 = the volume of urine (in liters) excreted in 24 hours per the Standard Man model (Radiological Health Handbook, Jan 1970, pg. 216).

Table 6, "Derived Investigation Levels (DIL) Corresponding to 10 percent ALI," gives DILs for various radionuclides of concern at FMSS. Note that the DILs given here are based upon 10 percent dose for individual radionuclides, and are used solely for determining feasibility of having a routine urinalysis program at the FMSS. A real intake at the FMSS would include a mixture of radionuclides, and the dose must be calculated using all the radionuclides that are expected to contribute significantly to the dose.

As is evident from the data in Table 6, the sensitivity of routine alpha spectroscopy is not sufficiently low to see down to the DIL for 10 percent ALI (10 CFR 20) for isotopes of thorium and uranium 30 days after an intake, or for isotopes of thorium if urine samples are collected 7 days after an intake. Since Th-232 is the predominate radionuclide at most of the FMSS (Table 3), urinalysis is not expected to provide the sensitivity needed to obtain meaningful data for routine exposures.

In addition to the limits of sensitivity, the concentration of the ROCs in naturally excreted urine from unexposed individuals has a large variability. In a study by P. Roth the concentration of Th-232 in urine in unexposed individuals was referenced to be as low as 3.4E-10 $\mu\text{Ci/day}$ and as high as 1.1E-07 $\mu\text{Ci/day}$. A single individual was reported to have a urine concentration that varied between 9.8E-10 and 6.3E-9 $\mu\text{Ci/day}$ over a 15-day period. The Department of Energy (DOE) conducted a study of the concentration of uranium in the urine of unexposed individuals at the Weldon Springs FUSRAP site. DOE reported an average concentration of 3.6E-8 $\mu\text{Ci/day}$ and a variation as high as 2.1E-7 $\mu\text{Ci/day}$ (95 percent) in unexposed individuals.

It is evident that the magnitude and variability of the ROCs in urine of unexposed individuals would introduce a large uncertainty into the interpretation of results. Had the individual reported by Roth whose Th-232 urine concentration varied between 9.8E-10 and 6.3E-9 $\mu\text{Ci/day}$ over a 15 day period had a baseline bioassay at the minimum activity and then later submitted a routine sample at the maximum activity, the dose for the single bioassay measurement could be assigned as 3 rem due to Th-232 variability alone (i.e., not including the contribution from Th-232 progeny and from the U-238 and U-235 decay chains). Conversely, a large dose might be missed if the baseline bioassay were on the higher end.

Urinalysis is not recommended as a sampling method to evaluate inhalation and ingestion intakes/doses at FMSS due to limitations of sensitivity and due to the variability of the ROCs in normal urine.

Urinalysis should be considered for evaluating incidents that are expected to result in large doses, particularly if a sample is collected within the first day after an accident. The first sample

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 22 of 95

should start immediately after the incident. A second sample is recommended the second day. Due to the sensitivity of a first day sample, a pre-incident baseline bioassay is not required.

4.3 In Vitro Counting - Fecal Analysis

Fecal sampling is often a method of choice for assessing acute actinide intakes. Fecal analysis is generally not performed on a routine basis. Fecal sampling is generally only suitable for assessing intakes when the sample is collected within 3 days after the intake.

The optimum time for collection of fecal samples is the second or third day following an intake. At this time the 24 hour fecal sample is expected to contain between 13 and 16 percent of the activity⁴ in the intake for the Class Y ROCs (NUREG/CR-4884). Samples collected before the first full day and after the third full day may be difficult to assess due to the expected small fraction of the intake activity. If a significant intake is suspected (greater than 25 percent of an ALI), multiple samples should be considered.

Because it is crucial that fecal material be gathered close to the time of the intake, the decision as to whether to gather the sample should be based on information gathered within a short time period of the suspected intake, including gross counts of breathing zone air (BZA) samplers and other air sampling filters, frisker and smear results, and the history of an event that could cause an intake.

A large fraction of inhaled class Y radioisotopes will be excreted in fecal material. Within 5 days⁵ almost 50 percent of the Class Y radioisotopes will have been excreted in feces, assuming a particle size of 1 micron AMAD (NUREG/CR-4884). This is even greater for larger particles. A limitation of the fecal analysis method is that larger particles are expelled from the lung into the GI tract more readily than smaller particles; hence, a larger fraction of the intake is excreted in the feces and the dose to the individual is less. Particle size estimates require that multiple bioassay samples be obtained over time, and require calculation of excretion fractions for those particle sizes because NUREG/CR-4884 gives values only for 1 micron particles.

The excretion fraction (E_t) is the fraction of the intake that would be excreted in the feces at the time of sample collection. E_t values are tabulated in NUREG/CR-4884. E_t is dependent upon a number of factors. These factors include the time after the intake, the chemical form of the element, the type of intake (ingestion or inhalation), the particle size, and physiological parameters related to the individual. The dose equivalent is calculated from the intake using dose conversion factors of FGR-11 (Eckerman, 1988) or from the ALI values in 10 CFR 20. The amount of radionuclide in the intake is calculated as follow:

$$I = \frac{A}{E_t}$$

Where:

- I = the intake activity at the time of intake.
- A = the activity in the fecal sample.

⁴ For 1 micron AMAD particles.

⁵ For Radium 226 which is Class W, the time period to attain this is about 1 day more.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 23 of 95

E_t = the fraction of the radionuclide excreted in the fecal sample at time t after the intake, from NUREG/CR 4884 (generally cumulative excretion values are used with activity of a sample collected over a duration of time.)

The analytical request should typically include all long-lived radioactive progeny of the decay chain. The intake from each element should be considered separately. The dose conversion factors of FGR-11 and 10 CFR 20 include the decay of radioactive progeny that are formed within the body from an intake of a pure parent.

The minimum dose detected by fecal sampling is typically less than 10 mrem CEDE at 3 days post intake. Normal ambient ROCs in feces contributes less than 10 mrem to the overall dose estimate, thus baseline samples are not required.

A similar method should be considered for evaluating ingestion doses, with changes to the retention and excretion fractions from NUREG/CR-4884 and the exposure-to-dose conversion factors (DCFs) from FGR-11 and 10 CFR 20. Fecal analysis should not be considered for evaluating injection doses for the relatively insoluble radionuclides at the FMSS.

Example Calculation for a Fecal Analysis Sample:

A worker is involved in an incident and is asked to submit a fecal sample. The sample is collected at 2 days post intake. The sample was found to contain 600 pCi of Th-232 in a 24-hour sample. The R_f is listed in NUREG/CR-4884 for Y class Th-232 in feces as 0.161. The intake is calculated as follows:

$$I = 600 \text{ pCi} * 10^{-6} \frac{\mu\text{Ci}}{\text{pCi}} = 3.7\text{E-}03 \mu\text{Ci}.$$

FGR-11 lists the DCFs as 4.99E-03 Sv/Bq for the bone surface (BS) and 3.11E-04 Sv/Bq for the committed effective dose equivalent (CEDE, whole body). The dose is calculated as follows:

$$\text{CDE (BS)} = 3.7\text{E-}03 \mu\text{Ci} * 4.99\text{E-}03 \text{ Sv/Bq} * 3.7\text{E+}04 \text{ Bq}/\mu\text{Ci} * 100 \text{ rem/Sv} = 69 \text{ rem}$$

$$\text{CEDE} = 3.7\text{E-}03 \mu\text{Ci} * 3.11\text{E-}4 \text{ Sv/Bq} * 3.7\text{E+}04 \text{ Bq}/\mu\text{Ci} * 100 \text{ rem/Sv} = 4.3 \text{ rem}$$

In this example, the CDE to the bone surface exceeds the organ dose limit while the CEDE does not exceed the whole body dose limit. Any exposure of such a magnitude should have a complete investigation, including a whole body or lung count.

NOTE: This example calculated only the contribution of Th-232. In an actual problem, the Th-232 progeny Ra-228 and Th-228 should be included in the fecal analysis. The intake for other progeny from the decay chain should be estimated to be equivalent to the intake of the parent radionuclide. The dose should be calculated for each of the radionuclides in the intake including progeny.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 24 of 95

5.0 INTERNAL DOSIMETRY PROGRAM – BREATHING ZONE AIR PARTICULATE SAMPLING

Use of personal air samplers (BZA samplers) is the primary method for assessing routine inhalation intakes of actinides such as the isotopes of thorium and uranium. Additionally, BZA count results can be used to identify large, non-routine intakes. The NRC recommends that personnel air-sampling methods be used to determine occupational dose because bioassay methods are not sufficiently sensitive to assess routine intakes of Th-232 (NRC, 1996, see Attachment 3). ICRP 54 also recommends that programs with Th-232, U-238 and other radionuclides for which bioassay sensitivities are poor use air sampling to evaluate routine intakes (ICRP, 1988).

Breathing air zone samplers are utilized because particulate concentrations in air vary greatly with small distances, and the BZA intake is located close to the face area of the worker. The air sampled with BZA samplers is therefore much more representative of a worker's intake than that sampled with a general area sampler. However, BZA samples typically have lower flow volumes than general areas, resulting in higher minimum detectable activities (MDA) for BZAs. The flow rate of a typical BZA sample pump is approximately 2 liters per minute (lpm), as compared to 50 lpm for a general area sample pump.

Air sampling equipment should be placed on the individual being monitored in a fashion so that air collected is representative of the breathing air and so that it does not interfere with work performance. The filter cassette should be attached to the shirt collar or as close as practical to the nose and mouth of the employee, i.e., in a hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches. The inlet should always be in a downward vertical position to avoid gross contamination. Excess tubing should be positioned so that it does not interfere with the work of the employee (OSHA, 1999).

Air filters may be analyzed using gross alpha counting of the filters and isotope specific analysis methods. Gross alpha counting uses gas flow proportional detectors. Isotopic specific results are obtained using radiochemistry. Isotopic specific methods are destructive assay methods, that is, they destroy the integrity of the air filter during the process. Isotopic analysis of the ROC may entail analysis of single filters or of multiple filters batched together.

Results from either gross counting or isotopic counting methods may be used to calculate and assign dose to individuals at FMSS. The method for calculating dose from batched air filters is the same as that for individual filters; however the resultant concentrations of isotopes for batches of air filters are applied to more persons. Methods for calculating dose are given below in sections 5.1 and 5.2. Section 5.1 calculates dosimetry based on the gross alpha analysis. Section 5.2 calculates dosimetry based on isotopic analysis of batched samples. Batches have the advantage of having better statistics and therefore lower decision levels and MDAs, however the subsequent dose is averaged and the high and low air filter results not captured. Other similar variations of this method may be used on a case-by-case basis.

A solubility study of two FMSS samples determined that thorium in the ground at FMSS is extremely insoluble in lung fluid (ORISE, 1996). Two samples evaluated in this study were from the existing Maywood Interim Storage Site (MISS) soil stockpile and from a waste sludge

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 25 of 95

retention pond on the MISS proper. Hydrological studies indicate that thorium present in the bedrock and overburden groundwater aquifers has low mobility (USACE, 2005). Therefore, Class Y DAC and ALI values are assumed to be appropriate for dose determinations at FMSS. Should additional information become available, that indicates localized differences in solubility, the RSO may adjust the calculations accordingly.

Note: All BZA filters generated by the FMSS project shall be gross counted individually prior to being sent for isotopic analysis.

5.1 Dose Calculated from Individual Air Filters Analyzed by Gross Alpha Activity

5.1.1 Effective Derived Airborne Concentration Based on Soil Sample Data

Radioactive contamination at FMSS consists of a mixture of radionuclides. An effective DAC (DAC_{eff}) may be developed and documented for each work area to represent the isotopes present in the work area. The DAC_{eff} may be developed from an isotopic analysis of a composite of air samples, from an analysis of general area samples, or from soil sampling data. The DAC_{eff} for each sample is assessed from the gross alpha activity contained on the filter paper and the DAC, and calculated as follows:

$$DAC_{eff} = f_{\alpha} \left[\sum_i (f_i / DAC_i) \right]^{-1}$$

Where:

- f_{α} = The ratio of the total alpha activity in the mixture to the total activity of the mixture.
- f_i = The ratio of the concentration of each radionuclide to the total activity of the mixture.
- DAC_i = The DAC for each nuclide in the mixture from FGR-11 or 10 CFR 20.

The isotopes of radon and their progeny should be excluded from the DAC_{eff} calculation. Excluding radon and their progeny is realistic as it is likely that radon isotopes will emanate from the filter paper, and the DACs for radon isotopes are relatively large.

NOTE: Radon and thoron progeny are generated on the filter from the decay of parent isotopes. A portion of these isotopes will remain entrained in the particulates on the filter paper and will not emanate from the paper. Hence, the gross alpha count will result in over-estimating the activity of the parent radionuclides, and the overall dose will be over-estimated.

For uranium with a mixed solubility class, either assume that all uranium is of the most conservative (e.g., limiting) solubility class (class Y per 10 CFR 20), or treat each solubility class as a separate isotope.

Radioactive progeny may be assumed to be in equilibrium with that of the parent. It is also acceptable to assume that the concentration of U-235 is 4.7 percent, by activity, of either U-238 or U-234.

NRC Reg. Guide 8.34 states that “if Appendix B to 20.10001 does not list a stochastic DAC...it is preferred (but not required) that the licensee calculate and use a stochastic DAC.” The

effective DAC may therefore be calculated using the most conservative of the stochastic and non-stochastic isotopic DAC values provided by 10 CFR 20 or FGR-11, and the resultant dose applied to both whole body and internal organ doses.

Note: The use of DAC values from 10 CFR 20 is a conservative approach and will overestimate the doses. Should the resulting dose approach dose limits or other action levels, the doses should be calculated using less conservative and more accurate methods.

Additionally, some radionuclides may be disregarded from the calculation of effective DAC in accordance with NRC Reg. Guide 8.34. If there is a mixture of several radionuclides present, it is permissible to disregard those radionuclides that do not contribute significantly to the mixture. Specifically, a radionuclide may be disregarded if:

- The concentration of any radionuclide disregarded is less than 10 percent of its DAC;
- The sum of percentages for all radionuclides disregarded is less than 30 percent; and
- The total activity of the mixture is used to demonstrate compliance.

5.1.2 Derived Airborne Concentration Fraction Based on Gross Count Data of Breathing Zone Air Filter

Once the DAC_{eff} has been established for a work area, the DAC fraction for individual air filter may be determined and is based on the gross alpha concentration on the air filter. The fraction of the derived air concentration (F_{DAC}) for each air sample is then calculated from the gross alpha activity concentration as follows:

$$F_{DAC} = \frac{C_{grossalpha}}{DAC_{eff}}$$

Where:

$C_{grossalpha}$ = The gross alpha concentration calculated for the air filter (see below)
 F_{DAC} = DAC fraction, the fraction of a DAC attributed to the filter's air sample

$$C_{grossalpha} = \frac{A_{grossalpha}}{f * t_f}$$

Where:

$A_{grossalpha}$ = The gross alpha activity measured for the air filter
 f = The flow rate for the air filter
 t_f = The duration that the air filter is drawing air at flow rate f

5.1.3 Dose Assignment to Individuals Based on Gross Count Data of Breathing Zone Air Filter

Exposure to 100 percent DAC for 2000 hours will result in an intake of one ALI and therefore resulting in the annual dose limit per NRC Reg. Guide 8.34. The whole body dose to each individual from the entry associated with an air filter may be calculated as follows:

$$D_j = F_{DAC} \left(\frac{5 \text{ rem}}{2000\text{h}} \right) t_j$$

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 27 of 95

Where:

D_j	=	Dose assigned to individual j
t_j	=	Duration of time for individual j that is associated with a particular air filter and F_{DAC}
5 rem	=	Whole body dose limit associated with an intake of 100 percent DAC for 2000 hours per NRC Reg. Guide 8.34
2000h	=	Duration of time for an individual breathing one DAC to intake of one ALI.

Organ dose (non-stochastic) may be assigned using the appropriate annual dose limit (50 rem) associated with an intake of one ALI.

Note: This dose calculation method overestimates both stochastic and non-stochastic doses as it uses the worst-case DAC values.

5.1.4 Example Dose Calculation from an Individual Air Filter Analyzed by Gross Alpha Activity

Assuming an area to be excavated has an average soil concentration of 200 pCi/g Th-232, 1000 pCi/g U-238 and 600 pCi/g of Ra-226. A worker is in the work area for a duration of 10 hours one day. The air filter associated with the work area and associated activity work permit for that day has a flow rate of 2 lpm and operated for 20 hours; the gross count of the filter shows a result of $4.8 \text{ E-}6 \mu\text{Ci}$. What dose would be assigned to the worker using the gross count result?

The DAC_{eff} may be calculated assuming that all uranium is present as class Y and that progeny are in equilibrium with the parent and have the same solubility class as the parent. In this example, U-235 is calculated to have an activity of 0.047 times the activity of U-238. The activity of each radioisotope in the decay chain, the fraction of the total activity, and DAC values are given in Table 7, "Calculation Example Soil Data."

The activity fraction of Th-232 is calculated as:

$$f_1 (\text{Th-232-Y}) = 200/6882 = 2.9\text{E-}02$$

The total alpha activity fraction is calculated as:

$$f_\alpha = 4388/6882 = 0.637$$

The effective DAC is calculated as:

$$DAC_{eff} = 0.637 \left(\frac{2.9\text{E-}2}{1\text{E-}12} + \frac{2.9\text{E-}2}{5\text{E-}10} + \dots \right)^{-1} = 8.0\text{E-}12 \text{ uCi/ml}$$

The fraction of the DAC for the air sample is then calculated as follows:

$$A_{gross\alpha} = \frac{4.8 \text{ E-}6 \text{ uCi}}{(2\text{ l/min})(20\text{ h})(1000\text{ ml/l})(60\text{ min/h})} = 2.0\text{E-}12 \text{ uCi/ml}$$

$$F_{DAC} = \frac{2.0\text{E-}12 \text{ uCi/ml}}{8.0\text{E-}12 \text{ uCi/ml}} = 0.25$$

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 28 of 95

The dose to the worker exposed to this DAC fraction for this entry into the work area is therefore:

$$D_j = 0.25 \left(\frac{5 \text{ rem}}{2000\text{h}} \right) 10\text{h} = 6.3E - 3\text{rem} = 6.3\text{mrem}$$

5.2 Dose Calculated from Individual or Batched Air Filters Analyzed by Isotopic Activity

The method for calculating dose is the same whether analyzing air filters individually or in batches. At FMSS, individual BZAs are generally assigned to a representative individual expected to be in the area with the highest airborne activity for a work activity. A radionuclide concentration and DAC fraction may then be determined from isotopic count results for that individual air filter or for a batch of air filters. Once the DAC fraction is determined, dose is calculated using the duration of time each individual worker was involved in a work activity associated with the air filter or batch of air filters. The dose calculation is essentially the same as that for a gross count DAC fraction (see Section 5.1.3, above).

All air filters within the batch should contain activity less than 50 percent of a DAC based on a preliminary gross counting analysis. Those samples with over 50 percent of a DAC shall not be batched (i.e., should either be analyzed individually by radiochemistry or using gross counting methodology).

When grouping samples into batches all samples within the batch should be taken from a single work site and be for similar work activities.

5.2.1 Derived Airborne Concentration Fraction Based On Isotopic Analysis of a Breathing Zone Air Filter

The derived air concentration fraction (F_{DAC}) for each air filter analyzed isotopically is then calculated from the radiochemical analysis as follows:

$$F_{\text{DAC}} = \sum_i \frac{C_i}{\text{DAC}_i}$$

Where:

- C_i = The concentration of isotope i calculated for an individual air filter or a batch of air filters
- DAC_i = The DAC for each nuclide in the mixture.

The concentration is calculated from each isotope in the sample as follows:

$$C_i = \frac{A_i}{\sum(f * t_f)}$$

Where:

- A_i = The isotopic activity measured for the sample

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 29 of 95

- $\sum (f * t_f)$ = The total volume associated with the isotopic sample (individual or batch)
- f = The flow rate for each air filter in the sample (individual or batch)
- t_f = The duration that each air filter is drawing air at flow rate f (individual or batch)

As with calculation of an effective DAC in section 5.1.1 above, radioactive progeny may be assumed to be in equilibrium with that of the parent. It is also acceptable to assume that the concentration of U-235 is 4.7 percent, by activity, of U-238 or U-234.

The isotopes of radon and their progeny should be excluded from the DAC_{eff}. Excluding radon and their progeny is negligible as the DACs for radon progeny are very large when compared to the parent isotopes.

For uranium with a mixed solubility class, either assume that all uranium is of the most conservative solubility class (class Y), or treat each solubility class as a separate isotope.

5.2.2 Dose Assignment to Individuals Based On Isotopic Analysis of Breathing Zone Air Filter(s)

Dose may be calculated in the same manner as in section 5.1.3, above.

5.2.3 Example Dose Calculation from an Air Filter Analyzed by Isotopic Analysis

A worker is in the work area for a duration of 20 hours in one week. Several air filters for that work area including the one for this worker's entries are batched together that week. The total volume of all samples collected in the batch is 1.3E+07 mL. Radiochemical analysis yields the data given in Table 8, "Example of Isotopic Data from Air Filter."

From this data, it is apparent that the value for U-235 could be better represented by the activity U-234 and U-238. In this example, it will be assigned a value equal to 4.7 percent of average activity for U-234 and U-238.

The activities of the progeny are assigned the same activity as the parent. The activity per unit volume of air is calculated by dividing the sample activity by the total volume of air collected by all individual samples. The total volume of air for the batch is 1.3E07 mL.

The pertinent data and calculations for each radionuclide are listed in Table 9, "Example Calculation of Derived Airborne Concentration Fraction for Radionuclide Mixture on Air Filter." DAC values are from 10 CFR 20 Appendix I.

The dose to the worker exposed to this DAC fraction is therefore:

$$D_j = 0.33 \left(\frac{5 \text{ rem}}{2000\text{h}} \right) 20\text{h} = 1.7E - 2\text{rem} = 17\text{mrem}$$

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 30 of 95

5.3 Count Times and Minimum Detectable Activities for Gross Alpha Counting of Breathing Zone Air Samples

A cumulative MDA equivalent to a Minimum Detectable Dose (MDD) of less than 100 mrem accumulated in a 2000-hour work year (250 work-days) was chosen as the criteria for setting the routine count time for multiple entry BZ samples using gross alpha counting techniques.

- 100 mrem is equivalent to an intake of 40 DAC-hr.
- 100 mrem is less than 500 mrem, the level at which monitoring is required per EM 385-1-1 06.E.05d, and 10 CFR 20.1502.
- 100 mrem is also equal to the level which monitoring is required by EM 385-1-80.
- Using an annual accumulation of 100 mrem for determination of detection sensitivity a count time results in sufficient sensitivity to show compliance with 29 CFR 1910s 40 MPC-hr limit for the expected ROC at the FMSS.

The combination of counting time and flow rate must be sufficient so that the MDA for individual BZA samples yields a Minimum Detectable Dose (MDD) less than 100 mrem for a 2,000 hour work year (250 work-days). The term MDD substitutes for MDA in the following equations.

It is presumed that a sample is collected for the entire length of time an individual is exposed for purposes of estimating the required MDA for individual samples. Thus, for the purpose of these calculations, the sample collection time is set equal to the work-shift. The MDD for a single work shift is estimated as follows:

$$MDD_{1-work\ shift} \cong \frac{3.29 \sqrt{B \cdot t_s \left(1 + \frac{t_s}{t_b} \right)}}{f \cdot W \cdot t_s \cdot Eff \cdot SAF \cdot 2.22E6\ dpm/uCi \cdot F_{DAC}} \cdot W$$

Where:

- B = the background count rate,
- t_s = the sample count time,
- t_b = the background count time,
- f = the sample flow rate,
- Eff = the detector efficiency,
- SAF = is the sample self-absorption coefficient for gross alpha counting,
- F_{DAC} = the DAC fraction, and
- W = the hours in an average sample collection time and is assumed to be equal to the work shift time.

It is assumed that the worker works for 250 average work shifts in a year for purposes of estimating the overall MDD. The effect on the overall MDA is equivalent to multiplying the background counts for a single shift ($B \cdot t_s$) by 250, multiplying the total volume ($f \cdot W$) by 250 and by multiplying the total number of work shifts by 250. Statistically, dividing an individual's sample for the entire year into 250 un-equally divided pieces and analyzing each

piece for the same period of count time would be the same as to hypothetically analyze the overall sample once on an instrument with 250 times the background count rate. The overall MDD for an entire year is equal to:

$$MDD_{250\text{-work shifts}} \cong \frac{3.29 \sqrt{250 \cdot B \cdot t_s \left(1 + \frac{t_s}{t_B}\right)}}{250 \cdot f \cdot W \cdot t_s \cdot Eff \cdot SAF \cdot 2.22E6 \text{ dpm/uCi} \cdot F_{DAC}} \cdot 250 \cdot W$$

The equation reduces to:

$$MDD_{250\text{-work shifts}} \cong \sqrt{250} \cdot MDD_{1\text{-work shift}} = 15.8 \cdot MDD_{1\text{-work shift}}$$

Hence, to achieve a MDD for the entire year of 40 DAC-hrs (100 mrem), the MDD for an average work shift should be:

$$MDD_{1\text{-work shift}} = \frac{40 \text{ DAC-hrs}}{15.8} = 2.52 \text{ DAC-hrs}$$

In practice the MDA of the individual sample can be calculated using the following equation,

$$MDA \cong \frac{2.7 + 3.29 \sqrt{B \cdot t_s \left(1 + \frac{t_s}{t_B}\right)}}{f \cdot W \cdot t_s \cdot Eff \cdot SAF \cdot 2.22E6 \text{ dpm/uCi}}$$

Conservatism is also built into the equation, as it is also unlikely that any worker will be working in radiological zones for 250 days in a year.

The requisite count time for samples is determined from the MDD for an individual sample taken for one work shift is as follows:

$$MDD \cong \frac{2.7 + 3.29 \sqrt{B \cdot t_s \left(1 + \frac{t_s}{t_B}\right)}}{f \cdot W \cdot t_s \cdot Eff \cdot SAF \cdot 2.22E6 \text{ dpm/uCi} \cdot F_{DAC}} \cdot W = 2.52 \text{ DAC-hrs}$$

Given that the fact that the background will be counted for a time that is much longer than the sample count time, the equation reduces to:

$$2.52 \text{ DAC-hrs} \cong \frac{2.7 + 3.29 \sqrt{B \cdot t_s}}{f \cdot t_s \cdot Eff \cdot SAF \cdot 2.22E6 \text{ dpm/uCi} \cdot F_{DAC}}$$

Default values for typical gross alpha counting are substituted and the sample count time, t_s , calculated empirically. The default values are:

- F = 2 lpm (Nominal flow rate for BZA samplers currently in use),
- Eff = 29 percent (The actual efficiency of the detector currently in use),
- B = 0.1 cpm (Conservative to the actual detector background),
- F_{DAC} = 2.6E-12 $\mu\text{Ci/mL/DAC}$

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 32 of 95

$$SAF = 0.7$$

Solving empirically, the count time should be at least 22 minutes for the instruments currently in use, regardless of the sample collection volume.

5.4 Use of Negative Numbers

Per NRC Regulatory Guide 8.25, “the monitoring criteria should not be considered requirements on the sensitivity of a particular measurement because when the results of multiple measurements are summed, the sum will have a greater statistical power than the individual measurements” and “to achieve the greater statistical power, the licensee should record all numerical values measured, even values that are negative because the measured count rate is below the background.” “Results should not be recorded as “below MDA” or similar statements”.

Therefore, when analyzing data for workers who have made multiple entries to the Restricted Area in a year, and who have multiple samples associated with their entries, it is prudent to include all analytical results in the overall summation of dose without regard as to each sample result is greater than the MDA, positive or negative. The same is true whether analyzing individual samples by gross alpha, isotopically in a batched sample, or individual isotopes in a single isotopically analyzed sample.

Use of the MDA to estimate dose for individual sample results that are less than the L_c should be only on a case-by-case basis when assessing a single potentially large exposure (i.e., an exposure for which the calculated dose is at or near action levels).

5.5 Gross Alpha Analysis

The analytical instrument for performing air sample analysis should be a gas flow proportional detector with a cosmic guard detector. Analysis instruments should have stable efficiencies and backgrounds, and should have as low as practical and stable backgrounds.

It is also necessary to minimize interference from the decay of Pb-212, 10.6 hr half-life and Rn-220 progeny, collected on the filter paper. This can be achieved by waiting a minimum of five (5) full days after sample collection prior to performing a record count.

5.6 Occupational Safety and Health Administration Compliance

The OSHA limit related to internal exposure is 40 MPC-hours in a week. Compliance should be routinely demonstrated by monitoring the exposure in DAC hours per week. The value is obtained by the following formula:

$$\text{Limit} = 40 \text{ MPC-hrs} * \text{MPC}_{\text{eff}}/\text{DAC}_{\text{eff}}$$

Attachment 1 gives the individual MPC and DAC for each isotope and for the overall series. For the most conservative case of Th-232 in equilibrium with its progeny (Th-232_{eff}), the limiting value is 125 DAC-hrs per week, as shown below:

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 33 of 95

$$OSHA \text{ Limit} = 40 \text{ MPC} - \text{hrs}/\text{week} * \frac{8.2E-12 \text{ uCi}/\text{ml}/\text{MPC}}{2.6E-12 \text{ uCi}/\text{ml}/\text{DAC}} = 126 \text{ DAC} - \text{hrs}/\text{week}$$

The OSHA dose limit is 1.25 rem per quarter. The OSHA dose limit of 1.25 rem per quarter is expected to be approached only if the average weekly DAC-hrs over a 13-week period approaches 126 DAC-hrs since:

- The external dose for the radionuclides of concern is small with respect to internal dose.
- The value for the Thorium-232_{eff} DAC is three times more conservative than that for the Thorium-232_{eff} MPC (Section 5.6 and Attachment 1).

The intake for Th-232_{eff} equivalent to the OSHA quarterly dose limit is calculated as follows:

$$LI = MPC * BR * t$$

Where

- LI = the limit of intake in μCi for time period t .
MPC = the OSHA MPC. MPC = $8.2E-12 \mu\text{Ci}/\text{mL}$ for Th-232_{eff}
BR = the Occupational Breathing Rate = $1E7 \text{ mL}$ per 8 hours
T = the time duration of the intake, or 500 hours per quarter

$$LI = 8.2E-12 \mu\text{Ci}/\text{mL} * 1E7 \text{ mL}/8\text{hr} * 500 \text{ hr}$$

$$= 5.1 E-3 \mu\text{Ci}$$

Since the above is based on the Th-232 decay chain which has more conservative (smaller) MPC values than the U-238 decay chain or than Ra-226, half of the above or an intake of $2.5E-3 \mu\text{Ci}$ in one quarter may be used as an action level for determining if more specific OSHA dose calculations based upon isotopic activities should be performed prior to reporting to OSHA.

NOTE: Intakes this large are highly unlikely with the concentrations of radionuclides at the FMSS since the maximum annual intakes at the FMSS have been on the order of hundreds of DAC-hrs total for a year. Maximum annual intakes at the FMSS have been less than $1E-04 \mu\text{Ci}$ per year.

5.7 Identifying Abnormally High Intakes and Follow-Up Bioassay

When performing activities that could potentially lead to a significant intake of radioactive materials, a preliminary count should be performed to identify abnormally high intakes so that fecal samples may be collected for assessing such intakes. Fecal sampling is generally only suitable for assessing intakes when the sample is collected within 3 days after the intake. The preliminary counts are in addition to the record counts and should not be used as the record count. The intent of this section is to provide guidance as to when to consider fecal sampling. The decision to actually perform fecal sampling should be based on the judgment of the radiation protection staff.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 34 of 95

A preliminary gross alpha count taken shortly after sample collection is expected to be elevated, due to interferences from radon progeny. The isotopes responsible are the Rn-220 progeny (half life) Pb-214 (26.8 min) and Bi-214 (19.9 min) and the Rn-222 progeny Pb-212 (10.6 hr).

The level at which fecal sampling should be considered is 5 DAC (to yield 40 DAC-hrs in an 8-hr work day). The DAC_{eff} to be used in initial calculations should either be calculated from method #1 above, or be 2.6E-12 for Th-232 in equilibrium with its progeny.

An initial count should be taken after 5 hours, to allow for the decay of Pb-214 and Bi-214. The following logic should be utilized in determining if bioassay is required:

- If the initial count yields less than 5 DAC, then no further action is required.
- If the initial count is greater than 5 DAC and the initial count was performed at 3 or more days post intake, then consider immediately having all affected employees submit a fecal sample.
- If the initial count is much greater than 5 DAC, then consider immediately having all affected employees submit a fecal sample.
- If the initial count is greater than 5 DAC and the initial count was performed at less than 2 days post intake, then perform a second count the following morning. If the second count is less than 5 DAC, no further action is required. If the second count is also greater than 5 DAC, then perform a decay correction, described below, to assess the activity due to long-lived isotopes. If the decay corrected activity is greater than 5 DAC, then consider having all affected employees submit a fecal sample.

The equation to account for the decay of Pb-212 in an air sample is:

$$DAC_{LL} = \frac{DAC_2 - DAC_1 * e^{-\lambda\Delta t}}{1 - e^{-\lambda\Delta t}}$$

Where:

- DAC_{LL} = the derived air concentration due to long-lived isotopes,
- DAC₁ = the derived air concentration from the first count,
- DAC₂ = the derived air concentration from the second count,
- Δt = the time difference in hours between the first and second count, and
- λ = the decay constant for Pb-212, 0.0655 hr⁻¹.

When considering fecal sampling, the ideal time for collecting a sample is after one (1) full day post intake through the third (3rd) full day post intake. Samples collected before the first full day and after the third full day are difficult to assess as the radionuclide excretion is extremely variable from case to case. If a significant intake is suspected (greater than 25 percent of an ALI), multiple samples should be considered over a period of a few days. From a dosimetry standpoint, it is better to collect an unnecessary sample than not to collect a sample at all and lose the opportunity to collect useful data.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 35 of 95

5.8 Breathing Zone Air Sampling Frequency

The recommended frequency when assigning BZ samples is as follows:

- When the work area is expected to exceed 5 percent of a DAC and the work is expected to exceed 1 hour in duration, the recommended frequency is a minimum of one worker out of every five should wear a BZA sampler. If there are less than five workers, at least one worker should wear a BZA sampler. The recommended BZ frequency is not intended to include workers spending less than 1 hour in the work area.
- Consider increasing the number of BZ samplers assigned when the work area is expected to exceed 25 percent of a DAC to one (1) worker out of every two (2).

10 CFR 20.1502 and USACE EM385-1-1 06.E.05 is interpreted to require individual monitoring for any worker who has exceeded, or could be expected to exceed, a CEDE of 500 mrem. Individuals who have exceeded, or potentially could exceed the ALARA goal of 500 mrem per year should always wear a BZA sampler whenever the work area has the potential to exceed 5 percent of a DAC.

5.9 Dose Assignment Strategy

Note: The dose assignment strategy discussed in this section is one approach suitable for determining occupational exposures for FMSS workers. Alternative methodologies may be employed provided they captured under separate technical basis and are reviewed/approved by the Project CHP and Project RSO.

The assignment of an air concentration to individual workers should follow the below listed decision scheme:

- An individual who wears a BZA Sampler should be assigned the dose based on the air concentration resulting from the BZA Sampler worn.
- When an individual does not wear a BZA Sampler, but other workers do AND the air concentration from all samplers is less than 50 percent of a DAC for an activity work permit for a given day:
 - All members of the same craft should be assigned a dose based on the air concentration from the average of all BZA Samplers worn by the same craft for the same activity work permit on the same day.
 - Individuals in crafts in which no members of the craft have worn a BZA Sampler should be assigned the dose based on the air concentration based on the average of all BZA Samplers worn by all crafts for the same activity work permit.
- For entries into areas in which no BZA Samplers were worn for the activity work permit, a dose should be assigned based on the greater of the average air concentration from BZA Sampler filters for the activity work permit spanning the entire month or the highest concentration found from general area sampling and perimeter sampling.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 36 of 95

- When an individual does not wear a BZA Sampler, but other workers do and the air concentration from any BZA Sampler is greater than 50 percent of a DAC for an activity work permit for a given day, then consideration should be given to assigning all individuals a dose based on the highest air concentration found for the day.

5.10 Reporting Internal Doses

All positive internal doses for the year should be reported as the actual level calculated. Doses less than zero should be reported as zero. Internal doses calculated from the use of 10 CFR 20 DAC values should be reported with one significant figure. Doses calculated from bioassay measurements may be reported as two significant figures.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 37 of 95

6.0 AREA AND PERIMETER AIR PARTICULATE SAMPLING

6.1 General Area Air Samples

General area air samples are collected in the work area, generally with a low volume air sample pump with a flow of approximately 50 lpm. General area samples are obtained to supplement BZA samples and should be taken in conjunction with operations involving radioactive materials. General area sampling is much more sensitive than BZA sampling due to higher flow rates and sample volumes. Sensitivity for general area samples is not expected to be a concern. However, because the BZA samples are taken near the nose and mouth, BZA samples are much more representative of a workers intake than general area samples.

The specific goals of general area sampling are:

- To provide a backup sample in case of a failure to obtain adequate BZA samples.
- To verify that breathing air concentrations are low during expected work that is short in duration.
- To confirm that breathing air has a low concentration during operations that are not expected to generate significant airborne radioactivity.
- To verify that the air concentration is low outside of work areas when those areas are occupied by radiation workers, e.g. at a control point.

Because general area samples are not directly representative of breathing air, an evaluation should always be performed when using a general area sample to assign dosimetry to an employee. Calculations of dose should be generally similar to those from BZA samples. The evaluation should typically contain the following components:

- An evaluation of the sampler placement in relation to work activities and employee locations.
- A comparison of the results from valid BZA samples to corresponding general area samples. If a ratio is found between general area sample results and BZA sample results, it may be applied to general area sample results to estimate the activity in breathing air.
- An estimate of the exposure period and the calculation of individual exposures.

6.2 Perimeter Air Samples

The controlling limit for airborne effluent is 10 mrem/yr to the maximum exposed member of the general public in accordance with 40 CFR 61 (NESHAP). Doses to the public are formally assessed using the CAP88-PC model per NESHAP and reported in the Annual Environmental Monitoring Report. FMSS perimeter air sampling is used primarily to verify the adequacy of site engineering and administrative controls, and can be used to support compliance with NESHAP, 10 CFR 20 and EM 385-1-1 dose limits to the public by ensuring that air effluent leaving the site and resulting internal exposures to members of the public meet the effluent release limits of

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 38 of 95

NESHAP, which is the most restrictive of the dose limits. NESHAP dose limits are 10 mrem/year to members of the public. This is accomplished by verifying that the annual average air effluent from the site is less than a derived effluent limit (DEL). The DEL levels are equivalent to a value of 1/5 the level of 10 CFR 20 Appendix B, Table 2 effluent limit for air.

Perimeter monitors at the FMSS consist of permanently installed air samplers at the MISS perimeter and temporary monitors located at publicly accessible boundaries near active work sites. Perimeter samplers at the MISS are to run 7 days a week 24 hours per day. Temporary monitors may be set to run only during active, localized operations.

Ordinary ambient airborne radioactivity from natural sources is expected to contribute to the total activity of perimeter air samples. The relevant ambient isotopes present in the atmosphere are Pb-210 (22.3 yr beta emitter; progeny of Rn-222) and its progeny Po-210 (138.4 d alpha emitter). The ambient concentration of these nuclides could be equal to or greater than the DEL for Th-232. Pb-210 is a beta emitter and will not be detected using gross alpha counting methods.

Due to the ambient concentration of Pb-210 and Po-210, all sampling efforts should include an associated offsite measurement for ambient radionuclides. Each individual sample should be counted by a gross alpha measurement. The net activity of the filter can be calculated by subtracting the offsite measurement from the perimeter sample activity. It is recommended that perimeter samples be batched together and analyzed by radiochemical methods.

As with the BZA samples, radioactive progeny may be assumed to be in equilibrium with that of the parent. It is also acceptable to assume that the concentration of U-235 is 4.7 percent, by activity, of U-238 or U-234.

The isotopes of radon and their progeny should be excluded from the DEL calculation. Excluding radon and their progeny is conservative as it is likely that radon isotopes will emanate from the filter paper and the DEL for each isotope is relatively large.

For uranium with a mixed solubility class, either assume that all uranium is of the most conservative solubility class (class Y), or treat each solubility class as a separate isotope.

Gross alpha measurements should be reduced in a manner similar to BZA samples. For conservatism, the DEL_{eff} may be assigned a value of 2.8E-15 for Th-232 in equilibrium with its progeny. The DEL_{eff} can be calculated more precisely from either batched BZA samples, soil samples, or batched perimeter samples. The DEL_{eff} is calculated as follows:

$$DEL_{eff} = f_{\alpha} \left[\sum_i (f_i / DEL_i) \right]^{-1}$$

Where:

- f_{α} = The ratio of the total alpha activity in the mixture to the total activity of the mixture.
- f_i = The ratio of the concentration of each radionuclide to the total activity of the mixture.
- DEL_i = The DEL for each nuclide in the mixture.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 39 of 95

In addition to a gross alpha analysis, it is recommended to batch several samples together and determine the DEL of the batch through a radiochemical analysis. Each individual sample should be assigned the DEL of the batch.

The DEL for each batch is then calculated from the radiochemical analysis as follows:

$$DEL = \sum_i \frac{C_i}{DEL_i}$$

Where:

- C_i = the concentration of isotope i. The ratio of the total alpha activity in the mixture to the total activity of the mixture.
 DEL_i = the DEL for each nuclide in the mixture.

6.2.1 Minimum Volumes and Minimum Detectable Activities

The minimum volume for sample collection is a function of the desired MDA for analysis. The MDA for each gross alpha analysis should be less than approximately 25 percent of the DEL, assuming samples are also analyzed by radiochemical methods. Due to the large expected background contribution, a lower level would result in more accurate results; however 25 percent of a DEL is the lowest realistic level achievable level.

The Table 10, "Collection Volumes for Perimeter Samples to Meet Required MDA on the Gross Alpha Count as a Function of Count Time," is a guide in determining minimum sample volumes, and the same instrument parameters are assumed as in the BZA samples. The following equation was used in developing Table 10:

$$25\% DEL = \frac{2.7 + 3.29 \sqrt{B \cdot t_s \left(1 + \frac{t_s}{t_b}\right)}}{V \cdot t_s \cdot Eff \cdot SAF \cdot 2.22E6 \text{ dpm/uCi} \cdot DEL_{Eff}}$$

Where:

- B = the background count rate (set to 0.1 cpm)
 t_s = the sample count time
 t_b = the background count time (set equal to t_s)
 V = the volume in mL
 Eff = the detector efficiency (set equal to 0.29)
 SAF = the sample self absorption coefficient for gross alpha counting (set equal to 0.7)
 DEL_{Eff} = the Effective Derived Effluent Limit (set equal to $2.8E-15 \mu\text{Ci/mL}$)

As can be seen from the Table 10, it is not possible to collect an adequate perimeter sample volume for a gross alpha analysis for short duration work with a sample pump that draws 50 L/min. All such samples should be batched and submitted for isotopic counting.

6.2.2 Gross Alpha Analysis

As with the BZA samples, it is desired to count all samples on a detector with a stable efficiency and background that is as low as practical and stable background. The analytical instrument for

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 40 of 95

performing air sample analysis should be a gas flow proportional detector with a cosmic guard detector.

It is also necessary to minimize interference from the decay of Pb-212, 10.6 hr half-life and Rn-220 progeny, collected on the filter paper. For perimeter samples, this can be achieved by waiting a minimum of 10 full days after sample collection prior to performing a record count.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 41 of 95

7.0 OCCUPATIONAL RADON EXPOSURE

The dosimetry program must account for exposure to radon and its progeny, when the source of elevated radon levels is from FUSRAP materials (NRC, 1995). Ambient sources do not need to be considered. Unlike exposure to other radionuclides, USACE and NRC limits for radon exposure are based on intake as opposed to dose received from an intake.

The 10 CFR 20 ALI for Rn-222 and its progeny is 4 working level months (WLM) per year or $1\text{E}+02$ μCi . The DAC is 0.33 working levels (WL) or $3\text{E}-08$ $\mu\text{Ci}/\text{mL}$. The ALI for Rn-220 and its progeny is 12 WLM per year or $2\text{E}+01$ μCi . The DAC is 1.0 WL or $9\text{E}-09$ $\mu\text{Ci}/\text{mL}$. One WL is the quantity of radon progeny in air that will ultimately release $1.3\text{E}+05$ megaelectron volt (MeV) of energy. A WLM is the exposure to one (1) WL for 170 hours.

Dose received from exposure to radon isotopes are the assigned the values from 10 CFR 20. Rn-222 exposures will be assigned 1.25 rem CEDE/WLM. Rn-220 exposures will be assigned 0.42 rem CEDE/WLM.

The 10 CFR 20 ALI for Rn-222 without its progeny is $1\text{E}+04$ μCi . The DAC is $4\text{E}-06$ $\mu\text{Ci}/\text{mL}$. The ALI for Rn-220 without its progeny is $2\text{E}+04$ μCi . The DAC is $7\text{E}-06$ $\mu\text{Ci}/\text{mL}$.

Monitoring of individual exposure to radon is required when an individual is likely to receive 10 percent or more of the ALI. To assess radon exposure, it is necessary to measure the radon concentration in the air above background and to track individual exposure times. Detection methods for radon include: (1) alpha track-etch detectors, (2) electrets, (3) continuous radon monitors, (4) continuous working-level meters, and (5) particulate grab samples.

Alpha track-etch detectors, electrets, and continuous radon measurements are relatively easy and inexpensive measurements. The track-etch detectors and electrets are sensitive to the concentration of radon gas averaged over an extended period of time. The three methods are sensitive to the concentration of radon gas, and does not measure the concentration of radon progeny nor discriminate between Rn-220 and Rn-222. When these techniques are used, it is appropriate to use DAC values expressed in units of $\mu\text{Ci}/\text{mL}$.

Particulate grab samples directly measure the progeny concentration in the air. Grab samples are more are time intensive and hence more expensive. The grab sample is a five-minute sample followed by a gross alpha analysis of the filter paper. A second gross alpha count can account for both isotopes of radon. A continuous working level meter also measures directly the radon progeny in the air. The special devices should be considered when planning long-term work activities in high radon areas. When assessing dosimetry from these techniques, it is appropriate to use DAC values expressed in WL.

Air purifying respirators are effective in removing radon progeny from the air, but not the radon gas. Dosimetry calculations include both the contribution from radon and its progeny present (multiplied by the respiratory protection factor) and the contribution from radon with its progeny removed (without a respiratory protection factor).

For example:

Assume an individual works in an atmosphere of 1.5 WL of Rn-222 for 8 hours and is wearing an air purifying respirator with a protection factor of 100. The contribution of Rn-220 is negligible, as demonstrated by the following evaluation.

- a) Radon Gas. In the absence of more information, it can be assumed that 0.33 WL is equivalent to a gas concentration of $3E-08 \mu\text{Ci/mL}$. Hence, it can be inferred that the gas concentration is $1.4E-07 \mu\text{Ci/mL}$. The exposure received from the radon gas is:

$$CEDE = \frac{1.4E-07 \mu\text{Ci}/\text{ml} * 8\text{hrs}}{4E-06 \mu\text{Ci}/\text{ml}/\text{DAC}} * 2.5 \text{mrem}/\text{DAC} - \text{hr} = 0.68 \text{mrem}$$

- b) Radon Particulates. The appropriate DAC value to use is 0.33 WL multiplied by the respiratory protection factor. The exposure received from the radon particulates is:

$$CEDE = \frac{1.5 \text{WL} * 8\text{hrs}}{0.33 \text{WL}/\text{DAC} * 100} * 2.5 \text{mrem}/\text{DAC} - \text{hr} = 0.91 \text{mrem}$$

- c) Total Radon Exposure. The total exposure from this work is the sum of both exposure from both the gas and particulates:

$$CEDE = 0.68 \text{mrem} + 0.91 \text{mrem} = 1.6 \text{mrem}$$

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 43 of 95

8.0 EXTERNAL DOSIMETRY

The DDE is the WB dose (to the head, trunk, arms above the elbow, or legs above the knee) at a tissue depth of 1 cm. It is commonly measured with a thermoluminescent dosimeter (TLD). A description of the TLD is found in Attachment 3, "Thermoluminescent Dosimeter Description." Alternative means for recording DDE are optically stimulated luminescent dosimeters, film badges, electronic dosimeters, or direct self-reading dosimeters.

The SDE is the dose equivalent to the skin of the whole body or any extremity at a tissue depth of 0.007 cm averaged over an area of 1 square centimeter. The dose to the skin of the whole body and to extremities are measured separately. SDE_WB is the dose to the skin of the whole body. The dose to the skin is measured with a TLD badge.

The SDE_ME is the dose to the extremities. The SDE_ME is monitored in cases where the dose to an extremity could exceed the ALARA goal of 0.5 rem in a calendar year. The dose to extremities is measured, as necessary, with a special TLD that is made to fit over one's finger.

The LDE is the dose equivalent to the lens of the eye at a tissue depth of 0.3 cm. The LDE is generally not measured at FMSS. Routine compliance with applicable regulatory standards is by demonstrating that both the SDE to the skin and the DDE are less than 1.25 rem in any quarter. Meeting the ALARA goal is demonstrated when both the SDE to the skin and the DDE are less than 0.15 rem per year ALARA goal for the lens of the eye (see Section 2.2.2). If the SDE or DDE is over 0.15 rem per year, an investigation would be performed to determine the LDE.

The TLD in use at FMSS is Code 9:TLD-XBG manufactured by the Radiation Detection Company. Attachment 4, "Derived Air Concentrations Values and Dose Conversion Factors for use at the Maywood Superfund Site," contains manufactures literature detailing the construction, response characteristics, and dose calculations. It uses a single lithium fluoride (TLD-100) chip and one tube of TLD-100 powder. As with any TLD, the response is dependent upon the energy of the incident radiation. The dosimeter is normally calibrated for photons using a Cs-137 point source and a U-238 slab source. The response of the TLD from to the calculation of the SDE, and DDE from any energy photons above 30 kiloelectron volts (0.03 MeV) is within 75 percent of the calibrated response. The response of the TLD from beta particles to the calculation of the SDE is highly dependent on the energy of the beta, it may differ as much as a factor of 7 from the calibration response. The dosimeter may also be used to assess the LDE, however, this should only be done after careful consideration of the beta energy and any shielding present (e.g. safety glasses or mask lenses). The sensitivity of the dosimeter for quarterly monitoring is 20 mrem for photons, 100 mrem for beta particles with a maximum energy greater than 1 MeV and 500 mrem for beta particles with a maximum energy less than 1 MeV. The maximum reportable dose from the dosimeter is 500 rem.

It is not expected that external exposures will approach 10 percent of the applicable regulatory limits of 10 CFR 20 nor 25 percent of the applicable regulatory limits of 29 CFR 1910.1096. Thus, there is NOT a regulatory mandate to perform external exposure monitoring. However, due to the inexpensive nature of external exposure monitoring, it is elected that external exposure monitoring will be routinely performed. All radiation workers should be issued a TLD before entry into a radiologically controlled area. Each group of visitors entering a radiologically controlled area should be issued a TLD or alternate dosimetry. To demonstrate compliance with

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 44 of 95

quarterly exposure guidelines of OSHA, TLDs should be read quarterly or more frequently as necessary. Due to the uncertainty in calibration of the TLD from beta sources, all external exposures in excess of ALARA goals should be investigated.

8.1 Reporting External Exposures

The minimum reporting level for DDE and SDE, under routine circumstances, is 10 mrem. Doses calculated under this level will be reported as ND for non/not detectable. Doses below this level are reported as not detectable by the TLD vendor. The LDE and SDE_ME will normally be reported as NM (for non/not measurable). If extremity dosimetry is issued specially, the SDE_ME would be reported. If the SDE or DDE is above 0.15 rem, the level for ensuring compliance with the ALARA goal, an investigation as to the actual LDE would be performed and the dose reported.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 45 of 95

9.0 REFERENCES

American National Standards Institute, 1999, *Practice for Occupational Radiation Exposure Records Systems*, ANSI/HPS N13.6-1999, May.

American National Standards Institute, 2001, *Design of Internal Dosimetry Programs*, ANSI/HPS N13.39-2001, May.

Brookhaven National Laboratory, 1987, *Interpretation of Bioassay Measurements*, NUREG/CR-4884.

Eckerman, K.F., A.B. Wolbarst, and A.C.B. Richardson, 1988, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, Federal Guidance Report No. 11, EPA 520/1-86-020, U.S. Environmental Protection Agency.

International Commission on Radiological Protection, 1987, *Recommendations of the ICRP*, ICRP Publication 26, Reprinted (with additions) in 1987.

International Commission on Radiological Protection, 1988, *Individual Monitoring for Intakes of Radionuclides by Workers: Design and Interpretation*, ICRP Publication 54.

Keele, B.D., 2001, *DAC Values and Dose Conversion Factors for use at the Maywood Superfund Site*, Calculation 085750402-RAD-2001-004, July.

McCully, R., 1992, *Letter from Ruth McCully, Director, OSHA Office of Health Compliance assistance, to Richard Schreiber, Environmental Specialist, Georgia Radon Program*, Occupational Safety and Health Administration, October 6.

Oak Ridge Institute for Science and Education, 1996, *Lung Fluid Solubility Studies for Samples from FUSRAP Sites*, prepared by M.J. Laudeman for the U.S. Department of Energy, April.

Occupational Safety and Health Administration, 1999, *OSHA Technical Manual, Section II: Sampling Measurement Methods and Instruments*, TED 1-015A, Jan. 20.

Reider, B.L., 2001, *Mean Activities and Ratios of Activities in Soil of Phase II Properties at Maywood FUSRAP*, Calculation 085750402-RAD-2001-002, July.

Roth, P., et. al., 1997, *Journal of Radioanalytical and Nuclear Chemistry*, Vol. 226.

Transmittal FMSS00.017 from SEC to Stone & Webster, Dated 3/20/2000, “(1) Radiological Survey Air Survey – Thoron Daughters – Sheets for January 18, 2000 through February 25, 2000” and Attachments.

Transmittal FMSS00.092 From SEC to Stone & Webster, Dated 1/22/2001, “(1) Radiological Survey Air Sampling Radon Daughters dated 11/16/00 counted at 9:55; (2) Radiological Survey Air Sampling Radon Daughters dated 11/16/00 counted at 15:05 ” and Attachments.

U.S. Army Corps of Engineers, 2008, with 2010 Errata #1, *Safety and Health Requirements Manual*, EM 385-1-1.

U.S. Army Corps of Engineers, 2013, *Radiation Protection Manual*, EM 385-1-80.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 46 of 95

U.S. Army Corps of Engineers, 2013, *Soils Operable Unit (OU)-1 Remedial Action*, Contract No. W912DQ-13-D-3016.

U.S. Army Corps of Engineers, 2001, *Annual Environmental Monitoring Report- 2000*, FUSRAP Maywood Superfund Site, June.

U.S. Army Corps of Engineers, 2005, *Groundwater Remedial Investigation Report, Rev. 4*, FUSRAP Maywood Superfund Site, July.

U.S. Nuclear Regulatory Commission, 1995, *Question 4, Health Physics Questions and Answers Based on 10 CFR Part 20*, February 7.

U.S. Nuclear Regulatory Commission, 1996, *NRC Information Notice 96-18: Compliance with 10CFR Part 20 for Airborne Thorium*, see Attachment 3, March 25.

U.S. Office of the Federal Register, 1971, *Code of Federal Regulations, Title 10, Energy, Part 20, Standards for Protection against Radiation*.

U.S. Office of the Federal Register, 2001, *Code of Federal Regulations, Title 10, Energy, Part 20, Standards for Protection Against Radiation*, January.

U.S. Office of the Federal Register, 2001, *Code of Federal Regulations, Title 29, Labor, Part 1910.1096, Ionizing Radiation*, July.

U.S. Office of the Federal Register, 2001, *Code of Federal Regulations, Title 40, Protection of Environment, Part 61, National Emission Standards for Hazardous Air Pollutants, Subparts 90 through 108*, July.

Tables

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR
SAMPLING PROGRAMS

NO.: PP-8-500-4
(12/2013)

PAGE: 48 of 95

Table 1
Activity in Soil Samples

Property ID	Th-232 Mean Activity (pCi/g)	Th-232 Maximum Activity (pCi/g)	Ra-226 Mean Activity (pCi/g)	Ra-226 Maximum Activity (pCi/g)	U-238 Mean Activity (pCi/g)	U-238 Maximum Activity (pCi/g)	Ratios of Means Th-232/ Ra-226	Ratios of Means Th-232/ U-238
01a	1.23	1.47	0.74	1.01	1.05	1.66	1.67	1.18
02a	33.53	116.90	10.25	51.35	27.95	119.50	3.27	1.20
02c	9.87	31.64	1.19	2.16	5.24	11.16	8.32	1.88
02d	4.81	7.21	1.33	1.59	5.23	8.18	3.62	0.92
03a	1.02	1.24	0.95	0.99	2.66	5.19	1.07	0.38
04a	13.45	58.08	2.19	6.71	3.48	9.88	6.14	3.86
04b	2.77	7.20	1.07	1.81	1.97	4.46	2.59	1.40
05a	7.17	8.43	1.53	1.72	6.66	8.49	4.70	1.08
05b	2.76	4.17	1.56	3.06	2.19	4.14	1.77	1.26
05c	22.78	42.06	2.56	3.13	3.74	4.93	8.89	6.09
06a	29.39	180.00	5.43	30.14	9.68	42.11	5.41	3.04
06b	156.48	537.20	21.23	94.99	28.21	77.04	7.37	5.55
06c	16.68	71.73	2.94	9.29	6.62	11.02	5.67	2.52
06d	29.44	86.43	2.51	5.97	5.83	11.60	11.74	5.05
06e	1.00	1.16	0.66	0.72	1.55	2.20	1.50	0.64
07a	101.37	391.20	8.18	32.17	16.55	47.34	12.39	6.13
07b	1.22	1.45	1.92	3.55	36.09	105.00	0.64	0.03
08a	52.78	336.60	7.46	33.66	14.34	79.52	7.08	3.68

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
(12/2013)

PAGE: 49 of 95

Table 1 (continued)
Activity in Soil Samples

Property ID	Th-232 Mean Activity (pCi/g)	Th-232 Maximum Activity (pCi/g)	Ra-226 Mean Activity (pCi/g)	Ra-226 Maximum Activity (pCi/g)	U-238 Mean Activity (pCi/g)	U-238 Maximum Activity (pCi/g)	Ratios of Means Th-232/ Ra-226	Ratios of Means Th-232/ U-238
09a	10.10	26.62	2.81	6.64	3.77	11.06	3.60	2.67
10a	10.87	21.31	3.77	7.15	3.77	8.18	2.89	2.88
11a	1.73	1.84	1.30	1.31	1.97	2.63	1.33	0.88
11b	1.55	1.58	0.90	0.91	1.83	3.06	1.73	0.85
12a	450.86	1981.00	101.42	492.20	59.94	181.60	4.45	7.52
12b	119.41	1084.00	24.47	287.10	15.42	151.10	4.88	7.74

SOURCE:

Reider, B.L., 2001, Mean Activities and Ratios of Activities in Soil of Phase II Properties at Maywood FUSRAP, Calculation 085750402-RAD-2001-002, July.

Table 2
Radon Progeny Working Level Concentration in Building 76

	Radon Progeny Working Level Concentration
Mean	2.22E-2 +/- 1.05E-1
Maximum	0.33

Table 3
Estimated Relative Doses from Maywood Radionuclides

Radionuclide (Parent Chain)	NESHAP Relative Dose, Ballod	NESHAP Relative Activity, Ballod
Thorium-232	1	1
Thorium-228 (Thorium-232)	0.7	1
Thorium-230 (Uranium-238)	0.15	0.2
Uranium-234 (Uranium-238)	0.08	0.2
Uranium-238	0.07	0.2
Ac-227 (Uranium-235)	0.02	0.01
Pa-231 (Uranium-235)	0.01	0.01
Radium-224 (Thorium-232)	0.01	1
Radium-228 (Thorium-232)	0.01	1
Pb-210 (Uranium-238)	0.004	0.07
Uranium-235	0.003	0.01
Po-210 (Uranium-238)	0.002	0.07
Radium-226 (Uranium-238)	0.002	0.07

Table 4
Fraction Retained in Lung at 3 Days and 30 Days Post Inhalation Intake per 10 Code of
Federal Regulation 20/International Commission on Radiological Protection 30

Nuclide	Time Post Intake	ALI (μ Ci)	Fraction Intake Retained in Lungs per NUREG/CR-4884
Thorium-232	3 d	3.00E-3	1.65E-1
	30 d		1.45E-1
Uranium-238	3 d	4.00E-2	1.65E-1
	30 d		1.45E-1
Uranium-235	3 d	4.00E-2	1.65E-1
	30 d		1.45E-1

Table 5
Minimum Detectable Activities Expressed as Percent Annual Limit on Intake¹

Nuclide	MDA ² Lung Counter Activity (becquerel)	MDA 3 Days Post-Intake Lung Counter (% ALI)	MDA 30 Days Post Intake Lung Counter (% ALI)
Thorium-232	5.2	28%	32%
Uranium-238	47	19%	22%
Uranium-235	3.4	1%	2%

SOURCE:
10 CFR 20

Note(s):

- ¹ Per phone conversation with Dave Groff, Canberra Industries, June 2001. Minimum detectable activities (MDA) are expressed in terms of percent ALI. Note: MDAs are for an 1800 second count time, 1AMAD Class Y uranium and thorium, a single large intake, and a Livermore Realistic Phantom with a chest wall thickness of 2.25 cm). Percent ALI values were calculated using information supplied by D. Groff.
- ² The sensitivity of the in vivo bioassay for these radionuclides is dependent on the individual's chest wall thickness as well as factors such as location of material in the lungs, placement of detectors, and assumptions of equilibrium with daughter radionuclides. ALI denotes annual limit of intake.

Table 6
Derived Investigation Levels Corresponding to 10 Percent Annual Limit on Intake

Nuclide	ALI (uCi)	DIL (10%ALI) 7 Days Post Intake (uCi/l)	DIL (10%ALI) 30 Days Post Intake (uCi/l)	MDA ¹ Alpha Spectroscopy (uCi/l)
Thorium-232	3E-3	6E-10	6E-10	1E-7
Thorium-230	2E-2	4E-9	4E-9	1E-7
Uranium-238	4E-2	3E-7	9E-8	1E-7
Uranium-235	4E-2	3E-7	9E-8	1E-7
Radium-226	6E-1	8E-6	1E-6	1E-7

Note(s):

¹ Per Telephone Conversation 7/9/01, Bill McGowan of Thermo Retec (Eberline) and Barbara Reider, CHP, S&W. Values given for MDAs are for best practices used in the Albuquerque laboratory. Urinalysis MDAs for the Oak Ridge laboratory are 5 times greater (i.e., less sensitive).

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
(12/2013)

PAGE: 55 of 95

Table 7
Calculation Example Soil Data

Isotope	Concentration (pCi/g)	f_i	DAC _i (μCi/mL)
Thorium-232-Y (α)	200	2.9E-02	1.E-12
Radium-228-W (β)	200	2.9E-02	5.E-10
Ac-228-Y (β)	200	2.9E-02	2.E-08
Thorium-228-Y (α)	200	2.9E-02	7.E-12
Radium-224-W (α)	200	2.9E-02	7.E-10
Uranium-238-Y (α)	1000	1.5E-01	2.E-11
Thorium-234-Y (β)	1000	1.5E-01	6.E-08
Pa-234m-Y (β)	1000	1.5E-01	3.E-06
Uranium-234-Y (α)	1000	1.5E-01	2.E-11
Thorium-230-Y (α)	1000	1.5E-01	6.E-12
Radium-226-W (α)	600	8.8E-02	3.E-10
Uranium-235-Y (α)	47	6.8E-03	2.E-11
Thorium-231-Y (β)	47	6.8E-03	3.E-06
Pa-231-Y (α)	47	6.8E-03	2.E-12
Ac-227-Y (β)	47	6.8E-03	2.E-12
Thorium-227-Y (α)	47	6.8E-03	1.E-10
Radium-223-W (α)	47	6.8E-03	3.E-10
Total alpha activity	4388		
Total activity	6882		

Table 8
Example of Isotopic Data from Air Filter

Isotope	Activity (uCi/sample)
Thorium-232	2.4E-06
Thorium-228	2.6E-06
Uranium-238	4.4E-06
Uranium-234	2.8E-06
Thorium-230	5.3E-06
Radium-226	8.6E-06
Uranium-235	-7.4E-08

Table 9
Example Calculation of Derived Airborne Concentration Fraction for Radionuclide Mixture on Air Filter

Isotope	Activity (uCi/sample)	Activity ($\mu\text{Ci}/\text{mL}$)	DAC_i ($\mu\text{Ci}/\text{mL}$)	DAC Fraction
Thorium-232	2.40E-06	1.85E-13	1.E-12	1.85E-01
Radium-228	2.40E-06	1.85E-13	5.E-10	3.69E-04
Ac-228	2.40E-06	1.85E-13	4.E-09	4.62E-05
Thorium-228	2.60E-06	2.00E-13	7.E-12	2.86E-02
Radium-224	2.60E-06	2.00E-13	7.E-10	2.86E-04
Uranium-238	4.40E-06	3.38E-13	2.E-11	1.69E-02
Thorium-234	4.40E-06	3.38E-13	6.E-08	5.64E-06
Pa-234m	4.40E-06	3.38E-13	3.E-06	1.13E-07
Uranium-234	2.80E-06	2.15E-13	2.E-11	1.08E-02
Thorium-230	5.30E-06	4.08E-13	6.E-12	6.79E-02
Radium-226	8.60E-06	6.62E-13	3.E-10	2.21E-03
Uranium-235	1.69E-07	1.30E-14	2.E-11	6.51E-04
Thorium-231	1.69E-07	1.30E-14	3.E-06	4.34E-09
Pa-231	1.69E-07	1.30E-14	2.E-12	6.51E-03
Ac-227	1.69E-07	1.30E-14	2.E-12	6.51E-03
Thorium-227	1.69E-07	1.30E-14	1.E-10	1.30E-04
Radium-223	1.69E-07	1.30E-14	3.E-10	4.34E-05
			Total DAC Fraction	3.26E-01

Table 10
Collection Volumes for Perimeter Samples to Meet Required Minimum Detectable Activity
on the Gross Alpha Count as a Function of Count Time

Count time (min)	Minimum volume (liters) (10 CFR 20) for an MDA of 25% of a DEL	Sample collection time for a 50 L/min sample pump (24-hour days)
10	2425015	33.7
20	1517789	21.1
30	1168026	16.2
45	906194	12.6
60	760267	10.6
90	597008	8.3
120	504764	7.0
180	400264	5.6
240	340509	4.7
300	300819	4.2
360	272088	3.8
420	250090	3.5

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 59 of 95

**Attachment 1
Derived Air Concentrations, Annual Limits on Intake, and
Maximum Permissible Concentrations**

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
(12/2013)

PAGE: 60 of 95

Radionuclide, (Parent Chain)	ALI ¹ (μ Ci)	DAC ² (μ Ci/mL)	MPC ³ (μ Ci/mL)
Thorium-232	3E-3 Bone Surf (4E-3)	1E-12	3E-11
Radium-228 (Thorium-232)	1E+0 (W)	5E-10 (W)	6E-12
Ac-228 (Thorium-232)	4E+1	2E-8	2E-8
Thorium-228 (Thorium-232)	2E-3 Bone Surf (3E-3)	7E-12	6E-12
Radium-224 (Thorium-232)	2E+0 (W)	7E-10 (W)	7E-10
Rn-220 (Thorium-232)	2E+1 or 12 WLM	9E-9 or 1.0 WL	3E-7
Uranium-238	4E-2	2E-11	1E-10
Thorium-234 (Uranium-238)	2E+02	6E-8	3E-8
Pa-234m (Uranium-238)	8E+3	3E-6	1E-6
Uranium-234 (Uranium-238)	4E-2	2E-11	1E-10
Thorium-230 (Uranium-238)	2E-2 Bone Surf (2E-2)	6E-12	1E-11
Radium-226 (Uranium-238)	6E-1 (W)	3E-10 (W)	5E-11
Rn-222 (Uranium-238)	1E+2 or 4 WLM	3E-8 or 0.33 WL	3E-8

Radionuclide, (Parent Chain)	ALI ¹ (μCi)	DAC ² (μCi/mL)	MPC ³ (μCi/mL)
Pb-210 (Uranium-238)	2E-1 (D) Bone Surf (4E-1)	1E-10 (D)	2E-10
Po-210 (Uranium-238)	6E-1(D & W)	3E-10 (D & W)	2E-10
Uranium-235	4E-2	2E-11	1E-10
Thorium-231 (Uranium-235)	6E+3	3E-6	1E-6
Pa-231 (Uranium-235)	4E-3 Bone Surf (6E-3)	2E-12	1E-10
Ac-227 (Uranium-235)	4E-3	2E-12	3E-11
Thorium-227 (Uranium-235)	3E-1	1E-10	2E-10
Radium-223 (Uranium-235)	7E-1	3E-10	2E-10
Thorium-232 _{eff} ⁴		2.6E-12	8.2E-12
Uranium-Nat _{eff} ⁴		1.32E-11	2.9E-11

¹ 10CFR20 Appendix B, Class Y used unless noted. DACs are for Occupational Dose only and are not used for NESHAP calculations. Where an organ is listed, the dose to the organ is more restrictive than that to the whole body, and the whole body ALI is given in parentheses.

² 1971 revision of 10CFR20 Appendix B, Class I used unless noted

³ Thorium-232_{eff} and Uranium-Nat_{eff} are the effective DAC and effective MPC values for the entire decay chain in equilibrium, exclusive of radon and progeny, for use in analyzing gross alpha counting data. The DAC_{eff} (or MPC_{eff}) is calculated as follows:

$$DAC_{\text{eff}} = f_{\alpha} \left[\sum_i (f_i / DAC_i) \right]^{-1}$$

Where:

- f_{α} = The ratio of the total alpha activity in the mixture to the total activity of the mixture.
 f_i = The ratio of the concentration of each radionuclide to the total activity of the mixture.
DAC_i = The DAC for each nuclide in the mixture.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 62 of 95

CLIENT & PROJECT US Army Corps of Engineers – New York District, Kansas City District FUSRAP Maywood Superfund Site-Maywood, NJ.				PAGE 1 OF 8	
CALCULATION TITLE ICRP 30 Based Calculations of Occupational DAC and ALI Values for the U-235 progeny of Rn-219, Po-215, Pb-211, Bi-211, and Tl-207				QA CATEGORY (✓) <input type="checkbox"/> I NUCLEAR SAFETY RELATED <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> (other)	
CALCULATION IDENTIFICATION NUMBER					
JOB ORDER NO. 085750402	DISCIPLINE RAD	CURRENT CALC NO 001-003	OPTIONAL TASK CODE 	OPTIONAL WORK PACKAGE NO. N/A	
APPROVALS - SIGNATURE & DATE			REV. NO. OR NEW CALC NO.	SUPERSEDES CALC NO. OR REV NO.	CONFIRMATION REQUIRED <input checked="" type="checkbox"/>
PREPARER(S)/DATE(S)	REVIEWER(S)/DATES(S)	INDEPENDENT REVIEWER(S)/DATE(S)			YES NO
B. Keele, CHP	B. Reider, CHP	N/A	0	N/A	
DISTRIBUTION					
GROUP	NAME & LOCATION	COPY SENT (✓)	GROUP	NAME & LOCATION	COPY SENT (✓)
RECORDS MGT. Project CHP Project RSO Project SSHO USACE, Tulsa	A.Sverdlove B. Reider M. Winters B. Lenczuk David Hays				

Table of Contents

1.0	RECORD OF REVISIONS.....	64
2.0	INTRODUCTION	64
3.0	OBJECTIVE	64
4.0	REGULATORY REFERENCE.....	64
5.0	ASSUMPTIONs.....	64
6.0	METHODOLOGY	65
7.0	References	67
8.0	SUMMARY OF RESULTS.....	68
9.0	ATTACHMENTS	68

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 64 of 95

1.0 RECORD OF REVISIONS

Revision 0 - Original Issue

2.0 INTRODUCTION

U-235 progeny include the isotopes Rn-219, Po-215, Pb-211, Bi-211, and Tl-207, which do not have listed in 10CFR20 values for the Derived Air Concentration (DAC) and Annual Limit of Intake (ALI). The values for alpha emitters not individually listed in Appendix B, Table 1 to 10CFR20, are given a value of $2E-13$ uCi/ml. This may be unrealistically small for these isotopes given their short half-lives.

Derived values for the DAC and ALI are determined in this calculation for use in assigning dose from an intake, for the above listed radionuclides. The method used in this calculation is the method of ICRP30.

3.0 OBJECTIVE

Derived values for the DAC and ALI are determined in this calculation for use in assigning total dose from an intake from Rn-219 and progeny.

4.0 REGULATORY REFERENCE

NRC Regulatory guide 8.34 states "There are at least five methods acceptable to the NRC staff for calculating committed effective dose equivalent from inhaled radioactive materials. The five methods are described below." The third choice is the use of ICRP 30.

5.0 ASSUMPTIONS

5. Due to the short physical half-lives of the isotopes in question, it is assumed that all material which is deposited in the lung decays in the lung. No effort was made to account for physical removal from the lung and assimilation into other body organs.
6. ALIs and DACs are calculated only for alpha emissions from the nuclides of interest and their daughter products. The dose from beta and gamma emissions of Rn-219 and progeny inhaled was neglected because of the contribution was expected to be insignificant.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 65 of 95

7. ICRP30 specifies the use of a quality factor of 20 for alpha emissions. Since it's publication, the NRC in 10CFR20 specifies a quality factor of 20. A quality factor of 20 is also used in FGR-11 and in the development of values tabulated in 10CFR20. These calculations used a quality factor of 20.
8. The weighting factor is 0.12 for the lung as per ICRP30 and 10CFR20.1003

6.0 METHODOLOGY

ICRP30 figure 5.2 lists the deposition fractions of 1 um AMAD particles into the regions inside the lung as 0.3 for the N-P region, 0.8 for the T-B region and 0.25 into the P region. The dose to the N-P region is considered negligible by section 5.1 of ICRP30. Thus, it assumed that the deposition fraction is the sum of the deposition into the T-B and P region, or 0.33 per ICRP30. Due to the short physical half-lives of the subject radionuclides, the fraction deposited in the N-P region is assumed to contribute a negligible dose to the GI tract and other organs.

Equation 5.6 of ICRP 30 calculates the specific energy absorbed by an organ.

$$SEE(T \leftarrow S)_i = \frac{Y_i E_i AF(T \leftarrow S)_i Q_i}{M_t} \quad (1)$$

Where,

SEE (T←S) is specific energy absorbed in the target organ, T, from radiations of type i emitted from the source organ, S. In this case the target and source organ is always the same and is the lung. The units are MeV g⁻¹ per transformation.

Y_i is the yield of radiations of type i per transformation of radionuclide j. In this case the yield is assumed to be one (1), because each of the alpha emitting radionuclides in question decays by alpha emission virtually 100 percent of the time.

E_i is the average energy, weighted by the yield, of radiation in MeV

AF (T←S) is the average fraction of energy absorbed in target organ T per emission of radiation i in the source organ S. In this case, it is always assumed equal to 1.

Q_i is the quality factor; in this case the radiations are alpha emissions, so the quality factor is 20.

M_t is the mass of the target organ. The standard mass of the lung is considered to be 1000 grams by ICRP26 as referenced in ICRP30.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 66 of 95

The specific effective energy absorbed reduces to:

$$SEE(T \leftarrow S)_i = \frac{E_i * 20}{1000} \quad (2)$$

Equation 5.7 of ICRP 30 reduces the specific energy absorbed to the 50 year committed dose equivalent ($H_{50,T}$) in units of sieverts (Sv) per transformation. The equation reduces to the summation of the SEE for each emission from the parent and daughter nuclides:

$$H_{50,T} / transformation = 1.6 \times 10^{-10} \sum_i SEE(T \leftarrow S)_i \quad (3)$$

The calculations are simplified by performing the sum of emissions in the calculation of the SEE as follows:

$$SEE = \frac{\sum_i E_i * 20}{1000} \quad (4)$$

$$H_{50,T} / transformation = 1.6 \times 10^{-10} SEE \quad (5)$$

The number of transformation that occur is:

$$N = \lambda / A, \quad (6)$$

where λ is the decay constant and A is the activity.

Multiplying N by $H_{50,T}$ and by the deposition fraction yields the committed dose equivalent to the lung per unit of intake:

$$H_{50,T} = N * H_{50,T} / transformation * f \quad (7)$$

The effective committed effective dose equivalent (H_{50}) to the whole body is the product of the weighting factor and $H_{50,T}$:

$$H_{50} = wH_{50,T} \quad (8)$$

The H_{50} is reduced to the ALI in microcuries (uCi), by converting to a 5 rem per year basis:

$$ALI = \frac{1.35E - 6}{H_{50}} \quad (9)$$

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 67 of 95

The DAC in uCi/ml is calculated by dividing the ALI by the amount breathed during 2000 hours for a working year (equal to 2.4E+09 ml per 10CFR20):

$$DAC = ALI / 2.4E9 \quad (10)$$

The calculations yield the following results:

Parent Isotope and Alpha Progeny	Half life (sec)	Alpha Energy (MeV)	SEE MeV/g/d is	H50,T per transfrmt n (Sv/dis)	Total transfrmt n in lung per Bq inhaled	CDE (Lung) Sv/Bq	CEDE Sv/Bq	Stoch. ALI (uCi)	Stoch. DAC (uCi/mL)
Rn-219 Po-215 Bi-211	3.96	6.76 7.39 6.57 Sum: 20.7	0.414	6.63E-11	1.89	1.25E-10	1.499E-11	9.01E+04	3.76E-05
Po-215 Bi-211	1.78E-03	7.39 6.57 Sum: 14.0	0.279	4.46E-11	8.48E-04	3.79E-14	4.54E-15	2.97E+08	1.24E-01
Pb-211 Bi-211	2.17E+03	0 6.57 Sum: 6.57	0.131	2.10E-11	1031	2.16E-08	2.60E-09	5.20E+02	2.17E-07
Bi-211	1.28E+02	6.57	0.131	2.10E-11	61.13	1.28E-09	1.54E-10	8.77E+03	3.56E-06

7.0 REFERENCES

Code of Federal Regulations, Title 10, Part 20, *Standards for Protection against Radiation*, Jan. 1, 2000.

ICRP30, *Limits for Intake of Radionuclides by Workers*, International Commission on Radiological Protection, July 1978.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 68 of 95

FGR-11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, U.S. Environmental Protection Agency, 1988.

Chu, S.Y.F., L.P. Ekström, and R.B. Firestone, *The Lund/LBNL Nuclear Data Search, Version 2.0*, February 1999 (<http://nucleardata.nuclear.lu.se/NuclearData/toi/>)

NRC Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*, July 1992.

8.0 SUMMARY OF RESULTS

The decay chain of U-235 includes the isotopes Pa-231 and Ac-227, which ultimately decay into Rn-219 and progeny. The calculated DAC values for Pa-231 and Ac-227 are listed in 10CFR20 to be 2E-12 and 7E-13, respectively. The DAC values of Rn-219 and progeny are several orders of magnitude higher than other radionuclides present at the Maywood Site, including Pa-231 and Ac-227 values from the same U-235 decay chain. Hence, contributions from Rn-219 and progeny do not contribute significantly to the overall dose and can be disregarded in dosimetry calculations.

9.0 ATTACHMENTS

None.

**Attachment 2
Mean Soil Activity Values and Recommended Surface
Contamination Levels for use at the Maywood Superfund
Site**

CALCULATION TITLE Mean Soil Activity Values and Recommended Surface Contamination Levels for use at the Maywood Superfund Site				QA CATEGORY (✓) <input type="checkbox"/> I NUCLEAR SAFETY RELATED <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> (other)		
CALCULATION IDENTIFICATION NUMBER						
JOB ORDER NO. 085750201	DISCIPLINE Rad	CURRENT CALC NO. 2001-002	OPTIONAL TASK CODE	OPTIONAL WORK PACKAGE NO. N/A		
APPROVALS - SIGNATURE & DATE			REV. NO. OR NEW CALC NO. 0.1	SUPERSEDES CALC NO. OR REV NO. N/A	CONFIRMATION REQUIRED <input checked="" type="checkbox"/>	
PREPARER(S)/DATE(S) Barbara Reider, CHP	REVIEWER(S)/DATES(S) Brian Keele, CHP	INDEPENDENT REVIEWER(S)/DATE(S) NA			YES	NO
DISTRIBUTION						
GROUP	NAME & LOCATION	COPY SENT (✓)	GROUP	NAME & LOCATION	COPY SENT (✓)	
RECORDS MGT. RSO SSHO CHP PHP Project Engineer	Andrew Sverdlove Mike Winters Wil Stephan Barbara Reider, CHP Brian Keele, CHP Kevin Donnelly		USACE, Tulsa	David Hays		

Table of Contents

List of Attachments71

1.0 Purpose72

2.0 Inputs72

3.0 Assumptions72

4.0 Methodology/Calculations72

 4.1 Mean Activities73

 4.2 Total Standard Deviation ($SD_{T,i}$)73

 4.3 Standard Deviation of the Mean ($SD_{m,i}$)73

 4.4 Mean Count Error ($\sigma_{m,i}$)74

5.0 Results and Discussion74

6.0 Conclusion75

7.0 References75

List of Attachments

Attachment A Calculation Spreadsheet

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 72 of 95

1.0 PURPOSE

The mean activities, their associated standard deviations, and the ratios of activities for ROC at Maywood are calculated to determine the appropriate values of Table 1.6.2.15 of the Maywood Environmental Remediation Contract (U.S. Army Corps of Engineers, 1999) that should be used for decontamination and release of equipment at Maywood.

This calculation may also be used to support development of various Radiation Safety procedures at the Maywood FUSRAP project.

It should be noted that not enough soil characterization data are available to provide good statistics (i.e., small percent standard deviation corresponding to a 95 percent degree of confidence). Real-time monitoring data and updated characterization data should be used in the field to support or revise decisions based on data in this calculation.

2.0 INPUTS

Radionuclides of Concern (ROC) are Th-232, U-238, Ra-226, and their daughters (Stone & Webster, 1999)

Data are Ra-226, Th-232 and U-238 analysis results from the PDI data and associated information about the location of the data (Maywood Access database).

3.0 ASSUMPTIONS

All PDI data have been treated using the same preparation techniques, namely, they are dry, homogenous soil samples.

Historical data are not included in this calculation because it is not known if all of the soil is prepared in the same manner. Data may be less accurate if samples are wet and/or not homogenous, or if instruments are poorly calibrated.

4.0 METHODOLOGY/CALCULATIONS

Mean activities and 2 sigma (95 percent confidence) errors are calculated by location for Maywood vicinity property soil samples. Additionally, ratios of soil activities for Th-232/Ra-226 and Th-232/U-238 are calculated, for individual soil samples and for mean

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 73 of 95

activities at each property. Attachment A, "Calculation Spreadsheet," includes spreadsheets with calculations (both printout & floppy disk).

4.1 Mean Activities

The mean activity for each property is calculated as follows:

$$A_i = \frac{\sum (A_{i,n})}{(n)}$$

Where the following are calculated for each property:

- A_i is the mean activity for nuclide i
- $A_{i,n}$ is the activity for nuclide i , for sample number n
- n is the number of samples

4.2 Total Standard Deviation ($SD_{T,i}$)

The total standard deviation should incorporate all known errors that are expected to affect the variability of data. Because each sample measurement used to calculate the mean has a count error (σ_i) associated with it, the mean of the count errors ($\sigma_{m,i}$) must be propagated with the standard deviation of the mean ($SD_{m,i}$) in order to determine the total standard deviation. In most cases the standard deviation of the mean ($SD_{m,i}$) is much larger than the mean count error ($\sigma_{m,i}$).

$$SD_{T,i} = (SD_{m,i}^2 + \sigma_{m,i}^2)^{1/2}$$

Where the following are calculated for each property:

- $SD_{T,i}$ is the total standard deviation for nuclide i
- $SD_{m,i}$ is the standard deviation for the mean, for nuclide i
- $\sigma_{m,i}$ is the mean of the count error for nuclide i

Note: The total standard deviation is called 2 Sigma Err and Err (2s) in Attachment A.

4.3 Standard Deviation of the Mean ($SD_{m,i}$)

$$SD_{m,i} = \frac{(\sum (A_{i,n} - \bar{A}_i)^2)^{1/2}}{(n-1)}$$

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 74 of 95

Where the following are calculated for each property:

- SD_{p,i} is the standard deviation for the mean, for nuclide I
- A_i is the mean activity for nuclide i
- A_{i,n} is the activity for nuclide i, for sample number n
- n is the number of samples

Note: The standard deviation of the population is called Err (1s) in Attachment A.

4.4 Mean Count Error ($\sigma_{m,i}$)

$$\sigma_{m,i} = \frac{(\sum (\sigma_{i,n})^2)^{1/2}}{(n)}$$

Where the following are calculated for each property:

- $\sigma_{m,i}$ is the mean count error for nuclide i
- $\sigma_{i,n}$ is the count error for nuclide i, for sample number n Note that count errors from the Maywood Access database are 2 sigma and therefore must be divided by 2.
- n is the number of samples

5.0 RESULTS AND DISCUSSION

Results of calculations are included in Appendix A⁶. There is a large amount of variability in the activities of samples, which range from what appear to be background levels of radionuclides (approximately 1 pCi/g)⁷ up to activities of a few thousand pCi/g.

For most of the soil samples, Th-232 activities are greater than those of Ra-226 by a factor of 2 or greater⁸.

For most of the soil samples, Th-232 activities are greater than those of U-238, however there were some soil samples that had U-238 activities greater than Th-232. In some cases this appears to be due to background (see footnote 3, below), however, in some cases U-238

⁶ Soil_samples_means.xls

⁷ A background study for the Maywood soils has not been concluded, however, professional judgement and soil data indicate that the background for each of the three ROC is most likely less than a few pCi/g.

⁸ Cases where Th-232 activities are less than Ra-226 activities may be due to the fact that both activities are close to background activities.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 75 of 95

activities are much higher than background. The highest ratio of U-238 to Th-232 was greater than 100:1, and was clearly due to elevated U-238 in soil.

Although the measured activities are Th-232, U-238 and Ra-226, a mixture of radionuclides including daughter radionuclides from these and other primordial radionuclides is present. Acceptable surface contamination levels are given in Table 1.6.2.15 (U.S. Army Corps of Engineers, 1999) (Appendix B).

6.0 CONCLUSION

Acceptable surface contamination levels for Th-nat and Th-232 of 1000 dpm/100 cm² average, 3000 dpm/100 cm² max and 200 dpm/100 cm² removable from Table 1.6.2.15 (U.S. Army Corps of Engineers, 1999) are appropriate for use at all of the properties reviewed based on present PDI data.

The Th-nat values are conservative compared to U-nat values, and may be used where U-nat and U-238 predominate. Other values may be used on a case-by-case basis as needed should it be determined that radionuclides other than Thorium predominate.

7.0 REFERENCES

Maywood Access database.

Stone & Webster, 1999, *Final Site Safety & Health Plan FUSRAP Maywood Superfund Site, Maywood, New Jersey*, Section 4.0, August 6.

U.S. Army Corps of Engineers (USACE), 1999, *Maywood Environmental Remediation Contract*, Contract No. DACW41-99-9001, March.

**Attachment A
Calculation Spreadsheet**

(please see file for full calculation)

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
(12/2013)

PAGE: 77 of 95

Mean Soil Sample Activities at Each Property

Location	Mean Th-232 (pCi/g)	2 Sigma Err (pCi/g)	Mean Ra-226 (pCi/g)	2 Sigma Err (pCi/g)	Mean U-238 (pCi/g)	2 Sigma Err (pCi/g)	Th/Ra	Th/U
01a	1.23	0.51	0.74	0.41	1.05	1.19	1.67	1.18
02a	33.53	78.76	10.25	31.39	27.95	70.24	3.27	1.20
02c	9.87	29.31	1.19	1.64	5.24	8.57	8.32	1.88
02d	4.81	3.47	1.33	0.55	5.23	4.37	3.62	0.92
03a	1.02	0.41	0.95	0.14	2.66	4.50	1.07	0.38
04a	13.45	43.76	2.19	3.93	3.48	5.75	6.14	3.86
04b	2.77	5.46	1.07	0.90	1.97	3.43	2.59	1.40
05a	7.17	3.38	1.53	0.57	6.66	4.92	4.70	1.08
05b	2.76	1.47	1.56	1.43	2.19	2.59	1.77	1.26
05c	22.78	54.55	2.56	1.63	3.74	4.58	8.89	6.09
06a	29.39	133.13	5.43	21.84	9.68	29.12	5.41	3.04
06b	156.48	472.81	21.23	82.66	28.21	68.85	7.37	5.55
06c	16.68	55.72	2.94	6.59	6.62	8.18	5.67	2.52
06d	29.44	98.72	2.51	5.99	5.83	10.50	11.74	5.05
06e	1.00	0.29	0.66	0.14	1.55	2.33	1.50	0.64
07a	101.37	294.51	8.18	22.66	16.55	31.77	12.39	6.13
07b	1.22	0.80	1.92	2.83	36.09	119.43	0.64	0.03
08a	52.78	188.37	7.49	22.69	14.34	41.74	7.05	3.68
09a	10.10	18.41	2.81	4.34	3.77	6.45	3.60	2.67
10a	10.87	12.57	3.77	4.73	3.77	4.87	2.89	2.88
11a	1.73	0.33	1.30	0.13	1.97	2.41	1.33	0.88
11b	1.55	0.16	0.90	0.11	1.83	3.75	1.73	0.85
12a	450.86	1724.07	101.42	436.95	59.94	156.80	4.45	7.52
12b	119.41	566.14	24.47	124.85	15.42	69.88	4.88	7.74

**Attachment 3
Thermoluminescent Dosimeter Description**

**FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS**

NO.: PP-8-500-4
(12/2013)

PAGE: 79 of 95

Sent By: RON SMITH;

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Oct-18-01 9:47AM;

Page 1



RADIATION DETECTION COMPANY

8095 Camino Arroyo • Gilroy, California 95020
(408) 842-2700 • FAX (408) 847-2988

Fax Cover Page

To: Brian Keele From: John C Rodriguez
Receiver Fax Number: 201 843-4907
Date Sent: Oct. 18, 01 Time Sent: 9:45 am
Total Number of Pages (including cover page): 7

Description:
TLD holder description
RDC source information form. Please contact me with any questions.

Sincerely,


John C. Rodriguez, D.C.

Notice of Confidentiality

This fax may contain confidential information that is intended only for the use of the individual or entity named above (intended recipient). If you are not the intended recipient, any disclosure, copying, distribution or the taking of any action in reliance upon the contents of this information is STRICTLY PROHIBITED. If you have received this fax in error, immediately notify the sender by telephone for the return of this document.

Original to follow:

Yes No

From Radiation Detection Company, Inc.
Fax Number: (408) 847-2988
Date: 10/18/01
By: John C. Rodriguez

SERVICE IS OUR PRODUCT
NVLAP Service for Film and TLD Dosimetry
Instrument Calibrations • Radiation Surveys • Health Physics Consultation

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
(12/2013)

PAGE: 80 of 95

Sent By: RON SMITH;

4087209116 ;

Oct-18-01 9:47AM;

Page 2

Dosimeter Code 9: TLD-XBG

Description current as of: June 12, 1996

Physical Description:

Custom-designed rectangular plastic badge with metal clip. Badge is approximately 3.5 cm x 4 cm area, 0.4 cm thick, with 0.2 thick tube behind bottom edge for inserting one 30-mg sample of 80-200 mesh lithium fluoride powder (TLD-100) encapsulated in a 1 mm thick polyethylene capsule. Three cavities, 0.45 cm in diameter by 0.09 cm deep, are located on the upper front portion of the badge to hold TLD chip dosimeters. One TLD-100 1/8" x 1/8" x 0.035" chip dosimeter is located in one of the three cylindrical cavities under the tape retainer and badge identification label (total density thickness, 25 mg/cm).

Processing Equipment:

Harshaw 3500
Harshaw 3000
Teledyne 7300
Teledyne System 310
Victoreen 2800

Dosimeter Applications:

This dosimeter is useful for the reporting of photon and beta doses when effective energies are known and the appropriate calibration factors are applied. It also useful for reporting mixtures of photon and beta doses when the photon energy is known and is greater than 35 keV and the beta energy is known and is greater than 0.6 MeV.

Dose Determinations:

Calibration of dosimeters is based on exposure of controls to known doses of ¹³⁷Cs photons. Energy corrections are performed as follows:

The presence of beta dose is determined by the ratio of the powder and the chip doses. A ratio of less than or equal to 0.68 indicates the presence of a beta dose.

The photon shallow dose equivalent at 0.007 cm (H_s) is calculated by subtracting the appropriate background light output from the client powder element and multiplying by the correction factor^{1,2} for the known effective energy listed below.

<u>Effective Photon Energy (keV)</u>	<u>H_s Correction Factor (SDCF)</u>
10 - 14	.80
15 - 40	.75
40 - 59	.80
60 - 150	.90
150 - 300	.95
300 - 1000	1.0
1000 and above	1.04

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
 (12/2013)

PAGE: 81 of 95

Sent By: RON SMITH;

4087209116 ;

Oct-18-01 9:48AM;

Page 3

The photon deep dose equivalent at 1.0 cm ($H_p(1.0)$) is calculated by multiplying the photon shallow dose equivalent by the deep dose correction factor^{3,4} for the known effective energy.

<u>Effective Photon Energy (keV)</u>	<u>Deep Dose Correction Factor (DDCF)</u>
< 10	.0
10 - 14	.3
15 - 20	.45
21 - 30	.65
31 - 40	.80
41 - 59	.90
60 and above	1.0

The shallow dose equivalent from the beta at 0.007 cm is calculated by subtracting the powder dose from the chip dose and multiplying the difference by the appropriate beta correction factor⁴ below:

<u>Isotope</u>	<u>β_{max} (MeV)</u>	<u>Correction Factor</u>
⁹⁰ Sr/Y	0.544/2.245	1.2
P-32	1.7	1.2
Kr-85	0.672	7.6
Tl-204	0.765	4.5
U-238	(slab)	1.5

The total shallow dose equivalent is the sum of the photon shallow dose equivalent and the beta dose equivalent.

The beta dose equivalent at 0.3 cm (H_{lens}) is calculated by multiplying the shallow dose equivalent by the appropriate beta correction factor⁵ at 0.3 cm. For β_{max} below 1 MeV, the contribution of dose to the lens is nominal and therefore, no lens dose is added. For β_{max} above 1 MeV, the dose to the unshielded lens is significant and is evaluated. The correction factors for commonly used radioisotopes are listed below:

<u>Isotope</u>	<u>β_{max} (MeV)</u>	<u>Correction Factor</u>
U-238	(slab)	0.25
Sr-Y-90	0.544/2.245	0.23
P-32	1.7	0.12

The photon dose equivalent at 0.3 cm (H_{lens}) is calculated by multiplying the photon shallow dose equivalent by the lens of the eye correction factor for the known effective energy.

**FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS**

NO.: PP-8-500-4
(12/2013)

PAGE: 82 of 95

Sent By: RON SMITH;

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Oct-18-01 9:48AM;

Page 4/7

<u>Effective Photon Energy (keV)</u>	<u>Lens Dose Correction Factor (LDCF)*</u>
10 - 14	.75
15 - 20	.80
21 - 30	.90
31 - 40	.95
41 and above	1.0

*If a specific photon energy is known, the following correction factors can be used:

<u>Effective Photon Energy (keV)</u>	<u>Lens Dose Correction Factor (LDCF)*</u>
10	.24
11	.34
12	.44
13	.54
15	.74
18	.80
20	.84
21	.85
23	.88
26	.92
34	.96
≥ 35	1.0

Performance Characteristics:

Minimum reportable dose (mrem):

	<u>Photons</u>	<u>Beta</u>
Monthly wear period	10	50 (> 1 MeV) 250 (< 1 MeV)
Quarterly wear period	20	100 (> 1 MeV) 500 (< 1 MeV)

Maximum reportable dose (mrem): 500,000 500,000

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
 (12/2013)

PAGE: 83 of 95

Sent By: RON SMITH;

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Oct -18-01 9:48AM;

Page 5/7

Rounding of doses:

<u>Dose equivalent range</u> (mrem)	<u>Round to nearest</u> (mrem):
10 - 100	5
100 - 500	10
500 - 3000	50
3000 - 5000	100
5000 - 30000	500
30000+	1000

When calculating dose equivalents, the raw number is rounded, then the minimum reportable dose is applied.

Limitations of dosimeter:

To assure the greatest accuracy, the effective energy of the incident photons and beta particles must be known. For beta particles below 1 MeV, the sensitivity of the dosimeter is significantly reduced.

The response of this dosimeter is unknown for photons below 10 keV.

Accuracy and Precision: The accuracy and precision ($|P| + S$) of this dosimeter for ^{137}Cs and $^{90}\text{Sr-}^{90}\text{Y}$ is approximately 15% (shallow) and 5% (deep) as determined through NVLAP proficiency testing.⁶

% Fade⁷ - Studies indicate that loss of signal is less than 5% after 4 weeks⁷.

Sample Calculation:

Assuming 35 keV effective energy photons:

Light output of powder element = 2.72 units

1 Rem ^{137}Cs light output = 12.50 units

Background light output = 0.35 units

Calibration factor = $1000 \text{ mrem} / (12.50 - 0.35) = 82 \text{ mrem/unit}$

Shallow dose equivalent =

$[(2.72 - 0.35) \times 82] \times 0.75 \text{ (SDCF)} = 146 \text{ mrem} = 150 \text{ mrem}$ (Dose is rounded to the nearest 10 mrem.)

Deep dose equivalent =

$150 \text{ mrem} \times 0.80 \text{ (DDCF)} = 120 \text{ mrem}$

Lens dose equivalent =

$150 \text{ mrem} \times 0.95 \text{ (LDCF)} = 143 \text{ mrem} = 140 \text{ mrem}$

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
(12/2013)

PAGE: 84 of 95

Sent By: RON SMITH;

4087209116 ;

Oct-18-01 9:48AM;

Page 6/7

Assuming ^{137}Cs photons plus ^{238}U beta particles:

Chip dose, ^{137}Cs -equivalent = 1000 mrem

Powder dose, ^{137}Cs -equivalent = 400 mrem

Powder dose/chip dose = 0.4, therefore, a beta dose is indicated. (If this situation is not met, proceed to photon shallow dose determination below.)

Beta dose determination:

(Chip dose - powder dose) x beta dose correction factor

$(1000 - 400) \times 1.2 = 720$ mrem (rounded to 700 mrem)

Photon shallow dose determination:

Powder dose x shallow dose correction factor

$(400 \text{ mrem} \times 1.0) = 400$ mrem

Photon deep dose determination:

Powder dose x deep dose correction factor

$(400 \text{ mrem} \times 1.0) = 400$ mrem deep dose

Total shallow dose determination:

Photon shallow + beta dose

$(400 \text{ mrem} + 720 \text{ mrem}) = 1120$ mrem shallow dose (rounded to 1100)

Dose equivalent at 0.3 cm (H lens) determination:

Photon shallow dose x lens dose correction factor

$(400 \text{ mrem} \times 1.0) = 400$ mrem lens dose

Plus,

Beta dose x lens dose correction factor

$(720 \text{ mrem} \times 0.45) = 324$ (rounded to 320)

Total lens dose equivalent = 720 mrem

FMSS RADIATION PROTECTION PROGRAM
TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL
DOSIMETRY AND AIR SAMPLING PROGRAMS

NO.: PP-8-500-4
(12/2013)

PAGE: 85 of 95

Sent By: RON SMITH;

4087209116 ;

Oct-18-01 9:48AM;

Page 7/7

References:

- ¹ Tochilin, E., Goldstein, N., Lyman, J. and Miller, G., The Quality and LET Dependence of Three Thermoluminescent Dosimeters and Their Potential Use as Secondary Standards, NRD-TR-68-129, November, 1968.
- ² Bahne, F., Radiology, Vol. 123, No. 3, pp. 753-760, June 1977.
- ³ Plato, P., Miklos, J., Performance Testing of Personnel Dosimetry Services, NUREG/CR-2892, February, 1983.
- ⁴ RDC compilation of calibration testing data from Battelle (1987, 1990) and Atlan-Tech (1993).
- ⁵ Zummo, J., "Eye Dose Calculations for Photons and Beta Particles," June 1994, Rev 2.
- ⁶ VLAP Proficiency Testing Results Comparison for Radiation Detection Company for 1985, 1987, 1989 and 1991, dated 2/13/92, page 3.
- ⁷ Zummo, J., TLD Fade Study report dated August 18, 1994 and preliminary TLD Fade Study report dated December 2, 1994.

**Attachment 4
Derived Air Concentrations Values and Dose Conversion
Factors for use at the Maywood Superfund Site**

CLIENT & PROJECT US Army Corps of Engineers – New York District, Kansas City District FUSRAP Maywood Superfund Site-Maywood, NJ.	PAGE 1 OF 8
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CALCULATION TITLE DAC Values and Dose Conversion Factors for use at the Maywood Superfund Site	QA CATEGORY (✓) <input type="checkbox"/> I NUCLEAR SAFETY RELATED <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> (other)
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CALCULATION IDENTIFICATION NUMBER				OPTIONAL WORK PACKAGE NO.
JOB ORDER NO.	DISCIPLINE	CURRENT CALC NO	OPTIONAL TASK CODE	
0857504	RAD	2001-004		N/A

APPROVALS - SIGNATURE & DATE				REV. NO. OR NEW CALC NO.	SUPERSEDES CALC NO. OR REV NO.	CONFIRMATION REQUIRED <input checked="" type="checkbox"/>	
PREPARER(S)/DATE(S)	REVIEWER(S)/DATES(S)	INDEPENDENT REVIEWER(S)/DATE(S)	YES			NO	
Brian Keele, CHP	Barbara Reider, CHP	NA	0	N/A			

DISTRIBUTION

GROUP	NAME & LOCATION	COPY SENT (✓)	GROUP	NAME & LOCATION	COPY SENT (✓)
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Table of Contents

1.0 RECORD OF REVISIONS.....89

2.0 INTRODUCTION89

3.0 OBJECTIVE90

4.0 REGULATORY REFERENCE.....90

5.0 ASSUMPTIONS91

6.0 METHODOLOGY92

7.0 REFERENCES93

8.0 SUMMARY OF RESULTS.....94

9.0 ATTACHMENTS94

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 89 of 95

1.0 RECORD OF REVISIONS

Revision 0 - Original Issue

2.0 INTRODUCTION

Radioactive Materials at the Maywood site can produce internal exposure to employees which result from the intake of thorium, uranium and their daughter progeny. The calculation of internal exposure is a function of the intake and a dose conversion factor. The intake is estimated from air sampling and/or bioassay measurements.

Non-stochastic dose conversion factors relate an intake to the 50 year committed dose equivalent (CDE), received by organs. The units are typically sieverts per becquerel (Sv/Bq). The sum of the dose received by each organ multiplied by a weighting factor (w_T) for each organ results in the committed effective dose equivalent (CEDE). The weighting factors are designed so that the resulting CEDE from an intake is equal to the risk to the whole body from dose received from an external gamma-ray source.

The annual limit of intake (ALI) is the quantity, in microcuries (uCi), of an isotope that when inhaled will result in an exposure equal to the applicable NRC annual dose limit. The annual dose limits are 5 rem CEDE (the stochastic limit) and 50 rem CDE to any organ (the non-stochastic limit). When the non-stochastic limit is the most restrictive dose limit, the ALI is calculated for both the non-stochastic and stochastic limits. The annual limit of intake is calculated from the dose conversion factor.

The derived air concentration (DAC) is the air concentration, in uCi/ml, that if inhaled at a standard man breathing rate for 2000 hours per year will result in an intake equal to the ALI. When the non-stochastic limit is the most restrictive dose limit, the DAC is also calculated for both the non-stochastic and stochastic limits.

The DAC-hour is the product of the air concentration in DAC and the time spent in the air with an elevated concentration. A DAC-hour is a unit of dose equal to 2.5 mrem (5000 mrem/2000 hours * 1 hour). The annual dose received is then a summation of the DAC-hours received for each work zone entry.

When the intake is estimated from bioassay measurements, the dose assigned to individual workers is a product of the intake and the dose conversion factor. Each isotope taken into the body is accounted for individually.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 90 of 95

10CFR20 allows, but does not require the use of DAC and ALI values based on models developed in ICRP Publication 30 (ICRP30) and calculated in Federal Guidance Report Number 11 (FGR11). These values are tabulated in appendix B to 10CFR20. However, ICRP30 has been superseded by ICRP Publication 61 (ICRP61), which in turn has been superseded by ICRP Publication 68 (ICRP68.) ICRP68 incorporates a revised respiratory tract model described in ICRP Publication 66 (ICRP66) and revised weighting factors described in ICRP Publication 60 (ICRP60).

3.0 OBJECTIVE

To calculate ALI and DAC values from the DCFs published in ICRP68 for use in performing dosimetry calculations.

It is not the objective of this calculation to determine values for determining doses to the public as the use of public exposure values are detailed in agreements with the U.S. Environmental Protection Agency and the State of New Jersey.

4.0 REGULATORY REFERENCE

10CFR20.1201 (d) states "Derived air concentration (DAC) and annual limit of intake values are presented in Table 1 of Appendix B to part 20 and may be used to determine the individual's dose and to demonstrate compliance with the occupational dose limits". It is Stone and Webster's interpretation that the use of the word *may* allows the use of the DAC and ALI values calculated from current internationally accepted dose conversion factors tabulated in ICRP38.

U.S. NRC Regulatory Guide 8.34 states "There are at least five methods acceptable to the NRC staff for calculating committed effective dose equivalent from inhaled radioactive materials. The five methods are described below." The first four (4) alternatives are to use ICRP30 based values for dose calculations. The fifth (5) alternative is "NRC regulations (10CFR20.1204(c)) state that "When specific information on the physical and biochemical properties of the radionuclides taken into the body or the behavior of the material in an individual is known, the licensee may...use that information to calculate the committed effective dose equivalent..." No prior NRC approval is required for using this approach, but records must be kept." It is Stone and Webster's interpretation that the use of the statement *When specific information on the physical and biochemical properties of the radionuclides taken into the body..., the licensee may...use that information to calculate the committed*

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 91 of 95

effective dose equivalent allows the use of DAC and ALI values calculated from current internationally accepted dose conversion factors tabulated in ICRP68.

U.S. NRC Regulatory Guide 8.7 paragraph 2.2 states "Organ doses need not be calculated if the committed effective dose equivalent does not exceed 1 rem and there are no overexposures in any dose category within the monitoring year, including doses previously reported by other licensees." Stone and Webster's interpretation is that for all cases in which the CEDE does not exceed 1 rem, there are no overexposures, and individuals have not exceeded 1 rem in the current year from other sites, the use of stochastic DAC and ALI values are sufficient for use. If a situation were to arise where an organ dose needs to be calculated, then the use of non-stochastic DAC and ALI values will be utilized and those values will be determined through a separate calculation.

5.0 ASSUMPTIONS

9. Rn-219 and its daughter progeny present in the aerosol inhaled do not need to be considered as separate isotopes in the aerosol. Calculation 001-003 shows that, based on the ICRP30 model, due to their short half-life, their contribution to the DAC value of the mixture is negligible. It is also expected that a similar calculation based upon a ICRP66 respiratory tract model (the basis for the ICRP68 tabulation) would result in a negligible contribution to the overall DAC. Their contributions are included in the development of dose conversion factors for the longer-lived parents in the chain.
10. The isotopes Rn-222, Rn-220, and their daughter progeny are considered as separate isotopes in the aerosol. They do not have an ICRP68 tabulation for their values and present a minor contribution to the overall DAC of the mixture. DAC and ALI values presented in 10CFR20 Appendix B, Table 1, will be used for these isotopes.
11. At this time, all dosimetry values will be based on assumed 1 um AMAD particles. ICRP68 recommends a 5 um AMAD particle size. However, Stone and Webster has decided to use the 1 um AMAD particle size dosimetry values at this time. This assumption may be modified based on the review of additional publication literature or actual particle size measurements.
12. Class Y solubility class is assumed for all radionuclides other than radium per verbal communication between B. Reider (Stone and Webster) and David Hayes (U.S. Army Corps of Engineers) on July 11, 2001, where Mr. Hayes referenced a

former study performed at a series of northern New Jersey sites and concluded that both uranium and thorium were insoluble.

6.0 METHODOLOGY

The dose conversion factors for the committed effective dose equivalent (H_{50}) to the whole body are tabulated in ICRP68. The DCFs have the units Sv/Bq.

H_{50} is reduced to the ALI in microcuries (uCi), that would result in a stochastic dose of 5 rem per year:

$$ALI = \frac{1.35E-6}{H_{50}} \quad (1)$$

The DAC in uCi/ml is calculated by converting to an inhalation rate for a working year:

$$DAC = ALI / 2.4E9 \quad (2)$$

The calculations yield the following results:

Isotope	10CFR20 Appendix B, Table 1 most restrictive ALI value (uCi)	10CFR20 Appendix B, Table 1 stochastic ALI value (uCi)	10CFR20 Appendix B, Table 1 DAC value (uCi/ml)	ICRP68 stochastic DCF for 1 um AMAD particles (Bq/Sv)	Calculated stochastic ALI values based on ICRP68 DCFs for 1 um AMAD particles (uCi)	Calculated stochastic DAC values based on ICRP68 DCFs for 1 um AMAD particles (uCi/ml)
Th-232-Y	3.00E-03	4.00E-03	1.00E-12	2.30E-05	5.88E-02	2.448E-11
Ra-228-W	1.00E+00	1.00E+00	5.00E-10	2.60E-06	5.20E-01	2.166E-10
Ac-228-Y	4.00E+01	4.00E+01	2.00E-08	1.40E-08	9.65E+01	4.022E-08
Th-228-Y	2.00E-02	2.00E-02	7.00E-12	3.90E-05	3.47E-02	1.444E-11
Ra-224-W	2.00E+00	2.00E+00	7.00E-10	2.90E-06	4.66E-01	1.942E-10
Rn-220 (with daughters present)	2.00E+01	2.00E+01	9.00E-09			
U-238-Y	4.00E-02	4.00E-02	2.00E-11	7.30E-06	1.85E-01	7.713E-11

Isotope	10CFR20 Appendix B, Table 1 most restrictive ALI value (uCi)	10CFR20 Appendix B, Table 1 stochastic ALI value (uCi)	10CFR20 Appendix B, Table 1 DAC value (uCi/ml)	ICRP68 stochastic DCF for 1 um AMAD particles (Bq/Sv)	Calculated stochastic ALI values based on ICRP68 DCFs for 1 um AMAD particles (uCi)	Calculated stochastic DAC values based on ICRP68 DCFs for 1 um AMAD particles (uCi/ml)
Th-234-Y	2.00E+02	2.00E+02	6.00E-08	7.30E-09	1.85E+02	7.713E-08
Pa-234m-Y	7.00E+03	7.00E+03	3.00E-06	4.00E-10	3.38E+03	1.408E-06
U-234-Y	4.00E-02	4.00E-02	2.00E-11	8.50E-06	1.59E-01	6.624E-11
Th-230-Y	2.00E-02	2.00E-02	6.00E-12	1.30E-05	1.04E-01	4.331E-11
Ra-226-W	6.00E-01	6.00E-01	3.00E-10	1.60E-05	8.45E-02	3.519E-11
Rn-222	1.00E+02	1.00E+02	3.00E-08			
U-235-Y	4.00E-02	4.00E-02	2.00E-11	7.70E-06	1.76E-01	7.313E-11
Th-231-Y	6.00E+03	6.00E+03	3.00E-06	3.20E-10	4.22E+03	1.76E-06
Pa-231-Y	4.00E-03	6.00E-03	2.00E-12	3.20E-05	4.22E-02	1.76E-11
Ac-227-Y	4.00E-03	4.00E-03	2.00E-12	6.60E-05	2.05E-02	8.531E-12
Th-227-Y	3.00E-01	3.00E-01	1.00E-10	9.60E-06	1.41E-01	5.865E-11
Ra-223-W	7.00E-01	7.00E-01	3.00E-10	6.90E-06	1.96E-01	8.16E-11

7.0 REFERENCES

Code of Federal Regulations, Title 10, Part 20, *Standards for Protection against Radiation*, Jan. 1, 2000.

Federal Guidance Report number 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, U.S. Environmental Protection Agency, 1988.

ICRP Publication 30, *Limits for Intake of Radionuclides by Workers*, International Commission on Radiological Protection, July 1978.

ICRP Publication 68, *Dose Coefficients for Intakes of Radionuclides by Workers*, International Commission on Radiological Protection, July 1994.

FMSS RADIATION PROTECTION PROGRAM TECHNICAL BASIS FOR THE EXTERNAL AND INTERNAL DOSIMETRY AND AIR SAMPLING PROGRAMS	NO.: PP-8-500-4 (12/2013)
	PAGE: 94 of 95

NRC Regulatory Guide 87, Revision 1, *Instructions for Recording and Reporting Occupational Radiation Exposure Data*, June 1992.

NRC Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*, July 1992.

8.0 SUMMARY OF RESULTS

The above tabulated DAC and ALI values calculated from ICRP68 are for use in internal dosimetry calculations, with the exception of Rn-222 and Rn-220 values. For Rn-222 and Rn-220 the appropriate values are the values tabulated in 10CFR20 Appendix B, Table 1.

9.0 ATTACHMENTS

Calculation 001-003, *ICRP 30 Based Calculations of DAC and ALI Values for the U-235 progeny of Rn-219, Po-215, Pb-211, Bi-211, and Tl-207*.

FMSS RADIATION PROTECTION PROGRAM ISSUE AND USE OF STANDARD DOSIMETRY DEVICES	NO.: PP-8-501-2 (12/2013)
	PAGE: 1 of 4

1.0 PURPOSE

This procedure provides consistent methodology for the issuance of radiation monitoring dosimetry devices at the FUSRAP Maywood Superfund Site (FMSS).

2.0 APPLICABILITY

This procedure applies to FMSS Radiation Protection (RP) personnel issuing dosimetry devices.

3.0 REFERENCES

- U.S. Nuclear Regulatory Commission (NRC) 10 CFR 20, "Standards for Protection against Radiation."
- PP-8-1101, "General Employee Radiation Training."
- PP-8-1102, "Radiation Worker Training (RWT)."
- Cabrera Services, Inc., Radiation Safety Program, AP-008, "Operating Procedure for Dosimetry Program".

4.0 GENERAL

4.1 Discussion

This procedure describes the requirements for the issuance of standard dosimetry devices to visitors and radiation workers accessing Restricted Areas of the FMSS.

Whole Body Dosimeters/Dosimetry (WBD) (typically a Thermoluminescent Dosimeter (TLD), Optically Stimulated Dosimeter (OSL) or Film Badge) normally provide the dose of record, while a Self-Reading Dosimeter (SRD) provides a means of deep dose tracking prior to processing, as well as verifying the reasonableness of the results.

4.2 Definitions:

Radiation Worker: An individual who accesses any Restricted Area unescorted. Radiation Workers shall have successfully completed all requisite medical and training requirements for performing work in Restricted Areas as specified in Project Procedures PP-8-1101, "General Employee Radiation Training"; PP-8-1102, "Radiation Worker Training (RWT)" and in this procedure.

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

Visitor: An individual who accesses the project site for purposes other than working (e.g., tour the site or meet with an individual).

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- The RSO is responsible for implementing this procedure.

FMSS RADIATION PROTECTION PROGRAM ISSUE AND USE OF STANDARD DOSIMETRY DEVICES	NO.: PP-8-501-2 (12/2013)
	PAGE: 2 of 4

5.2 Radiation Protection Technicians (RPTs)

- RPTs are responsible for the performance of this procedure.

5.3 Project Personnel

- Provide the RP Dosimetry Group with required personal information to track and report radiation exposures (e.g., Social Security/ID Number, Address, Date of Birth, Exposure History from Other Sites, etc.)
- Comply with Radiation Protection Program (RPP) requirements, including dosimetry care & use requirements identified in Attachment 1.

6.0 PREREQUISITES

Individuals who are planning to visit other radiologically monitored facilities while being monitored at the FMSS shall notify the RSO prior to going to the other monitored facility(s).

7.0 PRECAUTIONS AND LIMITATIONS

- The NRC Form-4 for individuals with current year recorded or estimated exposures from other site(s) shall be reviewed by the RSO prior to issuance of dosimetry. The purpose of this review is to ensure that individuals would not exceed the project administrative annual exposure limit of 500 millirem Total Effective Dose Equivalent (10% of the NRC's limit).
- Any individual entering a Restricted Area or performing work under a AHA shall wear WBD.
- WBDs will be changed out on a quarterly basis.
- Employee personal information shall be accessible only to personnel authorized by the RSO, SSHO, or Project Manager.

8.0 APPARATUS

- Whole Body Dosimeter/Dosimetry (WBD) - e.g., TLDs, OSLs, or Film Badges
- Extremity Dosimeter/Dosimetry - e.g., devices affixed to legs, arms, or finger for monitoring localized (non-whole body) exposures
- Self-Reading Dosimeter (SRD) - portable exposure monitoring devices to provide real-time exposure results
- Electronic dosimetry system

9.0 RECORDS

- Occupational External Radiation Exposure History (NRC Form-4)
- Dosimetry Issue Form
- Whole Body Dosimetry Care & Use Acknowledgement
- Dosimetry Processor Chain-of-Custody

10.0 PROCEDURE

FMSS RADIATION PROTECTION PROGRAM ISSUE AND USE OF STANDARD DOSIMETRY DEVICES	NO.: PP-8-501-2 (12/2013)
	PAGE: 3 of 4

10.1 Dosimetry Issuance for Visitors

WBD is issued to escorted visitors accessing Restricted Areas, and as required by the RSO.

10.2 Dosimetry Issuance for Radiation Workers

1. Ensure that Radiation Worker Training has been successfully completed by the worker prior to dosimetry issue.
2. Ensure the individual has completed an NRC Form 4 "Occupational Radiation Exposure History."
3. Ensure the individual has completed the "Dosimetry Care & Use Acknowledgement" form (Attachment 1).
4. Ensure the worker understands the administrative dose limit and the fraction remaining (available dose) for the current year.
5. Review all other paperwork for completeness and legibility.
6. Issue a dosimeter to the individual by recording the pertinent information on the Dosimetry Issue Form.

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachment(s).

Attachment 1 Dosimetry Care & Use Acknowledgement Form

FMSS RADIATION PROTECTION PROGRAM ISSUE AND USE OF STANDARD DOSIMETRY DEVICES	NO.: PP-8-501-2 (12/2013)
	PAGE: 4 of 4

Attachment 1

DOSIMETRY CARE & USE ACKNOWLEDGEMENT

1. Use **only** dosimetry specifically issued to you.
2. Verify that you are wearing the appropriate dosimetry **prior** to entering Restricted Areas.
3. Unless otherwise directed by the RSO, or task-specific AHA, Whole Body dosimetry **shall** be worn facing out, and attached to clothing/lanyard on the front of the upper torso. **Do not** attach dosimetry to waist belt loops, safety glasses, or hard hats.
4. Extremity/non-whole body dosimetry shall be worn on body locations as directed by the AHA or as directed by the RSO.
5. Dosimetry **shall** be stored in the designated location during non-work periods.
6. Dosimetry **shall** not be worn off-site or to another radiological facility unless specifically authorized by the RSO.
7. If dosimetry is misplaced or damaged, **perform** the following:
 - a. Place work in a safe condition and exit the radiological area;
 - b. Report the lost dosimeter to RP Personnel;
 - c. RP shall initiate a Radiological Occurrence Report (ROR); and
 - d. Obtain RSO authorization to issue replacement dosimetry.
8. **Do not** tamper with or expose dosimetry to excessive heat, security x-rays, or medical radiation sources. Report instances of tampering or unnecessary exposure to the RSO immediately.

Dosimetry is used to monitor your exposure as required by Federal Law and Company Policy. Failure to comply with these or other Radiation Protection Program requirements implemented for your safety, and for the protection of the public and environment may result in revocation of Radiation Worker Training credentials and Restricted Area access privileges.

I have read and understood the information presented and will comply with the Radiation Protection Program requirements as established in the FMSS Site Safety & Health Plan.

Signature

Date

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-600-2 (12/2013)
ISSUE, CONTROL, AND ACCOUNTABILITY OF RADIATION PROTECTION INSTRUMENTATION	PAGE: 1 of 6

1.0 PURPOSE

This procedure defines the activities required to effectively provide the necessary quality required of the Radiation Protection (RP) Instrumentation.

2.0 APPLICABILITY

This procedure applies to all RP personnel qualified to operate the RP instruments.

3.0 REFERENCES

- ANSI N323A-1997, Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments.
- PP-8-1200, "Control of Radiation Protection Records."

4.0 DEFINITIONS

Continuous Use: One or more times daily.

In-Service Instrument: Instruments that are in proper working order, have a valid calibration label, a current response label (if applicable) or is in a location awaiting a routine response/source check.

Instrument: A complete system designed to quantify one or more characteristics of ionizing radiation or radioactive material (does not include laboratory instruments such as gamma or alpha spectroscopy systems and alpha beta gas proportional counters).

Intermittent Use: Less than once daily.

Long-Term Issue / Location Assigned: Instruments / equipment issued to an individual or assigned to a location for periods greater than one shift in duration.

Long-Term Storage: The locked or secured area where instruments / equipment are segregated from in-service instruments.

Non-Routine Maintenance: Non-routine equipment component modification or alteration. (This may include circuit board replacement, hardwired component adjustment / replacement, extensive disassembly, shielding modification / adjustment, any internal adjustments, etc.) Specific exemptions will be stated in the equipment operation and calibration procedures (if any).

Ready-Use Instruments: Instruments that are long-term issued to a control point for subsequent short-term issue to RP personnel. These instruments shall be response tested daily.

Short-Term Issue: Instruments / equipment assigned to a person or location for periods of less than or equal to one shift in duration.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

The RSO is responsible for the following:

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-600-2 (12/2013)
ISSUE, CONTROL, AND ACCOUNTABILITY OF RADIATION PROTECTION INSTRUMENTATION	PAGE: 2 of 6

- Reviewing and approving changes to this procedure and ensuring compliance with applicable regulations.
- Notifying the Project Manager, if the current inventory of field instruments is insufficient to support project needs.
- Overseeing the issue, control and accountability of RP instrumentation per the requirements of this procedure.
- Ensuring transmittal of all issue, control and accountability records to the appropriate document control authority when applicable.

5.2 Radiation Protection Technician (RPT)

The RPTs are responsible for the following:

- Maintaining instrument documentation and records as required by this procedure.
- Maintaining a sufficient percentage of the available instrument inventory operable, in order to support project needs.
- Notifying the RSO of instrument shortages that may affect the ability of the RP Group to support project needs.
- Identifying and maintaining secure location(s) for the storage of operable/inoperable field instruments.
- Verifying current calibration and response test dates prior to issue or use of instruments.
- Promptly returning instruments to their proper location when work is complete.
- Ensuring that instruments are properly surveyed for contamination and decontaminated as necessary, after use.

6.0 PREREQUISITES

- Only personnel with appropriate documented training shall issue or use RP instrumentation.
- Instruments and detectors shall be inspected for mechanical damage, and response tested prior to issue.
- Any instrument to be used shall have a current calibration label affixed to the instrument.

7.0 PRECAUTIONS AND LIMITATIONS

- ALARA practices shall be observed to minimize personnel exposure and the spread of contamination when using RP instrumentation.
- Instruments tagged as “Out of Service” (Attachment 1) and removed from service for calibration, repair, or failure of a response test should be physically segregated from those instruments available for issue.
- Ensure that instruments have been surveyed for contamination and decontaminated as necessary, prior to returning to the issue location.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-600-2 (12/2013)
ISSUE, CONTROL, AND ACCOUNTABILITY OF RADIATION PROTECTION INSTRUMENTATION	PAGE: 3 of 6

8.0 APPARATUS

None

9.0 RECORDS

All instrument specific calibration dates, manuals, and histories.

10.0 PROCEDURE

NOTE

The purpose of tagging instruments that require logging and initial set-up is to ensure that they are not accidentally used by field RP personnel prior to being placed into service. Instrument tagging is not required for instruments that will be logged, set-up, and placed into service at the time the instrument shipment is unpacked.

10.1 Receipt of Non-Inventory Equipment

Perform the following upon receipt of RP Instrumentation not in the current inventory:

1. Unpack and inspect the equipment for damage and immediately tag equipment; "Requires Setup".
2. Verify that applicable parts/service/operations manual is available for reference in the established instrument vendor file. If the manual is not available, notify RP Management to obtain replacement.
3. Initiate a data file for each piece of equipment. Include copies of the following, as applicable:
 - Calibration certificates
 - Calibration data sheets
 - Initial response test data
 - Vendor manuals
 - Charts, graph, tables or other applicable documents supplied by the vendor
3. Add the instrument to the RP instrumentation inventory list.
4. Draft one or more procedures, as necessary, which address:
 - Instrument operation
 - Instrument calibration
 - Instrument maintenance, if applicable
5. The instrument may be used for information only until:
 - The required procedures have been written, reviewed and approved.
 - The calibration requirements have been satisfied.
6. When the instrument is to be made available for field use, perform the following:
 - a. Perform the required instrument set-up and pre-operational checks.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-600-2 (12/2013)
ISSUE, CONTROL, AND ACCOUNTABILITY OF RADIATION PROTECTION INSTRUMENTATION	PAGE: 4 of 6

- b. Remove the “Out-of-Service” tag
- c. Provide the operable instrument to RP Personnel for use or, place the instrument in the designated storage location for in-use instruments.

10.2 Receipt of Inventory Equipment

Perform the following upon receipt of RP instrumentation sent to an approved vendor for calibration or maintenance:

1. Unpack and inspect the equipment for damage and immediately tag equipment; “Requires Setup”.
2. Review the vendor-supplied calibration.
3. Update the instrument data file with copies of the following information, as applicable:
 - Calibration certificates
 - Calibration data sheets
 - Initial response test data
 - Charts, graphs, tables or other applicable documents supplied by the vendor
 - Vendor manual updates
4. Update the RP Instrument Inventory Log.

10.3 Tagging and Processing of “Out-of-Service” Instruments

Perform the following for any instrument that fails pre-use operability checks, is noted to require periodic calibration, or becomes inoperable (i.e., not immediately serviceable by field RP Personnel) during use:

1. Tag the instrument “Out-of-Service”.
 - a. Condition(s) of instrument failure during field use should be noted on the tag.
 - b. Condition(s) of instrument failure during pre-operational checks should be noted on the tag and on the applicable instrument source check log sheet.
2. Notify Lead RP Technician or RP Management of instrument failure.
3. Store instrument in designated location pending shipment for required servicing.
4. Perform the following when preparing instrument(s) for shipment:
 - Pull any remaining documentation (e.g., calibration records, set-up sheets, source check log sheets, etc.) from the instrument file and deliver to RP Records Coordinator for filing per RP-8-1200, “Control of Radiation Protection Records.”
 - Package shipments carefully to avoid damage during transport.
 - Maintain a copy of any packing lists prepared.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-600-2 (12/2013)
ISSUE, CONTROL, AND ACCOUNTABILITY OF RADIATION PROTECTION INSTRUMENTATION	PAGE: 5 of 6

- Update the RP Instrument Inventory Log.
- Notify the service vendor of shipment contents and expected turn-around time.

10.4 Instrument Accountability – RPT

1. Perform the following to determine instrument accountability:
 - Account for all ready-use and short-term issue equipment daily.
 - Account for all long-term issue and location assigned equipment monthly.
 - Perform a physical inventory of all RP instrumentation at least annually. This may be accomplished as part of the annual contractor-issued equipment government inventory process, provided that all non-government owned instruments are also accounted for.
2. Attempt to locate all unaccounted items. Report all missing items to the RSO.
3. Remove records of shipped, disposed, or otherwise retired equipment and forward to RP Records Coordinator (see PP-8-1200).
4. Note status of disposed or retired equipment from the RP instrument inventory system.
5. Perform a calibration-due sort of the RP instrumentation inventory list, to determine which equipment requires calibration in the following month, at least 1 week prior to the first of each month.

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 Out of Service Tag / Label (Typical)

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-600-2 (12/2013)
ISSUE, CONTROL, AND ACCOUNTABILITY OF RADIATION PROTECTION INSTRUMENTATION	PAGE: 6 of 6

ATTACHMENT 1
OUT OF SERVICE TAG / LABEL (TYPICAL)

<input type="checkbox"/>	OUT OF CALIBRATION / FAILED QC
<input type="checkbox"/>	REPAIR NEEDED
<input type="checkbox"/>	REQUIRES SET-UP
<hr/>	
<hr/>	

FMSS RADIATION PROTECTION PROGRAM PORTABLE COUNT RATE INSTRUMENTS	NO.: PP-8-601-2 (12/2013)
	PAGE: 1 of 10

1.0 PURPOSE

This work instruction specifies the methods for set-up, daily pre-operational check, and operation of portable count-rate survey instruments. These instruments are used for the detection of radioactivity on personnel, on or within material surfaces, and in the environment. This procedure does not include associated instrument calibrations or cover the operation of exposure rate instruments.

2.0 APPLICABILITY

This procedure specifically addresses those meter-probe combinations that report values in units of counts or counts per minute (cpm). The primary meters used at FUSRAP Maywood Superfund Site (FMSS) are the Ludlum Models 2221/2241 Scaler-Ratemeters and the Ludlum Model 177 Alarming Ratemeter. These meters are mated to probes including the Ludlum Model 44-10, 44-20, and 44-62 NaI Detectors, the Ludlum Model 43-5 and 43-90 Alpha Scintillation Detectors, and the Ludlum Model 44-9 Pancake Geiger-Mueller detector. Additional meters and probes may be reviewed by the RSO for inclusion under this procedure without revision.

3.0 REFERENCES

- ANSI N323A-1997, Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments.
- Instrument Technical Manuals.
- FMSS Site Safety & Health Plan (SSHP), Vol. 1.
- PP-8-805, Radiological Surveys

4.0 DEFINITIONS

cpm: counts per minute

DFSCCL: Daily Field Source Check Log Sheet.

dpm: disintegrations per minute

HV: High Voltage

MDA: Minimum Detectable Activity

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Reviewing and approving changes to this procedure and ensuring compliance with applicable regulations.
- Ensuring an adequate inventory of Radiation Protection instruments are available to support remediation activities.
- Overseeing the issue, control, and accountability of Radiation Protection instrumentation per the requirements of this procedure.
- Ensuring transmittal of all issue, control and accountability records to the appropriate document control authority when applicable.

FMSS RADIATION PROTECTION PROGRAM PORTABLE COUNT RATE INSTRUMENTS	NO.: PP-8-601-2 (12/2013)
	PAGE: 2 of 10

5.2 Radiation Protection Technician (RPT)

- Maintaining instrument documentation and records as required by this procedure.
- Maintaining adequate instrument and equipment availability.
- Verifying current calibration and response test dates prior to issue or use of instruments.
- Promptly returning instruments to their proper location when work is complete.
- Ensuring that instruments are properly surveyed for contamination and decontaminated as necessary after use.

6.0 PREREQUISITES

- Only personnel with appropriate documented training shall issue or use RP instrumentation.
- Instruments and detectors shall be inspected for mechanical damage, and response tested prior to issue.
- Any instrument to be used shall have a current calibration label affixed to the instrument.

7.0 PRECAUTIONS AND LIMITATIONS

- Portable count rate survey instrumentations are susceptible to damage from physical and environmental stresses.
- QA/QC requirements established by an approved survey plan (e.g., Master Final Status Survey Plan) supersede the requirements of this procedure.

8.0 APPARATUS

- Appropriate survey instruments

9.0 RECORDS

- Portable Instrument Set-Up Sheet
- Daily Field Source Check Log Sheet

10.0 PROCEDURE

10.1 General

- A. Ensure the meter-probe combination selected is within their acceptable calibration periods. The swapping of probes between meters is permitted, but not encouraged. The following precautions and limitations must be observed and the following action steps must be taken:
 - If the meter-probe combination is calibrated as a set, Probe swapping is not permitted, without specific RSO approval.
 - The HIGH VOLTAGE (HV) and THRESHOLD settings for the meter-probe combination shall be identical. Note that the Ludlum 177 and 2241 do not have user adjustable settings for HV and THRESHOLD.
 - An initial set-up must be performed for each meter-probe combination prior to field use.

FMSS RADIATION PROTECTION PROGRAM PORTABLE COUNT RATE INSTRUMENTS	NO.: PP-8-601-2 (12/2013)
	PAGE: 3 of 10

- A source with known pedigree must be counted to verify the efficiency is within 10% of the calibrated efficiency, as applicable.
- B. The RP Group will coordinate the calibration of meters and probes on a minimum annual basis and after major repair operations. Battery and / or cable change-outs (of the same length) do not require re-calibration. Calibration procedures are outside of the scope of this instruction.
- C. Pre-operational checks are required daily prior to use. Post-operational checks are performed as specified in work plans or procedures. Instruments used in the performance of daily activities do not normally require a post-operational check. An example of when post-operational checks are required is as specified in the Master Final Status Survey Plan, which requires both pre- and post-operational checks for instruments used to perform walkover surveys.
- D. Instruments that fail operational checks or malfunction during use should be tagged or labeled "Out-of-Service" or "Do Not Use" and segregated from operational instruments. If possible, describe the problem on the tag / label and add initials and date.
- E. Instruments leaving RP Group control (i.e., repair, calibration, excess, etc.) shall be surveyed for unconditional release according to the contamination criteria established in Table 6-1 of the Site Safety & Health Plan. The repair / calibration center may request a copy of the survey accompany any shipments of RP instruments.
- F. Ensure meters with a "WINDOW" or "WIN" setting are set to "OUT."
- G. Instruments may be operated in the FAST response mode if necessary. This setting is recommended if the audible response cannot be heard. SLOW response shall be used when performing instrument set-up and operational checks.
- H. Ludlum NaI crystals are located in the end of the probe opposite of the cable connection. Use this end for surveys.
- I. Calibration stickers are attached to the instruments and/or detectors. Illegible stickers should be replaced prior to instrument use.
- J. Instrument set-up and subsequent operational checks should be performed in the same location, with consistent temperature and background radiation levels.
- K. Unless otherwise directed by the RSO, source positioning devices (i.e., jigs) shall be used to ensure a reproducible geometry for routine response checks. Source geometry must be consistent between initial instrument set-up and subsequent operational checks.
- L. Instruments that do not have scaler capability should be set-up and checked by replacing one-minute timed counts with static count rate measurements. Each static measurement should last until the meter reading fully stabilizes.

10.2 Instrument Set-Up

- A. Inspect the meter-probe combination for physical damage or defect.
- B. Complete Section A of the Portable Instrument Set-Up Sheet (Attachment 1).

FMSS RADIATION PROTECTION PROGRAM PORTABLE COUNT RATE INSTRUMENTS	NO.: PP-8-601-2 (12/2013)
	PAGE: 4 of 10

- C. Perform 10 one-minute background counts followed by 10 one-minute source counts. During background counts, ensure that the source is sufficiently shielded so as not to impact background values.
- D. Document each count on the Portable Instrument Set-Up Sheet.
- E. Calculate and record the net count value by subtracting the corresponding background count from each source count.

NOTE
Determining Sigma (Standard Deviation) values is useful when specific plans or activities require higher data quality objectives and / or when the development of control charts is necessary.

- F. Calculate and record the following values from the obtained background counts:
 - Avg. Value (Sum of values / # of counts)
 - Sigma Value (Standard Deviation of all counts)
 - 20% Value (Avg. Value * 0.20)
- G. Calculate and record the +/- 20% Values.
- H. Calculate and record the +/- one, two, and three Sigma values using the AVG. VALUE as a reference point If applicable for specific instrument's QC).
- I. Repeat the previous two steps for determining NET COUNT acceptable ranges. The three (3) Sigma value must be less than the +/- 20% value.
- J. Obtain a blank Daily Field Source Check Log Sheet (DFSCCL) (Attachment 2) and transfer the instrument, source, and acceptable range data, as applicable, from the Portable Instrument Set-Up Sheet.
- K. Place the DFSCCL in the designated use location and forward the completed Portable Instrument Set-Up Sheet and submit to the RSO, or designee for review.
- L. Ensure sources are stored properly after use in the designated source storage location.

10.3 Operational Check

- A. Obtain the selected meter-probe combination and corresponding DFSCCL (Attachment 2).
- B. Record the date and time on the DFSCCL.
- C. Perform and document the following checks on the DFSCCL, as applicable:
 - Perform a physical inspection. Observe for instrument damage. Alpha probes should be checked for light leaks by inverting the probe face towards a light source and observing instrument response. If the instrument fails to respond at all or over-responds this may be an indication of a light leak and should be investigated further, prior to proceeding.
 - Perform a battery check. Instrument Models differ in method. Some meters have a visible battery range on the meter face. The Ludlum Model

2241 has a battery indicator in the digital display that lights if the batteries require replacement. The Ludlum Model 2221 has a BAT button that brings up the battery level in the digital display. Ensure this value is at least 5.0v. Change batteries and retest as necessary.

- Verify and adjust the HV, when possible, to match the initial set-up data. Minute differences in HV (+/- 5v) are acceptable without adjustment.
 - Perform an audio response check.
- D. Perform and record a one-minute background count. Report any abnormal background responses to the RSO, prior to instrument use. Normally acceptable background levels < 5 cpm for alpha probes, and < 100 cpm for Pancake G-M probes. Acceptable background levels for NaI probes are variable due to crystal size and based on technician experience.
- E. Perform and record a one-minute source gross count using the same source and geometry applied during initial set-up.
- F. Calculate and record the net count value.
- G. Compare the net count value to the acceptable range. If the instrument response is outside the acceptable range, the process may be repeated a maximum of one additional time before placing the instrument out-of-service.
- H. If the instrument fails the pre-operational checks, mark FAIL, initial the DFSCCL, and place the instrument out-of-service. Deliver completed DFSCCL to the RSO or designee, and explain the failed condition(s).
- I. If all checks pass, mark PASS, initial the DFSCCL, and return form to designated in-use storage location. This may be a binder, folder, or cabinet. The instrument is now ready for use.
- J. If the instrument will be used for routine personnel exit monitoring ensure the alarm threshold is set per PP-8-815, "Personnel Survey and Decontamination". Make adjustments as necessary.
- K. Ensure sources are stored properly after use in the designated source storage location.

10.4 Operations

- A. Operate instrument in a manner that minimizes the potential for cross-contamination and physical damage.
- B. Evaluate the surface or area to be surveyed for potential scanning interferences. For example, thin layers of water or soil can prevent the detection of alpha contamination. Another example is the use of a NaI probe to qualify soil contamination. The presence of standing water can have a significant impact on instrument response. Initiate necessary corrective actions prior to survey or note conditions during survey reporting.
- C. Most instruments will operate in temperatures between 10 and 120 degrees Fahrenheit. However, anytime the temperature is outside of the 32 degree (freezing) or 100 degrees ranges, observe the following precautions:
- Use particular caution with NaI crystals that may shatter under extreme temperature changes. If the temperature difference is greater than 30

degrees between storage and usage locations, wrap the probe tightly in a cloth towel or other insulator and allow to thermally equilibrate at least 30 minutes prior to use.

- Periodically check the instrument against a known source of radiation or contamination. If the instrument appears to be responding incorrectly contact the RSO or designee for guidance.
 - Contact the RSO for guidance anytime work is planned outside of the 10 to 120 degree range.
- D. Protect instruments to the extent possible from exposure to moisture (i.e., rain, snow, etc.) during use. Instruments shall be stored in a safe manner when not in use.
- E. Minimum Detectable Activities (MDA) for each survey should be determined by evaluating field background levels, not background values obtained during operational checks. Calculate MDA using the formula provided in PP-8-805, "Radiological Surveys."
- F. Determining activity in disintegrations per minute (dpm) should be performed using the instrument efficiency obtained during calibration. Efficiencies are normally not established for NaI probes, and therefore should not be used for quantifying activity concentrations. The use of NaI probes for activity quantification shall be evaluated by the RSO prior to performance.
- G. Observe the following when performing survey scans and static measurements:
- Alpha probes should be held within ¼-inch of the surface being surveyed. Probe speed should not exceed one probe width per second.
 - Beta probes should be held within ½-inch of the surface being surveyed. Survey speed should not exceed one probe width per second.
 - NaI probes should be held as close as possible to the surface being surveyed without contaminating the probe housing. Note that the crystal is located in the probe end opposite the cable connection. Use appropriate sleeving or wrapping in wet or dirty environments.
 - The normal scan speed for performing Final Status Survey gamma walkover surveys is 0.5 m/sec. Move the detector side to side using a one-meter path length. Each side-side swing should take 2 seconds to traverse the one-meter path. Advance the probe forward as you go at a rate of approximately 0.5 m/sec. Use the audio function. When increased counts are detected, slow down and locate the source as would be done in a normal survey. Walk parallel paths to ensure that 100% of the area is surveyed. Ensure that the survey extends to the boundaries of the survey unit. Pay particular attention to low lying areas, ditches, and points of possible contamination.
 - Static measurements should be performed in any location where scans indicated the presence of activity. This is due to the fact that instrument MDAs are normally based on a one-minute static measurement.

FMSS RADIATION PROTECTION PROGRAM PORTABLE COUNT RATE INSTRUMENTS	NO.: PP-8-601-2 (12/2013)
	PAGE: 7 of 10

- All static measurements should be at least one minute, if the instrument has a scaler function. If the instrument is a rate-meter only, static measurements should last until the meter reading has fully stabilized.

H. Perform a post-operational check after use if directed by work plan, procedure, or the RSO.

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 Portable Instrument Set-Up Sheet (Typical)

Attachment 2 Daily Field Source Check Log Sheet (Typical)

**Attachment 1
Portable Instrument Set-Up Sheet**

PORTABLE INSTRUMENT SET-UP SHEET

Set-Up Location: _____

INSTRUMENT DATA		COUNT (n)	Source Counts	Source Count Time (min)	Source CPM	Background Counts	Background Count Time (min)	Background CPM	NET CPM		
										INSTRUMENT	DETECTOR
MODEL		1									
SERIAL #		2									
CAL DUE		3									
HV											
THRESHOLD											
SOURCE DATA		4									
ISOTOPE		5									
SERIAL #		6									
ACTIVITY (uCi)		7									
ACTIVITY (dpm)		8									
		9									
		10									
REMARKS											
CALCULATED VALUES					ACCEPTABLE RANGES						
Background (CPM)			Net CPM			Background (CPM)			Net CPM		
			Average						+ 20 %		
			+/- Sigma						+ 3 Sigma		
			+/- 20 %						+ 2 Sigma		
									+ 1 Sigma		
									- 1 Sigma		
									- 2 Sigma		
									- 3 Sigma		
									- 20 %		
Performed By: _____			Date / Time: _____			Reviewed By: _____			Date / Time: _____		

**FMSS RADIATION PROTECTION PROGRAM
PORTABLE COUNT RATE INSTRUMENTS**

NO.: PP-8-601-2
(12/2013)

PAGE: 9 of 10

**Attachment 2
Daily Field Source Check Log Sheet**

DAILY FIELD SOURCE CHECK LOG

MONTH / YEAR: _____

INSTRUMENT DATA		Date/Time	Physical	Battery	High Voltage	Audio	Background CPM (A)	Source CPM (B)	Net CPM (C)	PASS or FAIL	Tech. Initials
INSTRUMENT	DETECTOR										
MODEL											
SERIAL #											
CAL DUE											
SOURCE DATA											
ISOTOPE											
SERIAL #											
ACTIVITY											
dpm											
INSTRUMENT RANGES											
	Background										
	Net CPM										
+ 20 %											
+ 3 Sigma											
+ 2 Sigma											
+ 1 Sigma											
- 1 Sigma											
- 2 Sigma											
- 3 Sigma											
- 20 %											
NET CPM CALCULATION											
{B} - {A} = {C}											
Remarks:											Reviewed by:

FMSS RADIATION PROTECTION PROGRAM PORTABLE COUNT RATE INSTRUMENTS	NO.: PP-8-601-2 (12/2013)
	PAGE: 10 of 10

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FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE GILIAN GILAIR-3 AIR SAMPLING PUMP	NO.: PP-8-602-1 (12/2013)
	PAGE: 1 of 10

1.0 PURPOSE

The purpose of this procedure is to establish and define consistent methodology for the calibration and operation of the Gilian™ sampling pumps, as well as the documentation of workplace surveys using Gilian sampling pumps - specifically the GilAir-3. The primary application of these pumps is to collect breathing zone (BZ) air samples of Project Radiation Workers, thus permitting a quantitative determination of airborne radioactivity levels.

2.0 APPLICABILITY

This procedure applies to all personnel who may reasonably be expected to utilize the Gilian Model GilAir-3 for workplace surveillance activities. Tasks requiring BZ sampling are described in Project Procedure PP-8-803-0, "Measurement of Airborne Radioactivity".

3.0 REFERENCES

- Gilian, "Operation & Service Manual," Revision D, Document No. 800880M
- Ness, S., "Air Monitoring for Toxic Exposures," 1991.
- US Army Corps of Engineers, EM 385-1-1, "Safety and Health Requirements Manual."
- US Army Corps of Engineers, EM 385-1-80, "Radiation Protection Manual."
- FUSRAP Maywood Superfund Site (FMSS), "Site Safety and Health Plan," (SSHP), Volume 1

4.0 GENERAL

4.1 Discussion

The constant-flow sampling pump is the primary device for actively collecting integrated samples on media. Constant-flow pumps like the Gilian and SKC models in use at the FUSRAP Maywood Superfund Site (FMSS) can cope with changing conditions, such as filter loading, and still maintain a constant sampling rate within certain limits by measuring and controlling the actual input flow. These pumps are suited for a broad range of applications and are ideal for industrial hygiene studies as well as environmental testing. The GilAir-3 is a lightweight sampling pump that combines lightweight compact design, computer-compatible circuitry, and an internal flow sensor.

4.2 Definitions

Activity Hazard Analysis (AHA): A document or series of documents prepared by OH&S and Radiation Protection (RP) to inform workers of the OH&S and/or radiological conditions that exist in the work area, work scope limitations, specific protective requirements, ALARA considerations, and instructions to workers.

Personal Air Sampling Pump (Lapel Pump): A compact, lightweight air sampling device able to be worn by individual workers and mechanically

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE GILIAN GILAIR-3 AIR SAMPLING PUMP	NO.: PP-8-602-1 (12/2013)
	PAGE: 2 of 10

designed to maintain fairly constant flow rates over a given sampling period, thus permitting occupational exposure calculations.

Primary Standard: A highly accurate flow calibration device with NIST-traceable specifications. Primary standards require no calibration of their own, but should be periodically returned to the manufacturer for suggested maintenance. Examples include the Gillian Gilibrator and Bios DryCal, which are accepted by OSHA as primary standards.

Sampling Train: The connected combination of collection media, sampling pump, tubing, and a flow rate-measuring device.

Calibration (Specific to this Instrument): The process of adjusting and recording flow rates of the sampling pump using a primary flow calibrator. Flow rates are documented before and after sampling events.

5.0 RESPONSIBILITIES

5.1 Site Safety & Health Officer (SSHO)

- Providing oversight to all Safety & Health Air Monitoring performed at the Project.
- Defining and establishing air sampling protocols for specific contaminants at the FMSS.

5.2 Radiation Safety Officer (RSO)

- Directing radiological air monitoring strategies based upon established protocols and plans.
- Reviewing air monitoring results and initiating necessary follow-up actions.

5.3 Radiation Protection Technician (RPT)

- Ensuring proper performance of air monitoring instrumentation through daily inspections and flow calibrations.
- Deploying and operating air sampling pumps in the workplace in a logical and effective manner so as to ensure representative sampling and meaningful exposure data.
- Performing regular “checkups” on deployed air sampling pumps, verifying proper operation, and noting any unusual occurrences, such as flow interruptions or inappropriate sampling locations.
- Documenting workplace air monitoring on appropriate documentation.

5.4 Project Personnel

- Complying with field directions from RPTs regarding the wearing of personal air sampling pumps.
- Alerting RP personnel of any unusual occurrences with personal air sampling pumps (e.g., flow interruptions, dead battery, job reassignment, etc.).

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE GILIAN GILAIR-3 AIR SAMPLING PUMP	NO.: PP-8-602-1 (12/2013)
	PAGE: 3 of 10

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

- Only properly trained and authorized personnel are permitted to operate personal air (lapel) air sampling pumps.
- Because personal air sampling pumps are often relied upon to provide critical personnel exposure data, quality care of these devices is essential. Pumps should be inspected after each survey for missing or damaged parts and repaired promptly.
- In order to have accurate volume calculations as well as be assured that flow rates are appropriate for specific types of sampling, flow rate measurements are mandatory before and after sampling events.
- Verify flow rates with a primary standard, such as a Gillian electronic bubble meter or Bios DryCal Flow Meter with the intended sampling media included in the sampling train.
- Constant-flow sampling pumps should be flow-calibrated at the same altitude at which they will be used. Verify that the appropriate sampling media is selected prior to commencing monitoring. This includes an understanding of the proper orientation of the filter media:
 - 25 mm diameter, 1.2 micron pore size borosilicate (glass) fiber filters are normally used for monitoring particulate airborne radioactivity. The slightly rougher (fuzzy) side faces outward.
 - 25 mm diameters, 0.45 micron membrane filters are normally used for radon grab sampling. Either side is acceptable for monitoring, however the outward face should be marked slightly (pen mark) to identify where contaminants are deposited on the filter. These filters normally come separated with a blue divider. This is not the filter.
 - 37 mm diameter, 0.8 micron Mixed Cellulose Ester (MCE) filter cassettes are normally used for metals.
 - 25 mm diameter, 0.8 micron MCE three-piece static conductive filter cassettes (with cowl) are normally used for asbestos air sampling.

Deviations from the filter media listed above require SSHO and RSO approval.

- The GilAir-3 sampling pump with installed battery pack has passed UL standards for intrinsic safety.
- Use only a Gillian-approved battery charger for pump charging. The battery charger is not intrinsically safe and therefore shall not be operated in hazardous atmospheres.
- Use caution when wearing pumps or handling sample media to avoid cross-contaminating or compromising the filter media. RPTs should explain proper wear and handling requirements to wearers prior to issuance.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE GILIAN GILAIR-3 AIR SAMPLING PUMP	NO.: PP-8-602-1 (12/2013)
	PAGE: 4 of 10

8.0 APPARATUS

- Gilian GilAir-3 air sampling pump, or equivalent
- Primary flow calibrator, such as Bios DryCal®, Gillian Gilibrator™, or equivalent
- PVC or Tygon® tubing, filter cassette, and appropriate sampling media
- Small hand tool kit for pump adjustments

9.0 RECORDS

- Personnel Pump Calibration Record
- Industrial Hygiene Air Monitoring Data Sheet

10.0 PROCEDURE

10.1 Setup

- 10.1.1 The user should become familiar with the instrument's display, key and switch positions, and port locations before operating. Refer to p.12 of the GilAir-3 Operation & Service Manual for the pump function diagram.
- 10.1.2 Ensure that the instrument has been sufficiently charged (overnight) to operate throughout a typical work shift (8 -10 hours).
- 10.1.3 Ensure that the vent control switch on top of the pump is in the "closed circle" position.
- 10.1.4 Battery Test:

IMPORTANT NOTE

The user must be sure that run time data from the previous sampling run has been recorded. Switching the pump ON from its low power state clears accumulated data.

- A. Move the power switch to the "ON" position.
- B. Check to verify that the battery charge indicator does illuminate (green) when the pump is turned on. A lit indicator means the battery is fully charged.

10.2 Calibration

- 10.2.1 Switch pump to the OFF position.
- 10.2.2 Depress the MODE/HOLD button twice on the side of the pump. A flashing "CAL" should be displayed.
- 10.2.3 Switch pump to the ON position. While in the "CAL" mode, connect the appropriate sample media (e.g., 25 mm glass fiber in cassette) to the inlet port of the primary standard flow calibrator, e.g. Bios Dry-Cal®.
- 10.2.4 Connect the tubing from the pump to the outlet port of the flow calibrator. Refer to Figure 1.

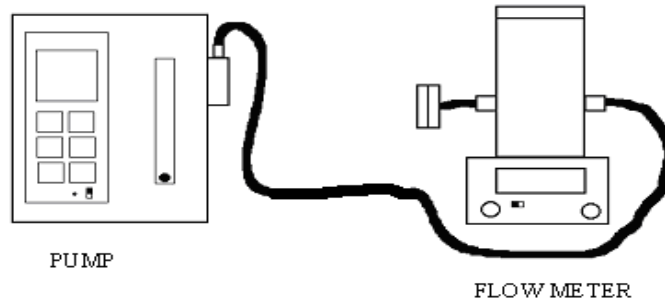


Figure 1
Properly connected sampling train

- 10.2.5 Turn on the flow calibrator.
- 10.2.6 Adjust the flow by turning the flow adjust screw. Use 2500 mL/min as a target flow rate for routine radiological air monitoring, unless otherwise directed by the RSO.
- 10.2.7 Collect three (3) readings from the flow calibrator by pressing the READ button three times. If the average flow rate is within $\pm 5\%$ of the desired flow rate (e.g., 2375 - 2625 ml/min for 2500 ml/min standard), then proceed to Step 10.2.8. If the measurements do not fall within this range, adjust the flow adjust screw until acceptable flow rates are obtained.
- 10.2.8 Record these (3) flow rate results and average flow rate onto the "Personnel Pump Calibration Record" (see Attachment 1 of this SOP) making sure all sections of the form are complete.
- 10.2.9 Place pump on "HOLD" by depressing the MODE/HOLD switch for 1 to 2 seconds.
- 10.2.10 Re-attach the sample cassette to the Tygon tubing leading to the pump's inlet port.
- 10.2.11 Switch the pump to the "OFF" position. Screw down tamper plate over clock display.
- 10.2.12 Fill out pre-use flow and pump information onto the pre-stamped manila envelopes and keep these envelopes with their respective pumps. The pump is now ready to be deployed into the work area.

10.3 Deployment

- 10.3.1 Determine the appropriate sampling location or wearer(s) based upon an evaluation of planned activities, the number and classification of site workers, or as specified in the approved procedure or AHA. At a minimum, one (1) Operating Engineer and (1) laborer per work area should be assigned lapel pumps during intrusive soil handling activities. Pumps should always be assigned to the potential "worst-case" exposure workers in any given area.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE GILIAN GILAIR-3 AIR SAMPLING PUMP	NO.: PP-8-602-1 (12/2013)
	PAGE: 6 of 10

- 10.3.2 Issue pump and document required use information (worker's name, AHA, property ID) on a sample envelope or log sheet.
- 10.3.3 Switch the pump "ON". Cover switch with anti-tamper plate and screw down to secure.
- 10.3.4 Attach pump to a belt at the waist with the tubing running up the back and over the shoulder of the worker. The filter cassette should be attached in the upper chest area (to collar of shirt or coveralls) and facing downwards – representative of the worker's breathing zone.
- 10.3.5 The lapel sampling pump should be placed in HOLD mode during those periods when the assigned worker is not inside the Restricted Area, e.g. coffee break, lunchtime, etc. Place pump on HOLD by depressing the MODE/HOLD button for 1-2 seconds. A flashing "hand" symbol will appear in the pump's clock display. Press the MODE/HOLD button again until pump restarts.
- 10.3.6 At the end of the sampling period, the RPT shall place the pump on HOLD until which time it is returned to the flow measuring station.
- 10.3.7 Upon completion of the sampling period, perform the following:
- A. Perform a flow check on the sampling pump following the procedure described in Section 10.2 **except** make no flow adjustments to the pump.
 - B. Obtain three consecutive flow measurements using the flow meter and record average reading on the "Personnel Pump Calibration Record" (See Attachment 1).
 - C. Record final flow information, including total run time from the instrument display on the air sample or log sheet. Place the used filter into a glassine sleeve and place into the air sample envelope.
 - D. Allow filters collected for radiological particulate air monitoring, excluding radon daughter products, to decay for a period of at least 4 days prior to counting, unless directed otherwise by the RSO or SSHO.
 - E. Turn the pump off and connect to battery charger. Verify the charge indicator is lit.
- 10.3.8 Industrial hygiene (chemical) sampling event information should be recorded on the "Industrial Hygiene Air Monitoring Data Sheet" (See Attachment 2).

10.4 Maintenance

From time to time, some components of the Gilian sampling pump must be removed, cleaned, or replaced. Components that may be serviced by end users as part of a routine maintenance schedule are:

10.4.1 Inlet filter

The user should periodically do a visual check of the inlet filter on the right side of the pump. This filter should be changed after six months of

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE GILIAN GILAIR-3 AIR SAMPLING PUMP	NO.: PP-8-602-1 (12/2013)
	PAGE: 7 of 10

use or whenever the outer portion of the filter becomes discolored. Replacement instructions are detailed on p. 25 of the GilAir-3 Operation Manual.

10.4.2 Battery

- A fully charged battery pack will operate a Gilian lapel sampler for a minimum of 10 hours at 2000 ml/min.
- The NiCad battery packs in the GilAir-3 pumps should be completely discharged from time to time to minimize the “memory effect” of rechargeable batteries. The Gilian pump chargers in use at the FMSS are cycling chargers, which cycle the NiCad batteries automatically. After several hundred charge cycles, Ni-Cad batteries lose performance characteristics and will eventually require replacement.

10.4.3 Replacement Parts

A list of replacement parts can be found on p.26, Appendix A of the GilAir-3 Operation Manual.

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 Personnel Pump Calibration Record (Typical)

Attachment 2 Industrial Hygiene Air Monitoring Data Sheet (Typical)

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE GILIAN GILAIR-3 AIR SAMPLING PUMP	NO.: PP-8-602-1 (12/2013)
	PAGE: 8 of 10

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Attachment 1 (Typical)

PERSONNEL PUMP CALIBRATION RECORD			
REFERENCE NUMBER: _____		LOCATION: _____	
PRE-SAMPLING CALIBRATION		POST SAMPLING CALIBRATION	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	

Attachment 2 (Typical)

INDUSTRIAL HYGIENE AIR MONITORING DATA SHEET			
HAZARDOUS SUBSTANCES DATA SHEET			
1. COMPANY NAME	2. CONTRACT NO.	3. SAMPLING NO.	
4. WORK ACTIVITY		5. SAMPLING DATE	6. SHIPPING DATE
7. PERSON PERFORMING SAMPLING (SIGNATURE)		8. PRINT LAST NAME	9. SSO
10. MONITORED WORKER (NAME, ADDRESS, PHONE NUMBER)	14. EXP. INFO.	a. NUMBER	b. DURATION
		c. FREQUENCY	
11. JOB TITLE	15. WEATHER CONDITIONS	16. PHOTO(S) YES NO	
13. PPE (TYPE AND EFFECTIVENESS)	17. PUMP CHECKS AND ADJUSTMENTS		
18. JOB DESCRIPTION, OPERATION, WORK LOCATION(S), VERIFICATION, AND CONTROLS			
JOB DESCRIPTION:			
OPERATION:			
WORK LOCATION:			
VERIFICATION:			
CONTROLS:			
FIELD SAMPLING DATA			
19. PUMP NUMBER:		30. CALCULATIONS AND NOTES:	
20. SAMPLE SUBMITTAL NO.			
21. SAMPLE TYPE			
22. SAMPLE MEDIA			
23. FILTER/TUBE NUMBER			
24. TIME ON/OFF	ON		
	OFF		
25. TOTAL TIME IN MINUTES			
26. FLOW RATE	PRE		
	L/MIN CC/MIN POST		
27. VOLUME (IN LITERS)			
28. NET SAMPLE WEIGHT (IN MG)			
29. ANALYZE SAMPLES FOR:			

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 1 of 13

1.0 PURPOSE

The purpose of this procedure is to establish consistent methodology for the set-up, calibration and operation of the HI-Q Environmental Products, Model HVP-3800AFC high volume air sampling pump and associated PM-10 Size Selective Inlet (SSI)

2.0 APPLICABILITY

This procedure applies to all personnel who may reasonably be expected to utilize the HVP-3800AFC sampling pump for workplace perimeter surveillance activities.

3.0 REFERENCES

1. HI-Q Environmental Products, "Technical Manual, Model: HVP-3800AFC," Rev. 03/99.
2. HI-Q Environmental Products, "Technical Manual, Model: Model PM-10 INLET.
3. FUSRAP Maywood Superfund Site (FMSS) "Site Safety and Health Plan" (SSHP).
4. U.S. Army Corps of Engineers (USACE), EM 385-1-1, "Safety and Health Requirements Manual."

4.0 GENERAL

4.1 Discussion

The HVP-3800AFC is a brushless, automatic-flow control, high volume air sampling device, designed for continuous outdoor use (the unit is housed in an anodized aluminum outdoor shelter). This sampling pump is the primary device used for actively collecting integrated samples on media. Automatic-flow control pumps like the HI-Q models in use at FMSS can cope with changing conditions such as filter loading and still maintain a constant sampling rate within certain limits by measuring and regulating the actual input flow.

Select units are fitted with the PM-10 SSI. The PM-10 SSI is a precision symmetrical designed inlet used to differentiate collected particulate by size. Larger particles are impacted on a greased shim plate. Small particles (< 10 microns) are collected on the 8" x 10" filter collection media. This unit is designed to collect uniformly across the sample media regardless of wind direction and wind speed. At the FMSS, the MVP-3800 AFC is typically used for sampling radiological particulates at work site perimeters to ensure compliance with off-site monitoring requirements

4.2 Definitions

High Volume (Hi-Vol) Air Sampling Pump: A portable air-sampling device designed to maintain fairly constant flow rates over a given sampling period thus permitting. Hi-Vol air samplers typically operate at flow rates between 0.2832 and 1.42 cubic meters per minute (10 and 50 cubic feet per minute)

Primary Standard: A highly accurate flow calibration device with NIST-traceable specifications

Sampling Train: The connected combination of collection media, sampling pump, tubing, and a flow rate-measuring device.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 2 of 13

Calibration check (specific to this instrument): The process of adjusting and recording flow rates of the sampling pump using calibration check devices such as the HI-Q Model HFC-50C or the HI-Q Model D-AFC-50. Flow calibrations using a primary standard shall be performed annually. Pump calibrations expire one year from date of last calibration.

5.0 RESPONSIBILITIES

5.1 Site Safety and Health Officer (SSHO)

The SSHO is responsible for:

- Providing oversight to all Safety and Health air monitoring performed on the Project.
- Defining and establishing air sampling protocols for specific contaminants at FMSS.
- Ensuring all electrical connections associated with the initial set-up of this equipment is performed in accordance with the applicable electrical codes and in compliance with the project SSHP.

5.2 Radiation Safety Officer (RSO)

The RSO is responsible for:

- Directing radiological air monitoring strategies based upon established protocols and plans.
- Reviewing air monitoring results and initiating necessary follow-up actions.

5.3 Radiation Protection Technicians (RPTs)

RPTs are responsible for:

- Ensuring proper performance of air monitoring instrumentation through routine inspections and established calibration requirements.
- Deploying and operating air sampling equipment in the workplace in a logical and effective manner so as to ensure representative sampling and meaningful exposure data.
- Performing regular inspections on deployed air sampling equipment to verify proper operation and to note any unusual occurrences such as flow interruptions or inappropriate sampling locations.
- Documenting workplace air monitoring activities on appropriate documentation.

5.4 Project Workers

Project workers are responsible for the following:

- Notifying RPTs of any power disconnections to or pump malfunctions of work area or perimeter air samplers.
- Providing assistance to RPTs in the setup of work area or perimeter air samplers, (e.g., relocating units, helping to obtain extension cords, constructing stands or shelters, etc.), if needed.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 3 of 13

6.0 PREREQUISITES

The pump must have been calibrated with a primary standard prior to field use. The HVP-3800AFC is calibrated before leaving the factory; therefore there is no need to calibrate the unit prior to initial set-up. Flow calibrations are valid for 365 days after calibration date. Calibration shall be performed with the intended sampling media (8" x 10" 0.3 micron glass fiber paper) included in the sampling train.

7.0 PRECAUTIONS AND LIMITATIONS

- The "calibration" performed in this procedure are only verifications of the primary factory calibrations.
- Only authorized personnel are permitted to operate air-sampling equipment.
- Because air-sampling pumps are often relied upon to provide critical exposure data, quality care of these devices is essential. Pumps should be inspected after each sampling event for missing or damaged parts and repaired promptly. Pumps with damaged power cords shall be tagged and taken out of service.
- Verify that the sampling media is appropriate for the intended sampling event (e.g., 8" x 10" 0.3 micron glass fiber filter for radiological particulate monitoring).
- This sampler model is outfitted with a totalizer to capture operating run times. These values should be recorded, if available, to better estimate overall sample volumes and to determine if interruptions in operations occurred. The totalizer must be reset after each sampling event.
- This equipment must not be used in any area contaminated by volatile or flammable materials since sparking is predicable in the normal operation of the motor and may ignite the volatiles.
- Use caution when handling the sensitive laminar flow element to avoid equipment damage.
- To avoid serious injury (electrical or mechanical) or equipment damage, do not open or disassemble the pump motor. The pump motor must be replaced if it fails.
- Use caution when adjusting potentiometers on the circuit board. 120VAC circuits will be directly exposed and can cause serious shock injury.

8.0 APPARATUS

- HI-Q Model HVP-3800AFC high volume air sampler
- Electronic mass flow meter, such as HI-Q Model HFC-1.4CMM calibrator
- HI-Q Model PM-10 Selective Size Impactor (SSI)
- Appropriate sampling media
- Small tool kit for pump adjustments

9.0 RECORDS

Completed "Calibration Certificate and Data Sheet for the Low Volume Air Sampler" will be sent to RPP Records until transmitted to Project Document Control.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 4 of 13

10.0 PROCEDURE

10.1 Instrument Setup

- The user should familiarize himself / herself with the HI-Q Technical Manual for the HVP-3800AFC and this procedure before using for the first time.
- Perform a visual inspection of the instrument unit making sure all components are in sound condition. The units are shipped in 2 or 3 boxes depending on the accessories purchased.
- For permanent installation, remove the 4 rubber shock absorbers on the leg bottoms.
- Use lag bolts or molly bolts to fasten the unit to a concrete pad or other type of base.
- Install the roof with the bolts provided
- Attach roof restrainer to the cabinet to prevent the roof from falling down when changing out filter paper.
- If using PM10 SSI, ensure 90-degree support stabilizers are attached at the base of each leg to prevent unit from tipping.
- Have a licensed electrician connect the unit's conduit and wire as required by the applicable electrical codes. The unit should be installed on a circuit breaker line of at least 15 amps.

10.2 Flow Calibration Check

- A. Verify normal operation of unit before proceeding with calibration.
- B. Turn motor switch off.
- C. Remove any old filter paper and replace with a clean sheet of the same type that will normally be used for sampling. Do not replace paper-clamping plate yet.
- D. Place calibrator adapter plate over filter paper.
- E. Place paper-clamping plate or clamping bars over calibrator adapter plate and tighten.
 - If the adapter plate is not sufficiently tight, airflow will fluctuate on the airflow display panel.
 - Tighten all four clamps, as necessary until flow rate stabilizes.
- F. Connect calibrator-to-calibrator adapter plate and tighten.
- G. Obtain a copy of the HVP-3800AFC Flow Calibration Work Sheet (attachment 1) and complete the first section of pertinent information (i.e. Unit No., Unit Location, date, time, etc.)
- H. Turn calibrator power switch on first (D-AFC-50 calibrator only).

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 5 of 13

- I. Obtain current temperature and barometric pressure and enter the information under section 1 of the "Calibration Work Sheet". If using the D-AFC-50 calibrator press "3" from the main menu to obtain this information.
- J. Look up temperature and barometric pressure correction factors from charts (attachments 2 & 3 respectively) and enter the information in the appropriate boxes.
- K. Calculate the overall Correction factor (C_f) by multiplying the Barometric Pressure C_f and the Temperature C_f
- L. Calculate the Calibrator Flow Rate by dividing Normal or Desired Sample Flow Rate (i.e. 1.13 SCMM) by the overall C_f calculated in step 9.
- M. Enter information under section 3 of the "Calibration Work Sheet".

FLOW CALCULATION EXAMPLE

- Normal Sample Rate is 1.13 SCMM
- Barometric pressure is 29.10" Hg. (Barometric Pressure $C_f = .9862$)
- Temperature is 77° Fahrenheit. (Temperature $C_f = .9770$)
- $C_f = \text{Barometric Pressure } C_f \times \text{Temperature } C_f = .9635$
- Calibrator Flow Rate = Normal Sample Rate $\div C_f$ ($1.13 \div .9635$) = 1.17 ACFM

- N. Turn main power to unit on and allow electronics to warm up for at least one minute.
- O. Turn motor switch on.
- P. Turn speed control clockwise or counter-clockwise until the Calibrator Flow Rate is equal to the calculation flow rate from the Flow Calibration Worksheet Attachment (1). As per the flow calculation example the Calibrator Flow Rate would be 1.17 ACMM.
- Q. If the flow rate display on the display panel indicates the Normal Sample Rate is within tolerances (i.e. 1.13 SCMM plus/minus 5%), then unit is within calibration. Skip to Totalizer Calibration Check.
- R. If flow rate is not within tolerance then potentiometer adjustment is required.
 1. Turn motor switch and main power switch off.

CAUTION!

120VAC connections will be accessible on circuit board. Take necessary precautions to prevent contact with any part of circuit board other than adjustment pots.

2. Remove the six screws that hold the display panel in place.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 6 of 13

3. Carefully slide display panel to the left and pull right side of panel out without putting strain on attached wires.
4. Locate pot "R19" on circuit board behind display panel. It is on the left side of the circuit board near the multi-pin connectors.
5. Support front panel so as to be able to view the display panel as well as adjusting pot "R19".
6. Turn main power to unit on and allow electronics to warm up for at least 1 minute.
7. Wait a few seconds for electronics to warm up and turn motor switch on.
8. Turn speed control clockwise or counter-clockwise.
9. Adjust speed control until Calibrator Flow Rate is equal to the calculation flow rate from the Flow Calibration Worksheet Attachment (1).
10. Adjust pot "R19" until flow rate display matches Normal Sample Rate (i.e. 1.13 SCMM). Check.
11. Flow display calibration is complete. Proceed to Totalizer Calibration check

10.3 Totalizer Calibration Check

- A. Set the flow rate (filter paper in place) at some value (i.e. 1.13 SCMM)
- B. Start a stopwatch at the same time the totalizer is reset.
- C. Run sampler until 9.0 SCMM volume is reached on the totalizer.
- D. Verify that the stopwatch recorded elapsed time is between 7 minutes 34 seconds and 8 minutes 22 seconds.
- E. If the stopwatch recorded elapsed time is not within the acceptable range, the test may be repeated one additional time prior to placing the unit out of service.
- F. Complete appropriate sections of Flow Calibration Worksheet Attachment (1).

10.4 Operation

- A. Consult with the RSO before initial deployment of work area or perimeter air samplers to verify locations, run times, monitoring strategies, and flow rates.
- B. Ensure the all associated hardware included with the HVP-3800 AFC air sampler is assembled (i.e. roof assembly, roof restrainer, rubber foot shock absorbers, etc.) and positioned between 4 and 6 feet above ground level.

NOTE

To determine TSP or PM-10 mass concentrations the unused (tare) and used (gross) filter weights must be recorded on the envelope or log sheet.

- C. Document the required use information on a sample envelope or log sheet.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 7 of 13

- D. Before pump activation, place the appropriate sampling media such as 8" x 10" 0.3 micron glass fiber filter into the filter holder.
- E. Using the 0.3 micron paper, insert the filter paper such that the "shiny" side is facing the pump.
- F. For automatic speed and flow control, you must set the flow to some rate that is less than the maximum obtainable flow rate of 1.42 standard cubic meters per minute (SCMM). Hence, when the flow is reduced by dust loading, the motor can speed up to compensate for the reduced flow. The recommended flow rate is 1.13 SCMM.
- G. Reset the elapsed timer to zero by depressing red button located beneath the "Elapsed Time, Hours" digital display.
- H. Start the unit by pushing the toggle "Motor Switch" to the up position. There will be a pause until the electronics warm up.
- I. Allow the motor to start and settle down to the "Speed Control" potentiometer (speed pot) setting.
- J. If the motor does not start, rotate the speed pot clockwise to start the unit, and then set it to the desired speed of 1.13 SCMM.
- K. Allow the unit to run for a few minutes to set the paper and warm up the motor.
- L. Close the unit and lock if required.
- M. Collect sample for desired time.
- N. As directed by the RSO, periodically verify pump operation and filter integrity. Notify RP Management immediately, if a unit is discovered to be damaged or otherwise non-operational.
- O. Upon completion of sampling period, turn unit off, collect/replace filter media and record final flow information, including total volume and total run time from the instrument display panel on the air sample envelope or log sheet.
- P. Place the used filter into the air sample envelope and return the log sheet and/or sample to the Radioanalytical Laboratory for analysis.

10.5 PM-10 SSI Assembly and Sampling

- A. Lift SSI, hood, and hood spacer bag from box.
- B. Cut cable tie on bottom of SSI that is holding the strut, and remove shoulder bolt and large washer.
- C. Align middle of strut with hole in spacer, and fasten with shoulder bolt and large washer. **Ensure large washer is on top.**
- D. Place SSI on shelter, and align the shelter base pan 10-24 nut set holes with the holes inside of the shelter.
- E. Insert 10-24 x 1" bolts. (CAUTION: Ensure that the shelter is securely mounted to ground floor prior to opening SSI)
- F. Place SSI hood onto acceleration nozzle plate (top of SSI).

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 8 of 13

- G. Locate hood spacer between hood and acceleration nozzle plate, then loosely fasten with 10-32 x 1/2" thumb bolt, making sure plastic washer is in place. (Do this loosely for all eight-hood spacers before tightening.
- H. Open SSI by disengaging hooks and lifting the middle section into the open position.
- I. Remove cardboard and rubber bands that are covering filter holder assembly opening.
- J. Lower filter holder assembly down through opening making sure 8" x 10" gasket is under filter holder and the brass bolt aligns with filter holder.
- K. Place appropriate filter collection media on the CFPH-810 filter holder.
- L. Replace rectangular paper retainer bracket/cover and align the brass bolt assembly accordingly.
- M. Tighten for airtight seal.
- N. Ensure the HIQ-6001-24 Shim Plate has been wiped clean and evenly treated with DOW Corning Silicone spray, prior to each sampling event.

10.6 PM-10 to Total Suspended Particulate (TSP) Conversion

- A. Shut down unit and remove sample paper cartridge per normal sampling procedures.
- B. Remove PM-10 sample head from 16" x 16" adapter frame.
- C. Completely loosen by hand the 8" x 10" holder gland nut located inside cabinet just above the blower.
- D. Carefully lift 8" x 10" holder out of housing without pulling on the attached flow probe wires. Rest filter holder on top of housing.

NOTE

Flow probe is fragile. Do not touch exposed flow element.

- E. Using a flat blade screwdriver, remove holding clamp and flow probe assembly from the 3" diameter neck of the 8" x 10" holder. Protect the flow probe from damage.
- F. Loosen the 4 clamping screws located on the sides of the 16" x 16" adapter frame and remove the adapter frame from the housing.
- G. Set 8" x 10" TSP filter holder (8" x 10" holder with swivel clamps) on top of housing.
- H. Place the flow probe into the 8" x 10" TSP filter holder with the groove on the stem facing up (towards filter paper). Tighten flow-probe-holding-clamp.
- I. Lower 8" x 10" TSP filter holder into place and tighten gland nut.
- J. Place gabled roof on top of housing
- K. Attach "T" hinge with bolts at rear of housing

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 9 of 13

- L. Attach folding roof support to housing with washer and nut
- M. Unit is now ready for TSP sampling.

10.7 TSP to PM-10 Conversion

- A. Remove sample paper cartridge per normal sampling procedures.
- B. Turn main power off.
- C. Remove gabled roof by reversing the steps in section 10.5-11.
- D. Completely loosen by hand the 8" x 10" TSP filter holder gland nut located inside cabinet just above the blower.
- E. Carefully lift 8" x 10" TSP filter holder out of housing without pulling on the attached flow probe wires. Rest filter holder on top of housing.
- F. Using a flat blade screwdriver, remove holding clamp and flow probe assembly from the 3" diameter neck of the 8" x 10" holder. Protect the flow probe from damage.
- G. Remove PM-10 head from the 16" x 16" adapter frame. Place 16" x 16" adapter frame on top of housing.
- H. Set PM-10 filter holder (8" x 10" holder without swivel clamps), on top of adapter plate.
- I. Place the flow probe into the PM-10 filter holder with the groove on the stem facing up (towards filter paper). Tighten flow probe holding clamp.
- J. Lower PM-10 filter holder into place and tighten gland nut.
- K. Secure 16" x 16" adapter frame with the 4 clamping screws located on the sides.
- L. Re-attach PM-10 head to adapter frame. Unit is now ready for normal PM-10 sampling.

10.8 Instrument Maintenance

The Timer, Rotameter, Blower, and Electronics are all maintenance free and must be factory serviced or replaced if necessary.

10.9 Instrument Documentation

- Record the flow calibration check data onto the "HVP-3800 AFC Flow Calibration Work Sheet" (Attachment 1).
- Record daily sampling event information and periodic equipment checks onto air sample envelopes or log sheets.

11.0 ATTACHMENTS

Attached form(s) are examples and may be modified by the RSO without revision to this procedure.

Attachment 1: "HVP-3800 AFC Flow Calibration Work Sheet"

Attachment 2: "Table A-32422, Air Temperature/Viscosity Correction Factors"

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-3800 AFC HIGH VOLUME AIR SAMPLER	NO.: PP 8-603-3 (12/2013)
	PAGE: 10 of 13

Attachment 3: "Table A-31031, Laminar Flow Element Pressure Correction Factor"

ATTACHMENT 1
HVP-3800 AFC FLOW CALIBRATION WORK SHEET

Unit Number:	
Unit Location:	
Date:	Time:
Calibrator Serial Number:	
Calibrator Calibration Due Date:	
Calibration Performed By:	

1. Enter current Barometric Pressure and Temperature in the table below.

Barometric Pressure:	“Hg
Temperature:	°F

2. Look up Barometric Pressure and Temperature correction factors on supplied charts and enter the values in the boxes below.
3. Multiply Barometric Pressure and Temperature correction factors to get the overall Correction factor (C_f)

Barometric Pressure Cf:	x	Temperature Cf:	=	Cf:
-------------------------	---	-----------------	---	-----

4. Enter the Normal Sample rate and Correction factor (from step #3) in the boxes below.
5. Divide the Normal Sample Rate (1.13 SCMM) by the Correction factor to get the Calibrator Flow Rate. Adjust pump speed until the calibrator matches the calculated calibrator flow rate (ACMM).

Normal Sample Rate: 1.13 SCMM	÷	Cf:	=	Calibrator Flow Rate: ACMM
---	---	-----	---	--------------------------------------

TOTALIZER CHECK

6. Ensure Hi-Q is running between 1.08 SCMM and 1.18 SCMM (nominal flow rate range). Note as-left, or current flow rate in box below.
7. Clock the time needed to collect exactly 9.0 m³ air to the nearest second, Note in box below. Compare to acceptable time period.
8. Repeat steps 6 and 7 if elapsed time falls outside of the acceptable period. If unit fails on second attempt, tag the unit out-of-service and arrange for further service/repair.

Current Flow Rate: SCMM

<u>Acceptable Time Period</u> 7 min 34 sec ~ 8 min 22 sec
--

Volume Air Sampled 9.0 SCMM

Collection Time min sec
--

ATTACHMENT 2
HI-Q Environmental Table A-32422
Air Temperature/Viscosity Correction Factors for SCFM
Air Base Temperature 70 °F, Viscosity 181.87 Micropoise
Reference NBS Circular 564

$$\text{CORRECTION FACTOR} = \sqrt{\frac{529.67}{459.67 + ^\circ\text{F}} \times \frac{181.87}{\mu\text{g}^*}} \quad \mu_{\text{air}} = \frac{14.58 \left(\frac{459.67 + ^\circ\text{F}}{18} \right)^{3/2}}{110.4 + \left(\frac{459.67 + ^\circ\text{F}}{18} \right)}$$

Temp °F	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	1.1350	1.1328	1.1306	1.1284	1.1262	1.1240	1.1219	1.1197	1.1175	1.1154
10	1.1133	1.1111	1.1090	1.1069	1.1048	1.1027	1.1006	1.0986	1.0965	1.0945
20	1.0924	1.0904	1.0883	1.0863	1.0843	1.0823	1.0803	1.0783	1.0763	1.0744
30	1.0724	1.0705	1.0685	1.0666	1.0646	1.0627	1.0608	1.0589	1.0570	1.0551
40	1.0532	1.0513	1.0495	1.0476	1.0458	1.0439	1.0421	1.0402	1.0384	1.0366
50	1.0348	1.0330	1.0312	1.0294	1.0276	1.0258	1.0241	1.0223	1.0205	1.0188
60	1.0171	1.0153	1.0136	1.0119	1.0102	1.0084	1.0067	1.0050	1.0034	1.0017
70	1.0000	0.9983	0.9967	0.9950	0.9934	0.9917	0.9901	0.9884	0.9868	0.9852
80	0.9836	0.9820	0.9804	0.9788	0.9772	0.9756	0.9740	0.9724	0.9709	0.9693
90	0.9677	0.9662	0.9646	0.9631	0.9616	0.9600	0.9585	0.9570	0.9555	0.9540
100	0.9525	0.9510	0.9495	0.9480	0.9465	0.9450	0.9436	0.9421	0.9406	0.9392
110	0.9377	0.9363	0.9349	0.9334	0.9320	0.9306	0.9291	0.9277	0.9263	0.9249
120	0.9235	0.9221	0.9207	0.9193	0.9180	0.9166	0.9152	0.9138	0.9125	0.9111
130	0.9098	0.9084	0.9071	0.9057	0.9044	0.9031	0.9017	0.9004	0.8991	0.8978
140	0.8965	0.8952	0.8939	0.8926	0.8913	0.8900	0.8887	0.8874	0.8862	0.8849
150	0.8836	0.8824	0.8811	0.8798	0.8786	0.8773	0.8761	0.8749	0.8736	0.8724

*When flowing gas other than air, use the viscosity in micropoise of the gas at flowing temperature in the Correction Factor equation.

Altitude Pressure Table
Mercury at 0°C (32°F)

Altitude in Feet	Inches of Mercury
-1,000	31.02
0	29.92
1,000	28.86
2,000	27.82
3,000	26.81
4,000	25.84
5,000	24.89
6,000	23.98
7,000	23.09
8,000	22.22
9,000	21.38
10,000	20.58

HI-Q Environmental Table A-31031
Laminar Flow Element Pressure Correction Factor (any gas)
Base Pressure (Assigned Standard) 29.92 Inches Mercury Absolute

Laminar Inlet Pressure Hg. ABS.		Laminar Inlet Pressure Hg. ABS.		Laminar Inlet Pressure Hg. ABS.		Laminar Inlet Pressure Hg. ABS.		Laminar Inlet Pressure Hg. ABS.	
	P _{cf.}		P _{cf.}		P _{cf.}		P _{cf.}		P _{cf.}
26.00	0.9322	28.00	0.9674	30.00	1.0013	32.00	1.0342	34.00	1.0660
26.05	0.9331	28.05	0.9682	30.05	1.0022	32.05	1.0350	34.05	1.0668
26.10	0.9340	28.10	0.9691	30.10	1.0030	32.10	1.0358	34.10	1.0676
26.15	0.9349	28.15	0.9700	30.15	1.0038	32.15	1.0366	34.15	1.0684
26.20	0.9358	28.20	0.9708	30.20	1.0047	32.20	1.0374	34.20	1.0691
26.25	0.9367	28.25	0.9717	30.25	1.0055	32.25	1.0382	34.25	1.0699
26.30	0.9376	28.30	0.9726	30.30	1.0063	32.30	1.0390	34.30	1.0707
26.35	0.9384	28.35	0.9734	30.35	1.0072	32.35	1.0398	34.35	1.0715
26.40	0.9393	28.40	0.9743	30.40	1.0080	32.40	1.0406	34.40	1.0723
26.45	0.9402	28.45	0.9751	30.45	1.0088	32.45	1.0414	34.45	1.0730
26.50	0.9411	28.50	0.9760	30.50	1.0096	32.50	1.0422	34.50	1.0738
26.55	0.9420	28.55	0.9768	30.55	1.0105	32.55	1.0430	34.55	1.0746
26.60	0.9429	28.60	0.9777	30.60	1.0113	32.60	1.0438	34.60	1.0754
26.65	0.9438	28.65	0.9785	30.65	1.0121	32.65	1.0446	34.65	1.0761
26.70	0.9447	28.70	0.9794	30.70	1.0130	32.70	1.0454	34.70	1.0769
26.75	0.9455	28.75	0.9803	30.75	1.0138	32.75	1.0462	34.75	1.0777
26.80	0.9464	28.80	0.9811	30.80	1.0146	32.80	1.0470	34.80	1.0785
26.85	0.9473	28.85	0.9820	30.85	1.0154	32.85	1.0478	34.85	1.0792
26.90	0.9482	28.90	0.9828	30.90	1.0162	32.90	1.0486	34.90	1.0800
26.95	0.9491	28.95	0.9837	30.95	1.0171	32.95	1.0494	34.95	1.0808
27.00	0.9500	29.00	0.9845	31.00	1.0179	33.00	1.0502	35.00	1.0816
27.05	0.9508	29.05	0.9854	31.05	1.0187	33.05	1.0510	35.05	1.0823
27.10	0.9517	29.10	0.9862	31.10	1.0195	33.10	1.0518	35.10	1.0831
27.15	0.9526	29.15	0.9870	31.15	1.0203	33.15	1.0526	35.15	1.0839
27.20	0.9535	29.20	0.9879	31.20	1.0212	33.20	1.0534	35.20	1.0847
27.25	0.9543	29.25	0.9887	31.25	1.0220	33.25	1.0542	35.25	1.0854
27.30	0.9552	29.30	0.9896	31.30	1.0228	33.30	1.0550	35.30	1.0862
27.35	0.9561	29.35	0.9904	31.35	1.0236	33.35	1.0558	35.35	1.0870
27.40	0.9570	29.40	0.9913	31.40	1.0244	33.40	1.0566	35.40	1.0877
27.45	0.9578	29.45	0.9921	31.45	1.0252	33.45	1.0573	35.45	1.0885
27.50	0.9587	29.50	0.9930	31.50	1.0261	33.50	1.0581	35.50	1.0893
27.55	0.9596	29.55	0.9938	31.55	1.0269	33.55	1.0589	35.55	1.0900
27.60	0.9604	29.60	0.9946	31.60	1.0277	33.60	1.0597	35.60	1.0908
27.65	0.9613	29.65	0.9955	31.65	1.0285	33.65	1.0605	35.65	1.0916
27.70	0.9622	29.70	0.9963	31.70	1.0293	33.70	1.0613	35.70	1.0923
27.75	0.9631	29.75	0.9972	31.75	1.0301	33.75	1.0621	35.75	1.0931
27.80	0.9639	29.80	0.9980	31.80	1.0309	33.80	1.0629	35.80	1.0939
27.85	0.9648	29.85	0.9988	31.85	1.0317	33.85	1.0636	35.85	1.0946
27.90	0.9657	29.90	0.9997	31.90	1.0326	33.90	1.0644	35.90	1.0954
27.95	0.9665	29.92	1.0000	31.95	1.0334	33.95	1.0652	35.95	1.0961

For values not shown in the table, interpolate or use equation:

$$P_{cf.} = \sqrt{\frac{P_{flow}}{P_{Base}}} = \sqrt{\frac{P_{flow}}{29.92}}$$

P_{cf.} = Pressure Conversion Factor

P_{Base} = Assigned Base Pressure of 29.92"Hg Abs.

P_{flow} = Laminar Inlet Pressure, " Hg. Abs.

The equation can be used up to and including two atmospheres absolute. It will be necessary to calibrate laminars for pressure exceeding above.

MSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE SKC AIRCHEK 2000 SAMPLING PUMP	NO.: PP-8-604-1 (12/2013)
	PAGE: 1 of 10

1.0 PURPOSE

The purpose of this procedure is to establish and define consistent methodology for the calibration and operation of the SKC sampling pumps, as well as the documentation of workplace surveys using SKC sampling pumps, specifically the SKC AirChek® 2000.

2.0 APPLICABILITY

This procedure applies to all personnel who may reasonably be expected to utilize the SKC AirChek® 2000 for workplace surveillance activities.

3.0 REFERENCES

- SKC, "Technical Manual, AirChek® 2000," Catalog No. 210-2002.
- Ness, S., "Air Monitoring for Toxic Exposures," 1991.
- US Army Corps of Engineers, EM 385-1-1, "Safety and Health Requirements Manual."
- US Army Corps of Engineers, EM 385-1-80, "Radiation Protection Manual."
- FUSRAP Maywood Superfund Site (FMSS), "Site Safety and Health Plan," (SSHP) Vol. 1.

4.0 GENERAL

4.1 Discussion

The constant-flow sampling pump is the primary device for actively collecting integrated samples on media. Constant-flow pumps like the SKC models in use at the FUSRAP Maywood Superfund Site (FMSS) can cope with changing conditions, such as filter loading, and still maintain a constant sampling rate within certain limits by measuring and controlling the actual input flow. These pumps are suited for a broad range of applications and are ideal for industrial hygiene studies as well as environmental testing. The AirChek® 2000 is an advanced, programmable, sampling pump that combines lightweight compact design, computer-compatible circuitry, and an internal flow sensor. This system has data logging capability. If data logging is used, follow software instructions.

4.2 Definitions

Personal Air Sampling Pump (Lapel Pump): A compact, lightweight air sampling device able to be worn by individual workers and mechanically designed to maintain fairly constant flow rates over a given sampling period, thus permitting occupational exposure calculations.

Primary Standard: A highly accurate flow calibration device with NIST-traceable specifications. Primary standards require no calibration of their

MSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE SKC AIRCHEK 2000 SAMPLING PUMP	NO.: PP-8-604-1 (12/2013)
	PAGE: 2 of 10

own, but should be periodically returned to the manufacturer for suggested maintenance. Examples include the Gillian Gilibrator and Bios DryCal, which are accepted by OSHA as primary standards.

Sampling Train: The connected combination of collection media, sampling pump, tubing, and a flow rate-measuring device.

Calibration (Specific to this Instrument): The process of adjusting and recording flow rates of the sampling pump using a primary flow calibrator. Flow rates are documented before and after sampling events.

5.0 RESPONSIBILITIES

5.1 Site Safety & Health Officer (SSHO)

- Provides oversight to all Safety & Health Air Monitoring performed at the Project.
- Defines and establishes air sampling protocols for specific contaminants at the FMSS.

5.2 Radiation Safety Officer (RSO)

- Directs radiological air monitoring strategies based upon established protocols and plans.
- Reviews air monitoring results and initiating necessary follow-up actions.

5.3 Radiation Protection Technician (RPT)

- Ensures proper performance of air monitoring instrumentation through daily inspections and flow calibrations.
- Deploys and operates air sampling pumps in the workplace in a logical and effective manner so as to ensure representative sampling and meaningful exposure data.
- Performs regular “checkups” on deployed air sampling pumps, verifying proper operation, and noting any unusual occurrences, such as flow interruptions or inappropriate sampling locations.
- Documents workplace air monitoring on appropriate documentation.

5.4 Project Workers

- Complies with field directions from RPTs regarding the wearing of personal air sampling pumps.
- Alerts RP personnel of any unusual occurrences with personal air sampling pumps (e.g., flow interruptions, dead battery, job reassignment, etc.).

MSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE SKC AIRCHEK 2000 SAMPLING PUMP	NO.: PP-8-604-1 (12/2013)
	PAGE: 3 of 10

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

- Only properly trained and authorized personnel are permitted to operate air samplers and associated instrumentation.
- Because personal air sampling pumps are often relied upon to provide critical personnel exposure data, quality care of these devices is essential. Pumps should be inspected after each survey for missing or damaged parts and repaired promptly.
- In order to have accurate volume calculations as well as be assured that flow rates are appropriate for specific types of sampling, flow rate calibrations are mandatory before and after sampling events.
- Verify flow rates with a primary standard, such as a Gillian electronic bubble meter or Bios DryCal Flow meter with the intended sampling media included in the sampling train.
- Constant-flow sampling pumps should be flow-calibrated at the same altitude at which they will be used. Verify that the appropriate sampling media is selected prior to commencing monitoring. This includes an understanding of the proper orientation of the filter media:
 - 25 mm diameter, 1.2 micron pore size borosilicate (glass) fiber filters are normally used for monitoring particulate airborne radioactivity. The slightly rougher side should face outward.
 - 25 mm diameter, 0.45 micron membrane filters are normally used for radon grab sampling. Either side is acceptable for monitoring, however the outward face should be marked slightly to identify where contaminants are deposited on the filter. These filters normally come separated with a blue divider. This is not the filter.
 - 37 mm diameter, 0.8 micron Mixed Cellulose Ester (MCE) filter cassettes are normally used for metals.
 - 25 mm diameter, 0.8 micron MCE three-piece static conductive filter cassettes (with cowl), are normally used for Asbestos air sampling.

Deviations from the filter media listed above require SSHO and RSO approval.

- The SKC sampling pump with installed battery pack has passed UL standards for intrinsic safety. See UL certificate in the SKC Technical Manual for details.
- Use only an SKC approved battery charger for pump charging. The battery charger is not intrinsically safe and therefore shall not be operated in hazardous atmospheres.

MSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE SKC AIRCHEK 2000 SAMPLING PUMP	NO.: PP-8-604-1 (12/2013)
	PAGE: 4 of 10

- Use caution when wearing pumps or handling sample media to avoid cross-contaminating or compromising the filter media. RPTs should explain proper wear and handling requirements to wearers prior to issuance.

8.0 APPARATUS

- SKC sampling pump, or equivalent
- Primary flow calibrator, such as Bios DryCal, Gillian Gilibrator, or equivalent
- Tygon tubing, filter cassette, and appropriate sampling media
- Small hand tool kit for pump adjustments

9.0 RECORDS

- Personnel Pump Calibration Record
- Industrial Hygiene Air Monitoring Data Sheet

10.0 PROCEDURE

10.1 Instrument Setup

- A. Users should familiarize themselves with the instrument's display, key and switch positions, and port locations before operating. Refer to first page of the AirChek® 2000 Technical Manual for the instrument's layout.
- B. Ensure that the instrument has been sufficiently charged (overnight) to operate throughout an average workday.
- C. Perform a visual inspection of the pump to verify all components are in sound condition.
- D. Perform a Battery Test:
 1. Press the * key to activate the display.
 2. View the display making sure that the battery power symbol is in full strength (three LCD bars within the battery symbol).
- E. Clear Accumulated Data:
 1. Press $\Delta\nabla$ to turn on pump.
 2. With the pump running, press $\Delta\nabla$ together to place the pump in HOLD mode, then **immediately** press the security code in sequence (* $\Delta\nabla$ *) within 10 seconds.
 3. Repeatedly press * until "CLR" appears on the display.
 4. Press $\Delta\nabla$ together, then press * until "End" appears.
 5. Press $\Delta\nabla$ together. The accumulated data are cleared and the pump is now in HOLD mode. (HOLD will flash in the display and the run time will display "0 min").

MSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE SKC AIRCHEK 2000 SAMPLING PUMP	NO.: PP-8-604-1 (12/2013)
	PAGE: 5 of 10

10.2 Instrument Calibration (Flow Checks and Adjustment)

- A. While in the "Hold" mode, connect the appropriate sample media (e.g., 25 mm glass fiber in cassette) to the inlet port of the primary standard flow-meter.
- B. Connect the tubing from the pump to the outlet port of the flow meter. The use of the inline "drum-shaped" damper is not required for the calibration of the SKC AirChek 2000 Sampler. Refer to Figure 1, as needed.

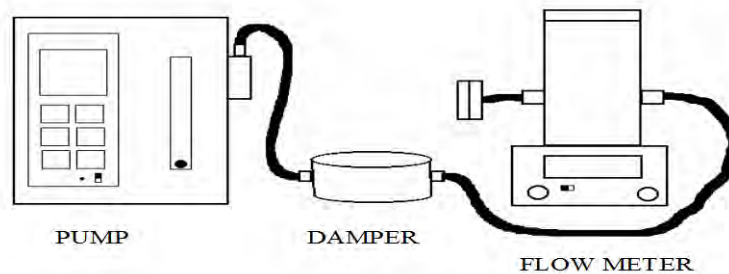


Figure 1
Properly Connected Sampling Train

- C. Connect the tubing from the pump to the outlet port of the flow meter. The use of the inline "drum-shaped" damper is not required for the calibration of the pump.
- D. Turn on the flow-meter.
- E. Use 2000 ml/min as a target flow setting for routine air monitoring activities, unless otherwise directed by the specific filter media use instruction, or by the RSO or SSHO.
- F. Press $\Delta\nabla$ together to start the pump. Collect three readings from the flow-meter by pressing the READ button three times. If the average of these readings is within $\pm 5\%$ of the desired flow rate (e.g., 1900 - 2100 ml/min for 2000 ml/min standard), then proceed to Step 10. If the average flow rate does not fall within this acceptable range, then place the pump on HOLD by pressing the $\Delta\nabla$ keys together and proceed to next step.
- G. Press $\Delta\nabla$ together to start the pump and immediately press the security code in sequence (* $\Delta\nabla$ * within 10 seconds). The flow rate and "SET" icon will display and flash. Allow a few seconds for the pump to stabilize the flow rate.
- H. Press * (A flashing "ADJ" appears).

MSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE SKC AIRCHEK 2000 SAMPLING PUMP	NO.: PP-8-604-1 (12/2013)
	PAGE: 6 of 10

- I. Press ∇ (**repeatedly if necessary**) if the flow rate needs to be adjusted downward. Press Δ (**repeatedly if necessary**) if the flow rate needs to be adjusted upward. When pressing Δ or ∇ , the pump display will indicate the adjustment made in ml/min.
- J. Collect 3 new flow rate readings from the flow-meter as a check on the adjustment performed in the above step. If the average of these readings is within $\pm 5\%$ of the desired flow rate, then proceed to next step.
- K. Press * to lock in the calibrated flow. Press * until "End" appears.
- L. Press $\Delta\nabla$ together until pump is placed on HOLD. Record these results onto the "Personnel Pump Calibration Record" making sure all sections of the form are complete.
- M. Re-attach the sample cassette to the Tygon tubing leading to the pump's inlet port.
- N. Fill out pre-use flow and pump information onto the pre-stamped manila envelopes and keep these envelopes with their respective pumps.
- O. The pump is now ready to be deployed into the work area.

10.3 Instrument Use

- A. Determine the appropriate sampling location or wearer(s) based upon an evaluation of planned activities, the number and classification of area workers, or as specified in the approved procedure or HWP.
- B. Issue pump and document required use information on a sample envelope or log sheet.
- C. Attach pump to a belt at the waist with the tubing running up the back and over the shoulder of the worker. The filter cassette should be attached in the upper chest area representative of the worker's breathing zone.
- D. The technician may review accumulated data on the pump by repeatedly pressing * while the pump is running. Viewable options include flow rate, sample volume, temperature, time-of-day, atmospheric pressure, and run time.
- E. At the end of the sampling period, the RPT shall place the pump on HOLD until which time it is returned to the flow measuring station. Pumps may be periodically paused during the workday as needed, using the HOLD function. For example, the pump should be paused while area workers are at lunch.
- F. Upon Completion of sampling, perform the following:

MSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE SKC AIRCHEK 2000 SAMPLING PUMP	NO.: PP-8-604-1 (12/2013)
	PAGE: 7 of 10

1. Perform a flow check on the sampling pump following the procedure described in Section 10.2 **except** make no flow adjustments to the pump.
2. Obtain three consecutive flow measurements using the flow meter and record average reading on the "Personnel Pump Calibration Record" (See Attachment 1).
3. Record final flow information, including total run time from the instrument display on the air sample envelope or log sheet.
4. Place the used filter into a glassine sleeve and place into the air sample envelope.
5. Filters collected for radiological particulate air monitoring, not Radon, should be allowed to decay for a period of at least 4 days prior to counting, unless directed otherwise by the RSO or SSHO.
6. Turn the pump off and connect to battery charger. Verify the charge indicator is lit.
7. To prolong battery life, it is recommended to periodically discharge the battery by pressing the SELECT button on the charger until the red "Discharge" indicator is lit. After discharging, the battery will automatically charge.
8. Record pre- and post-use flow checks and pump information onto the "Personnel Pump Calibration Record" (Attachment 1).
9. Record industrial hygiene sampling event information on the "Industrial Hygiene Air Monitoring Data Sheet" (Attachment 2).

10.4 Instrument Maintenance

From time to time, some components of the SKC sampling pump must be removed, cleaned, or replaced. Components that may be maintained or replaced by operating personnel as part of normal operation are:

A. Cleaning

Wipe the outside of the instrument with a soft, clean cloth. **Never** use solvents or cleaning solutions of any type.

B. Battery

- A fully charged battery pack will operate an SKC lapel sampler for a minimum of 10 hours at 2000 ml/min.
- The NiCad battery packs in the SKC sampler should be completely discharged from time to time to minimize the "memory effect" of rechargeable batteries. The SKC Battery Chargers in use at the FMSS are cycling chargers, which cycle the NiCad batteries automatically.
- After several hundred recharges, NiCad batteries lose performance characteristics and eventually will require

MSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE SKC AIRCHEK 2000 SAMPLING PUMP	NO.: PP-8-604-1 (12/2013)
	PAGE: 8 of 10

replacement.

C. Pump Inlet Filter

During the course of normal operations, the filter / trap located inside the clear plastic intake housing on the side of SKC sampling pump may become clogged, creating an excessive load on the pump. If upon visual inspection it is determined that maintenance or replacement of the filter trap is required, consult the RP Supervision for direction.

D. Replacement Parts

A list of replacement parts is available in the AirChek® 2000 Technical Manual.

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 Personnel Pump Calibration Record (Typical)

Attachment 2 Industrial Hygiene Air Monitoring Data Sheet (Typical)

Attachment 1

PERSONNEL PUMP CALIBRATION RECORD

REFERENCE NUMBER: _____		LOCATION: _____	
PRE-SAMPLING CALIBRATION		POST SAMPLING CALIBRATION	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL #	PUMP MODEL:	SERIAL #
DATE:	TIME:	DATE:	TIME:
FLOW RATE:		FLOW RATE:	
AVG. FLOW RATE:		AVG. FLOW RATE:	
PERFORMED BY:		PERFORMED BY:	

Attachment 2

INDUSTRIAL HYGIENE AIR MONITORING DATA SHEET			
HAZARDOUS SUBSTANCES DATA SHEET			
1. COMPANY NAME	2. CONTRACT NO.	3. SAMPLING NO.	
4. WORK ACTIVITY		5. SAMPLING DATE	6. SHIPPING DATE
7. PERSON PERFORMING SAMPLING (SIGNATURE)		8. PRINT LAST NAME	9. SSHO
10. MONITORED WORKER (NAME, ADDRESS, PHONE NUMBER)	14. EXP. INFO.	a. NUMBER	B. DURATION
	C. FREQUENCY		
11. JOB TITLE	15. WEATHER CONDITIONS	16. PHOTO(S) YES NO	
13. PPE (TYPE AND EFFECTIVENESS)	17. PUMP CHECKS AND ADJUSTMENTS		
18. JOB DESCRIPTION, OPERATION, WORK LOCATION(S), VERIFICATION, AND CONTROLS JOB DESCRIPTION: OPERATION: WORK LOCATION: VERIFICATION: CONTROLS:			
FIELD SAMPLING DATA			
19. PUMP NUMBER:		30. CALCULATIONS AND NOTES:	
20. SAMPLE SUBMITTAL NO.			
21. SAMPLE TYPE			
22. SAMPLE MEDIA			
23. FILTER/TUBE NUMBER			
24. TIME ON/OFF	ON		
	OFF		
25. TOTAL TIME IN MINUTES			
26. FLOW RATE	PRE		
LAMIN CC/MIN	POST		
27. VOLUME (IN LITERS)			
28. NET SAMPLE WEIGHT (IN MG)			
29. ANALYZE SAMPLES FOR:			

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF LOW VOLUME AIR SAMPLERS	NO.: PP-8-605-1 (12/2013)
	PAGE: 1 of 6

1.0 PURPOSE

The purpose of this Project Procedure is to establish and define consistent methodology for the calibration and operation of F&J LV-1 sampling pumps as well as the documentation of workplace surveys using LV-1 sampling pumps. Other Low Volume samplers with similar operating characteristics may be utilized under this procedure with approval of the Radiation Safety Officer (RSO).

2.0 APPLICABILITY

This Project Procedure applies to all personnel who may reasonably be expected to utilize the LV-1 sampling pump for workplace surveillance activities. Digital low-volume sampling pumps that perform self-calibration and flow correction may be used under this procedure when augmented by the use of the applicable instrument operations manual.

3.0 REFERENCES

1. F&J Specialty Products, "Technical Manual, Regulated Low Volume Air Sampler Model: LV-1," Rev. 06/09/95.
2. Ness, S., "Air Monitoring for Toxic Exposures," 1991.
3. U.S. Army Corps of Engineers (USACE), EM 385-1-1. "Safety and Health Requirements Manual"
4. FMSS "Site Safety and Health Plan" (SSHP), Volume 1.

4.0 GENERAL

4.1 Discussion

The constant-flow sampling pump is the primary device for actively collecting integrated samples on media. Constant-flow pumps like the F&J models in use at the FMSS can cope with changing conditions such as filter loading and still maintain a constant sampling rate within certain limits by measuring and regulating the actual input flow. At the FMSS, these pumps are typically used for general work area and perimeter air sampling for radiological particulates.

4.2 Definitions

Low Volume Air Sampling Pump: A portable air sampling device, generally a rotary vane pump, mechanically designed to maintain fairly constant flow rates over a given sampling period thus permitting occupational exposure calculations. The manufacturer of these pumps describes them as "low volume" although they typically operate at flow rates between 10 and 100 lpm.

Primary Standard: A highly accurate flow calibration device with NIST-traceable specifications. Primary standards, such as the F&J Model D-812 currently used at the FMSS, shall be returned to the manufacturer annually for maintenance and calibration assurance.

Sampling Train : The connected combination of collection media, sampling pump, tubing, and a flow rate measuring device.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF LOW VOLUME AIR SAMPLERS	NO.: PP-8-605-1 (12/2013)
	PAGE: 2 of 6

Calibration (specific to this instrument): The process of adjusting and recording flow rates of the sampling pump using a primary flow calibrator. Flow calibrations using a primary standard shall be performed annually. Pump calibrations expire one year from date of last calibration.

5.0 RESPONSIBILITIES

5.1 Site Safety and Health Officer (SSHO)

- Provides oversight to all Safety and Health air monitoring performed on the Project.
- Defines and establishes air sampling protocols for specific contaminants at the FMSS.

5.2 Radiation Safety Officer (RSO)

- Directs radiological air monitoring strategies based upon established protocols and plans.
- Reviews air monitoring results and initiates necessary follow-up actions.

5.3 Radiation Protection Technicians (RPTs)

- Ensures proper performance of air monitoring instrumentation through daily inspections and annual on-site calibrations.
- Deploys and operates air sampling pumps in the workplace in a logical and effective manner so as to ensure representative sampling and meaningful exposure data.
- Performs regular “checkups” on deployed air sampling pumps, verifying proper operation and noting any unusual occurrences such as flow interruptions or inappropriate sampling locations.
- Documents workplace air monitoring activities on appropriate documentation.

5.4 Project Workers

- Notifies RPTs of any power disconnections to or pump malfunctions of work area or perimeter air samplers.
- Provides assistance to RPTs in the setup of work area or perimeter air samplers, e.g., helping to obtain extension cords, constructing stands or shelters, etc., if needed.

6.0 PREREQUISITES

The pump must have been calibrated with an electronic mass flow meter, a primary standard prior to field use. Flow calibrations are valid for 365 days after calibration date. Calibration shall be performed with the intended sampling media (47 mm glass fiber filter) included in the sampling train.

7.0 PRECAUTIONS AND LIMITATIONS

- Only authorized personnel are permitted to operate air sampling equipment.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF LOW VOLUME AIR SAMPLERS	NO.: PP-8-605-1 (12/2013)
	PAGE: 3 of 6

- Because personal air sampling pumps are often relied upon to provide critical personnel exposure data, quality care of these devices is essential. Pumps should be inspected after each sampling event for missing or damaged parts and repaired promptly. Pumps with damaged power cords shall be tagged and taken out of service.
- Verify that the sampling media is appropriate for the intended sampling event, e.g., 47 mm glass fiber filter for radiological particulate monitoring.
- Samplers may be fitted with totalizers to capture operating run times. These values should be recorded, if available, to better estimate overall sample volumes and to determine if interruptions in operations occurred.

8.0 APPARATUS

- F&J LV-1 low volume air sampler
- Electronic mass flow meter, such as F&J Model D-812
- Tygon tubing, filter holder, and appropriate sampling media
- Small tool kit for pump adjustments

9.0 RECORDS

Completed "Calibration Certificate and Data Sheet for the Low Volume Air Sampler" will be sent to RPP Records until transmitted to Project Document Control.

10.0 PROCEDURE

10.1 Instrument Setup

- The user should familiarize himself / herself with the F&J Technical Manual for the LV-1 before using for the first time.
- Perform a visual inspection of the instrument unit making sure all components are in sound condition.

10.2 Instrument Calibration

- A. Obtain a "Calibration Certificate and Data Sheet for the Low Volume Air Sampler," an F & J LV-1 air sampler, and an electronic mass flowmeter.
- B. Record general site and pump information in the top section of the form.
- C. Connect the dual-head calibration filter holder assembly to the LV-1 in place of the regular filter holder. Verify that an intact 47mm glass fiber filter is properly positioned in the holder assembly.
- D. Turn on power to the LV-1 and to the mass flowmeter.
- E. Perform a physical inspection of the pump. Check SAT/UNSAT.
- F. Adjust the LV-1 rotameter to 50 lpm. Use the widest point (middle) of the float as an adjustment guide.
- G. Record the electronic mass flowmeter reading. Ensure this value is within 20% of the rotameter setting. Take instrument out of service if not within this range.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF LOW VOLUME AIR SAMPLERS	NO.: PP-8-605-1 (12/2013)
	PAGE: 4 of 6

- H. Perform 3 reproducibility measurements at 50 lpm. These three readings should be within 10% of their average.
- I. Adjust the LV-1 rotameter to 30 lpm. Record the electronic mass flowmeter value. Calculate the error and record on form.
- J. Repeat the above step for 40, 50, 60, and 70 lpm.
- K. If any calibration check point has an error greater than 10%, then affix a chart of actual versus indicated flow data to the LV-1.
- L. Affix calibration sticker with date due for next calibration and initials to LV-1.
- M. Submit calibration certificate to the RSO, or designee for review.
- N. Maintain completed documentation in RPP Records until transmitted to Project Document Control.

10.3 Instrument Use

- A. Consult with the RSO before initial deployment of work area or perimeter air samplers to verify locations and flow rates.
- B. Ensure low-volume samplers are positioned between 4 and 6 feet above ground level and that they are protected from inclement weather.
- C. Before pump activation, place the appropriate sampling media 47 mm glass fiber filter into the filter holder and screw down tightly.
- D. Document pump location, serial number, date, time on, and starting flow rate on pre-stamped manila envelope. Record applicable HWP and covered workers on envelope as well.

NOTE

General work area air samplers are typically set to 60 lpm on the rotameter scale. Only actual flow rates (as opposed to rotameter readings) shall be recorded on the envelope.

- E. Turn on pump. Adjust the flow to desired rate using the flow adjust knob. Use the middle (widest) point of the rotameter float as a guide.
- F. Perform periodic "checkups" on activated low-volume air samplers to confirm their proper operation.
- G. Upon completion of the sampling event, note final flow rate and off time. Turn off pump and secure for the next sampling event.
- H. Collect the filter from the holder. Place filter into glassine sleeve, then place glassine sleeve into the same manila envelope used to record initial start data. Record the time off, final flow rate, and initial the manila envelope.
- I. Filters collected for radiological particulate monitoring (except radon) should be allowed to decay for a period of at least 4 days prior to counting, unless directed otherwise by the RSO or SSHO.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF LOW VOLUME AIR SAMPLERS	NO.: PP-8-605-1 (12/2013)
	PAGE: 5 of 6

10.4 Instrument Documentation

- A. Record the annual flow calibration data onto the “Calibration Certificate and Data Sheet for the Low Volume Air Sampler.”
- B. Record daily sampling event information onto manila envelopes.

10.5 Instrument Maintenance

A. Lubrication

The oil-less pump motor requires no lubrication to maintain optimal efficiency during its service life.

B. Corrosion

The outer end plate, body, rotor and mounting bracket are all cast iron and will tend to corrode when exposed to moisture. Therefore, precautions should be taken to shelter or protect sampling pumps from water exposure.

C. Foreign Particles

Remove excessive dirt or foreign particles from inside motor housing using long tweezers. If this is not possible, loosen and remove the six bolts which connect the end plate and body housing to expose internal components for inspection.

D. Fuses

Fuses may blow from time to time due to line voltage fluctuations. Should a fuse blow and require replacement, first, disconnect power cord. Then open the fuse compartment door at the rear of the pump next to the on / off switch, remove blown fuse, and replace with new fuse (6 ¼ or 7 amp). Re-latch fuse cover.

E. Carbon Rotor Vanes

Carbon rotor vanes should have a useful service life between 5,000 and 10,000 hours depending on usage conditions. When vanes become worn, they should be replaced. Loosen and remove the six bolts which connect the end plate and body housing to expose the rotor vanes.

F. Replacement Parts

A list of replacement parts can be found on page15 of the F&J Technical Manual for the LV-1. Refer to the exploded view drawing of the LV-1 pump on page 15 for parts identification.

11.0 ATTACHMENTS

Attached form(s) are examples and may be modified by the RSO with revision to this procedure.

Attachment 1: “Calibration Certificate and Data Sheet for the Low Volume Air Sampler” (Typical)

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF LOW VOLUME AIR SAMPLERS	NO.: PP-8-605-1 (12/2013)
	PAGE: 6 of 6

ATTACHMENT 1

CALIBRATION CERTIFICATE AND DATA SHEET FOR THE LOW VOLUME AIR SAMPLER

SECTION 1: GENERAL INFORMATION

DATE:	LOCATION: <i>FMSS</i>	TECHNICIAN:
MANUFACTURER:	MODEL:	
SERIAL #:	DATE LAST CAL. EXPIRES:	
REASON FOR CALIBRATION: Due For Calibration <input type="checkbox"/> Repair (see remarks) <input checked="" type="checkbox"/> Other (see remarks) <input type="checkbox"/>		

EQUIPMENT USED:

TYPE:	IDENTIFICATION:	CAL. DUE DATE

FILTER HEAD AND FILTER TYPE USED:

SECTION 2: AS-FOUND DATA

PHYSICAL CONDITION: SAT / UNSAT	LO-VOL SET @ 50 LPM Y / N	ACTUAL:
---------------------------------	---------------------------	---------

IS THE ACTUAL READING WITHIN 20% OF THE INDICATED VOLUME ON THE AIR SAMPLER? Y / N

REPRODUCIBILITY 1	2	3	AVG:
-------------------	---	---	------

REPRODUCIBILITY: IS REPRODUCIBILITY WITHIN 10% OF THE AVERAGE? Y / N

SECTION 3: CALIBRATION DATA

TARGET VALUE	ACTUAL AIR FLOW (CAL. READING)	INDICATED AIR FLOW (ROTOMETER)	ERROR	IS ERROR WITHIN 10%	
				YES	NO
30 LPM					
40 LPM					
50 LPM					
60 LPM					
70 LPM					

IF ERROR IS GREATER THAN 10%, POST THE INSTRUMENT WITH A CHART OR GRAPH OF ACTUAL VERSUS INDICATED

REMARKS:

NEXT CALIBRATION DUE:	CALIBRATION STICKER ATTACHED? Y / N
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FMSS RADIATION PROTECTION PROGRAM FIXED COUNTING SYSTEMS	NO.: PP-8-606-1 (12/2013)
	PAGE: 1 of 11

1.0 PURPOSE

This procedure provides consistent methodology and guidelines for the operation of fixed counting systems to include Chi-squared testing, establishing acceptable ranges, daily performance testing, and sample counting operation of fixed counting systems.

2.0 APPLICABILITY

This procedure applies to Ludlum Model 2000/43-10, Ludlum Model 2929/43-10-1, instrument/detector combinations. The Radiation Safety Officer (RSO) may permit other instrument/detector combinations, similar in function, to be operated under the scope of this procedure.

3.0 REFERENCES

- Ludlum Measurements; Ludlum Model 2000 Scaler – Instruction Manual.
- Ludlum Measurements; Ludlum Model 43-10 – Instruction Manual.
- Ludlum Measurements; Ludlum Model 29-29 – Dual Channel Scaler Instruction Manual.
- Ludlum Measurements: Ludlum Model 43-10-1 – Instruction Manual.
- PP 8-805, “Radiological Surveys”

4.0 GENERAL

4.1 Discussion

This procedure provides guidance for Chi-squared testing, establishing acceptable ranges, performance testing and sample counting operation of fixed counting systems, to include Ludlum Model 2000/43-10, Ludlum Model 2929/43-10-1 instrument/detector combinations, and any other fixed counting system intended for similar use.

Performance checks are performed daily, or prior to intermittent use, whichever is less frequent. Post-operational performance checks are performed as required by specific plan, or procedure. A performance check should also be performed anytime instrument response is suspect.

Deviation from any aspect of this procedure requires specific RRSO approval.

4.2 Definitions

Minimum Detectable Activity / Minimum Detectable Concentration (MDA / MDC): The lowest activity or concentration of radioactive material in a sample that will yield a net count above system background, that will be detected with 95% confidence while accepting a 5% probability of a false positive (Type I error) or a false negative (Type II error). MDA / MDC depends upon the type of instrument, the counting geometry, and the radionuclide to be detected. MDA has the same meaning as Lower Limit of Detection (LLD).

The following MDA equation is to be used for a background count time equal to the sample count time:

FMSS RADIATION PROTECTION PROGRAM FIXED COUNTING SYSTEMS	NO.: PP-8-606-1 (12/2013)
	PAGE: 2 of 11

$$MDA = \left(\frac{(3 + 4.65\sqrt{B})}{(E)(A)(T_s)} \right)$$

Where:

- T_s* = Sample count time
ET = Instrument efficiency
A = Area correction factor, if applicable
B = Background cpm

The following equation is to be used for a background count time equal to 5 or more times the sample count time:

$$MDA = \left(\frac{(3 + 3.29\sqrt{B})}{(E)(A)(T_s)} \right)$$

Chi-Squared Test: A Chi-squared test is used to determine the precision of a counting system. It is a measure of the reproducibility of results. The Chi-squared value is calculated as:

$$\chi^2 = \frac{\sum(\chi_i - \bar{\chi})^2}{\chi}$$

Variance: Variance is defined as the amount of scatter of data points around the mean.

Standard Deviation: Standard Deviation is defined as the square root of the average squared variance and the population standard deviation is defined mathematically as:

$$\sigma = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$$

Acceptable Range: Acceptable range for background and source efficiency is defined as plus or minus 2 standard deviations of the mean or average value.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Oversight of the Radiation Protection (RP) Instrument Program.
- Reviewing instrumentation documentation.
- Approves deviations from this procedure.

FMSS RADIATION PROTECTION PROGRAM FIXED COUNTING SYSTEMS	NO.: PP-8-606-1 (12/2013)
	PAGE: 3 of 11

5.2 Radiation Protection Technician (RPT)

- Performing / overseeing daily performance checks and routine sample counting.
- Reviewing daily performance checks and routine sample counting documentation.

6.0 PREREQUISITES

- Instrument shall have been calibrated within the previous 12-month period.

7.0 PRECAUTIONS AND LIMITATIONS

- Inspections, Chi-square tests, establishing acceptable ranges, and daily performance checks shall only be performed by trained technicians.
- A physical inspection shall be performed prior to initiating any of the above operations. This inspection should include inspection of readouts, meters, slide-tray and cam-lock, cable(s), cords, and general physical condition of the instrument/detector. The inspection shall include confirmation of current calibration and that a current calibration sticker is affixed to both the instrument and the detector.
- Operating parameters shall be verified. These parameters should include operating voltage verified against the calibrated value and battery condition if in use.

CAUTION

The charge (CHG) position on the function switch shall not be used on Ludlum Model 2000 instruments utilizing non-rechargeable batteries. The non-rechargeable batteries could rupture or explode, causing corrosion to the battery holder and damage to the instrument.

- Any instrument/detector failing the above inspections shall not be used until corrective action has been made. If the calibration is in question, tag the instrument out-of-service until corrective actions have been completed and a new calibration performed.
- The background (BKG) count shall utilize the same counting geometry as the samples to be analyzed (i.e., a clean blank smear if smears are the media to be analyzed).
- The geometry of the source shall be the same as the sample to be analyzed (i.e., a 47-mm smear requires a 47-mm check source and a 25-mm air sample requires a 25-mm source).
- Chi-squared tests shall use 20 points of reference; both background and source counts. An acceptable value obtained from the Chi-squared test must fall between the values 10.12 and 30.14. Values outside these limits indicate the instrument/detector is not functioning correctly. The instrument/detector shall not be used for data collection until corrective action has been taken and an acceptable Chi-squared value has been obtained.

FMSS RADIATION PROTECTION PROGRAM FIXED COUNTING SYSTEMS	NO.: PP-8-606-1 (12/2013)
	PAGE: 4 of 11

- An acceptable range for background and source efficiency shall be established prior to operational data collection.
- Use gloves to handle the electroplated check sources. The use of tweezers may result in scratching the source and subsequent loss of activity.
- Use planchets for all source / sample counts, unless otherwise directed by the RSO.
- Select planchets with sidewalls short enough to avoid contact with the detector surface during instrument use and sample change-out.
- QA/QC requirements established by an approved survey plan (e.g., Master Final Status Survey Plan) supersede the requirements of this procedure.

8.0 APPARATUS

- Ludlum Model 2000; Scaler in combination with Ludlum Model 43-10; Alpha Sample Counter.
- Ludlum Model 2929; Scaler in combination with a Ludlum Model 43-10-1 Beta-Gamma / Alpha Sample Counter.
- Planchets state size and type (i.e. flat 47 mm with 3 mm wall stainless steel planchet, state Model and Manufacturer or equivalent).
- Check source(s) containing the nuclide(s) of interest or nuclide(s) with similar energy(ies). The source should have the same geometry as the sample to be analyzed.
- Blank filter or smear media.

9.0 RECORDS

- Chi-square / Acceptable Range Data Sheet (Attachment 1).
- Daily Field Source Check Log – Fixed Counting System (Attachment 2).
- Computer generated printouts of instrument operability.

10.0 PROCEDURE

The methods outlined in this procedure are intended to assure the clear and concise transfer of survey information. Variations or deviations from the protocols in this procedure are permitted if the clear transfer of information is maintained.

10.1 Chi-Squared Test

- A. Complete the required information on the “Chi-squared / Acceptable Range Data Sheet” (Attachment 1).
- B. Place the appropriate background blank or source in the detector.

FMSS RADIATION PROTECTION PROGRAM FIXED COUNTING SYSTEMS	NO.: PP-8-606-1 (12/2013)
	PAGE: 5 of 11

- C. Select the appropriate count time. The count times shall be the same as the operational count times for both background and source counts.
- D. Collect 20 background and 20 source counts. Alternate source and background counts.
- E. Record the gross readings in the appropriate section on the "Chi-squared / Acceptable Range Data Sheet" (Attachment 1).
- F. Enter the Gross BKG and gross source counts into the appropriate columns of the Chi-square (CHISQR) Excel® spreadsheet utility. The RSO or designee maintains this utility.
- G. Compare the Chi-square results. The results must fall between the values of 10.12 and 30.14.
- H. If a Chi-square value falls outside the range notify the Lead Radiation Protection Technician or RSO. The instrument shall not be used for data collection until corrective action has been taken and an acceptable Chi-square value has been obtained.
- I. Obtain a printout of CHISQR spreadsheet results.

10.2 Acceptable Range

- A. Calculate and / or record the background counts per minute, (BKG cpm), Column B and the Source cpm, Column D on the Chi-square / Acceptable Range Data Sheet. A computer printout with duplicate data may be attached in lieu of this step.
- B. Enter the above values into the appropriate columns of the Acceptable Range (ACTRNG) Excel® spreadsheet.
- C. Obtain a printout of ACTRNG spreadsheet results.
- D. Assemble, review, and sign an instrument acceptance package consisting of:
 - Chi-square / Acceptable Range Data Sheet
 - CHIQR printout(s)
 - ACTRNG printout(s)
- E. Submit the "Set-Up" package to the RSO or designee for review and signature.
- F. If package is approved, initiate a Daily Field Source Check Log – Fixed Counting System form (Attachment 2). Transpose the following information from the "Set-Up" package.
 - Instrument information
 - Source Data
 - Acceptable ranges (+/- 2 and 3 Sigma values)
- G. Place the "Set-Up" package in RP lab files until transmitted to Project Records. This data may need to be available for later review or for generation of control charts.

FMSS RADIATION PROTECTION PROGRAM FIXED COUNTING SYSTEMS	NO.: PP-8-606-1 (12/2013)
	PAGE: 6 of 11

- H. Place the Daily Field Source Check Log – Fixed Counting System form in the designated instrument file / folder for later use.
- I. The instrument is now available for sample counting.

10.3 Performance Checks

- A. Obtain the Daily Field Source Check Log for the instrument to be checked.
- B. Perform a background (BKG) count of sufficient time to meet required MDA or MDC values. Perform MDC calculation(s) as necessary to verify acceptability of background count times.
 - The BKG count time should be equal to the anticipated sample count time.
 - The BKG count shall utilize the same counting geometry as the samples to be analyzed (i.e., a clean blank smear if smears are the media to be analyzed).
- C. Record the Background Counts and Background Count Time (min) on the Daily Field Source Check Log (Attachment 2).
- D. Calculate and record the BKG counts per minute (cpm) on the Daily Field Source Check Log.
- E. Compare the BKG cpm to the BKG 2 sigma acceptable range.
 - **If** the BKG cpm does not fall with the 2-sigma range, **then** compare the result to the 3-sigma range.
 - **If** the instrument/detector fails to fall within the 3-sigma acceptable range, **then** the instrument/detector shall be tagged out-of-service and shall not be used.
 - **If** the BKG cpm does not fall within the 2-sigma acceptable range but is within the 3-sigma range, **then** perform and record on the Daily Field Source Check Log, another background count and compare that value to the 2-sigma acceptable range.
 - **If** the second count is within the 2-sigma acceptable range, **then** the instrument/detector may be used.
 - **If** the instrument/detector fails to fall within the 2-sigma acceptable range in two consecutive attempts, **then** the instrument/detector shall be tagged out-of-service and shall not be used.
- F. Perform a daily source count using the same source used during initial set-up. This count is not required to be of the same duration as the background or sample analysis count times. However, the source count time shall be at least 1 minute and should be long enough to produce reliable counting statistics and control chart results.
- G. Record the Gross Source Counts and Source Count Time (min) on the Daily Field Source Check Log.
- H. Calculate and record the source cpm.

FMSS RADIATION PROTECTION PROGRAM FIXED COUNTING SYSTEMS	NO.: PP-8-606-1 (12/2013)
	PAGE: 7 of 11

- I. Calculate and record the daily efficiency on the Daily Field Source Check Log. The formula is printed on the form as reference.
- J. Compare the daily efficiency to the source 2-sigma acceptable range.
 - **If** the daily efficiency does not fall within the 2-sigma range, **then** compare the result to the 3-sigma range.
 - **If** the instrument/detector fails to fall within the 3-sigma acceptable range, **then** the instrument/detector shall be tagged out-of-service and shall not be used.
 - **If** the daily efficiency does not fall within the 2-sigma acceptable range but is within the 3-sigma range, **then** perform and record, on the Daily Field Source Check Log, another source count and compare that value to the 2-sigma acceptable range.
 - **If** the second value is within the 2-sigma acceptable range, **then** the instrument/detector may be used.
 - **If** the instrument/detector fails to fall within the 2-sigma acceptable range in two consecutive attempts, **then** the instrument/detector shall be tagged out-of-service and shall not be used.
- K. Use daily background and source check results to generate control charts, unless otherwise directed by the RSO.
 - Review charts periodically for negative instrument performance trends. Negative trends can be identified by the lack of a reasonable distribution of data points on the chart (e.g., three identical values, three consecutively increasing or decreasing values, five consecutive data points on one side of the line, etc.)
 - Store control charts with the Daily Field Source Check Log sheet or electronically until completed.
 - Report Control Chart anomalies to the RSO or designee. Discontinue instrument use until anomalies are resolved.
- L. Complete and initial the Daily Field Source Check Log and return to the file / folder. If all checks were successful, the instrument is ready for use.
- M. When the instrument has completed its calibration cycle or is placed out-of-service requiring calibration, perform the following:
 - Assemble instrument set-up, source check, and control chart documentation into a package. Review for completeness and legibility.
 - Submit the package to the RSO or designee for review.

10.4 Counting Operations

- A. Record the required instrument information (e.g., model number, serial number, efficiency, MDA, etc.) on the appropriate survey form.
- B. Set the required count time utilizing the two-decade thumb-wheel and the time multiplier switch.

FMSS RADIATION PROTECTION PROGRAM FIXED COUNTING SYSTEMS	NO.: PP-8-606-1 (12/2013)
	PAGE: 8 of 11

- C. Using tweezers or gloves, Place the sample to be counted in a clean planchet.
- D. Place the planchet in the slide-tray. Close and lock the slide-tray.
- E. Initiate the count by pressing the "COUNT" button.
- F. Upon completion of the count period, record the results on the appropriate survey form.
- G. Open the slide tray and remove the sample.
- H. Continue with the previous steps until all samples are counted and recorded.
- I. Perform a post-operational check, if required by plan or procedure. This is accomplished in the same fashion as the daily operational check. Report any instrument failures immediately to the RSO or designee.
- J. Submit the data for review and data entry.

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 Chi-Square / Acceptable Range Data Sheet

Attachment 2 Daily Field Source Check Log – Fixed Counting System

Attachment 1

CHI-SQUARE/ACCEPTABLE RANGE DATA SHEET

DATE: _____ PERFORMED BY: _____

INSTRUMENT: _____ SERIAL # _____ CAL DUE: _____

PROBE: _____ SERIAL # _____ CAL DUE: _____

SOURCE: _____ SERIAL # _____ CAL DUE: _____

BKG COUNT TIME: _____ SOURCE COUNT TIME: _____

CALIBRATED OPERATING VOLTAGE: _____

COUNT #	GROSS BKG (A)	BKG CPM (B)	GROSS SOURCE (C)	SOURCE CPM (D)	EFF (E)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Note: Columns B, D, and E are not required to be completed if data is tabulated via computer utility with printouts attached.

DATA ENTRY VERIFIED BY: _____ DATE: _____

SET-UP REVIEWED BY: _____ DATE: _____

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-606-1 (12/2013)
FIXED COUNTING SYSTEMS	PAGE: 10 of 11

Attachment 2

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-607-1 (12/2013)
Set-Up and Operation of the Thermo-Scientific Model RO-20 Ion Chamber	PAGE: 1 of 7

1.0 PURPOSE

This work instruction specifies the methods for performing source checks and operating the Thermo Scientific Model RO-20 Ion Chamber Survey Meter. The RO-20 is a portable air ion chamber instrument used to detect beta (β), gamma (γ), and x-ray radiation. The instrument has five linear ranges of operation (0-5, 0-50, 0-500 mR/hr; and 0-5, 0-50 R/hr) to measure exposure rates, establish stay-times, and/or determine radiation area posting boundaries.

2.0 APPLICABILITY

This Project Procedure does not include instrument calibrations or cover the operation of gamma scintillation instruments (sodium iodide) or meters that read in uR/hr (e.g., Ludlum 12S) or uRem/hr (e.g., Bicron Micro Rem). Equivalent instruments that operate in a similar fashion to those identified in this section may be operated under this Project Procedure with RSO approval.

3.0 REFERENCES

1. ANSI N323A-1997, Radiation Protection Instrument Test and Calibration Portable Survey Instruments
2. Instrument Technical Manuals.
3. "Site Safety & Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan".

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Reviewing and approving changes to this procedure and ensuring compliance with applicable regulations.
- Ensuring an adequate inventory of Radiation Protection instruments are available to support remediation activities.
- Overseeing the issue, control, and accountability of Radiation Protection instrumentation per the requirements of this procedure.
- Ensuring transmittal of all issue, control, and accountability records to the appropriate document control authority when applicable.

5.2 Radiation Protection Technician (RPT)

- Maintaining instrument documentation and records as required by this procedure.
- Maintaining adequate instrument and equipment availability.
- Verifying current calibration and response test dates prior to issue or use of instruments.
- Promptly returning instruments to their proper location when work is complete.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-607-1 (12/2013)
Set-Up and Operation of the Thermo-Scientific Model RO-20 Ion Chamber	PAGE: 2 of 7

- Ensuring that instruments are properly surveyed for contamination and decontaminated as necessary, after use.

6.0 PREREQUISITES

- Only personnel with documented training shall issue or use RP instrumentation.
- Instruments and detectors shall be inspected for mechanical damage, and response tested prior to issue.
- Any instrument to be used shall have a current calibration label affixed to the instrument.

7.0 PRECAUTIONS AND LIMITATIONS

- Portable ion chamber survey meters are susceptible to damage from physical and environmental stresses.
- It is very important that the inside of the chamber assembly be kept dry to avoid current loss due to moisture. Replace the desiccant package located inside the instrument housing when the crystals become clear or pink.

8.0 APPARATUS

- Survey instrument
- check source
- Source positioning device (jig)

9.0 RECORDS

- FMSS RO-20 Daily Field Source Check Log (Attachment 1)

10.0 PROCEDURE

10.1 General

1. Ensure the instrument selected is within their acceptable calibration periods. This is indicated on an attached calibration sticker. Illegible stickers should be replaced prior to instrument use.
2. The RP Group will coordinate instrument calibration on a minimum annual basis and after major repair operations. Battery change-outs do not require re-calibration. Calibration procedures are outside of the scope of this instruction.
3. Pre-operational source checks are required daily, or prior to each intermittent use, whichever is less frequent. Post-operational source checks are performed as specified in work plans or procedures. Instruments used in the performance of daily activities do not normally require a post-operational source check.
4. Pre/post-operational source checks should be performed in the same location, with consistent temperature and radiation background levels.

Note: The RO-20 does not require an "Instrument Set-Up" be performed to establish the background and sigma ranges against which daily operational source checks will be assessed. Ambient background at the Maywood Site

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-607-1 (12/2013)
Set-Up and Operation of the Thermo-Scientific Model RO-20 Ion Chamber	PAGE: 3 of 7

is typically < 0.1 mR/hr and therefore below the detection capability of the RO-20. For the purpose of instrument response testing, background levels of ≤ 0.2 mR/hr will be considered acceptable. Source check ranges will be established at $\pm 20\%$ of the initial source-check value as noted on the Daily Field Source Check Log (Attachment 1).

5. Use a gamma check source with activity sufficient to produce a needle response on the scale that represents the highest anticipated radiation levels. At Maywood, a Cs-137 button source (~ 10 uCi) is typically used since it emits maximum energy beta particles of 511 keV (170 keV average); and 662 keV gamma rays which are representative of the mid-range of the beta/gamma energies encountered at Maywood. Alternate sources may be used with RSO approval.
6. Source positioning devices (i.e., jigs) should be used to ensure a reproducible geometry between instrument checks. Source geometry must be consistent between pre/post-operational source checks.

Note: The internal detectors are orientated towards the front of the instrument. Meter cases have visible indicators showing optimum locations to obtain measurements (i.e. effective detector center).

7. Source counts shall be performed with the beta shield in the “open window” (**OW**) position.
8. Allow instrument readings to maximize prior to recording instrument reading. This may take up to twenty seconds. Note that the needle may not rest on a single value, but may fluctuate slightly between two points on the scale. If this is the case, an average reading should be obtained by summing these two end points and dividing by two.
9. Report any abnormal instrument readings (e.g., unstable analog meter fluctuations), or background inconsistencies to the RSO, prior to continuing instrument use.
10. Instruments that fail operational checks or malfunction during use should be tagged or labeled “Out-of-Service,” or “Do Not Use,” and segregated from operational instruments. If possible, describe the problem on the tag / label and add initials and date.
11. Instruments leaving RP Group control (i.e., repair, calibration, excess, etc.) shall be surveyed for unconditional release. The repair / calibration center may request a copy of the survey to accompany shipments of RP instruments.

10.2 Instrument Source Check

1. Obtain the selected instrument.
2. Obtain the corresponding FMSS RO-20 Daily Field Source Check Log –, Attachment 1. This form will be referred to as the “Source Check Log.” Initiate a new Source Check Log, if necessary.
3. Perform a physical inspection of the instrument. Place particular emphasis on the following items:

<p style="text-align: center;">FMSS RADIATION PROTECTION PROGRAM</p> <p style="text-align: center;">Set-Up and Operation of the Thermo-Scientific Model RO-20 Ion Chamber</p>	<p>NO.: PP-8-607-1 (12/2013)</p>
	<p>PAGE: 4 of 7</p>

- Instrument case is not visibly damaged beyond minor scrapes and scratches.
 - Analog display is not cracked or otherwise damaged.
 - Switches and buttons are functional.
 - Calibration labels are legible and instrument is within calibration period.
4. Note results of physical inspection on the source check log by indicating *SAT* in the applicable box.
 5. There are two battery level indicators on the RO-20. Verify the battery levels are within the acceptable range as described below.
 - **BATTERY 1-** Power is provided by five standard “C” batteries. To test the battery level place the rotary switch in the **BATTERY 1** position; response above the **Battery Check** cut-off line on the display indicates there is sufficient power to operate the RO-20.
 - **BATTERY 2-** Power is provided by ten 3-volt lithium coin batteries that provide power for the air chamber bias. To test the battery level place the rotary switch in the **BATTERY 2** position; response above the **Battery Check** cut-off line on the display indicates that there is sufficient power to the ion chamber.
 - **DO NOT LEAVE SWITCH IN BATTERY 2 POSITION FOR EXTENDED PERIODS.**
 6. Note battery check results on the source check log by indicating *SAT* in the applicable box.
 7. Perform an instrument “zero” check by placing the rotary switch in the zero position and turn the **ZERO** adjustment knob to adjust the needle to zero on the display
 8. Note the “zero” check on the source check log by indicating *SAT* in the applicable box.
 9. Note that the ambient background is ≤ 0.2 mR/hr on the source check log by indicating *SAT* in the applicable box.
 10. Obtain the source to be used for instrument source checks. (Ensure the active side of the source is in the upright position. Typically the active side is void of any markings or etchings).
 11. Load the source and instrument onto the source jig. Ensure the beta shield is in the **OW** position.
 12. Obtain and record the “CONTACT” reading.
 13. Verify the contact reading is within the acceptable range (+/- 20%) as identified in the *Initial Instrument Reading* section of the Field Source Check Log (Attachment 1).
 14. If the contact source reading falls outside the acceptable range, tag the instrument out of service and notify the RSO, otherwise continue.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-607-1 (12/2013)
Set-Up and Operation of the Thermo-Scientific Model RO-20 Ion Chamber	PAGE: 5 of 7

15. Complete the source check log including technician initials. The instrument is now ready for use.
16. Ensure sources and forms are stored properly after use in the designated storage location. Forms are retained in the RP Instrument logbooks until which time the instrument is taken out of service (e.g. calibration or repair).
17. Completed forms are then submitted to the RP data clerk to initiate the document review and submittal process

10.3 Operations

1. Verify that required source checks have been performed prior to initial instrument use.
2. Operate the instrument in a manner that minimizes the potential for cross-contamination and physical damage.
3. The RO-20 can be operated between minus (-) 40 degrees and 140 degrees Fahrenheit (F). However anytime the temperature is below 0 degrees F, nickel-cadmium batteries should be used.
4. Limit readings taken while the instrument is positioned sideways to minimize the effects of "geotropism" on the analog needle.
5. Obtain readings by positioning the instrument as close to the detector's "effective center" as possible. The detector effective center is represented on the front of the instrument housing by small circular depressions.
6. Readings should be taken on contact with the target item; however anytime a contact reading equals or exceeds 5 mR/hr a 30 centimeter "general area" reading is also required to assess radiological posting requirements.
7. The RO-20 is equipped with a sliding beta shield on the bottom of the instrument housing that conceals a mylar window used for measuring exposure rates from beta radiation.
8. Obtain beta radiation readings by subtracting the closed window (CW) reading from the open window (OW) readings, then multiplying the difference by the beta correction factor (BCF) identified on the calibration sticker. Beta radiation readings should be reported in units of milli-rad per hour (mrad/hr).

$$\text{mrad/hr} = (\text{OW} - \text{CW}) \times \text{BCF}$$

Where:

OW = open window

CW = closed window

BCF = beta correction factor

9. Protect instruments, to the extent possible, from exposure to moisture (i.e. rain, snow, etc.) during use. Instruments shall be stored in a safe manner when not in use.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-607-1 (12/2013)
Set-Up and Operation of the Thermo-Scientific Model RO-20 Ion Chamber	PAGE: 6 of 7

10. Perform a post-operational source check after use, if directed by work plan, procedure, or the RSO.

11.0 ATTACHMENTS

Attached forms are examples and may be modified by the RSO, as needed, without revision to this procedure.

Attachment 1 FMSS RO-20 Daily Field Source Check Log (Typical)

Attachment 1

FMSS Daily Field Source Check Log – Exposure Rate Instruments (Typical)

RO-20 DAILY FIELD SOURCE CHECK LOG

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="2" style="text-align: center;">INSTRUMENT DATA</th></tr> <tr><td colspan="2" style="background-color: #cccccc;"> </td></tr> <tr><td colspan="2" style="text-align: center;">INSTRUMENT INFORMATION</td></tr> <tr><td>MODEL</td><td>RO-20</td></tr> <tr><td>SERIAL #</td><td> </td></tr> <tr><td>CAL. DUE</td><td> </td></tr> </table>	INSTRUMENT DATA				INSTRUMENT INFORMATION		MODEL	RO-20	SERIAL #		CAL. DUE		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="2" style="text-align: center;">SOURCE DATA</th></tr> <tr><td colspan="2" style="background-color: #cccccc;"> </td></tr> <tr><td>ISOTOPE</td><td>SERIAL #</td></tr> <tr><td>Cs137</td><td> </td></tr> <tr><td>ACTIVITY (uCi)</td><td>ACTIVITY (dpm)</td></tr> <tr><td>10</td><td>NA</td></tr> </table>	SOURCE DATA				ISOTOPE	SERIAL #	Cs137		ACTIVITY (uCi)	ACTIVITY (dpm)	10	NA	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="2" style="text-align: center;">INITIAL INSTRUMENT READINGS</th></tr> <tr><td colspan="2" style="background-color: #cccccc;"> </td></tr> <tr><td colspan="2" style="text-align: center;">Contact Source OW</td></tr> <tr><td>+ 20 %</td><td> </td></tr> <tr><td>* Initial</td><td> </td></tr> <tr><td>- 20 %</td><td> </td></tr> </table> <p style="font-size: small;">*Initial OW contact reading as measured upon receipt of instrument to the FMSS</p>	INITIAL INSTRUMENT READINGS				Contact Source OW		+ 20 %		* Initial		- 20 %	
INSTRUMENT DATA																																						
INSTRUMENT INFORMATION																																						
MODEL	RO-20																																					
SERIAL #																																						
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+ 20 %																																						
* Initial																																						
- 20 %																																						
SET-UP LOCATION: <u>MISS RP OFFICE</u>																																						
(SAT - UNSAT - N/A)																																						
	Date / Time	Physical Inspection	Battery 1	Battery 2	Zero	Big < 0.2 mR/hr	OW Contact Reading mR/hr	PASS	COMMENTS	TECH INITIALS																												
								FAIL																														
1																																						
2																																						
3																																						
4																																						
5																																						
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FMSS RADIATION PROTECTION PROGRAM SET-UP AND USE OF PORTABLE GAMMA SCINTILLATION DOSE RATE INSTRUMENTS	NO.: PP-8-608-1 (12/2013)
	PAGE: 1 of 8

1.0 PURPOSE

This work instruction specifies the methods for performing source checks and operating portable Gamma scintillation dose (including exposure) rate instruments, specifically, the Ludlum Model 12S and the Bicon Model Micro Rem. These instruments are used for the evaluation of exposure rates from radioactive materials and determining environmental radiation levels.

2.0 APPLICABILITY

This procedure specifically addresses those instruments that measure exposure rate from a scintillation detector and have displays that read in uR/hr (Ludlum 12S) or uRem/hr (Bicon Micro Rem). The primary meter used at the FMSS is the Bicon Micro Rem meter because it uses a plastic scintillation detector that has nearly a “tissue equivalent” response. The Ludlum Model 12S is available, but is normally used for engineering applications associated with historic radiation surveys at FMSS as it uses a sodium iodide scintillation detector that is not “tissue equivalent”.

This Project Procedure does not include associated instrument calibrations or cover the operation of exposure rate instruments that have an ion chamber (e.g. Eberline RO-2). Equivalent instruments that operate in a similar fashion to those identified in this section may be operated under this Project Procedure with RSO approval.

3.0 REFERENCES

- ANSI N323-1978, Radiation Protection Instrument Test and Calibration
- Instrument Technical Manuals
- “Site Safety & Health Plan” (SSHP), Appendix A of the FMSS “Accident Prevention Plan”

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Reviewing and approving changes to this procedure and ensuring compliance with applicable regulations.
- Ensuring an adequate inventory of Radiation Protection (RP) instruments are available to support remediation activities.
- Overseeing the issue, control and accountability of RP instrumentation per the requirements of this procedure.
- Ensuring transmittal of all issue, control and accountability records to the appropriate document control authority when applicable.

5.2 Radiation Protection Technician (RPT)

- Maintaining instrument documentation and records as required by this procedure.

FMSS RADIATION PROTECTION PROGRAM SET-UP AND USE OF PORTABLE GAMMA SCINTILLATION DOSE RATE INSTRUMENTS	NO.: PP-8-608-1 (12/2013)
	PAGE: 2 of 8

- Maintaining adequate instrument and equipment availability.
- Verifying current calibration and response test dates prior to issue or use of instruments.
- Promptly returning instruments to their proper location when work is complete.
- Ensuring that instruments are properly surveyed for contamination and decontaminated as necessary, after use.

6.0 PREREQUISITES

- Only personnel with documented training shall issue or use RP instrumentation.
- Instruments and detectors shall be inspected for mechanical damage, and response tested prior to issue.
- Any instrument to be used shall have a current calibration label affixed to the instrument.

7.0 PRECAUTIONS AND LIMITATIONS

Portable dose rate instruments are susceptible to damage from physical and environmental stresses.

8.0 APPARATUS

- Dose (or exposure) rate instrument
- Tech source
- Source positioning device (jig)

9.0 RECORDS

- FMSS Daily Field Source Check Log – Exposure Rate Instruments (Attachment 1)
- FMSS Exposure Rate Instrument Set-Up Sheet (Attachment 2)

10.0 PROCEDURE

10.1 General

- A. Ensure the instrument selected is within their acceptable calibration periods. This is indicated on an attached calibration sticker. Illegible stickers should be replaced prior to instrument use.
- B. The RP Group will coordinate instrument calibration on a minimum annual basis and after major repair operations. Battery change-outs do not require re-calibration. Calibration procedures are outside of the scope of this instruction.
- C. Pre-operational source checks are required daily, or prior to each intermittent use, whichever is less frequent. Post-operational source checks are performed as specified in work plans or procedures. Instruments used in the performance of daily activities do not normally require a post-operational source check.

FMSS RADIATION PROTECTION PROGRAM SET-UP AND USE OF PORTABLE GAMMA SCINTILLATION DOSE RATE INSTRUMENTS	NO.: PP-8-608-1 (12/2013)
	PAGE: 3 of 8

- D. Instrument set-up and subsequent operational checks should be performed in the same location, with consistent temperature and radiation background levels.
- E. Use a gamma check source with an activity sufficient to produce contact exposure rates at least ten times higher than background. Cs-137 is typically used at the FMSS since it emits 662 keV gamma rays which are representative of the mid-range of gamma energies encountered at the FMSS. Alternate sources may be used with RSO approval.
- F. Source positioning devices (i.e., jigs) should be used to ensure a reproducible geometry between instrument checks. Source geometry must be consistent between initial instrument set-up and subsequent operational checks.
- G. The Ludlum 12S may be operated in the FAST response mode. Switch to SLOW response for obtaining precise readings.
- H. Internal scintillation crystals are orientated towards the front of the instrument. Meter cases have visible indicators showing optimum locations to obtain measurements (i.e. effective detector center).
- I. Allow instrument readings to maximize prior to recording instrument reading. This may take up to twenty seconds. Note that the needle may not rest on a single value, but may fluctuate slightly between two points on the scale. If this is the case, an average reading should be obtained by summing these two end points and dividing by two.
- J. Instruments should be allowed to warm-up for at least one minute prior to obtaining readings.
- K. Report any abnormal instrument readings (e.g., unstable analog meter fluctuations), or background inconsistencies to the RSO, prior to continuing instrument use.
- L. Instruments that fail operational checks or malfunction during use should be tagged or labeled "Out-of-Service," or "Do Not Use," and segregated from operational instruments. If possible, describe the problem on the tag / label and add initials and date.
- M. Instruments leaving RP Group control (i.e., repair, calibration, excess, etc.) shall be surveyed for unconditional release. The repair / calibration center may request a copy of the survey to accompany shipments of RP instruments.

10.2 Instrument Source Check

- A. Obtain the selected instrument.
- B. Obtain the corresponding FMSS Daily Field Source Check Log – Exposure Rate Instruments form, Attachment 1. This form will be referred to as the "Source Check Log." Initiate a new Source Check Log, if necessary.
- C. Perform a physical inspection of the instrument. Place particular emphasis on the following items:

FMSS RADIATION PROTECTION PROGRAM SET-UP AND USE OF PORTABLE GAMMA SCINTILLATION DOSE RATE INSTRUMENTS	NO.: PP-8-608-1 (12/2013)
	PAGE: 4 of 8

- Instrument case is not visibly damaged beyond minor scrapes and scratches.
 - Analog display is not cracked or otherwise damaged.
 - Switches and buttons are functional.
 - Audio, if present, is functional.
 - Calibration labels are legible and instrument is within calibration period.
- D. Note results of physical inspection on the Source Check Log.
- E. Verify the battery level is within the acceptable range on the analog display. Replace batteries and re-verify, as necessary.
- F. Note battery check results on the Source Check Log.
- G. Verify the high voltage (HV) level is within the acceptable range on the analog display, if present. Place the instrument out-of-service if the HV is outside the acceptable range.
- H. Note the HV check results on the Source Check Log.
- I. If acceptable background ranges have not been established, perform the following:
- Obtain a blank FMSS Exposure Rate Instrument Set-Up Sheet, Attachment 2. This form will be referred to as the “Set-Up Sheet.”
 - Record the basic source and instrument information at the top of the form.
 - Using the instrument and the source jig (without source), obtain and record ten background readings. The instrument should be removed from the source jig and repositioned after each reading is obtained. Make sure the location where readings are obtained has stable background levels and is the location used for subsequent source checks.
 - Calculate and record the average background value and +/- 20% values on both the set-up and source check log sheets.
- J. Obtain and record an average background reading on the source check log.
- K. Compare the average background reading to the acceptable range. If background response is outside this range, report the condition to the RSO for evaluation, otherwise continue with source check process.
- L. Obtain the source to be used for instrument source checks.
- M. If acceptable source check ranges have not been established, perform the following:
- Obtain the Set-Up Sheet used to determine acceptable background ranges for the instrument.
 - Using the instrument and the source jig (with source), obtain and record ten contact source readings. The instrument and source should be removed from the source jig and repositioned after each reading is obtained. Make

FMSS RADIATION PROTECTION PROGRAM SET-UP AND USE OF PORTABLE GAMMA SCINTILLATION DOSE RATE INSTRUMENTS	NO.: PP-8-608-1 (12/2013)
	PAGE: 5 of 8

sure the location where readings are obtained is the same location where previous background readings were obtained.

- Calculate and record the average source value and +/- 20% values on both the set-up and source check log sheets.
- N. Load the source and instrument onto the source jig.
- O. Obtain and record the "CONTACT" reading.
- P. Verify the contact reading is within the acceptable range (+/- 20%).
- Q. If the contact source reading falls outside the acceptable range, tag the instrument out of service and notify the RSO, otherwise continue.
- R. Complete the source check log including technician initials. The instrument is now ready for use.
- S. Ensure sources and forms are stored properly after use in the designated storage location. Forms are retained in RP Instrument logbooks of field files during instrument use (i.e. calibration) cycle. Records are then reviewed by the RSO, or designee for completeness and forwarded to Project Records for retention.

10.3 Operations

- A. Verify that required source checks have been performed prior to initial instrument use.
- B. Operate instrument in a manner that minimizes the potential for cross-contamination and physical damage
- C. Limit readings taken while the instrument is positioned sideways to minimize the effects of "geotropism" on the analog needle.
- D. Obtain readings by positioning the instrument as close to the detector's "effective center" as possible. The detector effective center is represented on the instrument housing a cross inside a circle on the Bicon Micro Rem, and a small circular depression on the Ludlum 12S. Overall optimum readings are collected from the front of the instrument housing.
- E. Most instruments will operate in temperatures between 10 and 120 degrees Fahrenheit. However, anytime the temperature is outside of the 32 degree (freezing) or 100 degree ranges, observe the following precautions:
- Be observant of instrument response to background. If the instrument begins to show a decreased response to expected background levels contact the RSO, or designee for guidance.
 - If practicable, perform a period response check of the instrument against a known source of radiation. If the instrument appears to be responding incorrectly contact the RSO or designee for guidance.
 - Contact the RSO for guidance anytime work is planned outside of the 10 to 120 degree range.

<p style="text-align: center;">FMSS RADIATION PROTECTION PROGRAM</p> <p style="text-align: center;">SET-UP AND USE OF PORTABLE GAMMA SCINTILLATION DOSE RATE INSTRUMENTS</p>	<p style="text-align: right;">NO.: PP-8-608-1 (12/2013)</p>
	<p style="text-align: right;">PAGE: 6 of 8</p>

- F. Protect instruments, to the extent possible, from exposure to moisture (i.e. rain, snow, etc.) during use. Instruments shall be stored in a safe manner when not in use.
- G. Perform a post-operational source check after use, if directed by work plan, procedure, or the RSO.

11.0 ATTACHMENTS

Attached forms are examples and may be modified by the RSO, as needed, without revision to this procedure.

Attachment 1 FMSS Daily Field Source Check Log – Dose/Exposure Rate Instruments

Attachment 2 FMSS Dose/Exposure Rate Instrument Set-Up Sheet

Attachment 1

FMSS Daily Field Source Check Log – Dose/Exposure Rate Instruments (Typical)

FMSS DAILY FIELD SOURCE CHECK LOG
- EXPOSURE RATE INSTRUMENTS

MONTH / YEAR: _____

INSTRUMENT DATA	Date/Time	Physical	Battery	High Voltage	Audio	Background	Contact Source	PASS or FAIL	Tech. Initials
INSTRUMENT									
MODEL									
SERIAL#									
CAL DUE									
HV									
SOURCE DATA									
ISOTOPE									
SERIAL #									
ACTIVITY uCi									
INSTRUMENT RANGES									
Background									
Contact Source									
+ 20 %									
- 20 %									
Units (Circle One)									
uR									
uRem									
mR									
mRem									
R									
rem									
Remarks:	Reviewed by: _____								

Attachment 2

FMSS Dose/Exposure Rate Instrument Set-Up Sheet (Typical)

FMSS EXPOSURE RATE INSTRUMENT SET-UP SHEET										
Set-Up Location: _____										
INSTRUMENT DATA		READING (n)	Background Rate	Contact Source Rate	CALCULATED AVERAGE AND RANGES					
INSTRUMENT		1			Background	Contact Source				
MODEL		2			Average + 20%					
SERIAL #		3			Average					
CAL DUE DATE		4			Average - 20%					
HV		5								
SOURCE DATA		6			Units (Circle One)					
ISOTOPE		7			uR	urem	mR	mrem	R	rem
SERIAL #		8			REMARKS					
ACTIVITY (uCi)		9								
		10								
Performed By: _____		Date/Time: _____		Reviewed By: _____		Date/Time: _____				

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 1 of 22

1.0 PURPOSE

The purpose of this procedure is to establish consistent methodology for the set-up, calibration and operation of the HI-Q Environmental Products, Model HVP-4300AFC high volume air sampler including details for the optional use of the PM-10 Size Selective Inlet (SSI) sampling train.

2.0 APPLICABILITY

This procedure applies to all personnel who may reasonably be expected to utilize the HVP-4300AFC sampling pump for workplace perimeter surveillance activities.

3.0 REFERENCES

1. HI-Q Environmental Products, 2009, Technical Manual for Model HVP-4300AFC Brushless, Automatic Flow Control Outdoor Hi-Vol Air Sampler for Continuous Use.Rev. B., N.R. 06/09, June.
2. HI-Q Environmental Products, Technical Manual for Model PM10-INLET, U.S. EPA Federal Reference Number RFPS-0202-141.
3. HI-Q, 2006, Technical Manual for Model D-AFC-50 10-50 CFM Digital Air Flow Calibrator. NR Rev 06/06, June.
4. U.S. Army Corps of Engineers (USACE), 2013, Site Safety and Health Plan, FUSRAP Maywood Superfund Site, Revision 4. Prepared for USACE by Cabrera Services, Inc.
5. USACE, 2010, Ionizing Radiation Protection, ER 385-1-80, Washington, D.C., June 30, 2010.

4.0 GENERAL

4.1 Discussion

The HVP-4300AFC is a brushless, automatic-flow control, high volume air sampling device designed for continuous outdoor use (the unit is housed in an anodized aluminum outdoor shelter). This sampling pump is the primary device used for actively collecting integrated samples on media. Automatic-flow control pumps like the HI-Q models in use at Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS) can cope with changing conditions such as filter loading and still maintain a constant sampling rate within certain limits by measuring and regulating the actual input flow.

Select units are fitted with the PM-10 SSI. The PM-10 SSI is a precision symmetrical designed inlet used to differentiate collected particulate by size. Larger particles are impacted on a greased shim plate. Small particles (< 10 microns) are collected on the 8-inch by 10-inch filter collection media. This unit is designed to collect uniformly across the sample media regardless of wind direction and wind speed. At the FMSS, the HVP-4300AFC is typically used for sampling radiological particulates at work site perimeters to ensure compliance with off-site monitoring requirements.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 2 of 22

4.2 Definitions

Calibration check (specific to this instrument): The process of adjusting and recording flow rates of the sampling pump using calibration check devices such as the HI-Q Model D-AFC-50. Flow calibrations using a primary standard shall be performed annually. Pump calibrations expire one year from date of last calibration.

High Volume (Hi-Vol) Air Sampler: A portable air-sampling device designed to maintain a constant flow rate over a given sampling period. Hi-Vol air samplers typically operate at flow rates between 0.2832 and 1.42 cubic meters per minute (10 and 50 cubic feet per minute).

Litres versus Cubic Meters: 1 litre equals 0.001 cubic meters. Conversely, 1 cubic meter equals 1000 litres. The calibrator D-AFC-50 displays volumes in litres whereas the HVP-4300-AFC displays volumes in cubic meters; therefore, a simple correction of moving the decimal point three places is required (e.g., 1.13 standard cubic meters per minute [SCMM] equals 1130 standard litres per minute [SLPM]).

Primary Standard: A highly accurate flow calibration device with NIST-traceable specifications.

Sampling Train: The connected combination of collection media, sampling pump, tubing, and a flow rate-measuring device.

Standard Volume versus Actual Volume: Standard volume refers a volume of air at standard conditions, defined for this procedure as a temperature of 70° F (21.1° C) and an atmospheric pressure of 29.92 inches of Mercury (760 torr). Actual volume refers to the actual amount of gas regardless of temperature or pressure conditions. The HVP-4300-AFC units used on the FMSS are set to display flow rates and totalized volumes in terms of *standard* volumes meaning that they are automatically correcting for ambient temperature and pressure conditions. When performing calibrations the calibrator should be set to display units in standard volume. If the calibrator does not read in units of standard volume, then correction factors must be applied.

4.3 Acronyms and Abbreviations

ALPM—Actual Litres Per Minute

FMSS—FUSRAP Maywood Superfund Site

FUSRAP—Formerly Utilized Sites Remedial Action program

NIST—National Institute of Standards and Technology

RPT—Radiation Protection Technician

RSO—Radiation Safety Office

SCM—Standard Cubic Meters

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 3 of 22

SCMM—Standard Cubic Meters Per Minute

SLPM—Standard Litres Per Minute

SSI—Size Selective Inlet

SSHO—Site Safety and Health Officer

SSHP—Site Safety and Health Plan

TSP—Total Suspended Particulate

USACE—U.S. Army Corps of Engineers

5.0 RESPONSIBILITIES

5.1 Site Safety and Health Officer (SSHO)

The SSHO is responsible for:

- Providing oversight to all Safety and Health air monitoring performed on the Project.
- Defining and establishing air sampling protocols for specific contaminants at FMSS.
- Ensuring all electrical connections associated with the initial set-up of this equipment is performed in accordance with the applicable electrical codes and in compliance with the project SSHP.

5.2 Radiation Safety Officer (RSO)

The RSO is responsible for:

- Directing radiological air monitoring strategies based upon established protocols and plans.
- Reviewing air monitoring results and initiating necessary follow-up actions.

5.3 Radiation Protection Technician (RPT)

RPTs are responsible for:

- Ensuring proper performance of air monitoring instrumentation through routine inspections and established calibration requirements.
- Deploying and operating air sampling equipment in the workplace in a logical and effective manner so as to ensure representative sampling and meaningful exposure data.
- Performing regular inspections on deployed air sampling equipment to verify proper operation and to note any unusual occurrences such as flow interruptions or inappropriate sampling locations.
- Documenting workplace air monitoring activities on appropriate documentation.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 4 of 22

5.4 Project Worker

Project workers are responsible for the following:

- Notifying RPTs of any power disconnections to or pump malfunctions of work area or perimeter air samplers.
- Providing assistance to RPTs in the setup of work area or perimeter air samplers if needed (e.g., relocating units, helping to obtain extension cords, constructing stands or shelters, etc.).

6.0 PREREQUISITES

The pump must have been calibrated with a primary standard prior to field use. The HVP-4300AFC is calibrated before leaving the factory; therefore there is no need to calibrate the unit prior to initial set-up. Flow calibrations are valid for 365 days after calibration date. Calibration shall be performed with the intended sampling media (8-inch x 10-inch 0.3 micron glass fiber paper) included in the sampling train.

7.0 PRECAUTIONS AND LIMITATIONS

- The “calibrations” performed in this procedure are only verifications of the primary factory calibrations.
- Do not use the calibration mode on the D-AFC-50 calibrator.
- The D-AFC-50 and the HVP-4300AFC are sensitive to electrical changes; therefore, ensure a dependable electrical source.
- Only authorized personnel (i.e., FMSS personnel trained and signed-off on this procedure) are permitted to operate air-sampling equipment.
- Because air-sampling pumps are often relied upon to provide critical exposure data, quality care of these devices is essential. Pumps should be inspected after each sampling event for missing or damaged parts and repaired promptly. Pumps with damaged power cords shall be tagged and taken out of service.
- Verify that the sampling media is appropriate for the intended sampling event (e.g., 8-inch by 10-inch 0.3 micron glass fiber filter for radiological particulate monitoring).
- This sampler model is outfitted with a totalizer to capture operating run times. These values should be recorded, if available, to better estimate overall sample volumes and to determine if interruptions in operations occurred. The totalizer must be reset after each sampling event.
- This equipment must not be used in any area contaminated by volatile or flammable materials since sparking is predicable in the normal operation of the motor and may ignite the volatiles.
- Use caution when handling the sensitive laminar flow element to avoid equipment damage.
- To avoid serious injury (electrical or mechanical) or equipment damage, do not open or disassemble the pump motor. The pump motor must be replaced if it fails.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 5 of 22

8.0 APPARATUS

- HI-Q Model HVP-4300AFC high volume air sampler.
- Electronic mass flow meter, such as the HI-Q Model 10 – 50 CFM Digital Air Flow calibrator (e.g., Hi-Q Model D-AFC-50).
- HI-Q Model PM-10 SSI sample head (optional).
- Appropriate sampling media (e.g., 8-inch by 10-inch 0.03 micron glass fibre filter paper).

9.0 RECORDS

Completed “Calibration Certificate and Data Sheet for the High Volume Air Sampler” will be sent to RPP Records until transmitted to Project Document Control.

10.0 PROCEDURE

10.1 Instrument Setup

- The user should familiarize himself / herself with the HI-Q Technical Manual for the HVP-4300AFC and this procedure before using for the first time.
- Perform a visual inspection of the instrument unit making sure all components are in sound condition. The units are shipped in 2 or 3 boxes depending on the accessories purchased.
- For permanent installation, remove the 4 rubber shock absorbers on the leg bottoms.
- Use lag bolts or molly bolts to fasten the unit to a concrete pad or other type of base. Alternatively, the units may be fastened to fencing or secured by other means for temporary installations.
- Install the roof with the bolts provided.
- Attach roof restrainer to the cabinet to prevent the roof from falling down when changing out filter paper.
- If using PM10 SSI, ensure 90-degree support stabilizers are attached at the base of each leg to prevent unit from tipping.
- Have a licensed electrician connect the unit’s conduit and wire as required by the applicable electrical codes. The unit should be installed on a circuit breaker line of at least 15 amps.

10.2 Auto Flow Calibration Check

Do not use the calibration mode on the D-AFC-50

- Verify normal operation of unit before proceeding with calibration.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 6 of 22

- Verify normal operation of unit before proceeding with calibration.

o If the HVP-4300AFC unit is in use, this means checking to see that the flow rate is approximately equal to the set point prior to collecting the sample or turning the motor off. Check by pressing “1” on the keypad when the “main menu” is displayed; this will bring up the “Monitor” screen (If the main menu is not displayed, press the “ESC” button to return to the main menu).

o If the unit was not in use, this means turning the unit on and waiting for the flow rate to stabilize. When turned on the unit will initially run at a higher flow rate and slowly settle down to reach the set point, this process can take 10 minutes or longer. Once stabilized, check for normal operation by comparing the flow rate to the set point as described above.

o If the unit is not operating normally - for example if the flow rate is negative or is far removed from the set point, or if an “Air Flow Failure” warning is displayed - a manual calibration should be performed as described in Section 10.3 without attempting an automatic calibration.

- On the HVP-4300AFC, turn the Rotary Switch from “Continuous” to “Off” then turn the Main Switch off.
- Remove any old filter paper / collect sample and replace with a clean sheet of the same type filter paper that will normally be used for sampling. Do not replace paper-clamping plate yet.
- Place calibrator D-AFC-50 over filter paper.
- Place clamping bars over calibrator adapter plate and tighten as much as possible.
- Turn on the D-AFC-50 calibrator first. After (5) seconds the main menu will appear.
- Using the keypad of the D-AFC-50 calibrator press “1” to enter into the flow rate mode.
- To perform the calibration without the need to apply correction factors, change the units of the D-AFC-50 digital readout by pressing the Enter button (left pointing line with arrowhead) on the right side of the digital display to toggle between actual volumes (ACTUAL) and standardized volumes (STP). To proceed without having to apply correction factors, the units displayed should read SCFM, SLPM and SCMH, and the toggle switch should read “ACTUAL.”
- Start the HVP-4300AFC by turning the “MAIN SWITCH “on and place the rotary switch to “CONTINUOUS,” to run in continuous mode.
- Within (2) seconds the main menu will be displayed. Press “1” to enter the monitoring mode of the HVP-4300AFC.
- Let the flow rate stabilize. As described above, it may take up to 10 minutes or longer for the flow rate to reach the set point. Do not proceed until the flow rate is stabilized at the set point. It is imperative that auto-calibration NOT be attempted prior to unit stabilization.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 7 of 22

- The D-AFC-50 calibrator does not read in SCMM; therefore, a correction factor needs to be used for converting SLPM to SCMM. (1000 SLPM = 1.0 SCMM or 1130 SLPM = 1.13 SCMM).
- If the adapter plate is not sufficiently tight, airflow will fluctuate on the airflow display panel of the D-AFC-50 calibrator. Some fluctuation is expected, but should generally be limited to the set-point +/- 5 SLPM.
- Tighten all four clamps as necessary until flow rate stabilizes.
- When stabilization of the D-AFC-50 calibrator is obtained press “ESC” from the keypad of the HVP-4300AFC.
- This will bring up the main menu.
- From the Main Menu press “2” to enter into the “Calibration Password” screen shown in Figure 1.



Figure 1
CALIBRATION Password Entry

- Enter the password (“250”) using the keypad and press OK.
- When the password is accepted the following screen is displayed (**Figure 2**).



Figure 2

Calibration Mode Entry

- The calibration is performed automatically by the HVP-4300AFC by connecting the cable (provided with the HVP-4300AFC) between the HVP-4300AFC and the D-AFC-50 and keeping the rotary switch in “CONTINUOUS” position.
- Connect the communication cable between the HVP-4300AFC and the D-AFC-50 (the cable is already connected to the HVP-4300AFC and is stored behind the control panel).
- Press “1” to begin auto calibration. The motor will stop suddenly and slowly ramp-up. During this time the “Auto Calibration in Progress” will appear as in (Figure 3). The calibration takes approximately (5) minutes to complete the calibration cycle. If the unit takes longer than 10 minutes and the motor continuously cycles off and on, then the auto calibration is not working and a manual calibration should be performed.
- The HVP-4300AFC automatically performs a 15 point calibration based on the previous calibration. If the previous calibration did not work, then no subsequent auto-calibrations will work and a manual calibration must be performed.



Figure 3

Auto Calibration in Progress

- The AS-FOUND and AS-LEFT flow rates of HVP-4300AFC and D-AFC-50 at five different points are displayed when the calibration is complete (as shown in Figure 4).
- To determine the success of the calibration, compare the values of the two columns on the right side of the display underneath the AS-LEFT SCMM heading against each other. The AS-LEFT HVP numbers should match the ASLEFT D-AFC numbers; if they do not match, within reason, then a manual calibration should be performed. (The AS-FOUND values may be different; this is expected and does not affect the current calibration.)

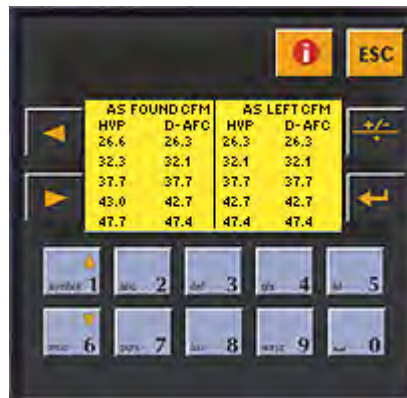


Figure 4
AS-FOUND and AS-LEFT Data

- When the auto calibration is completed, record the AS-FOUND and AS-LEFT readings on the calibration work sheet (Attachment 1).
- Disconnect the calibrator connection to the HVP-4300AFC and press “ESC” to return to the main menu. Take care to store the communication cable securely inside the unit housing to protect it from damage.
- Proceed to Section 10.4 and perform the totalizer calibration check.

10.3 Manual Flow Calibration Check

- Perform a Manual Calibration when the Auto Calibration AS-LEFT values are not in agreement, or when a previous auto-calibration attempt has failed, or if the unit does not seem to be operating normal (e.g., a negative flow rate is displayed or the unit does not stabilize to the set point or an “Air Flow Failure” warning is displayed).
- Turn the Main Switch of the HVP-4300AFC off.
- Remove any old filter paper / collect sample and replace with a clean sheet of the same type filter paper that will normally be used for sampling. Do not replace

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 10 of 22

paper-clamping plate yet. (Do not use a weighed filter for the calibration as these are designated for sample collection; just use a new filter out of the box).

- Place calibrator D-AFC-50 over filter paper.
- Place clamping bars over calibrator adapter plate and tighten as much as possible.
- Turn on the calibrator first. After (5) seconds the main menu will appear.
- Using the keypad press “1” to enter into the flow rate mode.
- To perform the calibration without the need to apply correction factors, change the units of the D-AFC-50 digital readout by pressing the Enter button (left pointing line with arrowhead) on the right side of the digital display to toggle between actual volumes (ACTUAL) and standardized volumes (STP). To proceed without having to apply correction factors, the units displayed should read SCFM, SLPM, and SCMh; the display next to the toggle button should read “ACTUAL.”
- Start the HVP-4300AFC by turning the “MAIN SWITCH” on and place the rotary switch to “CONTINUOUS” to run in continuous mode.
- Within (2) seconds the main menu will be displayed. Press “1” to enter the monitoring mode of the HVP-4300AFC. If “Air Flow Failure” is displayed, then press “ESC” to return to the main menu and press “1” again to return to the monitoring mode; this will clear the flow failure warning and flow information should now be displayed.
- Let the flow rate stabilize. As described above, it may take up to 10 minutes or longer for the flow rate to reach the set point. Do not proceed until the flow rate is stabilized at the set point. If the flow rate will not reach the set point it could indicate a malfunctioning unit; proceed with the calibration as normal to rule out calibration issues as the source of the problem.
- If the adapter plate is not sufficiently tight, airflow will fluctuate on the airflow display panel of the D-AFC-50 calibrator. Some fluctuation is expected, but should generally be limited to the set-point +/- 5 SLPM.
- Tighten all four clamps, as necessary until flow rate stabilizes.
- When stabilization is obtained press “ESC” from the keypad of the HVP-4300AFC. This will bring up the main menu.
- Turn the rotary switch from “CONTINUOUS” to “OFF” to stop the blower on the HVP-4300AFC. Wait until the motor completely stops before proceeding. Do NOT turn off the Main Switch. If the Main Switch is turned off, then begin the procedure from the beginning and wait again for flow rate stabilization.
- From the main menu press “2” to enter into the “Calibration Password” screen. Enter the password (250) and press “OK.”
- Press “2” from the Calibration Mode Entry screen (Figure 2) to perform manual calibration. The following screen will appear (Figure 5).



Figure 5
Zero Calibration Display

- To cancel the calibration procedure and retain the previous calibration, press ESC at any stage of the calibration procedure.
- When the D-AFC-50 calibrator reads 0 SLPM, press NEXT. This sets the zero point (0 SLPM) and the “Calibration Point 1” screen (Figure 6) will be displayed.

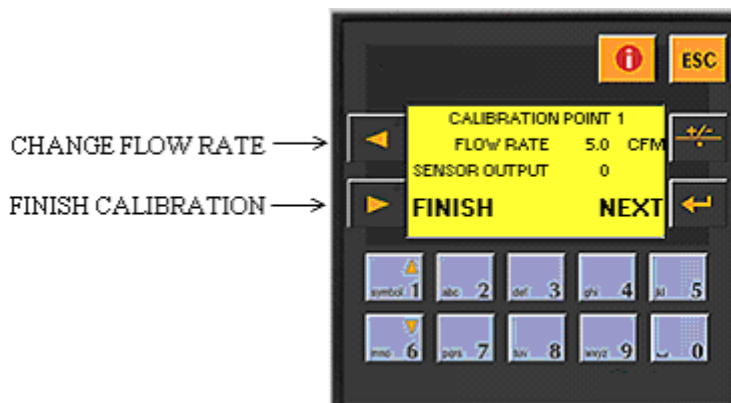


Figure 6
Calibration Point

- Turn on the HVP-4300AFC blower by turning the Rotary Switch to “CONTINUOUS,” to run in continuous mode.
- Verify that the FLOW RATE is set to the desired calibration point setting. Attachment 2 provides the flow rate settings to be used for all 15 calibration points. If the flow rate is not set to the appropriate value, then change the flow rate display point by pressing the left arrow as indicated in Figure 6.
- This will bring up the “Change Flow Rate” screen (Figure 7). Using the keypad, type in the desired set point (for Calibration Point 1 this means typing in “0.300” SCMM).

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 12 of 22

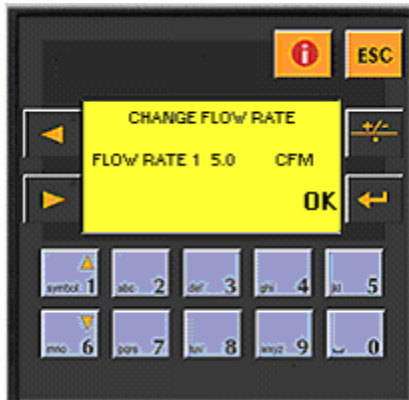


Figure 7
Change Flow Rate

- Press “OK” to set the point and return to the “Calibration Point 1” screen.
- From the Calibration Point 1 screen, use the up arrow (1) and the down arrow (6) to control the Sensor Output
- The motor will not run until the Sensor Output is increased to approximately 500.
- Press and hold the Up Arrow (1) until the flow rate displayed on the D-AFC-50 calibrator reaches the flow rate indicated on the Calibration Point 1 screen of the HVP-4300ACF. The D-AFC-50 readout is in SLPM and therefore a factor of 1000 must be applied to compare the calibrator to the desired set point of the HVP-4300AFC. For Calibration Point 1 the calibrator should read 300 SLPM (equals 0.300 SCMM).

TIP:

The calibration is made easier by listening to the motor while watching the flow rate of the calibrator. While pressing and holding the up arrow, the motor increases stepwise in 10 SLPM intervals with about a 2 second delay between steps. By listening to the motor increase its output and keeping track of the flow rate on the calibrator, the desired set point can be attained quickly.

- The flow rate of the calibrator will fluctuate continuously about +/- 5 SLPM of the target value. When the desired flow rate is attained, observe the flow rate on the calibrator for a few moments to verify that the target value is approximately in the center of the fluctuations (e.g., for Calibration Point 1, the flow rate will probably fluctuate between 295 and 305 SLPM).
- Once the flow rate of the calibrator is verified to be reading the desired value, Press “Next” on the HVP-4300AFC display panel to set the point. This will bring up the “Calibration Point 2” screen.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 13 of 22

- Repeat the above steps up to the desired number of calibration points. The maximum allowed number of calibration points is 15. It is recommended to use all 15 calibration points as provided on Attachment 2.
- To complete calibration with less than 15 points, press FINISH (Right Arrow) at any stage of calibration, as shown in Figure 6. Note: Since the intended sampling flow rate is 1.13 SCMM, calibration points should encompass this flow rate if the unit is going to be deployed in the field (i.e., the calibration should include the first 11 calibration points at a minimum).
- After attaining the flow rate for Calibration Point 15, Press FINISH to save the calibration and return to the Main Menu.
- Complete the Flow Calibration Work Sheet (Attachment 1) by entering “N/A” in the Auto Calibration Results section, and checking the appropriate box in the Manual Calibration Results section. If less than 15 calibration points were used, explain in the space provided.
- In case of error or doubt, press ESC to restore the previous calibration table and start over again at any point during the calibration.
- Once the calibration is complete, perform the Totalizer Calibration Check in Section 10.4.

10.4 Totalizer Calibration Check

- Press “3” from the “MAIN MENU” to enter the reset parameters screen. This is where the totalizer and elapsed timer can be reset to zero.
- Enter password 250, then press OK.
- The RESET Totalizer and elapsed Timer screen will appear as in Figure 8.



Figure 8
RESET Totalizer and Elapsed Timer

- Press the RESET button to reset the totalizer and elapsed timer to zero.
- Start a stopwatch at the same time the totalizer is reset.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 14 of 22

- Run sampler until a volume of 9.0 SCM volumes is reached on the totalizer.
- Verify that the stopwatch recorded elapsed time is between 7 minutes 34 seconds and 8 minutes 22 seconds.
- If the stopwatch recorded elapsed time is not within the acceptable range, the test may be repeated one additional time prior to placing the unit out of service.
- Complete appropriate sections of Flow Calibration Worksheet (Attachment 1).

10.5 Operation

- Consult with the RSO before initial deployment of work area or perimeter air samplers to verify locations, run times, monitoring strategies, and flow rates.
- Ensure that all associated hardware included with the HVP-4300 AFC air sampler is assembled (i.e. roof assembly, roof restrainer, rubber foot shock absorbers, etc.) and positioned between 4 and 6 feet above ground level.

NOTE

To determine TSP or PM-10 mass concentrations the unused (tare) and used (gross) filter weights must be recorded on the envelope or log sheet.

- Document the required use information on a sample envelope or log sheet.
- Before pump activation, place the appropriate sampling media such as 8-inch x 10-inch 0.3 micron glass fiber filter into the filter holder.
- Insert the 0.3 micron filter paper such that the “shiny” side is facing the pump.
- For automatic speed and flow control, you must set the flow to some rate that is less than the maximum obtainable flow rate of 1.42 standard cubic meters per minute (SCMM). Hence, when the flow is reduced by dust loading, the motor can speed up to compensate for the reduced flow. The recommended flow rate is 1.13 SCMM.
- Start the unit by pushing the toggle “Motor Switch” to the up position. There will be a pause until the electronics warm up.
- The screen as shown in (**Figure 9**) will be displayed a few seconds after the main switch has been turned



Figure 9
Startup Display

- Two (2) seconds later, the Main Menu screen shown in **(Figure 10)** will be displayed.



Figure 10
Main Menu

- The keypad buttons and corresponding functions in this menu are:
 - 1) Monitor
 - 2) Calibration
 - 3) Reset system
 - 4) Seven Day Timer
 - 5) Elapsed Time Shutoff
 - 6) Totalizer Shutoff
 - 7) Analog Output
- Monitor by pressing (1) from the “Main Menu” TO ENTER THE Monitor screen as shown in **(Figure 11)**.



Figure 11

Monitor Screen

- The parameters displayed in this screen are: Set Point, Flow rate, Total Flow and Elapsed Time. Press “ESC” to return to main menu.
- Reset System by pressing (3) from the “Main Menu” to enter the reset parameters screen.
- This is where the totalizer and elapsed timer can be reset to zero.
- The following screen (**Figure 12**) prompts the user to enter a password. The factory password for the RESET function is (250).



Figure 12

RESET password entry

- Enter (250) using the keypad and press OK (or ESC to Main Menu).
- Press the RESET button from the following screen (**Figure 13**) to reset the totalizer and elapsed timer to zero (or Esc to return to Main Menu without resetting).

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 17 of 22

- Press OK to return to the Main Menu.

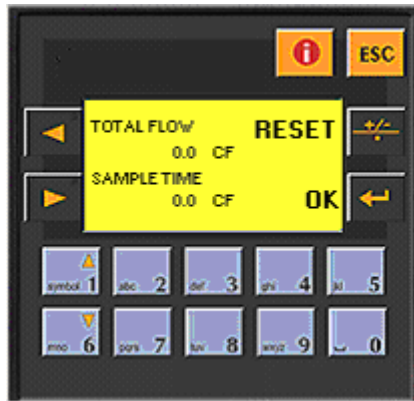


Figure 13

RESET Totalizer and Elapsed Timer

- Turn the Rotary Switch to CONTINUOUS to run in continuous mode.
- The motor will start and settle down to the speed control setting. Press (1) Up Arrow or (2) Down Arrow to increase or decrease the pre-set flow rate (only when monitor screen shown in **Figure 11** is displayed).
- After setting the desired flow of 1.13 SCMM, let the unit run for a few minutes to warm up the motor.
- Close the unit and lock if required.
- Collect sample for desired time.
- As directed by the RSO, periodically verify pump operation and filter integrity. Notify RP Management immediately, if a unit is discovered to be damaged or otherwise non-operational.
- Upon completion of sampling period, turn unit off, collect/replace filter media and record final flow information, including total volume and total run time from the instrument display panel on the air sample envelope or log sheet.
- Place the used filter into the air sample envelope and return the log sheet and/or sample to the Radioanalytical Laboratory for analysis.
- The HVP-4300AFC performs functions not normally used at FMSS, (Seven Day Timer, Elapsed Time Shutoff, Totalizer Shutoff and Analog Output) for these functions reference the HVP-4300AFC operating manual.

10.6 PM-10 SSI Assembly and Sampling

- Lift SSI, hood, and hood spacer bag from box.
- Cut cable tie on bottom of SSI that is holding the strut, and remove shoulder bolt and large washer.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 18 of 22

- Align middle of strut with hole in spacer, and fasten with shoulder bolt and large washer. **Ensure large washer is on top.**
- Place SSI on shelter, and align the shelter base pan 10-24 nut set holes with the holes inside of the shelter.
- Insert 10-24 x 1-inch bolts. (CAUTION: Ensure that the shelter is securely mounted to ground floor prior to opening SSI)
- Place SSI hood onto acceleration nozzle plate (top of SSI).
- Locate hood spacer between hood and acceleration nozzle plate, then loosely fasten with 10-32 x ½-inch thumb bolt, making sure plastic washer is in place. (Do this loosely for all eight-hood spacers before tightening.
- Open SSI by disengaging hooks and lifting the middle section into the open position.
- Remove cardboard and rubber bands that are covering filter holder assembly opening.
- Lower filter holder assembly down through opening making sure 8-inch x 10-inch gasket is under filter holder and the brass bolt aligns with filter holder.
- Place appropriate filter collection media on the CFPH-810 filter holder.
- Replace rectangular paper retainer bracket/cover and align the brass bolt assembly accordingly.
- Tighten for airtight seal.
- Ensure the HIQ-6001-24 Shim Plate has been wiped clean and evenly treated with DOW Corning Silicone spray, prior to each sampling event.

10.7 PM-10 to Total Suspended Particulate (TSP) Conversion

- Shut down unit and remove sample paper cartridge per normal sampling procedures.
- Remove PM-10 sample head from 16-inch x 16-inch adapter frame.
- Completely loosen by hand the 8-inch x 10-inch holder gland nut located inside cabinet just above the blower.
- Carefully lift 8-inch x 10-inch holder out of housing without pulling on the attached flow probe wires. Rest filter holder on top of housing.

NOTE

Flow probe is fragile. Do not touch exposed flow element.

- Using a flat blade screwdriver, remove holding clamp and flow probe assembly from the 3-inch diameter neck of the 8-inch x 10-inch holder. Protect the flow probe from damage.
- Loosen the 4 clamping screws located on the sides of the 16-inch x 16-inch adapter frame and remove the adapter frame from the housing.

FMSS RADIATION PROTECTION PROGRAM CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER	NO.: PP-609-2 (12/2013)
	PAGE: 19 of 22

- Set 8-inch x 10-inch TSP filter holder (8-inch x 10-inch holder with swivel clamps) on top of housing.
- Place the flow probe into the 8-inch x 10-inch TSP filter holder with the groove on the stem facing up (towards filter paper). Tighten flow-probe-holding-clamp.
- Lower 8-inch x 10-inch TSP filter holder into place and tighten gland nut.
- Place gabled roof on top of housing
- Attach "T" hinge with bolts at rear of housing
- Attach folding roof support to housing with washer and nut
- Unit is now ready for TSP sampling.

10.8 TSP to PM-10 Conversion

- Remove sample paper cartridge per normal sampling procedures.
- Turn main power off.
- Remove gabled roof by reversing the steps in section 10.6.
- Completely loosen by hand the 8-inch x 10-inch TSP filter holder gland nut located inside cabinet just above the blower.
- Carefully lift 8-inch x 10-inch TSP filter holder out of housing without pulling on the attached flow probe wires. Rest filter holder on top of housing.
- Using a flat blade screwdriver, remove holding clamp and flow probe assembly from the 3-inch diameter neck of the 8-inch x 10-inch holder. Protect the flow probe from damage.
- Remove PM-10 head from the 16-inch x 16-inch adapter frame. Place 16-inch x 16-inch adapter frame on top of housing.
- Set PM-10 filter holder (8-inch x 10-inch holder without swivel clamps), on top of adapter plate.
- Place the flow probe into the PM-10 filter holder with the groove on the stem facing up (towards filter paper). Tighten flow probe holding clamp.
- Lower PM-10 filter holder into place and tighten gland nut.
- Secure 16-inch x 16-inch adapter frame with the 4 clamping screws located on the sides.
- Re-attach PM-10 head to adapter frame. Unit is now ready for normal PM-10 sampling.

10.9 Instrument Maintenance

The Timer, Rotameter, Blower, and Electronics are all maintenance free and must be factory serviced or replaced if necessary.

<p style="text-align: center;">FMSS RADIATION PROTECTION PROGRAM</p> <p style="text-align: center;">CALIBRATION AND OPERATION OF THE HI-Q MODEL HVP-4300 AFC HIGH VOLUME AIR SAMPLER</p>	<p>NO.: PP-609-2 (12/2013)</p>
	<p>PAGE: 20 of 22</p>

10.10 Instrument Documentation

- Record the flow calibration check data onto the HVP-4300AFC “Flow Calibration Work Sheet” (Attachment 1) and submit paperwork to the RPT Supervisor.
- Complete a calibration sticker and affix to the unit upon successful calibration. If calibration was unsuccessful, tag the unit out of service.
- Record daily sampling event information and periodic equipment checks onto air sample envelopes or log sheets.

11.0 ATTACHMENTS

Attached form(s) are examples and may be modified by the RSO without revision to this procedure.

Attachment 1: “HVP-4300AFC Flow Calibration Work Sheet”

Attachment 2:” Factory set points for the (15) calibration points on the HVP-4300AFC”.

ATTACHMENT 1
HVP-4300AFC FLOW CALIBRATION WORK SHEET

Unit Number:	
Unit Location:	
Date:	Time:
Calibrator Serial Number:	
Calibrator Calibration Due Date:	
Calibration Performed By:	

Auto Calibration Results

AS FOUND CFM		AS LEFT CFM	
HVP	D-AFC	HVP	D-AFC

Insert Rev1 Manual Calibration Results Table

TOTALIZER CHECK

1. Ensure Hi-Q is running between 1.08 SCMM and 1.18 SCMM (nominal flow rate range). Note as-left, or current flow rate in box below.
2. Clock the time needed to collect exactly 9.0 m³ air to the nearest second, Note in box below. Compare to acceptable time period.
3. Repeat steps 1 and 2 if elapsed time falls outside of the acceptable period. If unit fails on second attempt, tag the unit out-of-service and arrange for further service/repair.

Current Flow Rate: SCMM

<u>Acceptable Time Period</u> 7 min 34 sec ~ 8 min 22 sec
--

Volume Air Sampled 9.0 SCM

Collection Time min sec
--

ATTACHMENT 2

Factory set points for the (15) calibration points on the HVP-4300AFC.

Calibration Point 1	Flow rate <u>0.300 SCM.</u>
Calibration Point 2	Flow rate <u>0.400 SCM.</u>
Calibration Point 3	Flow rate <u>0.500 SCM.</u>
Calibration Point 4	Flow rate <u>0.600 SCM.</u>
Calibration Point 5	Flow rate <u>0.700 SCM.</u>
Calibration Point 6	Flow rate <u>0.800 SCM.</u>
Calibration Point 7	Flow rate <u>0.900 SCM.</u>
Calibration Point 8	Flow rate <u>1.000 SCM.</u>
Calibration Point 9	Flow rate <u>1.050 SCM.</u>
Calibration Point 10	Flow rate <u>1.100 SCM.</u>
Calibration Point 11	Flow rate <u>1.150 SCM.</u>
Calibration Point 12	Flow rate <u>1.200 SCM.</u>
Calibration Point 13	Flow rate <u>1.250 SCM.</u>
Calibration Point 14	Flow rate <u>1.300 SCM.</u>
Calibration Point 15	Flow rate <u>1.350 SCM.</u>

1.0 PURPOSE

The purpose of this procedure is to establish and define consistent methodology for the calibration and operation of the SKC™ sampling pumps, as well as the documentation of workplace surveys using SKC sampling pumps - specifically the Leland Legacy. The primary application of these pumps is to collect breathing zone (BZ) air samples of Project Radiation Workers, thus permitting a quantitative determination of airborne radioactivity levels.

2.0 APPLICABILITY

This procedure applies to all personnel who may reasonably be expected to utilize the SKC Model Leland Legacy for workplace surveillance activities. Tasks requiring BZ sampling are described in Project Procedure PP-8-803, "Measurement of Airborne Radioactivity".

3.0 REFERENCES

1. SKC, "Operating Instructions," Revision 1, Form No. 40075
2. Ness, S., "Air Monitoring for Toxic Exposures," 1991.
3. US Army Corps of Engineers, EM 385-1-1, "Safety and Health Requirements Manual."
4. US Army Corps of Engineers, EM 385-1-80, "Radiation Protection Manual."
5. "Site Safety and Health Plan," (SSHP), Appendix A of the FMSS "Accident Protection Plan"
6. NUATRC Research Report Number 5, 2005.

4.0 GENERAL

4.1 Discussion

The constant-flow sampling pump is the primary device for actively collecting integrated samples on media. Constant-flow pumps like the Gilian and SKC models in use at the FMSS can cope with changing conditions, such as filter loading, and still maintain a constant sampling rate within certain limits by measuring and controlling the actual input flow. These pumps are suited for a broad range of applications and are ideal for industrial hygiene studies as well as environmental testing. The Leland Legacy is a lightweight sampling pump that combines lightweight compact design, computer-compatible circuitry, and an internal flow sensor that provides for a relatively high sampling volume for lapel pumps. See Figure 1 for overview diagram of the Leland Legacy.



Figure 1 Overview diagram of the Leland Legacy sampling Pump.

4.2 Definitions

Activity Hazard Analysis (AHA): A document or series of documents prepared by OH&S and Radiation Protection (RP) to inform workers of the OH&S and/or radiological conditions that exist in the work area, work scope limitations, specific protective requirements, ALARA considerations, and instructions to workers.

Personal Air Sampling Pump (Lapel Pump): A compact, lightweight air sampling device able to be worn by individual workers and mechanically designed to maintain fairly constant flow rates over a given sampling period, thus permitting occupational exposure calculations.

Primary Standard: A highly accurate flow calibration device with NIST-traceable specifications. Primary standards require no calibration of their own, but should be periodically returned to the manufacturer for suggested maintenance. Examples include the Gillian Gilibrator and Bios DryCal, which are accepted by OSHA as primary standards.

Sampling Train: The connected combination of collection media, sampling pump, tubing, and a flow rate-measuring device.

Calibration (Specific to this Instrument): The process of adjusting and recording flow rates of the sampling pump using a primary flow calibrator. Flow rates are documented before and after sampling events.

5.0 RESPONSIBILITIES

5.1 Site Safety & Health Officer (SSHO)

- Providing oversight to all Safety & Health Air Monitoring performed at the Project.
- Defining and establishing air sampling protocols for specific contaminants at the FMSS.

<p align="center">FMSS RADIATION PROTECTION PROGRAM</p> <p align="center">CALIBRATION AND OPERATION OF THE SKC LELAND LEGACY SAMPLING PUMP</p>	<p>NO: PP-8-610-1 (12/2013)</p> <hr/> <p align="right">PAGE: 3 of 12</p>
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5.2 *Radiation Safety Officer (RSO)*

- Directing radiological air monitoring strategies based upon established protocols and plans.
- Reviewing air monitoring results and initiating necessary follow-up actions.

5.3 *Radiation Protection Technician (RPT)*

- Ensuring proper performance of air monitoring instrumentation through daily inspections and flow calibrations.
- Deploying and operating air sampling pumps in the workplace in a logical and effective manner so as to ensure representative sampling and meaningful exposure data.
- Performing regular “checkups” on deployed air sampling pumps, verifying proper operation, and noting any unusual occurrences, such as flow interruptions or inappropriate sampling locations.
- Documenting workplace air monitoring on appropriate documentation.

5.4 *Project Workers Personnel*

- Complying with field directions from RPTs regarding the wearing of personal air sampling pumps.
- Alerting RP personnel of any unusual occurrences with personal air sampling pumps (e.g., flow interruptions, dead battery, job reassignment, etc.).

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

- Only properly trained and authorized personnel are permitted to operate personal air (lapel) air sampling pumps.
- Because personal air sampling pumps are often relied upon to provide critical personnel exposure data, quality care of these devices is essential. Pumps should be inspected after each survey for missing or damaged parts and repaired promptly.
- In order to have accurate volume calculations as well as be assured that flow rates are appropriate for specific types of sampling, flow rate measurements are mandatory before and after sampling events.
- Verify flow rates with a primary standard, such as a Gillian electronic bubble meter or Bios DryCal Flow Meter with the intended sampling media included in the sampling train.
- Constant-flow sampling pumps should be flow-calibrated at the same altitude at which they will be used. Verify that the appropriate sampling media is selected prior to commencing monitoring. This includes an understanding of the proper orientation of the filter media:

- 25 mm diameter, 1.2 micron pore size borosilicate (glass) fiber filters are normally used for monitoring particulate airborne radioactivity. The slightly rougher (fuzzy) side faces outward.
- 25 mm diameters, 0.45 micron membrane filters are normally used for radon grab sampling. Either side is acceptable for monitoring, however the outward face should be marked slightly (pen mark) to identify where contaminants are deposited on the filter. These filters normally come separated with a blue divider. This is not the filter.
- 37 mm diameter, 0.8 micron Mixed Cellulose Ester (MCE) filter cassettes are normally used for metals.
- 25 mm diameter, 0.8 micron MCE three-piece static conductive filter cassettes (with cowl) are normally used for asbestos air sampling.

Deviations from the filter media listed above require SSHO and RSO approval.

- The Leland Legacy sampling pump with installed battery pack has not passed UL standards for intrinsic safety and should not be used in explosive environments.
- Use only a SKC-approved battery charger for pump charging. The battery charger is not intrinsically safe and therefore shall not be operated in hazardous atmospheres.
- Use caution when wearing pumps or handling sample media to avoid cross-contaminating or compromising the filter media. RPTs should explain proper wear and handling requirements to wearers prior to issuance.

8.0 APPARATUS

- SKC Leland Legacy air sampling pump or equivalent.
- Primary flow calibrator, such as Bios DryCal®, Gillian Gilibrator™, or equivalent
- PVC or Tygon® tubing, filter cassette, and appropriate sampling media

9.0 RECORDS

- Personnel Pump Calibration Record
- Industrial Hygiene Air Monitoring Data Sheet

10.0 PROCEDURE

10.1 Setup

10.1.1 The user should become familiar with the instrument's display, key and switch positions, and port locations before operating. Refer to the quick guide of the Leland Legacy "Operating Instructions" Manual for the pump function instructions.

10.1.2 Ensure that the instrument has been sufficiently charged (overnight) to operate throughout a typical work shift (8 -10 hours).

10.1.3 Battery Test:

- A. Verify that the Li-Ion charging unit on the unit is flashing on at a 0.25 second interval – this indicates that the unit is fully charged (a steady light indicates charging in progress and 2 second flash intervals indicate an 80% charge).
- B. Activate the power by pressing any button on the sampling pump. This will place the pump into hold mode which will be indicated on the LCD screen.
- C. Check the battery indicator level on the pump LCD screen to verify the unit has been fully charged.

10.1.4 Reset Accumulated Data:

IMPORTANT NOTE

The user must be sure that run time data from the previous sampling run has been recorded.

10.1.4.1 Switch pump to the ON position by pressing the ▲▼ buttons simultaneously then press the security code *▲▼* in sequence. The flow rate and Set will flash.

10.1.4.2 Press * and scroll through the Setup options until CLr displays then press the ▲▼ buttons simultaneously to clear the accumulated data (pressing * will scroll through the Setup options and repeat after END is reached).

10.1.4.3 Press * until end appears then press the ▲▼ buttons simultaneously to confirm the data reset.

10.2 Calibration

Note: Ensure that the pump has been run for 5 minutes before performing calibration and that the unit has had time to acclimate to the environment in which it is being calibrated.

10.2.1 Connect the appropriate sample media (e.g., 25 mm glass fiber in cassette) to the inlet port of the primary standard flow calibrator, e.g. Bios Dry-Cal®.

10.2.2 Switch pump to the ON position by pressing the ▲▼ buttons simultaneously, then press the security code *▲▼* in sequence. The flow rate and Set will flash.

10.2.3 Ensure that the flow rate is set to 6.5 L/min – by pressing the ▲ or ▼ button until the desired rate is achieved.

10.2.4 Press * to enter the adjustment mode. “ADJ” will appear and set will continue to flash (mode parameters will repeat after “END” is reached).

10.2.5 While in the “ADJ” mode, connect the appropriate sample media (e.g., 25 mm glass fiber in cassette) to the inlet port of the primary standard flow calibrator, e.g. Bios Dry-Cal®.

10.2.6 Connect the tubing from the pump to the outlet port of the flow calibrator. Refer to Figure 2.

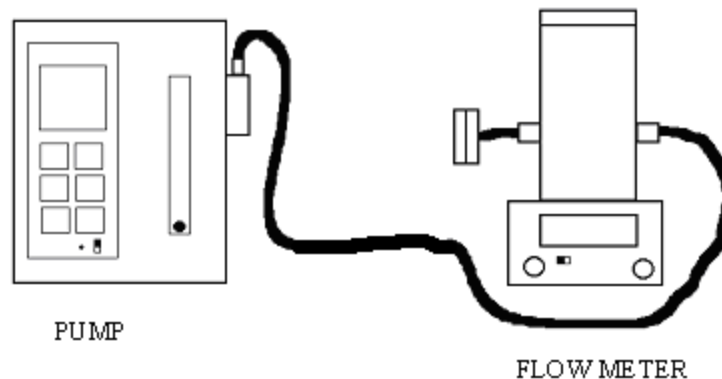


Figure 2
Properly connected sampling train

10.2.7 Adjust the flow by pressing the ▲ or ▼ button to respectively increase or decrease until calibrator reads within 10 ml of the pump indicator set previously. Use 6.50 L/min as a target flow rate for routine radiological air monitoring, unless otherwise directed by the RSO.

10.2.8 Collect three (3) readings from the flow calibrator by pressing the READ button three times. If the average flow rate is within $\pm 5\%$ of the desired flow rate (e.g., 6.175 - 6.825 L/min for a 6.500 ml/min standard), then proceed to Step 10.2.9. If the measurements do not fall within this range, re-adjust the flow until acceptable flow rates are obtained.

10.2.9 Record these (3) flow rate results and average flow rate onto the “Personnel Pump Calibration Record” (see Attachment 1 of this SOP) making sure all sections of the form are complete.

10.2.10 Press * until End appears.

10.2.11 Press ▲▼ to save new flow rate and Adjustments and exit Setup.

10.2.12 Re-attach the sample cassette to the Tygon tubing leading to the pump's inlet port.

10.2.13 Fill out pre-use flow and pump information onto the pre-stamped manila envelopes and keep these envelopes with their respective pumps. The pump is now ready to be deployed into the work area.

10.3 Deployment

10.3.1 Determine the appropriate sampling location or wearer(s) based upon an evaluation of planned activities, the number and classification of site workers, or as specified in the approved procedure or HWP. At a minimum, one (1) Operating Engineer and (1) laborer per work area should be assigned lapel pumps during intrusive soil handling activities. Pumps should always be assigned to the potential "worst-case" exposure workers in any given area.

10.3.2 Issue pump and document required use information (worker's name, HWP, property ID) on a sample envelope or log sheet.

10.3.3 Press ▲▼ simultaneously to switch the pump "ON".

10.3.4 Attach pump to a belt at the waist with the tubing running up the back and over the shoulder of the worker. The filter cassette should be attached in the upper chest area (to collar of shirt or coveralls) and facing downwards – representative of the worker's breathing zone.

10.3.5 The lapel sampling pump should be placed in HOLD mode during those periods when the assigned worker is not inside the Restricted Area, e.g. coffee break, lunchtime, etc. Place pump on HOLD by depressing the ▲▼ buttons. Press the ▲▼ buttons again until pump restarts.

10.3.6 At the end of the sampling period, the RPT shall place the pump on HOLD until which time it is returned to the flow measuring station.

10.3.7 Upon completion of the sampling period, perform the following:

A. Record total run time from the instrument display on the air sample or log sheet.

Perform a flow check on the sampling pump following the procedure described in Section 10.2 **except** make no flow adjustments to the pump.

B. Obtain three consecutive flow measurements using the flow meter and record average reading on the "Personnel Pump Calibration Record" (See Attachment 1).

C. Record final flow information, on the air sample or log sheet. Place the used filter into a glassine sleeve and place into the air sample envelope.

D. Allow filters collected for radiological particulate air monitoring, excluding radon daughter products, to decay for a period of at least 4 days prior to counting, unless directed otherwise by the RSO or SSHO.

E. Place the pump in hold mode by pressing the ▲▼ buttons simultaneously (the unit automatically shuts down completely in 5 minutes when left in hold mode) and connect to battery charger. Verify that the charge indicator is lit.

10.3.8 Industrial hygiene (chemical) sampling event information should be recorded on the "Industrial Hygiene Air Monitoring Data Sheet" (See Attachment 2).

10.4 Maintenance

From time to time, some components of the SKC sampling pump must be removed, cleaned, or replaced. Components that may be serviced by end users as part of a routine maintenance schedule are:

Inlet filter

The user should periodically do a visual check of the inlet filter on the pump. This filter should be changed after six months of use or whenever the outer portion of the filter becomes discolored.

Battery

A fully charged battery pack will operate a SKC lapel sampler for a minimum of 10 hours at 6.500 L/min.

Replacement Parts

A list of replacement parts can be found in the Leland Legacy Operation Manual.

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 Personnel Pump Calibration Record (Typical)

Attachment 2 Industrial Hygiene Air Monitoring Data Sheet

(Typical) Attachment 3 Leland Legacy Quick Guide

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Attachment 1 (Typical)

PERSONNEL PUMP CALIBRATION RECORD

REFERENCE NUMBER: _____

LOCATDN: _____

PRE-SAMPLING CALIBRATION

POST SAMPLING CALIBRATION

PUMP MODEL::	SERIAL#	PUMP MODEL:	SERIAL#
DATE	TIME:	DATE:	TIME:
FLOW RATE:	I	FLOW RATE::	
AVG. FLOWRATE:		AVG. FLOW RATE	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL::	SERIAL#	PUMP MODEL:	SERIAL#
DATE	TIME:	DATE:	TIME:
FLOW RATE:	I	FLOW RATE::	
AVG. FLOWRATE:		AVG. FLOW RATE	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL::	SERIAL#	PUMP MODEL:	SERIAL#
DATE	TIME:	DATE:	TIME:
FLOW RATE:	I	FLOW RATE::	
AVG. FLOWRATE:		AVG. FLOW RATE	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL:	SERIAL#	PUMP MODEL:	SERIAL#
DATE	TIME:	DATE:	TIME:
FLOW RATE:	I	FLOW RATE::	
AVG. FLOWRATE:		AVG. FLOW RATE	
PERFORMED BY:		PERFORMED BY:	_____
PUMP MODEL::	SERIAL#	PUMP MODEL:	SERIAL#
DATE	TIME:	DATE:	TIME:
FLOW RATE:	I	FLOW RATE::	
AVG. FLOWRATE:		AVG. FLOW RATE	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL::	SERIAL#	PUMP MODEL:	SERIAL#
DATE	TIME:	DATE:	TIME:
FLOW RATE:	I	FLOW RATE::	
AVG. FLOWRATE:		AVG. FLOW RATE	
PERFORMED BY:		PERFORMED BY:	
PUMP MODEL::	SERIAL#	PUMP MODEL:	SERIAL#
DATE	TIME:	DATE:	TIME:
FLOW RATE:	I	FLOW RATE::	
AVG. FLOWRATE:		AVG. FLOW RATE	
PERFORMED BY:		PERFORMED BY:	

Attachment 2 (Typical)

INDUSTRIAL HYGIENE AIR MONITORING DATA SHEET

HAZARDOUS SUBSTANCES DATA SHEET

1. COMPANY NAME		12. CONTRACT NO.		3. SAMPLING NO.	
4. WORK ACTIVITY				5. SAMPLING DATE	6. SHIPPING DATE
7. PERSON PERFORMING SAMPLING (SIGNATURE)				8. PRINT LAST NAME	9. SSHO
10. MONITORED WORKER (NAME, ADDRESS, PHONE NUMBER)		14. EXP. INFO. a. NUMBER		B. DURATION	
		C. FREQUENCY			
11. JOB TITLE		15. WEATHER CONDITIONS		16. PHOTO(S) YES NO	
13. PPE (TYPE AND EFFECTIVENESS)		17. PUMP CHECKS AND ADJUSTMENTS			
18. JOB DESCRIPTION, OPERATION, WORK LOCATION(S), VERIFICATION, AND CONTROLS					
JOB DESCRIPTION:					
OPERATION:					
WORK LOCATION:					
VERIFICATION:					
CONTROLS:					
FIELD SAMPLING DATA					
19. PUMP NUMBER:			30. CALCULATIONS AND NOTES:		
20. SAMPLE SUBMITTAL NO.					
21. SAMPLE TYPE					
22. SAMPLE MEDIA					
23. FILTER/TUBE NUMBER					
24. TIME ON/OFF		ON			
		OFF			
25. TOTAL TIME IN MINUTES					
26. FLOW RATE		PRE			
L/MIN	CC/MIN	POST			
27. VOLUME (IN LITERS)					
28. NET SAMPLE WEIGHT (IN MG)					
29. ANALYZE SAMPLES FOR:					

Leland Legacy Quick Guide

Terms »

Star button *

- Scrolls through runtime data and Setup options

Up and down arrow buttons ▲▼

- Toggle between display choices and increase or decrease sampling parameters in Setup

Button sequence

▼ * = press buttons individually

[▲▼] = press simultaneously

▲▼ = security code, always press in sequence

Security code *▲▼*

- Prevents unauthorized changes to the pump's sampling program

Programming Sequences »

• To activate pump (e.g., to change pump from Sleep to Hold):

Press any button

• To change pump from Hold to Run to Hold:

Press [▲▼]

• To reset accumulated data:

Press [▲▼], then *▲▼*. Press * until *CLr* displays then press [▲▼]; press * until *End* displays then press [▲▼]

• To set pump flow rate:

Press [▲▼], then *▲▼*. Flow rate and SET flash. Press ▲ or ▼ to change flow rate. Press * until *END* appears then press [▲▼] to save setting and place pump in Hold.

• To calibrate flow rate with standard calibrator:

Press [▲▼], then *▲▼*. Flow rate and SET flash. Press ▲ or ▼ to change flow rate. Press * until *ADJ* displays then press [▲▼] to save setting and place pump in Hold. For *CalChk Calibration*, see operating instructions.

• To change temperature scale from F to C or C to F:

Press [▲▼], then *▲▼*. Press * until temperature displays. Press ▲ or ▼ to switch units; press * until *END* appears then press [▲▼] to save new setting.

• To change atmospheric pressure scale (mm, mb, In):

Press [▲▼], then *▲▼*. Press * until pressure displays then press ▲ or ▼ to switch units; press * until *END* displays then press [▲▼] to save new setting.

• To change time scale (12 Hr/24 Hr/Dela):

Press [▲▼], then *▲▼*. Press * until 12 Hr, 24 Hr, or Dela displays then press ▲ or ▼ to switch units; press * until *END* displays then press [▲▼] to save new setting. *To set delayed start (Dela)*, see operating instructions.

• To change clock:

Press [▲▼], then *▲▼*. Press * until clock displays then press ▲ or ▼ to change flashing hour; press * to move minutes and ▲ or ▼ to change setting. Press * until *END* displays then press [▲▼] to save new setting.

• To change the sampling time function:

Press [▲▼], then *▲▼*. Press * until *ST L/min* displays then press ▲ to change flashing digit; Press * until *END* displays then press [▲▼] to save new setting. To delete, follow above steps and press ▼ until 0 appears. Exit Setup.

Note: When in Setup, choosing Esc instead of End will exit Setup without saving new settings

FMSS RADIATION PROTECTION PROGRAM ACCESS CONTROL	NO.: PP-8-701-2 (12/2013)
	PAGE: 1 of 8

1.0 PURPOSE

The purpose of this procedure is to provide consistent methodology for controlling the access of personnel, equipment, and vehicles into radiological areas at the FUSRAP Maywood Superfund Site (FMSS).

2.0 APPLICABILITY

This procedure applies to all Project personnel and visitors, equipment, and vehicles entering Restricted Areas.

3.0 REFERENCES

- 10 CFR 19, "Notices, Instructions and Reports to Workers Inspection."
- 10 CFR 20, "Standards for Protection Against Radiation."
- Regulatory Guide (RG) 8.13, "Instruction Concerning Pre-natal Radiation Exposure".
- EM 385-1-80 "Radiation Protection Manual," United States Army Corps Of Engineers (USACE).
- "Site Safety and Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan".
- PP-8-301 "Embryo-Fetus Protection Program".
- PP-8-702, "Radiological Posting Requirements."
- PP-8-803, "Measurement of Airborne Radioactivity."
- PP-8-1101, "General Employee Radiation Training."
- PP-8-1102, "Radiation Worker Training (RWT)."
- 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response."
- OSHA Interpretation Letter for 29 CFR 1910.120, "Employees at hazardous waste sites not necessarily related to cleanup", 09/08/1992.

4.0 GENERAL

4.1 Discussion

Access controls are used to ensure the radiological safety of personnel entering into Restricted Areas. These controls include, but are not limited to Training, Dosimetry, Posting, Area Monitoring, and Activity Hazard Analyses (AHAs).

4.2 Definitions

NOTE

Specific area definitions and radiological posting criteria are established in the FMSS Site Safety and Health Plan, Volume 1, Section 6. "Site Controls".

ALARA: Means as low as reasonably achievable.

FMSS: FUSRAP Maywood Superfund Site and associated vicinity properties

GET: FMSS General Employee Training

FMSS RADIATION PROTECTION PROGRAM ACCESS CONTROL	NO.: PP-8-701-2 (12/2013)
	PAGE: 2 of 8

GERT: General Employee Radiation Training

HAZWOPER: 40-Hour Hazardous Waste Operations and Emergency Response training in accordance with 29 CFR 1910.120

Activity Hazard Analysis (AHA): A document or series of documents prepared by Occupational Health and Safety (OH&S) and Radiation Protection (RP) to inform workers of the OH&S and/or radiological conditions that exist in the work area, work scope limitations, specific protective requirements, ALARA considerations, and instructions to workers.

Radiation Worker: An individual who accesses any Restricted Area unescorted. Radiation Workers shall have successfully completed all requisite medical and training requirements for performing work in Restricted Areas as specified in Project Procedures PP 8-1101-0, "General Employee Radiation Training" and PP 8-1102-0, "Radiation Worker Training (RWT)," and in this procedure.

RPT: Radiation Protection Technician

RSO: Radiation Safety Officer

SSHO: Site Safety and Health Officer

SRD: Self-Reading Dosimeter

Visitor: An individual who accesses the project site for purposes other than for assignment as a Project Worker (e.g., site visit, performance of an essential short-term task).

5.0 RESPONSIBILITIES

5.1 Site Safety & Health Officer (SSHO)

- Ensures that all activities performed within this procedure conform with the requirements of the FMSS Site Safety & Health Plan (SSHP).
- Authorizes escorted visitor entries into Restricted Areas. This responsibility may be designated.
- Evaluates visitor entries to Restricted Areas to minimize or eliminate exposure risk to personnel who lack adequate training.

5.2 Radiation Safety Officer (RSO)

- Implements this procedure.
- Approves AHAs to control access to Restricted Areas.
- Reviews and approves training programs related to work in Restricted Areas.
- Implements the requirements of the FMSS Radiation Protection Program.
- Provides direction to the Project Personnel regarding radiological matters.
- Authorizes escorted visitor entries into Restricted Areas. This responsibility may be designated.
- Evaluates visitor entries to Restricted Areas to minimize or eliminate exposure risk to personnel who lack adequate training.

5.3 Radiation Protection Technician (RPT)

- Identifies and posts Restricted Areas.

FMSS RADIATION PROTECTION PROGRAM ACCESS CONTROL	NO.: PP-8-701-2 (12/2013)
	PAGE: 3 of 8

- Provides AHA briefings to individuals entering Restricted Areas.
- Conducts radiation and contamination surveys, and keeping legible records.
- Monitors work activities to ensure compliance with the requirements of the Radiation Protection Program.

5.4 Project Supervisor

- Ensures that personnel assigned to work in Restricted Areas or with radioactive material, attend required training and perform work in a radiologically sound and safe manner.
- Contacts the RSO or designee, to obtain approval to bring escorted visitors into Restricted Areas of the FMSS.
- Notifies the RSO or designee, in advance (when possible) of the need to bring any non-project owned equipment / vehicles into the Restricted Area to arrange for incoming/baseline contamination surveys.

5.5 Project Personnel

- Attends designated training classes.
- Follows directions from the RPT with regards to Safety and Health.
- Maintains their personnel exposures ALARA.
- Limits the amount of material taken into Restricted Areas to that necessary for task performance.
- Works in a manner so as to prevent spread of contamination and reduce airborne radiological emissions to the extent possible.

6.0 PREREQUISITES

6.1 Individuals requiring unescorted access into a Restricted Area shall submit the following documentation to the SSHO prior to entry:

- Evidence of initial 40-Hour OSHA HAZWOPER Training
- Evidence of the annual 8-Hour OSHA HAZWOPER Refresher Training, if the 40-Hour training is greater than 1 year old.
- Current medical examination performed within the past 12 months.
- Evidence of successful completion of FMSS General Employee/Radiation Training (GET/GERT) and Radiation Worker Training (RWT).

6.2 Individuals requiring unescorted access into a Restricted Area shall meet the requirements for Restricted Area access and have the following at a minimum:

- Whole Body WBD) or Self-Reading Dosimeter (SRD).
- Personal Protective Equipment (PPE) specified by posting and/or AHA.

6.3 Visitor access into Restricted Areas is limited to essential tasks which meet all of the following requirements:

- The task cannot be performed by appropriately trained Project Personnel.

FMSS RADIATION PROTECTION PROGRAM ACCESS CONTROL	NO.: PP-8-701-2 (12/2013)
	PAGE: 4 of 8

- The task is time critical in nature and would have a negative impact on safety & health or project operations if not performed.
- The task cannot be deferred until the Restricted Area is remediated or down posted.

7.0 PRECAUTIONS AND LIMITATIONS

- No unessential visitors shall be allowed access to the Restricted Areas.
- Visitors shall receive visitor specific site orientation training prior to accessing a Restricted Area. Training shall be documented.
- Personnel, equipment, and vehicle entry control shall be maintained for each Restricted Area.
- No radiological control(s) shall be installed in any area that would prevent the rapid evacuation of personnel in an emergency situation.
- Trained emergency response personnel (Fire Dept., Ambulance/EMT, Law Enforcement) responding to on-site emergencies are exempt from the requirements of this procedure.
- Any member of the public exposed to radiation and / or radioactive material at the FMSS shall not exceed 0.1 rem Total Effective Dose Equivalent per year.
- All visitors entering into a Restricted Area shall be escorted at all times by a qualified radiation worker. The RSO and SSHO or designee(s) shall approve these entries. The escort is responsible for visitor compliance with site protocols.
- Visitors may not enter a posted High Contamination Area, Radiation Area, High Radiation Area, or Airborne Radioactivity Area.
- Visitors shall not perform any work of an intrusive nature (i.e., digging, drilling, sampling, etc.) or an abrasive nature (i.e., welding, sanding, grinding, etc.) in Controlled Areas unless evaluated and approved by the RSO or designee.
- Visitors may only enter those areas where hazardous atmospheres do not exceed 50% of the Permissible Exposure Limit and where radiation exposures would not exceed the annual dose limit to a member of the public as specified in 10 CFR 20.
- The RSO and SSHO shall ensure that risk of exposure to hazardous materials is minimized or eliminated prior to authorizing visitor entry into Restricted Areas. No work of an intrusive nature that may produce radioactive airborne particulates shall take place during visitor access to a Restricted Area.
- Visitors shall not be allowed to come into contact with tools, vehicles or materials that are contaminated above the release levels established in the SSHP.
- Project personnel who are required to escort individuals into a Restricted Area shall have successfully completed Radiation Worker Training (RWT), which includes training on the requirements of this procedure, and have a demonstrated knowledge of the FMSS layout, site history, and emergency response protocols.
- Project personnel who are required to escort individuals into a Restricted Area shall ensure the visitors complete the "FMSS Visitor Access Control Form" (see Attachment 1).

FMSS RADIATION PROTECTION PROGRAM ACCESS CONTROL	NO.: PP-8-701-2 (12/2013)
	PAGE: 5 of 8

- RPTs shall perform exit frisking of visitors from Restricted Areas when frisking is required by AHA. Visitor access times and dates, PPE, controls and conditions shall be documented.

8.0 APPARATUS

None

9.0 RECORDS

- FMSS Visitor Access Control Form
- AHA Access Registers are maintained under separate procedure.
- Quality Records generated under this procedure submitted to Project Records.

10.0 PROCEDURE

10.1 Restricted Areas

- A. Enter the Restricted Area **ONLY** through the designated Access Control Point unless instructed otherwise by the RPT.
- B. Inform the Access Control Point RPT of the nature of your work in the Restricted Area. Provide details as requested by the RPT
- C. Adhere to the requirements of Section 10.2 of this procedure if taking equipment or vehicles into the Restricted Area.
- D. Review the applicable AHA and assemble/don the appropriate PPE.
- E. Sign-in on the AHA Access Register. Signatures must be clear and legible, and must be accompanied by time of access and site badge number.
- F. Conduct all activities in a safe manner while working in the Restricted Area. Adhere to established safety and housekeeping protocols.
- G. Exit the Restricted Area **ONLY** through the Access Control Point unless instructed otherwise by the RPT. Perform an exit frisk as required by AHA.
- H. Sign-out on the appropriate AHA Access Register. Signatures must be clear and legible, and must be accompanied by time of egress.

10.2 Equipment and Vehicles Entering and Exiting Restricted Areas

- A. Notify the RPT of any equipment / vehicles that need to be taken into a Restricted Area.
- B. Incoming surveys are performed on equipment and materials entering Restricted Areas. The purpose is to protect the client from financial liability associated with decontaminating equipment that arrived on the site with existing contamination.
- C. The decision regarding what must be surveyed will be made by the RSO
- D. The degree of thoroughness of the survey and the requisite cleanliness of the equipment is at the discretion of the RSO.
- E. Bring only the required equipment / supplies necessary for the task into the Restricted Area

FMSS RADIATION PROTECTION PROGRAM ACCESS CONTROL	NO.: PP-8-701-2 (12/2013)
	PAGE: 6 of 8

- F. When practicable, use contamination prevention methods such as wrapping or sleeving of equipment taken into a CA or ARA.
- G. Remove as much packaging material as possible (i.e., plastic or cardboard) prior to entering a Restricted Area.
- H. Notify the RPT of any equipment / vehicles that need to be removed from a Restricted Area.

10.3 Visitor Escorts

- A. Discuss planned activities, work locations, and site hazards with the Visitor. Discuss any restrictions on where the Visitor may go and what the Visitor may do within the Restricted Areas. Define the obligations of the Visitor with respect to following instructions of the escort and of safety personnel.
- B. Provide the Visitor with a copy of the FMSS Visitor Access Control Form (Attachment 1).
- C. Instruct the Visitor to review the form, complete the top portion, and sign.
- D. Answer any questions the Visitor may have. RP personnel are available to answer questions as needed.
- E. Sign the FMSS Visitor Access Control Form acknowledging escort responsibilities.
- F. Obtain RSO and SSHO signature permitting Restricted Area access.
- G. Give completed form to RP Personnel.
- H. RP Personnel should assign a personnel dosimeter to the Visitor or group of visitors (this is a standard WBD unless otherwise instructed by the RSO). Note Self-Reading Dosimeter (SRD) in/out readings, if used, on the AHA Access Register.
- I. Review the appropriate AHA with the Visitor, and ensure the Visitor dons PPE and signs and records the time of entry onto the AHA Access Register.
- J. Escort the Visitor into the Restricted Area observing all escort responsibilities.
- K. Upon completion of activities, assist visitor with PPE removal, and AHA sign-out. An RPT will perform the exit frisking.
- L. Escort the Visitor out of the Restricted Area.
- M. Take the personnel dosimeter and give it to the RP personnel. RP Personnel shall notify the RSO immediately if SRD readings indicate a personnel exposure.

11.0 ATTACHMENT

Attachment may be revised without formal review of this procedure and is attached as an example only. Please contact the RSO for a current copy of this attachment.

Attachment 1 FMSS Visitor Access Control Form (FRONT & BACK)

FMSS RADIATION PROTECTION PROGRAM ACCESS CONTROL	NO.: PP-8-701-2 (12/2013)
	PAGE: 7 of 8

ATTACHMENT 1
FMSS VISITOR ACCESS CONTROL FORM (FRONT)

FULL NAME:		DOB:	
EMPLOYER:		SSN:	
STREETADDRESS:			
CITY, STATE, ZIP:			

Some work at the FMSS involves exposure to hazardous environments, radiation or radioactive materials. In keeping with the provisions of the Code of Federal Regulations Title 10, Part 19, this is to inform you of the extent of the hazards to which you may be exposed.

Radiation and radioactive materials on this project site are confined within clearly posted and delineated areas. Other hazardous materials may be present in these areas. Signs in these areas are magenta or purple and yellow in color and contain the international symbol for radiation, a trefoil or **three-bladed design. (ESCORT: SHOW VISITOR AN EXAMPLE OF A RADIOLOGICAL POSTING).**

During your visit, you will be provided with an escort. You must remain with your escort at all times. In the unlikely event of an incident involving radioactive or other hazardous materials, your escort will provide you with instructions. Comply with the instructions of your escort. If exit frisking is required by the AHA, Radiation Protection Personnel will perform the exit frisk.

Do not enter any areas posted "RADIATION AREA", "HIGH RADIATION AREA", "HIGH CONTAMINATION AREA", or "AIRBORNE RADIOACTIVITY AREA."

Do not perform work of an intrusive nature (i.e., digging, drilling, sampling, etc.) or any abrasive work (i.e., welding, sanding, grinding, etc.) without specific written approval of the RSO.

Nuclear Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure" is available for review upon request. Address any questions you may have to your escort or to the person you are visiting. Questions may also be directed to the Occupational Health and Safety Department.

I have read and understand the above. I agree to comply with the terms of this form.	
Visitor Signature	Date
I have reviewed the above with the visitor and agree to comply in full with FMSS established radiological escort protocols including, but not limited to, those specific requirements specified on the back of this form.	
Escort Signature	Date
ALL SIGNATURES MUST BE PRESENT ON THIS FORM PRIOR TO RESTRICTED AREA ACCESS! REFER TO FORM BACK FOR RSO/SSHO NOTATIONS AND ACCESS APPROVAL SIGNATURES.	

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL POSTING REQUIREMENTS	NO.: PP-8-702-1 (12/2013)
	PAGE: 1 of 4

1.0 PURPOSE

The purpose of this procedure is to provide consistent methodology for posting requirements for the various radiological hazard areas of the FUSRAP Maywood Superfund Site (FMSS).

2.0 APPLICABILITY

This procedure applies to all areas within the FMSS, which require radiological postings.

3.0 REFERENCES

- 10 CFR 19, "Notices, Instructions, and Reports to Workers; Inspection."
- 10 CFR 20, "Standards for Protection Against Radiation."
- EM 385-1-80 "Radiation Protection" Manual, United States Army Corps of Engineers (USACE).
- "Site Safety and Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan".

4.0 GENERAL

4.1 Discussion

Radiological postings are used to delineate areas containing radiological hazards and to inform personnel of hazards. In addition, supplemental or informational postings may be included which provide personnel with entry requirements or protective equipment requirements. Barriers may be used in conjunction with postings to ensure that personnel do not inadvertently enter into an area with a radiological hazard. Barriers at the Maywood Interim Storage Site (MISS) and the vicinity properties are normally composed of rope, tape, or fencing.

4.2 Definitions

NOTE

Specific area definitions and radiological posting criteria are established in the FMSS SSHP, Section 6. "Site Controls"

FMSS: Means the FUSRAP Maywood Superfund Site proper, as well as any vicinity properties under control by Project Management.

Posting: A standardized sign or label which bears the standard trefoil radiation symbol in magenta or black on a yellow background and information concerning a specific radiological hazard.

5.0 RESPONSIBILITIES

5.1 Site Safety & Health Officer (SSHO)

Ensures all activities performed within this procedure conform to the requirements of the SSHP.

5.2 Radiation Safety Officer (RSO)

- Implements this procedure.

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL POSTING REQUIREMENTS	NO.: PP-8-702-1 (12/2013)
	PAGE: 2 of 4

- Reviews pertinent survey data and makes periodic tours to verify all areas within the FMSS are properly posted.
- Authorizes the de-posting or down-posting of areas.
- Providing technical direction to the Radiation Protection Technicians (RPTs).

5.3 Radiation Protection Technician (RPT)

- Directs the placement of radiological postings and barriers.
- Performs periodic radiation / contamination surveys to ensure radiological conditions have not changed.

5.4 Project Supervisors

- Ensures that personnel working in their particular area obey all radiological postings.

5.5 Project Personnel

- Obeys all radiological postings.
- Follows directions from the RPT with regards to radiological postings.
- Maintains their personnel exposures as low as reasonably achievable (ALARA).

6.0 PREREQUISITES

RPTs will be trained to assess and recognize the various radiological hazards present at the FMSS.

7.0 PRECAUTIONS AND LIMITATIONS

- Barriers and other means shall be used as required to maintain control of areas requiring posting.
- At a minimum, all access / egress points to areas requiring radiological posting shall be conspicuously posted with the appropriate signs which includes area descriptions and specific requirements for entry.
- Appropriate signs should be placed approximately every 40 feet around the perimeter of a posted area. At least one sign should be placed on each side of an area's boundary, visible from any normal avenue of approach. These signs require only area identifiers (e.g., Restricted Area, Radioactive Materials Area, Radiation Area, etc.) in addition to the standard "Caution" or "Warning" and the trefoil.
- An RPT with the appropriate field survey instrumentation may serve as the radiological posting in situations where the task is of a short duration or at the discretion of the RSO.
- No radiological control(s) shall be installed in any area that would prevent the rapid evacuation of personnel in an emergency situation.

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL POSTING REQUIREMENTS	NO.: PP-8-702-1 (12/2013)
	PAGE: 3 of 4

- Trained emergency response personnel (Fire Dept, Ambulance / EMT, Law Enforcement) responding to on-site emergencies are exempt from the requirements of this procedure.
- Postings should be as clear and concise as possible to prevent confusion on the part of personnel desiring to enter an area.
- Postings should not be hung from ladders, electrical wire, switches, vehicles, or any other item that could be damaged, moved, or could cause injury to personnel.
- If more than one level of radiological posting is required in an area, posting for each unique condition shall be identified starting with the highest hazard potential. However, it is not required to post areas with area identifiers that are superseded by postings identifying a higher hazard potential (e.g., posting a Contamination Area as a Radioactive Materials Area, etc.).
- Radiological postings shall not be moved or altered without approval from the RSO or the RPT covering the work.

8.0 APPARATUS

- Yellow and magenta barrier supplies (e.g., rad-rope, rad-tape, rad-ribbon, etc.)
- Signs and inserts as required
- Radioactive Material Labels or tags
- Stands or Stanchions

9.0 RECORDS

All surveys performed for radiological posting placement will be forwarded to project document control.

10.0 PROCEDURE

10.1 Controlled Areas

All access points to areas meeting the definition of a Controlled Area shall be posted with the words "CONTROLLED AREA," or "US GOVERNMENT PROPERTY" plus any additional verbiage deemed appropriate by Project Management.

10.2 Restricted Areas

All access points to areas meeting the definition of a Restricted Area shall be posted with the words "RESTRICTED AREA."

10.3 Contamination Areas

All access points to areas meeting the definition of a Contamination Area shall be posted with the words "CAUTION, CONTAMINATION AREA," and with the words "RESTRICTED AREA," as well as any special instructions deemed necessary by the RSO.

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL POSTING REQUIREMENTS	NO.: PP-8-702-1 (12/2013)
	PAGE: 4 of 4

10.4 High Contamination Areas

All access points to areas meeting the definition of a Contamination Area shall be posted with the words "CAUTION, HIGH CONTAMINATION AREA," and with the words "RESTRICTED AREA," as well as any special instructions deemed necessary by the RSO.

10.5 Radiation Areas

All access points to areas meeting the definition of a Radiation Area shall be posted with the words "CAUTION, RADIATION AREA" as well as any special instructions deemed necessary by the RSO.

10.6 High Radiation Areas

All access points to areas meeting the definition of a High Radiation Area shall be posted with the words "DANGER, HIGH RADIATION AREA" as well as any special instructions deemed necessary by the RSO.

10.7 Radioactive Materials Areas

All access points to areas meeting the definition of a Radioactive Materials Area shall be posted with the words "CAUTION, RADIOACTIVE MATERIALS AREA" as well as any special instructions deemed necessary by the RSO.

10.8 Airborne Radioactivity Area

All access points to areas meeting the definition of an Airborne Radioactivity Area shall be posted with the words "CAUTION, AIRBORNE RADIOACTIVITY AREA" as well as any special instructions deemed necessary by the RSO.

10.9 Posting / De-Posting / Down-Posting

Posting, De-posting, and Down-posting activities should be noted in the appropriate technician logbook with reference to applicable survey number(s).

11.0 ATTACHMENTS

None

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 1 of 12

1.0 PURPOSE

This procedure establishes the basis and methodology for the placement and use of air monitoring equipment, as well as the collection, analysis, and documentation of air samples. Radiological air sampling and analysis is performed to monitor concentrations of radionuclides in the air for purposes of tracking internal radiation exposure to occupational radiation workers, determining appropriate respiratory protection devices, establishing radiological posting boundaries, verifying effluent airborne radioactivity concentrations, and providing information on radiological conditions in the work area.

2.0 APPLICABILITY

This procedure applies to all radiological air monitoring activities performed in support of FUSRAP Maywood Superfund Site (FMSS) activities.

3.0 REFERENCES

- 10 CFR 20, "Standards for Protection Against Radiation."
- "Site Safety and Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan".
- "Technical Basis for Dosimetry & Air Sampling Programs at the Maywood FUSRAP Project", Rev. 0, Shaw? 2002.
- Rock, R.L., "Sampling Mine Atmospheres for Potential Alpha Energy Due to the Presence of Radon-220 (Thoron) Daughters", Informational Report No. 1015, United States Department of the Interior, Mining Enforcement and Safety Administration, 1975.
- Kusnetz, H.L., "Radon Daughters in Mine Atmospheres, A Field Method for Determining Concentrations", Am. Ind. Hyg. Assoc. Quat., Vol. 17, No. 87, 1956.
- ANSI N13.1, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities".
- Regulatory Guide 8.25, U.S. Nuclear Regulatory Commission (NRC), "Air Sampling in the Workplace".
- EM 385-1-80, United States Army Corp of Engineers (USACE) Radiation Protection Manual.
- EM 385-1-1, United States Army Corp of Engineers (USACE) "Safety and Health Requirements Manual."
- 29 CFR 1910.1096, United States Occupational Health & Safety, Ionizing Radiation.

4.0 DEFINITIONS

Activity Hazard Analysis (AHA): A document or series of documents prepared by OH&S and Radiation Protection (RP) to inform workers of the OH&S and/or radiological conditions that exist in the work area, work scope limitations, specific protective requirements, ALARA considerations, and instructions to workers.

Airborne Radioactivity: Radioactive material in any chemical or physical form that is dissolved, misted, suspended, or otherwise entrained in air.

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 2 of 12

Ambient Air: Air in the volume of interest, such as room atmosphere, as distinct from a specific stream or volume of air that may have different properties.

Annual Limit on Intake (ALI): The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent (CEDE) of 5 rems or a committed dose equivalent (CDE) of 50 rems to any organ or tissue.

Breathing Zone (BZ): A uniform description of the volume of air around the worker's upper body and head which may be drawn into the lungs during the course of breathing.

Committed Dose Equivalent (CDE): The dose equivalent to tissues or organs of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

Committed Effective Dose Equivalent (CEDE): The sum of committed dose equivalents (CDEs) to various tissues in the body, each multiplied by the appropriate weighting factors found in 10 CFR 20.

Derived Air Concentration (DAC): The concentration of a given radioactive nuclide in air which, if breathed by the reference man for a working year of 2000 hours under conditions of light work (1.2 m³ of air per hour), would result in an intake of one (1) ALI.

DAC-hour (DAC-hr): The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the DAC for each radionuclide) and the time of exposure to that radionuclide in hours. A facility may take 2000 DAC-hr to represent 1 ALI.

Grab Sample: A single sample of ambient air collected over a short time.

Maximum Permissible Concentration (MPC): That concentration of radionuclides in air or water that will result in the Maximum Permissible Body Burden or Organ Burden and result in a whole body or organ receiving the annual dose limit if breathed in by a worker for 2000 hours.

Monitoring: The measurement of radiation levels, airborne radioactivity concentrations, radioactive contamination levels, quantities of radioactive material, or individual doses and the use of the results of these measurements to evaluate radiological hazards or potential and actual doses resulting from exposures to ionizing radiation.

MPC-hour (MPC-hr): The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the MPC for each radionuclide) and the time of exposure to that radionuclide in hours.

Occupational Dose: An individual's ionizing radiation dose (external and internal) received as a result of that individual's work assignment.

Protection Factor: The degree of protection given by a respirator. The protection factor is used to estimate radioactive material concentrations inhaled by the wearer and is expressed as the ratio of ambient concentration of airborne radioactive materials to the concentration that can be maintained inside the respirator during use.

Representative: Sampling in such a manner that the sample closely approximates both the amount of activity and the physical and chemical properties of the material (e.g., particle size and solubility in the case of aerosol to which workers are exposed).

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 3 of 12

Air sampling performed within the Breathing Zone (BZ) is considered representative of the airborne radioactive material concentration inhaled by the worker.

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

5.0 RESPONSIBILITIES

5.1 Site Safety & Health Officer (SSHO)

- Ensures all activities performed within this procedure conform to the requirements of the SSHP.

5.2 Radiation Safety Officer (RSO)

- Manages the implementation of this procedure.
- Ensures technicians performing activities under this procedure are competent and have sufficient experience to perform assigned tasks.

5.3 Radiation Protection Technician (RPT)

- Initiates, collects, submits, counts, and documents air samples according to the requirements of this procedure, and the SSHP.
- Ensures he / she has sufficient experience and / or knowledge to perform assigned duties under this procedure.

6.0 PRECAUTIONS AND LIMITATIONS

- Running air samplers for extended periods may cause excessive dust loading of the filter media. The frequency of filter change-out should be increased if excessive dust loading is observed.
- Air samplers shall not be used in combustible / explosive atmospheres.
- Air sampling and sample counting equipment shall not be operated beyond their respective calibration periods.
- Air samples shall be taken in such a manner as to not contaminate the filter with materials that were not airborne during the sample interval or by re-suspension of loose contamination from surfaces near the sampling head.
- Sampler exhaust may cause the re-suspension of loose surface contamination if the sampler is positioned improperly.
- Consider higher volume air samplers when covering short duration tasks.
- The decision to provide individual monitoring devices to workers is influenced by the expected levels of intake, likely variations in dose among workers, and the complexity of measurement and interpretation of results.
- Operating instructions for air sampling equipment are addressed in separate instrument-specific procedures.

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 4 of 12

7.0 PROCEDURE

7.1 Air Monitoring Methods

7.1.1 Utilize the following monitoring methods to implement the radiological air monitoring program:

- General Area (GA) Air Monitoring
- Breathing Zone (BZ) Air Monitoring
- Passive Radon Monitoring
- Particulate Radon Grab Samples
- Perimeter Monitoring, frequently referred to as Air Environmental (AE)

7.1.2 Air sampling equipment should be placed so as to:

- Not directly contact a contaminated (transferable) surface.
- Minimize interference with the performance of work.
- Be easily accessible for changing filters and servicing.
- Be downstream of potential release points.
- Minimize the influence of supply airflow.

7.1.3 An airflow study of any indoor area to be monitored should be performed prior to placement of the sampler (other than BZ samplers). Additional studies should be performed after changes in the work area setup, ventilation systems, or seasons, if seasonal changes may affect airflow patterns.

7.1.4 Perform BZ air sampling in occupied areas where, under typical conditions, a worker is likely to be exposed to an air concentration of 10 % or more of the DAC.

7.2 General Area (GA) Air Sampling

7.2.1 GA samples are typically taken with low volume samplers such as LV-1 or equivalent.

7.2.2 GA sampling shall be performed with instrumentation operating at volumes capable of meeting the Minimum Detectable Concentration (MDC) values established in the "Technical Basis Document for Dosimetry and Air Sampling".

7.2.3 GA samples should be collected:

- During work activities as a supplement to Breathing Zone (BZ) sampling as deemed appropriate.
- At site boundaries to confirm effluent air discharge concentrations. These are the Air Environmental (AE) type samples.
- At discharge points to determine the worst case airborne radiological conditions.

7.2.4 Document airflow studies, if performed in the appropriate project logbook or as directed by the RSO.

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 5 of 12

- 7.2.5 Select a calibrated low / high volume sampler with the appropriate glass fiber air filter and place the sample head into position. The fuzzy side of the filter should face outwards.
- 7.2.6 Turn the sampler ON. At a minimum, document the following information on the air filter envelope or log sheet:
- Sampling Location
 - Sample Purpose (e.g., “GA” or “AE”)
 - Applicable AHA
 - Sampler model
 - Serial number
 - Date / time on
 - Flow rate
 - On by (individual starting sampler)
- 7.2.7 When air monitoring is complete, observe the sampler flow rate and turn the sampler off. At a minimum, document the following information on the air filter envelope or log sheet:
- Date / time off
 - Flow rate
 - Total Run Time (if available)
 - Total Volume Sampled (if available)
 - Off by (individual terminating sample)
- 7.2.8 Remove and / or replace the sample head and filter using caution to prevent cross-contamination.
- 7.2.9 Store the filter in a protective container to minimize the loss of collected material.
- 7.2.10 Submit sample and associated sample-specific information to the counting lab for analysis.

7.3 Breathing Zone (BZ) Air Sampling

- 7.3.1 Collect BZ samples during entries into posted airborne radioactivity areas and during activities which have a reasonable potential of producing airborne radioactivity (e.g., excavating contaminated soils, surface destructive activities on surfaces with fixed contamination) as determined by the RSO.
- 7.3.2 Position the sampler on the individual representative of the worst-case exposure for the group if a single lapel sampler is used for multiple members of a work group. Base this selection on operating experience and consultation with the RSO. A single lapel sampler should be used for a group of no more than four workers spending greater than one hour in the work area under the same AHA.

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 6 of 12

- 7.3.3 Ensure the sample head is positioned as close to the breathing zone as practical without interfering with the work or the worker.
- 7.3.4 Operate sampler(s) according to the appropriate instrument use procedure. At a minimum, document the following information on the air filter envelope or log sheet:
- Primary Wearer's name(s) and/or site badge number
 - Sample Purpose (i.e., "BZ")
 - Applicable AHA number
 - Sampler model / serial numbers
 - Date / time On
 - Flow rate (sampler must be running)
 - On by (individual starting sampler)
- 7.3.5 Upon exit from the work area, note the flow rate, turn the sampler OFF and detach from the worker / object. Note that unless otherwise authorized by the RSO, BZ sampling should be suspended / restarted during the workday to facilitate break periods when no one is in the work area. Accurate volume tracking is crucial during these periods of non-operation.
- 7.3.6 Perform necessary post-operation sampler checks according to the specific instrument use procedure
- 7.3.7 Carefully, remove the air filter from the sample head and place in air filter envelope. Complete the pre-printed air filter envelope or sample log sheet:
- Date / time off
 - Flow rate
 - Total Run Time (if available)
 - Total Volume Sampled (if available)
 - Off by (individual stopping sampler)
- 7.3.8 Submit sample to Counting Room for analysis.

7.4 Radon and Thoron Progeny

- 7.4.1 High volume or low volume grab samplers such as HV-1, LV-1, or RAS-1 (typically in the 35-75 lpm range) should be used for collecting radon and thoron samples.
- 7.4.2 Radon and thoron samples should be collected:
- During work activities as deemed appropriate by the RSO or designee.
 - At restricted area boundaries as deemed appropriate by the RSO or designee.
 - Each frequently occupied work location should have its own samplers.
 - Airflow patterns should be considered in placing samplers so that the sampler is likely to be in the airflow downstream of the source.
 - A simultaneous background sample shall be taken upwind of all activities when radon and thoron sampling is performed. This sample is critically important.

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 7 of 12

- When collecting a radon and thoron breathing zone sample, the sampler should be located in the breathing zone for the worker. Preferably it should be held immediately downwind of the worker and moved around with the worker.
- 7.4.3 Select a calibrated high volume sampler with a 47 mm filter and place the sample head into position. The preferred filter is a membrane filter. The approved membrane filter is the F&J Specialty Products, Inc. model number A020A047A. Alternatively, a glass fiber filter is the F&J Specialty Products, Inc. model number AE-47.
- 7.4.4 Turn the sampler ON and complete the required information on the air filter envelope to include:
- AHA number, if appropriate
 - Sampler model and serial number
 - On date, time, and flow rate
 - On by (site worker initials)
 - Sample location
- 7.4.5 Collect a sample for exactly 5 minutes, with no more than a 5-second uncertainty. Exercise caution when handling sample head so as not to cross-contaminate the air filter.
- 7.4.6 Remove air filter from sample head and place in air filter envelope. Complete the required information on the air filter envelope including:
- Off date, time, and flow rate
 - Site worker stopping the sampler
- 7.4.7 Submit the sample to the counting room within 30 minutes after collection. Samples must be counted between 40 and 90 minutes, or they will be void.
- 7.4.8 Analyze the sample in accordance with Sections 8.1 or 8.2, whichever is appropriate
- 7.4.9 Alternate industry-accepted methods for radon-thoron monitoring may be used at the discretion of the RSO with concurrence from the Project Certified Health Physicist.

7.5 Perimeter/ Environmental Air (AE) Sampling

- 7.5.1 Perimeter/Environmental air samples are taken with high volume air samplers such as the Hi-Q Model HVP-3800AFC or equivalent. Low volume air samplers, such as the LV-1, may be used, at the discretion of the RSO.
- 7.5.2 AE samples are collected to verify compliance with off-site release criteria.
- 7.5.3 AE samples are collected at locations designated by the RSO. At least four continuously operating perimeter air-sampling stations are positioned along MISS boundaries. Vicinity property perimeter monitoring will be performed during remediation activities at these properties. The vicinity property air sampling stations will be established at the most likely downwind perimeter boundary, as determined by evaluation of local meteorological data, and / or the nearest perimeter boundary from active work areas.

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 8 of 12

- 7.5.4 All Maywood Interim Storage Site (MISS) perimeter samplers are to operate 24 hours a day 7 days a week. Vicinity property perimeter monitoring may be suspended by the RSO during non-work hours and terminated once Restricted Area postings have been removed.
- 7.5.5 Filters from continuously operating perimeter air samplers are normally changed out after one to four weeks of operation depending on dust loading and associated sampler performance capabilities. Filter change-out of perimeter air samplers will be performed at a frequency long enough to ensure acceptable counting statistics and short enough to maintain consistent sampler flow rates.
- 7.5.6 Perimeter sampler operation shall be verified on a daily basis around locations when airborne generating activities are in progress. This requirement may be relaxed by the RSO for samplers with data logging capability.
- 7.5.7 Document daily verification (i.e., flow rate) and notify the RSO of any discrepancies. Replace filter and investigate pump operation if daily flow rates vary by greater than 20%.
- 7.5.8 Any sampler that is out of service due to malfunction for more than 1 hour and any invalid samples should be brought to the attention of the RSO.
- 7.5.9 Samples are to be collected in accordance with Section 7.2, Steps 5-10.

7.6 Passive Radon Monitoring

- 7.6.1 Passive radon monitoring methods include the use of either alpha track-etch detectors or electrets.
- 7.6.2 Detectors should be placed for a length of time (generally one month or longer), so that the minimum detectable concentration is 0.1pCi/l or less, following manufacturer guidelines. Locations selected should be representative of the breathing zone, when practical. A simultaneous background sample shall be taken at a location unaffected by site activities.
- 7.6.3 Open the bag containing the detector and place the detector in a protective container to allow for air circulation. Follow manufacturer guidelines to activate the detector, as necessary.
- 7.6.4 Record in the logbook:
 - Sample location
 - Date and time of placement
 - Serial number of the detector
 - Initials of the worker placing the detectors
- 7.6.5 Ship the detector to the manufacturer's processing center for analysis.

8.0 ANALYSIS OF AIR SAMPLES

General Area (GA), Breathing Zone (BZ), and Air Environmental (AE) samples should be submitted to the counting room for gross alpha analysis. Samples may be analyzed for isotopic content, as deemed appropriate by the RSO. Data reduction and

interpretation of results will be performed in accordance with the “Technical Basis Document for Dosimetry and Air Sampling”.

8.1 Analysis for Radon and Thoron Progeny from a 5-Minute Low Volume Grab Sample

8.1.1 Count the sample twice (5-minutes each) for alpha activity using a Ludlum 2929, Ludlum 2000, or Equivalent.

- The first count should start at least 40 minutes after the end of the sample, but not greater than 90 minutes at the end of sample collection.
- The second count should start at least 5 hours after the end of the count, but not greater than 17 hours after the end of the first count.

NOTE

It is not recommended that a gas flow proportional counter be used for this analysis as there is a reasonably high probability of contaminating the instrument with radon and / or thoron progeny.

8.1.2 Calculate the thoron daughter concentration (TDC) in working levels from the delayed (second) count as follows:

$$TDC = \frac{cpm_{net}}{E \cdot V \cdot CE \cdot SAF \cdot F_{Th}}$$

where,

cpm_{net} = (gross counts/count time) - background cpm of counting instrument

V = Volume of air in liters

E = efficiency of counting instrument

CE = Filter collection efficiency (normally 0.998)

SAF = Self absorption factor (normally 0.7 for glass fiber filters and 1.0 for membrane filters)

F_{Th} = Working level factor from Graph 1 (Attachment 1).

8.1.3 Calculate the radon daughter concentration (RDC) in working levels from the first count as follows:

$$RDC = \frac{\left(\frac{cpm_{net}}{E \cdot V \cdot CE \cdot SAF} - TDC \times 16.5 \right)}{F_{Rn}}$$

where,

cpm_{net} = (gross counts/count time) - background cpm of counting instrument

V = Volume of air in liters

E = efficiency of counting instrument

FMSS RADIATION PROTECTION PROGRAM MEASUREMENT OF AIRBORNE RADIOACTIVITY	NO.: PP-8-803-2 (12/2013)
	PAGE: 10 of 12

CE = Filter collection efficiency (normally 0.998)

SAF = Self absorption factor (normally 0.7 for glass fiber filters and 1.0 for membrane filters)

F_{Rn} = Radon working level factor from Graph 2 (Attachment 2).

TDC = Thoron Daughter Concentration determined from second count

8.2 Alternate Method for the Analysis of Radon Progeny from a 5-Minute Low Volume Grab Sample

This section only applies to the determination of radon and not the determination of thoron.

- 8.2.1 Count the sample once for alpha activity using a Ludlum 2929, Ludlum 2000, or Equivalent. The count should start at least 40 minutes after the end of the sample, but not greater than 90 minutes at the end of the count. Count the sample for 5 minutes.

NOTE

It is not recommended to use a gas flow proportional counter for this analysis as there is a reasonably high probability of contaminating the instrument with radon and / or thoron progeny.

- 8.2.2 Calculate the radon daughter concentration (RDC) in working levels from the first count as follows:

$$RDC = \frac{cpm_{net}}{E \cdot V \cdot CE \cdot SAF \cdot F_{Rn}}$$

where,

cpm_{net} = (gross counts/count time) - background cpm of counting instrument

V = Volume of air in liters

E = efficiency of counting instrument

CE = Filter collection efficiency (normally 0.998)

SAF = Self absorption factor (normally 0.7 for glass fiber filters and 1.0 for membrane filters)

F_{Rn} = Radon working level factor from Graph 2 (Attachment 2).

9.0 REPORTS

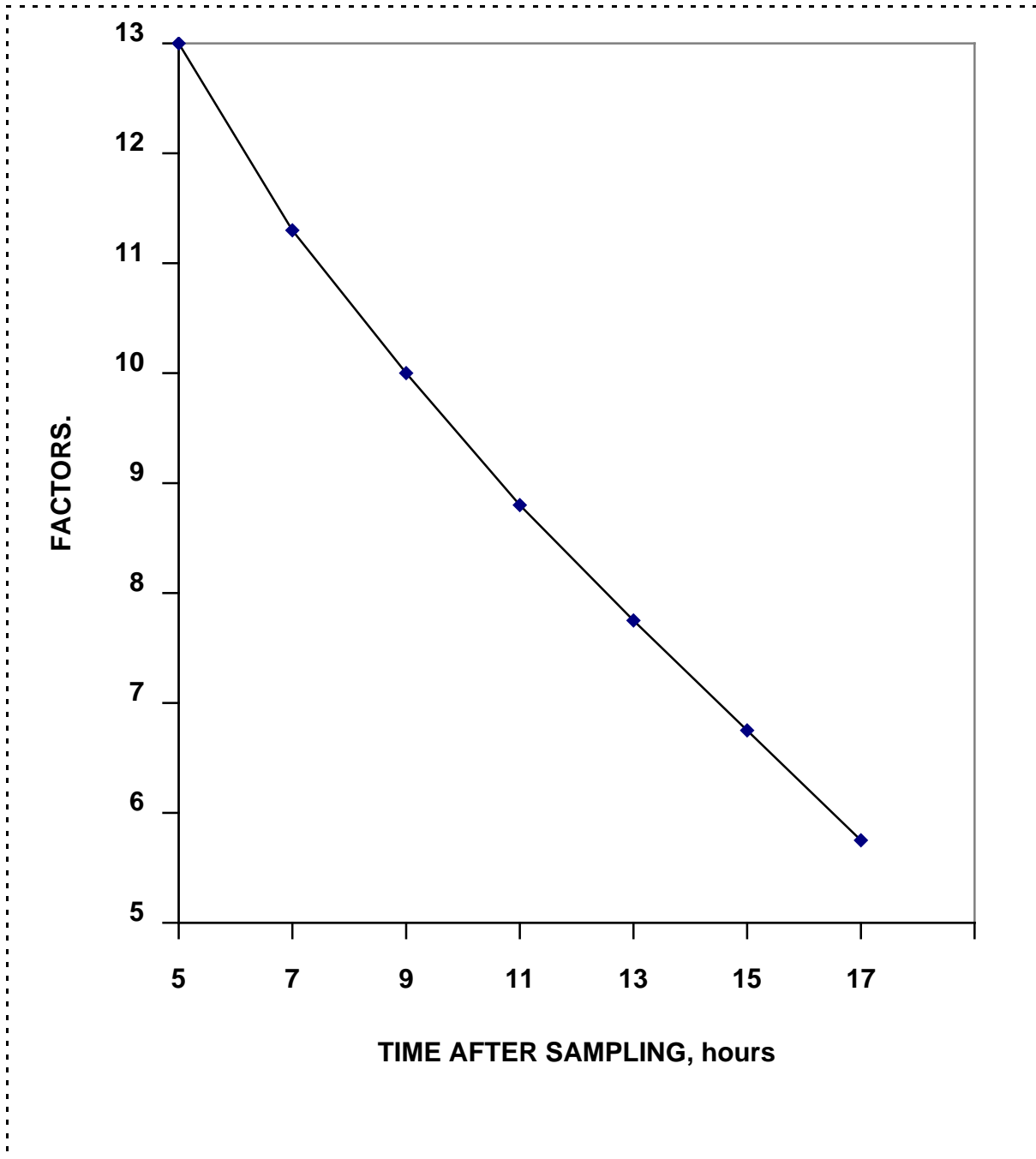
Maintain air monitoring instrument data, sampling data, and analysis results as a quality record.

10.0 ATTACHMENTS

Attachment 1 Graph 1, Thoron Working Level Factors

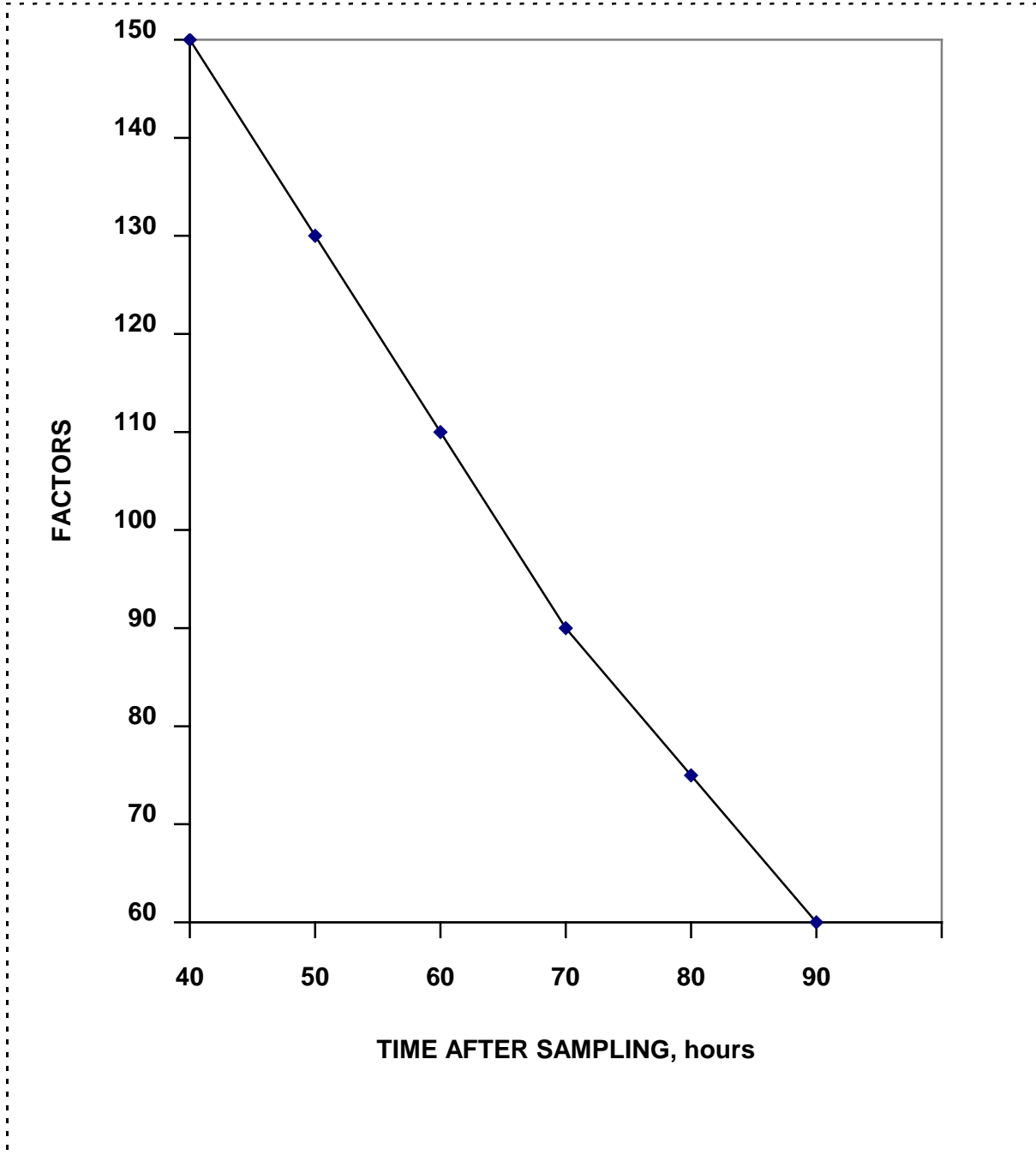
Attachment 2 Graph 2, Radon Working Level Factors

ATTACHMENT 1
GRAPH 1, THORON WORKING LEVEL FACTORS



Time factors versus time after sampling for thoron daughter samples.

ATTACHMENT 2
GRAPH 2, RADON WORKING LEVEL FACTORS



Time factors versus time after sampling for radon daughter samples.

FMSS RADIATION PROTECTION PROGRAM SURVEY DOCUMENTATION AND REVIEW	NO.: PP-8-807-1 (12/2013)
	PAGE: 1 of 9

1.0 PURPOSE

This procedure establishes consistent methodology for documenting radiological surveys and provides criteria for the review of these surveys.

2.0 APPLICABILITY

This procedure is applicable to all radiological surveys excluding air samples.

3.0 REFERENCES

- 10 CFR 20, "Standards for Protection Against Radiation."
- EM 385-1-80 "Radiation Protection" Manual, United States Army Corps of Engineers (USACE).
- "Site Safety and Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan".
- PP 8-702, "Radiological Posting Requirements."
- PP 8-805, "Radiological Surveys."
- PP 8-810, "Conveyance Survey."

4.0 GENERAL

4.1 Discussion

The results of surveys will be documented on survey forms or in designated logs as approved by the Radiation Safety Officer (RSO). Survey data will contain enough detail to provide personnel with adequate information concerning radiological conditions existing in the area surveyed.

The RSO or designee will review completed survey documentation to ensure appropriate, adequate and complete information is recorded. The individual reviewing the survey will ensure that the recorded results are legible, in accordance with the Radiation Protection Program (RPP) implementing procedures, consistent with anticipated levels, and will determine the reason for any variances.

4.2 Definitions

Airborne Radioactivity Area (ARA): An ARA is any room enclosure or area in which airborne radioactive materials exist in concentrations that exist in concentrations:

1. In excess of the derived air concentrations (DACs) specified in appendix B, to 10 CFR 20.1001–20.2401, or
2. To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

Contamination Area (CA): Means any area accessible to personnel with loose surface contamination values in excess of the values specified in the United States Army Corps of Engineers (USACE) Radiation Protection Manual, "Acceptable

FMSS RADIATION PROTECTION PROGRAM SURVEY DOCUMENTATION AND REVIEW	NO.: PP-8-807-1 (12/2013)
	PAGE: 2 of 9

Surface Contamination Levels,” (also refer to PP-8-805, “Radiological Surveys,”) or any additional area specified by the Radiation Safety Officer (RSO). The Contamination Area posting requirement is more restrictive than the Radioactive Material Area posting requirement. Any area posted as a Contamination Area shall also be considered to be a Radioactive Materials Area.

Contact Dose Rate: A radiation dose rate as measured at contact or within 1/2 inch of the surface being measured.

General Area Dose Rate (GA Dose Rate): The highest radiation dose rate accessible to any portion of the whole body measured at a distance of 30 cm (12 inches) from a significant radiation source or combination of sources.

Activity Hazard Analysis (AHA): A document or series of documents prepared by Occupational Health and Safety (OH&S) and Radiation Protection (RP) to inform workers of the OH&S and/or radiological conditions that exist in the work area, work scope limitations, specific protective requirements, ALARA considerations, and instructions to workers.

Radiation Area (RA): Means any area, accessible to personnel, where the whole body dose rate can exceed 5 mrem in 1 hour at 30 cm from the source.

Radioactive Material: Material activated or contaminated by the operation or remediation activities and by-product material procured and used to support the operations.

Radioactive Materials Area (RMA): Any area or room where quantities of radioactive materials in excess of 10 times the 10 CFR 20, Appendix C quantities are used or stored, or any area designated by the RSO which does not exceed the site Contamination Area criteria.

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

5.0 RESPONSIBILITIES

5.1 Site Safety & Health Officer (SSHO)

The SSHO is responsible for ensuring all surveys are performed in accordance with the requirements of the Site Safety and Health Plan (SSHP).

5.2 Radiation Safety Officer (RSO)

The Radiation Safety Officer (RSO) or designee is responsible for reviewing radiological surveys performed by Radiation Protection Technicians (RPT).

5.3 Radiation Protection Technician (RPT)

RPTs are responsible for documenting surveys in a legible manner on approved forms.

6.0 PREREQUISITES

Surveys for radiation and contamination have been performed in accordance with Project Procedure.

7.0 PRECAUTIONS AND LIMITATIONS

Surveys for airborne radioactivity will be documented in accordance with PP-8-803, "Measurement of Airborne Radioactivity."

8.0 RECORDS

- FMSS Survey Data Sheet (Attachment 1)
- FMSS Survey Tracking Log (Attachment 2)
- Radiation Protection Technician (RPT) Logbooks

9.0 PROCEDURE

The methods outlined in this procedure are intended to assure the clear and concise transfer of survey information. Variations or deviations from the protocols in this procedure are permitted if the clear transfer of information is maintained.

9.1 Documentation

A. General

1. Record all information on survey forms in a neat and legible manner.
2. Document all surveys on a form with approved project heading. Technician logbooks may be used for documenting surveys (e.g., daily routines, material transfers, minor posting changes, etc.) as authorized by the RSO and providing instrument serial numbers are documented with survey data.
3. When recording information on survey forms, check all appropriate boxes and circle all appropriate answers.
4. Use a survey form with pre-drawn diagrams when available. If not, draw a diagram or picture of the object surveyed. Should a diagram not be appropriate, use a lined survey form.
5. Assign the next sequential survey number to the survey from the survey number logbook.
6. Complete the following information for all surveys:
 - Date, time, location, and purpose of survey
 - Instrument type and serial numbers and associated supporting information (i.e., detector efficiencies, calibration dates, background values, etc.)
 - AHA number, if applicable
 - Name and signature of surveyor
 - Indicate Radiological Hazard Area boundaries on the survey form using x's and -'s (-x-x or **).
 - Note the posted Radiological Hazard using common designator such as
 - Contamination Area = CA

- Radiation Area = RA
- Radioactive Material Area = RMA
- Airborne Radioactivity = ARA
- The use of Greek alphabet and other nuclear industry standard nomenclature (e.g., “k” = 1000) is acceptable when documenting surveys.

B. Survey Tracking Log

1. The FMSS Survey Tracking Log (Attachment 2) is to be used to assign a unique sequential number to each survey form package. This number provides the ability to track individual surveys as well as ensuring the submittal of a complete documentation package for archiving.
2. Unless otherwise directed by the RSO, survey numbers will be assigned with the following format:

FMSSyyRS.xxxx

Where:

- “FMSS” corresponds to “FUSRAP Maywood Superfund Site”
 - “yy” is the last two digits in the year
 - “RS” refers to “Radiological Survey”
 - “xxxx” refers to the sequential survey number.
3. As surveys are generated, the RPT will take the next sequential number on the form and fill in the remaining boxes with a brief description of the reason for the survey as well as the date and RPT’s initials.

C. Radiation Surveys

1. Indicate GA dose rates by underlining the radiation level on the FMSS Survey Data Sheet (Attachment 1) at the appropriate location (Example: 25 uR/hr).
2. Indicate CONTACT dose rates by recording the radiation level with an asterisk on the FMSS Survey Data Sheet at the appropriate location (Example: * 25 uR/hr). If there are corresponding 30 cm and GA readings, document them as follows:

*** CONTACT / @ 30 cm / GA**

3. Use a legend to inform the reviewer of any other notation utilized or if deviating from standard protocol.

D. Contamination Surveys

1. Indicate survey locations by placing sequential numbers within a circle on the Survey Sheet. The Survey Sheet has corresponding direct and transferable columns for both alpha and beta / gamma activity.
2. Use a legend to inform the reviewer of any other notation utilized or if deviating from standard protocol.

FMSS RADIATION PROTECTION PROGRAM SURVEY DOCUMENTATION AND REVIEW	NO.: PP-8-807-1 (12/2013)
	PAGE: 5 of 9

3. The use of the letter “K” to indicate units of a thousand is acceptable.

9.2 Technician Review and Evaluation

- A. After completing the surveys, evaluate the results against previous surveys or anticipated results.
- B. Verify that radiological boundaries and postings are correct in accordance with PP 8-702, "Radiological Posting Requirements".
- C. Take any immediate actions required based on survey results.
- D. Ensure all relevant supporting documentation (e.g., count room print-outs, etc.) are attached to the survey package and that the package is properly paginated.
- E. Submit documentation to the RSO or designee for supervisory review.

9.3 Supervisory Review

- A. Ensure that the survey form is complete and legible.
- B. Ensure that all required information has been completed.
- C. Ensure that any changes, single line cross-outs, or deletions are initialed and dated at time performed.
- D. Verify that results are consistent with those anticipated. If results are not consistent, ensure that appropriate actions have been taken to explain the results or re-examine the area.
- E. Sign-off in the appropriate review section of the survey form and submit package to RP Document Control for retention / transmittal to Project Files.

10.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 FMSS Survey Data Sheet

Attachment 2 FMSS Survey Tracking Log

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-807-1 (12/2013)
SURVEY DOCUMENTATION AND REVIEW	PAGE: 6 of 9

Attachment 1

**FUSS RADIATION PROTECTION PROGRAM
SURVEY DOCUMENTATION AND REVIEW**

NO.: PP-8-807-1
(12/2013)

PAGE: 7 of 9

FUSRAP Survey Data Sheet

Survey No.: Date: Survey Tech.: Count Rm. Tech.: Date Counted: Survey Type: Level of Posting:		Item Surveyed: Contaminant/Limits: Comments:				Project:			
<p>Notes:</p> <p>ACF = Area Correction Factor $T_1 = \text{Background Count Time}$ $T_2 = \text{Sample Count Time}$ $R_1 = \text{Blgd count rate}$ $*\text{Bcpm} = \text{Background cpm} \times R_1$</p> <p>Direct $(\text{dpm}) = (\text{cpm} - \text{Bcpm}) / (\text{eff} \cdot \text{ACF})$</p> <p>Removable $(\text{dpm}) = (\text{cpm} - \text{Bcpm}) / \text{eff}$ * dpm readings are per 100cm²</p>	Parameters	Rate	Gamma	Corr uR	Alpha	Total	Beta-Gamma	Beta-Gamma	
	Instrument Model: Instrument SN: Cal. Exp. Date:	Rate N/A	Gamma 	Corr uR N/A	Alpha 	Total 	Beta-Gamma 	Beta-Gamma 	
	x, y int. Efficiency: BKG: Bcpm **: ACF: *B: T₁: T₂: I_c: MDC:								
	x	y	z	uR/hr	cpm	*dpm	cpm	*dpm	
	x	y	z	uR/hr	cpm	*dpm	cpm	*dpm	
No.	Descriptions							cpm	*dpm

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1.0 PURPOSE

The purpose of this procedure is to provide instruction for performing conveyance surveys to meet the transportation requirements of the U.S. Department of Transportation (DOT), U.S. Army Corps of Engineers (USACE), and the FUSRAP Maywood Superfund Site (FMSS) Radiation Protection Program (RPP), as well as other appropriate regulations, for the offsite transfer of radioactive materials and contaminated items. This procedure also establishes a separate class of periodic survey requirements for intrasite transportation (i.e. non-DOT regulated—no public roadways involved) of radioactive materials and contaminated items.

2.0 SCOPE

This instruction applies specifically to standard survey requirements for vehicles and packages transporting radioactive material or contaminated items onto or across public roads and railroads.

This instruction also applies a separate set of survey requirements for vehicles and packages which transport radioactive material or contaminated items but do NOT access public roadways, e.g.: travel over the constructed internal haul road between the 149-151 Maywood Avenue property ("Cluster 9a") and the MISS Soil Staging area, or inside the fenced area enclosing the Stepan plant facility and the MISS Controlled Area (see Section 6.5).

The surveys described in this procedure do not constitute a release for unrestricted use. Vehicles subject to the survey requirements described in Section 10.0 must undergo either a separate conditional release survey if leaving the MISS Controlled Area temporarily (e.g. refueling) or an unconditional release survey if leaving the MISS Controlled Area permanently (e.g. return to vendor).

The Radiation Safety Officer (RSO) may apply all or portions of this procedure to shipments of radioactive material which are below DOT criteria for placarding or are of a non-routine nature.

3.0 REFERENCES

3.1 Internal References

- USACE, 2013, *Site Safety and Health Plan, FUSRAP Maywood Superfund Site*, Revision 4. Prepared for USACE by Cabrera Services, Inc..
- USACE, 2013, *Survey Documentation and Review*, Revision 0, FMSS Radiation Protection Program Procedure PP-8-807. Prepared for USACE by Cabrera Services, Inc..
- Winters, M., 2005, *Dose Rate Threshold Analysis for Evaluating Dump Truck DOT Classification at Maywood Vicinity Properties*, Shaw Calculation RP-0029, Shaw Environmental, Inc. January.

3.2 External References

- Code of Federal Regulations (CFR), Title 10, Part 20, *Standards for Protection Against Radiation*, U.S. Government Printing Office, Washington, D.C., June, 2011
- CFR, Title 49, Part 173, *Shippers – General Requirements for Shipments and Packagings*, U.S. Government Printing Office, Washington, D.C., October 1, 2011.
- USACE, 2010, *Ionizing Radiation Protection*, ER 385-1-80, Washington, D.C., June 30, 2010.

4.0 DEFINITIONS

Definitions of words and key terms within the context of this procedure:

- **CFR**—Code of Federal Regulations.
- **Consignee**—Receiver of a shipment.
- **Consignor**—Shipper of shipment.
- **Contaminated Items**—Equipment or material that are contaminated with radioactivity in excess of USACE site release criteria.
- **Conveyance**—Any vehicle which could be used to transport equipment or materials.
- **DOT**—U.S. Department of Transportation.
- **Exclusive Use**—Means sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consignment. The consignor must provide to the initial carrier specific written instructions for maintenance of exclusive use shipment controls, including the vehicle survey requirement of 49 CFR 173.443 (c) as applicable, and include these instructions with the shipping paper information provided to the carrier by the consignor.
- **MDC**—Minimum Detectable Concentration.
- **MISS**—Maywood Interim Storage Site.
- **Transport Index (TI)** —A unitless number expressed to one decimal place that is derived from the maximum radiation level (in millirem/hr) at a distance of one meter from the outer surface of the shipping container. TI values are rounded up to the nearest tenth of a millirem (mrem). For example, if the exposure rate reading at one meter is 0.31 mrem/hr, the TI would be “0.4”. The TI is used to designate the degree of control required by the carrier during transportation. Note that the minimum radiation level requiring a TI is 0.05 mrem/hr (50 microrem [μ rem]/hr), which would be recorded as a TI of “0.1”. Class 7 shipments with exposure rates less than 0.05 mrem/hr are recorded as a TI of “0”. At Maywood, background is included in dose rate measurements used to establish TI values.
- **Package**—The packaging together with its radioactive contents as presented for transport.
- **Radioactive Material**—Any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in the table in 49 CFR 173.436 or values derived according to the instructions in 49 CFR 173.433.
- **Radioactive Material Area**—An area or room where quantities of radioactive material in excess of 10 times the 10 CFR 20, Appendix C quantities are used or stored, or any additional area designated by the RSO.
- **Restricted Area**—An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.
- **Specific Activity**—*Specific activity* of a radionuclide means the activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

- **RSO**—Radiation Safety Officer.
- **USACE**—U.S. Army Corps of Engineers.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

The RSO is responsible for oversight and implementation of this Conveyance Survey Procedure.

5.2 Radiation Protection Technician (RPT)

RPTs are responsible for the following:

- Inspecting conveyances for container/package integrity (i.e., leakage).
- Stopping the loading or transport of any shipment and notifying the RSO, if container/package integrity has been compromised.
- Conducting and documenting survey activities according to procedure and direction from the RSO.

6.0 PREREQUISITES

None.

7.0 PRECAUTIONS AND LIMITATIONS

- Based on the maximum hazard potential of site radionuclide concentrations, routine Maywood remedial support activities (i.e., soil transport by truck/rail, and transfer of surface contaminated objects by truck) may be performed under this procedure without additional RSO approval (except as noted in the procedure). Any non-routine conveyance events shall be coordinated with the RSO to assess the applicability of this procedure and any additional regulatory requirements for shipment.
- Refer to Section 6.4, "Procedure" below.

8.0 APPARATUS

- Portable Contamination Survey Instruments
- Appropriate Protective Clothing
- Smear Counter
- Smears
- Documentation
- Dose Ratemeter

9.0 RECORDS

- Conveyance survey data will be recorded on survey forms or logs, approved for use by the RSO.
- The shipment number will be recorded on all survey documentation on outgoing shipments to facilitate tracking.

- When survey documentation is required to accompany the shipment, original survey documentation will accompany the shipment and copies will be maintained on-site.

10.0 PROCEDURE

10.1 Discussion

- Vehicles traveling onto or across public roads, air, railways, waterways, etc. which are used to transport radioactive materials or contaminated items to or from off-site work areas are subject to requirements as forth in U.S. DOT 49 CFR 173.
- Vehicles used to transport radioactive materials or contaminated items within the MISS exclusively, or between the adjacent vicinity properties (Stepan Co. and Sears Logistical Services, "SLS") and the MISS Soil Staging Area that do NOT travel onto or across public roads, railways, waterways, etc will be subject to the periodic survey requirements detailed in Section 6.5.
- All shipments of radioactive materials or contaminated items (above applicable limits) leaving a site will be manifested. Shipments will be accompanied by other survey documentation as deemed appropriate.
- Whenever a vehicle is transporting bulk radioactive material (i.e., dump trucks) the vehicle itself is considered a "package" and must meet DOT packaging requirements.
- Railcar surveys are documented on Attachment 1. Other conveyance surveys are documented per PP-8-807, "Survey Documentation and Review".
- Surveys of shipments that do not meet DOT criteria for radioactive material will be at the discretion of the RSO.

10.1.2 Contamination Surveys (Incoming Surveys)

Unless otherwise directed by the RSO, any vehicle that enters a Restricted Area or, that will be used to transport radioactive materials or contaminated items, shall have an incoming vehicle survey performed, regardless of conveyance.

10.1.3 DOT Conveyance Surveys (Railcar Shipments)

DOT only requires transferable contamination and dose rate surveys for vehicles transporting radioactive materials or contaminated items. If direct contamination surveys are requested, the results will be documented on the appropriate survey form. All survey documentation will accompany shipping manifests.

All conveyances will be inspected for package/container integrity (i.e., leakage) and will have a survey performed prior to entering a public roadway or off-site railway. Results of this survey must be below DOT limits (Attachment 2). Surveys will be documented on the appropriate survey form. Due to ALARA concerns, activity found significantly above USACE contamination limits as specified in the SSHP Table 6-1, but below DOT limits, should be brought to the attention of the RSO.

10.1.3.1 Dose Rate Measurements

- Dose rate surveys will be performed on all conveyances transporting radioactive material or contaminated items from a site onto or across public roads to ensure that radiation levels on the vehicle do not exceed the limits.
- Dose rate measurements shall be recorded in mrem/hr as denoted on the appropriate

survey form.

- Survey, using a calibrated dose rate survey instrument, each side of the vehicle on contact with the surface. Record the highest measurement in mrem/hr. Surveys will include the top and underside of the vehicle. **If the on-contact reading for all sides of the vehicle is less than 10 mrem/hr, the 2-meter reading will not be required.**
- 2-meter Survey: Using a calibrated dose rate survey instrument, each side of the vehicle at 2 meters from the surface. Record the highest reading in mrem/hr. For flatbed trailers, surveys will be conducted using the vertical planes and horizontal (for the top) of the trailer as described in 49 CFR 173.441(b) (3). Surveys will include the top and underside of the vehicle.
- If any measurement exceeds DOT limits (Attachment 2), survey personnel will immediately notify the RSO that the vehicle cannot depart the site until further adjustments are made to the package to reduce dose rates to acceptable levels.

10.1.3.2 Transferable Contamination Survey

Vehicles will be surveyed in accordance with 49 CFR 173.443 requirements:

- The minimum protective clothing required for the performance of transferable surveys is surgeons-type (e.g. blue nitrile) gloves (in addition to the modified Level D requirements required by the SSHP).
- Each wipe sample should be collected over an area between 100 cm² and 300 cm² of the package surface. For Project consistency, survey results are documented in units of dpm/100cm².
- The RPT will submit smear samples to the counting lab for gross alpha/gross beta analysis as soon as possible. Record results on the survey form and report any results that exceed Site or DOT contamination limits to the RSO.
- A detailed description of the survey location will be entered onto the appropriate survey form. A sketch of the vehicle should be attached which more clearly defines all survey locations.
- DOT limits for transferable contamination will be used (Attachment 2). Hot spot averaging does not apply to DOT contamination limits. Due to ALARA concerns, activity found significantly above USACE contamination limits, but below DOT limits, should be brought to the attention of the RSO.
- Special attention should be given to likely-contaminated locations (i.e. tailgate on dump trucks, tires, and floor of cab).
- If any contamination limit is exceeded, the vehicle will be decontaminated and resurveyed. No vehicle shall be released until it is decontaminated to levels below these limits.

10.1.3.3 Special Considerations for Over-the-Road Exclusive Use Vehicles Used to Transport Waste from Vicinity Properties to the Maywood Interim Storage Site (MISS)

Special considerations are established for the conveyances like dump trucks, vacuum trucks, and roll-off containers that are actively used in the routine waste transport loop between the MISS and nearby vicinity properties. **The use of these modified practices do not apply to waste shipments destined for off-site disposal facilities and do not constitute an**

unconditional release survey.

A. Field Screening for DOT Shipment Classification

In situations where soil concentration data is not readily available to classify waste shipments to the MISS from Vicinity Properties, perform the following site-specific DOT Class screening steps:

1. Perform standard dose rate survey of vehicle.
2. If the maximum contact dose rate is greater than 0.025 mrem/hr (25 μ rem/hr), above background, the shipment shall be placarded as "Class 7-Radioactive" and "Radioactive LSA". In addition, establish a Transport Index (TI) value and record the TI on the Transport Vehicle Bill-of-Lading.
3. If the maximum contact dose rate is less than 0.025 mrem/hr (25 μ rem/hr), above background, no special placarding is required.

B. Field Surveys for Transferable Contamination

Under routine field operating conditions, conveyances used to complete the waste transport loop between vicinity properties and the MISS may be surveyed for transferable contamination under the following conditions and steps:

1. The RPT shall ensure that, to the extent practicable, vehicles entering Contamination Areas remain on maintained clean surfaces (e.g., swamp mats, sheet plastic, stone, etc.).
2. The RPT shall direct the removal of any visible soil deposits (e.g., on tailgate, caked in tire treads, etc.) prior to conducting surveys for transferable contamination.
3. Direct alpha measurements, using portable survey instruments, may be used in lieu of wipe samples provided the instrument minimum detectable activity is below 200 dpm/100cm² and vehicle surfaces are visibly clean (e.g., no soil caked in tire treads) and dry. The equilibrium condition between alpha emitting parents in Maywood soils and their beta emitting daughter products establishes that compliance with the more restrictive alpha limit ensures compliance with the higher beta-gamma limit.
4. Reasonable accommodations are established to allow for the performance of surveys in wet conditions where the efficient detection of alpha contamination is unlikely. **"Wet conditions" would apply when trucks leaving the posted area have undergone a wet (water hose) decon and are still damp or during periods of precipitation.** Under conditions, where the conveyance is wet but otherwise free of any visible soil accumulation, transferable surveys may be performed using the following technique:
 - a. Ensure the ambient background in the survey area is < 100 cpm for a pancake-style probe.
 - b. Conduct direct beta measurements or collect a large-area wipe and field count for gross beta activity.
 - c. If any gross beta activity above background is detected, contact the RSO for direction, otherwise the conveyance may be released. Collect smear samples for drying and subsequent gross alpha/beta analysis in the counting lab.

- d. Notify the RSO immediately if any smear result exceeds the more restrictive site contamination limits.

10.2 Survey Requirements for Vehicles Transporting Bulk Radioactive Material NOT Accessing Public Roads or Railways (Intrasite Non-DOT Regulated Transport)

1. Prior to performing any vehicle egress surveys described in this section, the RPT shall verify that an access-egress pathway is in place which provides a clean barrier between underlying soil contamination and the tires of vehicles maneuvering within a Restricted Area / Contamination Area. Examples of barrier materials include swamp mats, structural fill (stone, "DGA"), plastic sheeting or geotextile fabric. Installation of swamp mats is the preferred method for providing vehicle access into and out of a Restricted/Contamination Area.
2. The RPT shall perform periodic surveys on vehicles (including dump trucks, vacuum trucks and roll-off containers) exiting a Restricted Area at a frequency no less than 20% (1 in 5 vehicles). A minimum of one (1) exit survey is required if less than five (5) vehicles exit the posted area during the daily shift. This frequency may be modified by the RSO as in-process survey data warrants.
3. Smears or large-area wipes (Masslinn[®]) should be collected over the tailgate and tires and counted for gross alpha activity (during dry conditions) or gross beta-gamma activity (during wet conditions). If any removable activity measurements exceed site criteria, (200 dpm/100 cm² alpha or 1000 dpm/100 cm² beta-gamma), notify the RSO immediately and direct the affected truck to remain within (or return to if already outside) the Restricted/Contamination Area for decontamination.
4. After the removable survey, the RPT shall scan the sides of the loaded dump truck with a calibrated dose rate survey instrument and note the maximum reading on the survey form per PP-8-807, "Survey Documentation and Review".
5. While it is preferable to perform the periodic survey inside the Restricted/Contamination Area, loaded dump trucks may be allowed to exit the posted area with RPT or RSO approval and park just outside the rad boundary for surveying in order to allow a successive vehicle passage.
6. Considering the outdoor nature of remediation activities and the frequency at which transports of waste are made between adjacent properties and the MISS using Project- controlled Haul Roads, reasonable accommodations are established to allow for the performance of surveys in wet conditions where the efficient detection of alpha contamination is unlikely. Conditions are established in this series of steps that allow for continuation of the waste transport loop in such adverse surveying conditions. The presence of equilibrated beta-gamma emitting daughter products in the Maywood waste stream and the application of more stringent action levels ensure that negative contamination control trends are adequately identified. **"Wet conditions" would apply when trucks leaving the posted area have undergone a wet (water hose) decon and are still damp or during periods of precipitation.** Under conditions, where the vehicle is wet but, is otherwise free of any visible soil accumulation, transferable surveys may be performed using the following technique:
 - a. The area background in the survey area must be less than 100 cpm for a pancake-style probe. Conduct direct beta measurements or collect a large-area wipe (Masslinn[®]) and field count for gross beta activity. If the gross beta-gamma activity is greater than 1000 dpm/100 cm², contact the RSO for direction, otherwise the conveyance may be released to complete the waste transport loop.
 - b. To supplement the large-area Masslinn[®] wipes, regular smear samples may be

collected for drying and subsequent gross alpha/beta analysis in the counting lab at the RPTs discretion. Notify the RSO immediately if any smear result exceeds site removable contamination limits.

7. The RPT shall perform a daily removable contamination survey within the periodic truck survey area, (e.g. a 20' x 20' square) to monitor for migration of contamination outside the posted area. The RPT may choose to supplement (or replace with RSO approval) the removable contamination survey with a gamma walkover scan if local background levels are low enough to permit a scan MDC commensurate with the Unrestricted Use soil criteria (5 pCi/g combined radium-226 + thorium-232). Collection of a composite surface soil sample within the periodic survey box may be necessary if the RPT determines a buildup of potentially contaminated soil has occurred.
8. The RPT shall notify the RSO of any results collected within the periodic survey zone which indicate removable activity or gamma walkover measurements greater than 50% of applicable limits, i.e. 100 dpm/100 cm² alpha activity, 500 dpm/100 cm² beta-gamma activity, or 3.32 pCi/g radium-226 plus thorium-232 combined activity.

11.0 ATTACHMENTS

Attached survey form(s) are examples and may be modified by the RSO with revision to this procedure.

- Attachment 1, FMSS Railcar Survey Form
- Attachment 2, Derived Shipping Limits

12.0 REVISION HISTORY AND APPROVAL

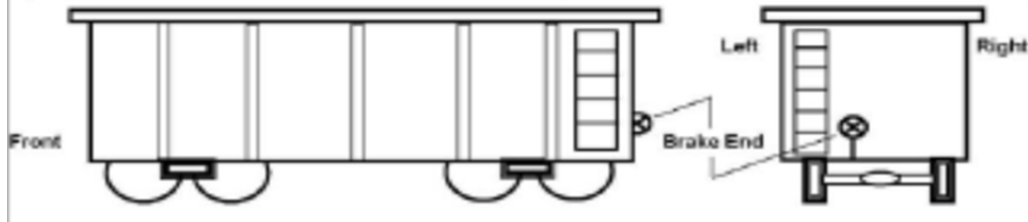
Revision Level	Revision Description	Responsible Manager
Revision Date		
00	Initial Issue.	Mike Winters
06/2002		
01	General Revision.	Mike Winters
06/2006		
02	General Revision (introduce periodic survey protocol for non-DOT regulated waste shipments within the FMSS Controlled Area)	Brian Miller
05/2012		
03	Periodic Review and Editorial Revision	Roy Racino
11/2013		

**Attachment 1
FMSS Railcar Survey Form**

**FMSS RAILCAR SURVEY FORM
INCOMING / OUTGOING**
(circle one)

Gondola Rail Car ID # _____

#	Area Surveyed	Dose Rates (mrem/hr)			Removable Contamination (dpm/100cm ²)			
		Contact	1 Meter	2 Meter	Alpha		Beta-Gamma	
					Gross CPM	NET DPM*	Gross CPM	NET DPM"
1	Brake End of Car							
2	Left Side O/S							
3	O/S Bottom							
4	Front end of Car							
5	Right Side O/S							
6	Top Front O/S Liner							
7	Top Rear O/S Liner							
8	liS Floor of Car							
9	Left Side I/S							
10	Right Side I/S							



Comments:	Radiation Survey	Smear Counting		
	Instrument Data	Instrument Data	Alpha	Beta Gamma
1. All direct reading air measurements taken from interior of railcar.	Model #	Bkg Count Time	1 min	1 min
2. Dose rate information for incoming surveys not applicable (n/a).	Serial #	Bkg CPM		
3. Smear locations for #1 thru #7 are not applicable for incoming surveys.	Cal Due:	Efficiency 1100		
	Direct Reading: Air	Area Correction Factor	1	1
	Multi-Rae SIN:	Sample Ct Time	1min	1min
VISUAL INSPECTION COMMENTS:	VOC (ppm):	MDA		
	O ₂ (%):	Instrument Model	L2929	L2929
	LEL (%):	Serial #		
	CO (ppm):	Cal Due Date		
	H ₂ S (ppm):	Probe Model	L-43-10-1	L-43-10-1
		Serial #		
		Cal Due Date		
Surveyed by:	Date:	Counted by:	Date:	
		Reviewed by:	Date:	

*NOTE FOR SHIPPER- WHEN ENTERING WIPE DATA ON DOT SHIPPING RECORDS MULTIPLY REPORTED NET DPM BY A FACTOR OF 10 (49 CFR 173.443(a)(1) "WIPE EFFICIENCY")

**Attachment 2
Derived Shipping Limits**

<p>Package Dose Rate Limits [49 CFR 173.443(a)]</p>	<p align="center"><u>ON CONTACT</u> 200 mrem/hour 1000 mrem/hour⁽¹⁾</p>	<p align="center"><u>AT 2 METERS</u> 10 mrem/hour</p>
<p>Vehicle Dose Rate Limits for Exclusive Use Shipments [49 CFR 173.443 (b)(1), (b)(2), and (b)(3)]</p>	<p align="center"><u>ON CONTACT</u> 200 mrem/hour</p>	<p align="center"><u>AT 2 METERS</u> 10 mrem/hour</p>
		<p align="center"><u>NORMALLY OCCUPIED SPACE</u> 2 mrem/hour</p>
<p>Transferable Contamination Limits⁽²⁾ [derived for Maywood from 49 CFR 173.443(a)]</p>	<p align="center"><u>ALPHA /100 cm²(3)</u> 220 dpm/100 cm²</p>	<p align="center"><u>BETA-GAMMA/100 cm²</u> 2200 dpm/100 cm²</p>

Footnotes:

¹ Exclusive Use Only AND In accordance with 49 CFR 173.441

² Derived Limits assumes a 10% Wipe Efficiency per 49 CFR 173.443(a)(1)

³ Although the majority of Maywood alpha emitters are classified as "low-toxicity", the more conservative 49 CFR 173.443(a)(Table 9) Alpha Limit (22 dpm/cm²) is used as the basis for the derived shipping limits.

FMSS RADIATION PROTECTION PROGRAM VEGETATION SURVEYS	NO.: PP-8-811-1 (12/2013)
	PAGE: 1 of 4

1.0 PURPOSE

The purpose of this procedure is to provide instruction for the performance of radiological surveys specific to waste vegetation generated during site clearing and to provide a protocol for the disposition of this waste stream.

2.0 APPLICABILITY

This instruction applies specifically to survey requirements for vegetation, such as trees, bushes, shrubs, etc., which are typically removed by the Project as part of general work area preparations. This procedure applies only to clearing activities performed in support of the remediation of the FUSRAP Maywood Superfund Site (FMSS). This procedure does not apply to similar work performed by outside parties on impacted properties not under government control. For example, routine pruning and clearing in adjacent contaminated rights-of-way, performed by New York, Susquehanna, and Western (NYS&W) Railroad or by the NJDOT along Rt. 17, are outside the scope of this procedure.

3.0 REFERENCES

- “Site Safety and Health Plan” (SSHP), Appendix A of the FMSS “Accident Prevention Plan”.
- EM 385-1-80 “Radiation Protection” Manual, United States Army Corps of Engineers (USACE).

4.0 GENERAL

4.1 Discussion

This procedure ensures that vegetative materials are adequately characterized so as to determine their ultimate disposition, (i.e. unregulated landfill waste or contaminated FUSRAP waste). Also, this procedure ensures that survey results are documented in the Project Record.

The activities addressed in this procedure will, in many cases, not create the potential for worker or equipment contamination and so could be accomplished with non-Rad workers wearing Level D PPE as prescribed in the relevant Activity Hazard Analysis (AHA). However, radiological monitoring is necessary because of the natural involvement of potentially contaminated soils with removed vegetation. For example, trees rooted in significantly contaminated soils may uptake FUSRAP radionuclides to a level that exceeds FMSS cleanup criteria. Also, work activities associated with cutting, grubbing, and clearing are likely to disturb surface soil contamination. Even if no surface contamination is present, removing roots and stumps may expose subsurface contamination. Therefore, periodic radiological surveillance, at a minimum, is necessary for these types of activities.

4.2 Definitions

Contaminated Items: Equipment or materials that are contaminated with radioactivity greater than USACE site acceptable surface contamination limits.

FUSRAP: Formerly Utilized Sites Remedial Action Program

G-M: Geiger-Müller

MISS: Maywood Interim Storage Site (100 W. Hunter Ave., Maywood)

Radiation Worker: An employee assigned to the FMSS site who has completed site-specific radiation safety training and has been approved to work unescorted in Restricted Areas.

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

RSO: Radiation Safety Officer

USACE: U.S. Army Corp of Engineers

5.0 RESPONSIBILITIES

5.1 Site Safety & Health Officer (SSHO)

- Ensuring all surveys are performed in accordance with the requirements of the SSHP

5.2 Radiation Safety Officer (RSO)

- Overall implementation of this procedure
- Ensuring appropriate radiation surveys are performed to measure and document radiation levels
- Ensuring that all completed surveys are adequately reviewed
- Providing technical direction to RPT's

5.3 Radiation Protection Technicians (RPT)

- Conducting and documenting all vegetation surveys in accordance with this instruction
- Performing all necessary pre/post use operability checks
- Creating neat, legible, and concise records
- Verifying that Site Supervisors have communicated potential site hazards and the controls established in this procedure to field personnel performing clearing activities.

5.4 Site Supervisors

- Ensuring clearing activities are performed in a controlled manner and according to the requirements established in this procedure.

FMSS RADIATION PROTECTION PROGRAM VEGETATION SURVEYS	NO.: PP-8-811-1 (12/2013)
	PAGE: 3 of 4

- Taking necessary precautions to minimize the potential for the spread of contamination
- Complying with radiological safety direction provided by the Radiation Protection (RP) Group personnel
- Communicating potential site hazards and the controls established in this procedure to workers performing clearing activities.

5.4 Site Workers & Visitors

- Ensuring clearing activities are performed in a controlled manner, and according to the requirements established in this procedure.
- Complying with radiological safety direction provided by RP Group personnel.

6.0 PREREQUISITES

Prior to the start of work, Site Supervisors and the RPTs providing job coverage shall ensure that workers are aware of the potential for the spread of contamination in the work area and the controls established in this procedure and the SSHP.

7.0 PRECAUTIONS AND LIMITATIONS

- Personnel implementing this procedure should read the AHA(s) addressing tree cutting and clearing/grubbing. These AHA's are found in the SSHP.
- Attempting to qualitatively assess elevated activity in vegetation placed in areas of elevated background may result in the release of contaminated materials for unrestricted use.

8.0 APPARATUS

Portable survey instruments: (Nal gamma scintillation probe, alpha scintillation probe, and G-M pancake probe each connected to a scaler-ratemeter).

9.0 RECORDS

Surveys generated during the implementation of this procedure shall be documented according to the survey requirements established in the Radiation Protection Program (RPP), located in the FMSS SSHP.

10.0 PROCEDURE

- 10.1 Aboveground components of vegetation will be cut or broken down into manageable pieces. Care should be taken not to allow falling pieces to impact and introduce themselves into contaminated soils.
- 10.2 If at any time during this process, the potential for worker/equipment cross-contamination is identified in a work area, qualified site workers with appropriate personal protective equipment shall complete the task.
- 10.3 Vegetative structures (e.g., stumps, roots, fallen limbs, grass, etc.) that have been in direct contact with contaminated soils will be removed by qualified site workers and transported back to the MISS for disposal as FUSRAP waste.

FMSS RADIATION PROTECTION PROGRAM VEGETATION SURVEYS	NO.: PP-8-811-1 (12/2013)
	PAGE: 4 of 4

- 10.4 The RPT providing job coverage identifies suitable area(s), with background radiation levels less than twice-normal background, to stockpile cleared materials for surveying. Contact the RSO for guidance, if there are problems obtaining a suitable area to perform gamma scans.
- 10.5 Cut pieces of vegetation will be piled on plastic or placed into a waste container to minimize the possibility of cross-contamination.
- 10.6 The RPT then surveys the pile with a 2"x 2" NaI detector.
- 10.7 If elevated gamma rates above normal background fluctuation are identified while surveying, then the load will be delivered to the MISS for disposal as FUSRAP waste.
- 10.8 If no gamma activity greater than normal background fluctuation is encountered, the waste may be considered for unrestricted release as "non-impacted."
- 10.9 Prior to demobilization, perform a contamination survey of equipment (e.g., chainsaws, truck beds, waste containers, etc.) and personnel performing clearing activities to verify levels are within established unrestricted release criteria.
- 10.10 The RPT will document surveys performed to support this procedure either in the pertinent field logbook or on a standard Survey Data Sheet. Digital photographs of surveyed items are recommended.
- 10.11 If at any time unexpected contamination or radiation levels are encountered; the RPT providing job coverage shall stop work and contact the RSO, or designee, for direction.

11.0 ATTACHMENTS

None

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 1 of 14

1.0 PURPOSE

This procedure describes the proper methods for monitoring of personnel (commonly referred to as “frisking”) for external radioactive contamination. This procedure also describes the appropriate actions in the event contamination is detected during the frisking process.

2.0 APPLICABILITY

This procedure applies to all FUSRAP Maywood Superfund Site (FMSS) Project Personnel, subcontractors, and visitors who access areas where a potential for spread of radiological contamination exists. Frisking of personnel is required when personnel are exiting Restricted Areas that are Contamination Areas and / or Airborne Radioactivity Areas.

This procedure **does not apply** during emergency response or evacuation activities. Procedural compliance is suspended for personnel that are involved in the emergency and who must exit a Restricted Area promptly until the emergency condition is terminated. **Evacuation from or response to acute health/life threatening conditions takes precedence over radiological hazard considerations.** Under emergency response/evacuation scenarios, the Radiation Safety Officer (RSO) will direct Project Personnel and provide guidance to Emergency Responders in a manner that best minimizes the spread of contamination without interfering with life-saving action(s).

3.0 REFERENCES

- 10 CFR 20, “Standards for Radiation Protection.”
- “Site Safety & Health Plan” (SSHP), Appendix A of the FMSS “Accident Prevention Plan”.
- PP-8-501, “Issue and Use of Dosimetry Devices”.
- PP-8-701, “Access Control.”
- PP-8-1102, “Radiation Worker Training (RWT).”
- PP-8-1201, “Radiological Occurrence Reports.”

4.0 GENERAL

4.1 Discussion

Personnel working in the radiological areas or with radioactive materials have a potential for becoming externally contaminated. The uncontrolled spread of contamination can be prevented if personnel are properly monitored, contamination found, and the personnel decontaminated. Early detection and removal of contamination from personnel will reduce internal dose from the ingestion and inhalation pathways, and will reduce external dose. This procedure is to be performed with portable contamination survey instruments.

4.2 Definitions

Personnel Contamination Event (PCE): A radiological occurrence that results in the detectable presence of radioactivity (excluding radon) on skin or clothing in

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 2 of 14

excess of normal background. PCE are documented for tracking & trending potential contamination control/worker practice issues.

Personnel Contamination Incident (PCI): A PCE where the initially identified radioactivity (excluding radon) concentration exceeds SSHP Table 6-1, "Average" contamination levels or any PCE where a potential intake may have occurred (i.e., detectable facial contamination). Because of the potential client/regulatory implications, PCIs shall be reported by the RSO to the Project Manager, the Project CHP, and to the senior on-site USACE representative.

Frisk: A commonly used nuclear industry term referring to monitoring performed by individuals using portable contamination survey instruments. Frisking is commonly performed at egress points from posted radiological areas, but can be required at any point by RP.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Oversees implementation of this procedure, particularly personnel (or, "decon") efforts and associated dosimetric assessments.
- Directs Project Personnel and provides guidance to Emergency Responders, during emergencies, in a manner that best minimizes the spread of radioactive contamination without interfering with life-saving action(s).
- Evaluates nuclear medicine studies/treatments reported by Project Personnel, determines whether a temporary withholding of Restricted Area access permissions is required, and consults with Project Management, as appropriate.
- Ensures the Project Manager, the Project Certified Health Physicist, and USACE are notified of any PCI.

5.2 Project Supervisors

- Ensures access control point shelters (i.e., protective coverings/enclosures used for donning, doffing, and monitoring without exposure to elements) are established and maintained, unless otherwise authorized by the RSO.
- Ensures personnel under their supervision understand and comply with this procedure and subsequent direction from Radiation Protection (RP) personnel.
- Immediately informs RP of frisker alarms or suspected contamination.
- Does not permit self-decontamination without RP present.

5.3 Radiation Protection Personnel

- Ensures, in a timely manner, that sufficient operational frisker(s) are available for use by Project Personnel at the designated Access Control Point.
- Routinely verifies the operational status and set points for instruments used for exit monitoring.
- Performs personnel monitoring if contamination is suspected by a worker or as a result of frisker alarm.
- Documents suspected-PCE response and associated actions taken.

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 3 of 14

- Initiates a Radiological Occurrence Report (PP-8-1201) for any confirmed PCE.
- Performs personnel decontamination according to this procedure and RSO direction.

5.4 Project Personnel

- Notifies the RSO of any nuclear medicine procedure (diagnostic or therapeutic) where radionuclides are injected or ingested into the body. This notification should occur as early as possible (i.e., no later than immediately upon reporting to the work site after the procedure).
- Performs routine frisking upon exiting areas where monitoring is required in accordance with this procedure and RP direction.
- Does not access a Restricted Area, where exit monitoring is required, unless operational frisker(s) are set-up and available for use.
- Immediately informs RP of elevated frisker count rates, alarms, or suspected contamination.
- Does not attempt self-decontamination without RP present.
- Follows directions regarding radiological matters from RP.

6.0 PREREQUISITES

- Personnel shall ensure an operational frisker is present at the Access Control Point prior to entering an area where personnel monitoring is required to exit.
- Personnel performing personnel monitoring shall be trained in frisking techniques and subsequent actions in the event contamination is suspected or detected. This is accomplished primarily through Radiation Worker Training (RWT) as described in procedure PP 8-1102, "Radiation Worker Training (RWT)."

7.0 PRECAUTIONS AND LIMITATIONS

- Elevated ambient background radiation levels can limit an instrument's detection sensitivity and hide the presence of contamination during personnel monitoring.
- Individuals who have received a recent nuclear medicine procedure (diagnostic or therapeutic) can emit radiation and radioactive materials from their body. The short-lived radionuclides, typically beta-gamma emitters, used in nuclear medicine can cause false frisker alarms and create unnecessary radiation exposure to co-workers. The RSO must be notified of any nuclear medicine procedure in order to evaluate the radiological status of the affected worker(s).
- To the extent practicable, avoid direct contact with the detector surface. The detector surface is highly susceptible to physical damage and cross-contamination.
- Poor frisking technique/conditions will cause contamination to not be detected. Alpha particles are particularly difficult to detect due to their limited travel distance (typically less than one inch in air) and ease in which they are shielded by dust, dirt, moisture, etc.
- Smears should not be used to determine contamination levels on the skin.

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 4 of 14

- Facial contamination is an indication of a possible intake and should be investigated further per RSO instruction.
- Areas under jewelry may concentrate contamination. If contamination is suspected, jewelry should be removed and appropriate surveys and smears taken.
- Surface contamination on clothing from radon daughters can be increased by environmental factors such as rain and rapid weather changes. Additionally, certain types of materials such as plastics and polyester tend to “attract” radon daughters due to the build-up of static charge.
- Skin decontamination techniques, if performed improperly, can cause injury to contaminated individuals.
- Decontamination efforts should be performed by RP of the same sex as the contaminated individual, if the efforts will potentially require exposing private body areas. If this is not possible, a witness, of the same sex as the individual, shall be present to observe and assist with decon efforts.
- Decontamination methods should limit the possibility of breaking the skin barrier. The alpha emitting radionuclides of concern at Maywood are of concern primarily if they are taken into the body. Use of hot water, harsh chemicals, abrasive materials and washing more than is advised below may open the pores and allow contamination that was superficial into the body.
- Any tools or solutions used to support personnel decontamination efforts shall be handled as potentially contaminated until evaluated and released by RP.

8.0 APPARATUS

- Portable Contamination Survey Instruments (Friskers)
- Decontamination Supplies

9.0 RECORDS

- Personnel Contamination Event Report (Attachment 1)
- Skin Dose Assessment (Attachment 2)
- Site RP Logbook(s)

10.0 PROCEDURE

10.1 RP Requirements for Access Control Point Frisker Set-Up and Operation

- Except as directed by the RSO, RP shall establish Access Control Point Frisking Stations according to the following requirements:
- Ensure that a sufficient supply of frisker(s) is available to personnel at exit points from radiological areas where frisking is required. There should be at least one frisker for every five to six workers normally assigned to work in an area.
- Ensure that frisker stations at Access Control Points are set-up and maintained in a manner that facilitates compliance with this procedure by Project Personnel (i.e., frisker operational with probe face up and readily

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 5 of 14

accessible at the step-off point on the “clean” side of the radiological boundary.

- In order to maintain instrument minimum detectable activities as low as possible, ensure areas where personnel monitoring will be performed have average background levels less than 5 cpm (alpha frisker) and 50 cpm (beta-gamma frisker). The RSO should be contacted for guidance, if these background limitations are not achievable at the work site or with the equipment type in use.
- To prevent instrument damage, friskers that can be directly exposed to potential inclement weather (i.e., not in a shed or other weather-protective structure) shall not be left unattended.
- Except as noted in Section 10.3, RP shall not use or provide beta-gamma friskers for personnel monitoring.
- All friskers used for personnel monitoring shall have an audible response (i.e., clicks) and visual counts per minute (CPM) response readout (analog or digital).
- Alpha friskers established for worker use, without direct continuous observation of the count rate display by RP, shall have a visual and/or audible alarm indicating potential contamination.
- The generally acceptable alarm threshold range is **10-25** gross cpm.
- The alarm threshold should be set as low as possible without triggering spurious alarms. Spurious alarms may be caused by instrument noise or minor variations in background levels.
- Specific RSO authorization is required to exceed an alarm threshold of **25** gross cpm.
- RP personnel assigned to a given work site shall verify frisker operations and alarm threshold set-points periodically during the work shift. The verification shall be documented in the work-site RP logbook.

10.2 Worker Requirements for Routine Exit Monitoring (Frisking)

- A. Routine exit frisking may be performed by trained radiation workers.
- B. Contact RP to perform exit frisking on all visitors. Contact RP to perform or directly observe whenever a worker suspects a Personnel Contamination Event (PCE) has occurred, or under wet conditions.
- C. Frisking is required upon exiting a Contamination Area (CA), an Airborne Radioactivity Area (ARA), or any areas where the Activity Hazard Analysis (AHA) or posting requires frisking; frisking is also required if directed by RP.
- D. Follow training instructions for the sequence of removal of Personal Protection Equipment (PPE) per procedure PP-8-1102, “Radiation Worker Training (RWT)”, taking note of the following:
 - Prior to removing PPE and frisking, examine Anti-C PPE for any rips or tears. Take special care when frisking areas under the locations of rips or tears.

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 6 of 14

- Prior to frisking, inspect personal clothing for signs of contamination (i.e., soiled areas). Take special care when frisking soiled areas that could be contaminated.
- E. Unless otherwise authorized by the RSO or, specified in the AHA all exit monitoring shall be whole-body frisks. Using proper technique is essential to a good survey. Poor technique **will** cause contamination to not be detected. Observe these key points:
- Before frisking, check the instrument switch settings (i.e., power (ON), response speed (SLOW), range setting (X1)). Report problems to RP.
 - Verify that the instrument, probe, and cable are free of physical damage that may affect instrument operation. Report problems to RP.
 - Use caution when handling the instrument and frisking to avoid damaging or contaminating the detector surface.
 - Probes should be held as close to the skin or clothing as possible without direct contact with the sensitive detector surface (i.e., within ¼-inch for Alpha detectors and ½-inch for Beta detectors). The detector surface is highly susceptible to physical damage and cross-contamination.
 - Frisking speed shall not exceed one probe width per second.
 - If possible, frisk bare hand prior to picking up probe.
 - Frisk any personal items that were handled while in the work areas (e.g., cell phones, clip boards, hard hats, traffic safety vests, safety glasses, etc.)
 - Commence whole-body frisk at the top of the head, working down the body to the bottoms of shoes/feet.
 - A routine whole-body frisk using probes with surface areas less than 50cm² (7.75 in²) shall last no less than 120 seconds.
 - A routine whole-body frisk using probes with surface areas equal to or greater than 50cm² (7.75 in²) shall last no less than 60 seconds.
 - If counts above background are encountered, stabilize probe face over the suspected area for approximately ten seconds. If the count rate remains above normal background, or if the instrument alarms, immediately notify RP. Stay at the Access Control Point, if possible.
 - If no contamination is detected, replace the probe face up and exit the area. Switch instrument power OFF, if directed by RP.

10.3 Worker/RP Requirements for Exit Monitoring under Wet Conditions

Surveying under wet conditions is possible, but shall not be considered a routinely accepted activity. One of the primary purposes of establishing access control point shelters is to provide workers with a donning, doffing, and frisking area free of environmental exposure. If frisking is required under wet conditions, contact RP for guidance and to assist with frisking. RP will perform the following:

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 7 of 14

- Direct personnel to remove and examine Anti-C PPE for any rips or tears. If damage is found, ensure that the corresponding location on skin or personnel clothing is completely dry prior to frisking.
- Inspect personal clothing for signs of contamination (i.e., soiled areas). If contamination is suspected, ensure that the corresponding location on skin or personnel clothing is completely dry prior to frisking.
- Direct individual to dry exposed skin, hair, and clothing to the extent possible using a clean towel (cloth or paper).
- Perform a careful frisk concentrating on areas of greatest contamination potential. The use of a beta frisker is recommended, if available.
- Consider any detectable activity above background as an indicator of potential personnel contamination and contact the RSO for guidance.

10.4 RP Requirements for Responding to Suspected Personnel Contamination Events

NOTE

- The threshold for a PCE is any confirmed case of skin/clothing contamination detectable above background. **RP shall immediately notify the RSO of any confirmed PCE.** The RSO may direct/oversee decontamination efforts.
- The threshold for a PCI is any PCE where the initial contamination levels exceed SSHP, Table 6-1, "Average" contamination levels or any PCE where a potential intake may have occurred (i.e., detectable contamination is noted on the mouth or under the nasal passages)
- The goal for personnel/clothing decontamination is "no detectable activity above background". The RSO will decide when further decontamination is not feasible or would be detrimental to the individual.
- Clothing/Skin decontamination efforts shall be performed in a manner that protects the privacy/modesty of the contaminated individual and minimizes the further spread of contamination.
- Radon gas and associated daughter products may accumulate on clothing. Typically synthetics are most likely to attract radon due to the build-up of static charge on clothing. Contamination caused by radon does not constitute a PCE.
- Skin under contaminated permeable clothing must be evaluated for potential cross-contamination.
- Alcohol-free wipes may be used as a first step in clothing/skin decon, at RP discretion.
- Avoid the use of solvents/cleaners that could destroy clothing or cause chemical exposure to the individual.
- RP should always attempt to identify the cause of any PCE. This includes work area/equipment surveys and interviews of affected individual(s) to isolate the root cause.

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 8 of 14

A. Suspected Clothing Contamination

1. Verify the presence of detectable contamination. If no activity above background is detected, release the individual.
2. If activity above background is detected, contact the RSO for guidance. Depending on the activity levels and feedback from RP and the affected individual, the RSO may direct any of the following:
 - a. Evaluation of potential skin contamination.
 - b. Direct surface decontamination in a manner that prevents the uncontrolled spread of contamination or subsequent skin exposure.
 - c. Initiation of a PCE Report and/or Radiological Occurrence Report.
 - d. Survey and disposal of the clothing as radioactive waste.
 - e. A “hold-for-decay” process if radon is suspected:
 - 1) Survey clothing and record initial activity levels.
 - 2) Apply a static-release spray to the clothing, if available.
 - 3) Place article of clothing into a rad bag and seal.
 - 4) Wait up to 24 hours and resurvey clothing.
 - 5) If an appreciable reduction of radioactivity is noted, radon should be assumed. Notify the RSO and continue the decay process until all detectable activity has been eliminated. Then return the clothing to the individual and document initial/final readings and any actions taken in the site RP logbook. No further actions are required.
 - 6) If no appreciable reduction of radioactivity is noted, initiate a PCE Report, a Radiological Occurrence Report, and contact the RSO for guidance and clothing disposition. If the post-decay radioactivity levels exceed the SSHP, Table 6-1 “Average” contamination levels the RSO will make the appropriate notifications and initiate a skin dose assessment.

B. Suspected Skin Contamination

CAUTION

Decontamination of wound orifices and other intrusive decon methods (e.g., skin removal) shall only be performed under the direction of trained medical personnel. If medical personnel do decontaminate wounds the tissue removed should be saved for analysis.

1. Verify the presence of detectable contamination. If no activity above background is detected, release the individual.

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 9 of 14

NOTE

Each decon step is to be performed gently, followed by a resurvey, and should be performed in order.

Decon efforts and results should be documented on the PCE form during the decon process.

2. If activity above background is detected, contact the RSO for guidance. Depending on the activity levels and feedback from RP and the affected individual, the RSO may direct the following process:
 - a. Utilize an area that ensures personal privacy for the contaminated individual.
 - b. Identify all areas of contamination and initiate PCE documentation
 - c. Wipe the affected area with a damp towel or alcohol-free "baby" wipe.
 - d. Wash the affected area with hand soap and tepid water. Do NOT use hot water. Low pH soap such as Phisoderm, PhisoHex, or RadCon is recommended. Repeat a maximum two additional times. If washing hair, use a low pH shampoo, and avoid rinsing into facial areas. Use suitable low pH cleansers for face washing. A soft bristle brush suitable for skin scrubbing may be used during this process.
 - e. Damp swabs may be used by the individual being decontaminated to clean nasal passages. Potable water may be used to rinse mouth in the event of dust getting into the face. Eyewash solution may be used to wash contaminated dust or of eyes. Swabs used for nasal passage swipes and water used to wash out mouth should be saved for analysis.
 - f. Perform a final release survey. If all detectable contamination has been removed, release the individual.
 - g. If decon efforts were unsuccessful, contact the RSO for additional guidance. The RSO may determine that additional decon efforts are not feasible or appropriate.
 - h. The RSO and contaminated individual shall concur before any hair cutting is performed.
 - i. Gather all necessary information to complete the PCE form and submit to the RSO for review and any necessary follow-up actions.
 - j. Save any decon rags or nasal swabs used in a radioactive material bag until directed to dispose of them by the RSO. Isotopic analysis of these items may be required.

C. Dosimetry Calculations

- The Project CHP and RSO shall cooperatively investigate, calculate, and document the following:
 - Estimated skin dose for any PCI. (Attachment 2 or equivalent)
 - Estimated intake for any facial contamination.

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 10 of 14

- Ensure skin doses exceeding 100 mrem are included in individual exposure records.
- Collection of a fecal bioassay sample should be considered if facial contamination is identified. The optimal time for collection of a fecal sample is between the second and third day following a suspected intake.

D. Occurrence Recordkeeping

In addition to radiological surveys and logbook entries, the following documents shall be generated (based upon occurrence classification):

- Confirmed PCE
 - PCE Report
 - Radiological Occurrence Report
- Confirmed PCI
 - PCE Report
 - Radiological Occurrence Report
 - Skin Dose Assessment Form (or equivalent)

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 Personnel Contamination Event Report

Attachment 2 Skin Dose Assessment

ATTACHMENT 1
PERSONNEL CONTAMINATION EVENT REPORT (FRONT)

Name: _____ Site Badge# _____ AHA No. _____

Employer: _____ Date _____ Time: _____ Location of Incident: _____

Description of Work being performed: _____

Description of Circumstances and the Suspected Cause _____

Skin Contamination Survey Summary

Body Location *	Initial Levels dpm/100cm ²	1st Decon Method	Attempt Results dpm/100 cm ²	2ND Decon Method	Attempt Results dpm/100 cm ²	3rd Decon Method	Attempt Results dpm/100 cm ²
A							
B							
C							
D							

* Indicate location on back of form

Nasal Swab Activity: Swab 1 _____ dpm/100 cm² Swab 2 _____ dpm/100 cm²

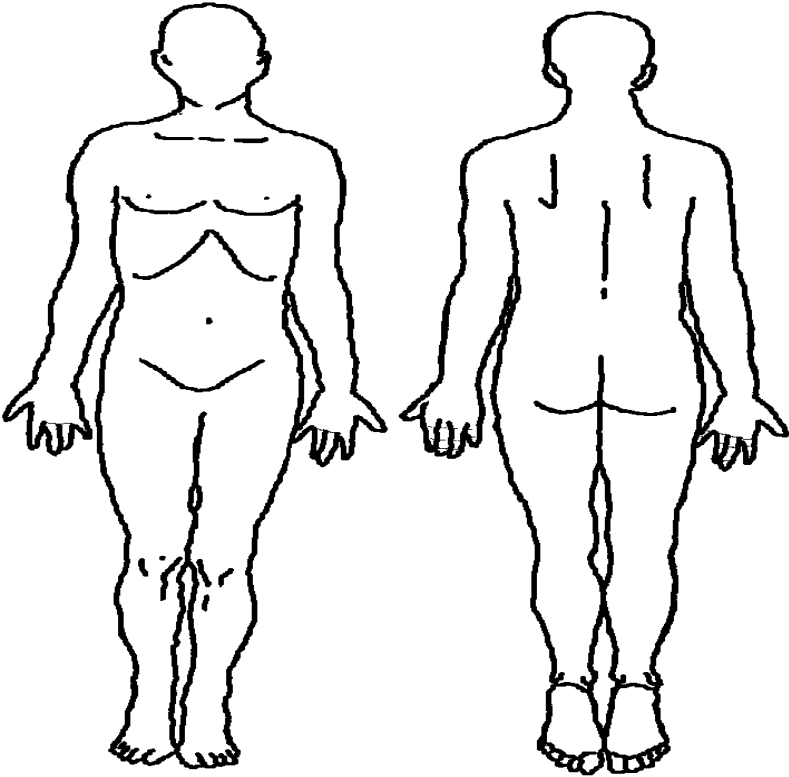
Clothing Contamination Survey Summary

Item	Initial Levels dpm/100 cm ²	Decon Method	Final Results dpm/100 cm ²	Released to employee (Y/N)

Bioassay Skin Dose ROR Follow-up Potential for Intake?
[] Scheduled / [] N/A [] Calculated / [] NA [] Initiated / [] NA [] Yes / [] N

RSO Date RP Technician Date

ATTACHMENT 1 (BACK OF FORM)
PERSONNEL CONTAMINATION EVENT REPORT



Comments and additional detail (identify by letter and include estimated area in square cm):

RP SURVEY INSTRUMENT(S) INFORMATION

Instrument Model	Serial Number	Cal. Due Date

ATTACHMENT 2
SKIN DOSE ASSESSMENT

NAME: _____ SITE BADGE# _____ AHA# _____

DATE/TIME of OCCURRENCE _____, of RELEASE _____

A. INITIAL DOSE EVALUATION

Body Location	Activity or Dose Rate (specify units)	Conversion Factor	Exposure Time (hours)	Dose Estimate (mrem)

B. Overall Dose Estimate _____

C. Comments:

D. Signature and Review

Calculated by: _____ Title: _____

Signature: _____ Date: _____

Reviewed by: _____ Title: _____

Signature: _____ Date: _____

ENSURE A COPY OF THIS FORM IS MAINTAINED WITH INDIVIDUAL'S EXPOSURE RECORDS

FMSS RADIATION PROTECTION PROGRAM PERSONNEL SURVEY AND DECONTAMINATION	NO.: PP-8-815-2 (12/2013)
	PAGE: 14 of 14

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FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL MATERIAL CONTROL PROGRAM	NO.: PP-8-900-2 (12/2013)
	PAGE: 1 of 12

1.0 PURPOSE

This procedure provides guidance and requirements for the control of radioactive materials. The Radioactive Material Control Program includes receipt, inventory, storage and handling, the release of materials, radioactive sealed source control, control of materials entering Restricted Areas, and the control of contaminated tools and equipment entering the Restricted Area.

2.0 APPLICABILITY

This procedure applies to all FUSRAP Maywood Superfund Site (FMSS) Project personnel. This procedure does not apply to the monitoring of liquid and gaseous effluents, radiological environmental monitoring, or final status survey of areas/facilities.

3.0 REFERENCES

- 10 CFR 20, "Standards for Protection Against Radiation"
- 10 CFR 71, "Packaging and Transportation of Radioactive Material"
- "Site Safety and Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan"
- U.S. Nuclear Regulatory Commission (NRC) Circular 81-07, "Control of Radioactively Contaminated Materials"
- NRC IE Information Notice No. 80-22, "Breakdowns in Contamination Control Programs"
- USAS N13.2-1969, "USA Standard Guide for Administrative Practices in Radiation Monitoring (A Guide for Management)"
- PP 8-702, "Radiological Posting Requirements"
- PP 8 -805, "Radiological Surveys"
- PP-8-810, "Conveyance Survey"
- PP 8-902, "Unrestricted Release Requirements"
- PP 8-1201, "Radiological Occurrence Reports"
- PP 8-1200, "Control of Radiation Protection Records"

4.0 GENERAL

4.1 Discussion

Radioactive material controls are established to provide positive control of radioactive material, prevent inadvertent release of radioactive material to uncontrolled areas, ensure personnel are not unknowingly exposed to radiation from lost or misplaced radioactive material, and to minimize the amount of radioactive waste material generated during FMSS activities.

4.2 Definitions

Aggregate Material: Items or materials that by their physical nature do not lend themselves to being effectively surveyed using portable instrumentation and

FMSS RADIATION PROTECTION PROGRAM RADIOACTIVE MATERIAL CONTROL PROGRAM	NO.: PP-8-900-2 (12/2013)
	PAGE: 2 of 12

require bulk or composite survey techniques or representative sampling and analysis.

Conditional Release of Material: Items or materials that do not meet unconditional release criteria and that are released under the control of FMSS Radiation Protection (RP) personnel.

Contamination Area (CA): Means any area with loose surface contamination values in excess of the values specified in Table 6-4 "Acceptable Surface Contamination Levels" of the U.. Army Corps of Engineers (USACE) Radiation Protection Manual that is accessible to personnel, or any additional area specified by the RSO. The Contamination Area posting is defined as more restrictive than Radioactive Material Areas, hence all Contamination Area postings are considered to be Radioactive Material postings.

Minimum Detectable Activity (MDA): The smallest amount or concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal. MDA depends upon the type of instrument, the counting geometry, and the radionuclide to be detected. MDA has the same meaning as Lower Limit of Detection (LLD). (ANSI N13.3, 1989).

Radioactive Material: Material activated or contaminated by the operation or remediation of the site and by-product material procured and used to support the operation or remediation.

Radioactive Material Area: Any area or room where quantities of radioactive materials in excess of ten times the 10 CFR 20 Appendix C quantities are used or stored, or any area designated a RMA by the RSO which does not exceed the site Contamination Area criteria.

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

Unconditional Release of Material: Release of equipment or material to the general public. The equipment and / or material is deemed to meet site release criteria for both total and removable contamination.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Ensures adequate staffing, facilities and equipment are available to perform the radioactive material control functions assigned to RP personnel.
- Investigates and initiates corrective actions for the improper handling of radioactive material.
- Approves purchase or acquisition of radioactive sources.
- Ensures a source inventory and leak testing program is established.
- Authorizes the establishment of radioactive material and sealed source storage locations.

FMSS RADIATION PROTECTION PROGRAM RADIOACTIVE MATERIAL CONTROL PROGRAM	NO.: PP-8-900-2 (12/2013)
	PAGE: 3 of 12

- Directs the packaging and transfer of radioactive material to appropriate authorities.
- Administers receipt / release survey programs of radioactive material.
- Administers radioactive source inventory and leak testing.
- Ensures correct posting of radiological area.
- Reviews results of sample analysis and survey data as required to determine acceptability for release of items.

5.2 Radiation Protection Technician (RPT)

- Performs and documents radiation and contamination surveys, inspections and leak tests.
- Posts, secures, and controls radioactive material and source storage areas.
- Safely opens packages of radioactive material.
- Identifies radioactive material.
- Releases material in accordance with this and implementing procedures.
- Notifies the RSO or designee on arrival of radioactive material.

5.3 Project Personnel

- Adheres to all policies, procedures and other instructions, verbal and written, regarding control and minimization of radioactive material and contaminated material.
- Reports any concerns about the control and minimization of radioactive material and contaminated material to supervision.
- Maintains good housekeeping at work sites and assists in preventing the build-up and spread of contamination.
- Obtains RSO authorization prior to accepting receipt of radioactive material at the project. This includes, but is not limited to items such as sealed sources, liquid standards, contaminated equipment from other sites, and waste generated outside normal project remediation activities. This is to ensure that required receipt surveys are scheduled, appropriate ALARA considerations are implemented, and that the source term is evaluated for possible effects to the project waste stream criteria.
- Complies with direction from RP personnel regarding the proper methods for receipt, handling, decontamination, packaging, storage, and disposal of radioactive material.

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

Packages of radioactive material or sources shall NOT be opened until the required receipt survey is performed by RP personnel.

FMSS RADIATION PROTECTION PROGRAM RADIOACTIVE MATERIAL CONTROL PROGRAM	NO.: PP-8-900-2 (12/2013)
	PAGE: 4 of 12

8.0 APPARATUS

None

9.0 RECORDS

- Receipt Radiological Surveys
- Source Inventory which includes Leak Test Results

Records generated shall be transmitted to Project Document Control for filing according to established RP Records Retention Schedules and procedure PP-8-1200.

10.0 PROCEDURE

10.1 Receipt of Radioactive Material

1. Obtain RSO authorization prior to accepting receipt of radioactive material at the project.
 - Radioactive materials which may be received include, but are not limited to, items such as sealed sources, liquid standards, contaminated equipment from other sites, waste generated outside normal project remediation activities and shipments of radioactive materials from vicinity properties to the Maywood Interim Storage Site (MISS) for storage and / or transportation and disposal. This is to ensure that required receipt surveys are scheduled, appropriate ALARA considerations are implemented, and that the source term is evaluated for possible effects to the project waste stream criteria.
 - Refer to 10 CFR 71.4 and Appendix A to 10 CFR 71 for definition and limits for "Type A Quantities" of radioactive materials.
 - The RSO may direct receipt surveys to be performed on any incoming radioactive material shipment.
2. If an expected package exceeds Type A quantities, the package requestor shall make arrangements with RP and the carrier to receive or pick-up the shipment when the carrier makes notification of package availability.
3. RP personnel perform receipt inspections and surveys of incoming radioactive material shipments which exceed a Type A quantity (refer to 10 CFR 71.4 and Appendix A of 10 CFR 71) as follows:
 - The inspection and survey shall be performed within three hours of receipt. If received after normal work hours, the survey is required with three hours from the beginning of the next business day.
 - Don latex gloves, at a minimum, when performing incoming inspections and surveys.
 - Inspect the package for leaks or apparent damage.
 - Ensure the contents match the packing slip or shipping papers.
 - Perform a radiation survey of the package exterior.
 - Perform a removable contamination survey of the package interior and exterior.

FMSS RADIATION PROTECTION PROGRAM RADIOACTIVE MATERIAL CONTROL PROGRAM	NO.: PP-8-900-2 (12/2013)
	PAGE: 5 of 12

4. RP Personnel shall store the package in a secure, radiologically posted area, notify the RSO or designee and initiate a Radiological Occurrence Report (PP 8-1201) if any the following conditions are observed during receipt of a radioactive material shipment:
 - Contents do not match packing slip or shipping papers
 - The contents of the package do not contain the isotopes or quantities of material as ordered or expected.
 - Package is leaking or sufficiently damaged to compromise package contents.
 - The receipt survey results exceed any of the following limits:
 - Radiation (mrem/hr) – 200 @ Contact or 10 @ 1 meter from the package
 - Removable Contamination (dpm/100cm²) – 2200 Beta-Gamma, 220 Alpha

10.2 Identification of Radioactive Material

1. Radioactive material exceeding limits specified in 10 CFR 20, Appendix C shall be identified and labeled by RP personnel:
 - On receipt of packages containing radioactive material or sources.
 - During removal of items or material from contaminated systems or areas, or from radioactive materials areas.
 - In the course of performing area and job specific surveys.
 - In the course of surveying items for release.
2. Items that meet or exceed the contamination limits established in the SSHP should be labeled radioactive material.
3. Use the following guidance, as a minimum, when labeling radioactive material:
 - Labels shall only be placed or removed by RP personnel.
 - Unique features (e.g., yellow plastic bags, yellow and magenta tags, purple paint, etc.) should be used to clearly identify the physical and radiological parameters of the material.
 - Labeling shall state "CAUTION - RADIOACTIVE MATERIAL."
4. Exceptions to labeling requirements for radioactive material are as follows:
 - The item or material is under the direct control of personnel who are aware of the contents and the associated radiological hazards.
 - The material is radiation protection equipment (e.g., respirators, instruments. etc.).
 - The material consists of radiological samples being analyzed or sampling equipment controlled by RP personnel.
 - The material is packaged and labeled in accordance with DOT regulations while awaiting transport.

FMSS RADIATION PROTECTION PROGRAM RADIOACTIVE MATERIAL CONTROL PROGRAM	NO.: PP-8-900-2 (12/2013)
	PAGE: 6 of 12

- The material is contained in permanently installed equipment and / or potentially contaminated systems.
 - The material consists of permanently installed equipment or components, including check sources installed in radiation monitoring equipment, which have manufacturer supplied check source labels affixed. Radiation level posting requirements shall remain applicable.
 - The material consists of laundered protective clothing:
 - a. In controlled use, inside the Restricted Area; or
 - b. Stored in designated laundry containers.
 - The material consists of check sources or sealed sources and source storage containers identified as radioactive material with identifiable labels affixed to the source.
 - The material is stored or in-use in a posted Contamination Area or Airborne Radioactivity Area. All items in these areas are considered potentially radioactive/contaminated until properly dispositioned by RP personnel.
 - The material consists of contaminated items (e.g., hand tools) impractical to label, that are marked with magenta paint.
5. Project personnel should notify RP of any items or containers with lost or damaged radioactive material labels.
 6. Material requiring labeling as radioactive material which is found uncontrolled and outside a Restricted Area shall be brought to the immediate attention of RP Personnel.

10.3 Storage of Radioactive Material

1. Radioactive Material Storage Areas shall be posted in accordance with PP 8-702, "Radiological Posting Requirements."
2. Radiation Protection personnel should consider the following when specifying radiological requirements for Radioactive Material Storage Areas:
 - Changes to radiation levels in an area as a result of material storage.
 - External environmental conditions are such that significant container degradation does not occur during storage.
 - Material is adequately packaged and controlled to minimize the potential for loss of radioactive material control

10.4 Special Considerations for Control of Accountable Radioactive Sources

1. The RSO, or designee, shall serve as the Source Custodian and shall be responsible for the following:
 - Ensuring that all accountable radioactive sources are stored in their designated storage location when not in use.

- Maintaining a source inventory that includes accountable source identification, isotopic content, activity, assay date, designated storage location, and date and results of most recent semi-annual leak test.
2. Any individual planning to procure a radioactive source for the project shall request approval from the RSO in writing. This request shall include a justification for bringing additional sources onto the project and shall include all necessary source information to update the source inventory.
 3. Licensed sources under the control of a licensee (e.g., radiography sources, soil density gauges, etc.) are not maintained in the project accountable source inventory. Project personnel requesting such vendor services shall ensure that the RSO receives evidence of the following prior to source mobilization to the project:
 - Source license including isotope and source activity
 - Semi-annual leak testing performed by the licensee
 4. Source Custodian, or designee, shall ensure that a leak test is performed and documented for any accountable source in inventory under any the following conditions:
 - Upon source receipt in inventory
 - Semi-annually
 - Prior to transfer to a new permanent storage location
 - Prior to disposal
 - If source integrity is compromised
 5. A source leak test consists of a physical source inventory, a visual inspection for source integrity and a contamination survey capable of detecting the presence of 0.005 microcuries (200 Bq) of removable radioactivity.
 6. If direct contact with the source is impractical (i.e., inaccessible, unsafe from an ALARA standpoint, or could potentially compromise source integrity) the source container or storage location may be surveyed as representative of the leak test.
 7. All accountable sealed radioactive sources or their individual storage containers shall bear a durable label or tag which includes the following minimum information:
 - Source Identification
 - Radionuclide(s)
 - Source Activity
 - Assay Date
 - Source Custodian Name and Contact Number
 8. The RSO shall establish designated locations for the storage of accountable radioactive sources using the following guidance:

FMSS RADIATION PROTECTION PROGRAM RADIOACTIVE MATERIAL CONTROL PROGRAM	NO.: PP-8-900-2 (12/2013)
	PAGE: 8 of 12

- Sources should be stored in a lockable location
- Sources should be stored to minimize exposure to fire or combustible materials
- Sources should be stored in such a manner to minimize radiation exposure to personnel routinely present in the area.

10.5 Movement of Radioactive Material

1. Radioactive material or contaminated material shall be properly contained before moving to minimize radiation levels and prevent spread of contamination.
2. Obtain direction from the Project Transportation Specialist, Transportation and Disposal Coordinator, and / or the RSO prior to transporting radioactive materials across public highways or railroads regulated by the Department of Transportation. Transport shall be performed in accordance with 10 CFR 71 "Packaging and Transport of Radioactive Material". Surveys shall be performed in accordance with Project Procedure PP-8-805, "Radiological Surveys" and PP-8-810, "Conveyance Survey"

10.6 Control of Tools, Equipment and Material

1. All items to be released from radiological controls shall be surveyed by RP personnel.
2. The RSO may authorize the establishment of "Hot Tool" storage areas for reusable contaminated tools, components, equipment and material. If labeling of these items (e.g., hand tools) is impractical, magenta paint may be used to identify the item as radioactive material.
3. Project Management should ensure that adequate supplies of clean and "hot" tools are available project personnel. This maximizes worker effectiveness in radiological areas, minimizes survey and decontamination efforts, and reduces radioactive waste generated.
4. Radioactive waste receptacles will be established and maintained for the disposal of items.

10.7 Release of Items from Radioactive Material Controls

1. RP personnel shall perform surveys to release items from radioactive material controls, with the following exception:
 - Hand-carried items (e.g., pens, paper, flashlights, logbooks, clipboards, safety glasses, dosimetry, badges, etc.) under a single individual's control and that are not expected to have come into contact with potentially contaminated surfaces may be monitored by that individual during the personnel frisking process.
2. RP personnel will survey items designated for unrestricted release according to PP-8-902, "Unrestricted Release Requirements."
3. RP personnel shall ensure the labeling is appropriate and direct Project personnel as how to best disposition the item (i.e., decontamination,

FMSS RADIATION PROTECTION PROGRAM RADIOACTIVE MATERIAL CONTROL PROGRAM	NO.: PP-8-900-2 (12/2013)
	PAGE: 9 of 12

packaging, storage, or disposal as radioactive waste) if an item is contaminated and cannot be released for unrestricted use.

4. RP personnel shall ensure that any labeling or marking identifying the item as radioactive material is removed or thoroughly defaced if the release survey indicates that the item may be released for unrestricted use.

11.0 ATTACHMENTS

Attachment 1: Values for Exemption of Sealed Sources from Inventory and Integrity Testing

Attachment 2: FMSS Source Inventory Log (Example)

Attachment 3: FMSS Source Check Out Log (Example)

ATTACHMENT 1

Values for Exemption of Sealed Sources
 from Inventory and Integrity Testing

Less than 300 μCi (1×10^7 Bq)

H-3	Be-7	C-14	S-35	Ca-41	Ca-45	V-49	Mn-53
Fe-55	Ni-59	Ni-63	As-73	Se-79	Rb-87	Tc-99	Pd-107
Cd-113	In-115	Te-123	Cs-135	Ce-141	Gd-152	Tb-157	Tm-171
Ta-180	W-181	W-185	W-188	Re-187	Ti-204		

Less than 30 μCi (1×10^6 Bq)

Cl-36	K-40	Fe-59	Co-57	Se-75	Rb-84	Sr-85	Sr-89
Y-91	Zr-95	Nb-93m	Nb-95	Tc-97m	Ru-103	Ag-105	In-114m
Sn-113	Sn-119m	Sn-121m	Sn-123	Te-123m	Te-125m	Te-127m	Te-129m
I-125	La-137	Ce-139	Pm-143	Pm-145	Pm-147	Sm-145	Sm-151
Eu-149	Eu-155	Gd-151	Gd-153	Dy-159	Tm-170	Yb-169	Lu-173
Lu-174	Lu-174m	Hf-175	Hf-181	Ta-179	Re-184	Re-186m	Ir-192
Pt-193	Au-195	Hg-203	Pb-205	Np-235	Pu-237		

Less than 3 μCi (1×10^5 Bq)

Be-10	Na-22	Al-26	Si-32	Sc-46	Ti-44	Mn-54	Fe-60
Co-56	Co-58	Co-60	Zn-65	Ge-68	Rb-83	Y-88	Zr-88
Zr-93	Nb-94	Mo-93	Tc-95m	Tc-97	Tc-98	Ru-106	Rh-101
Rh-102	Rh-102m	Ag-108m	Ag-110m	Cd-109	Sn-126	Sb-124	Sb-125
Te-121m	I-129	Cs-134	Cs-137	Ba-133	Ce-144	Pm-144	Pm-146
Pm-148m	Eu-148	Eu-150	Eu-152	Eu-154	Gd-146	Th-158	Tb-160
Ho-166m	Lu-176	Lu-177m	Hf-172	Ta-182	Re-184m	Os-185	Os-194
Ir-192m	Ir-194m	Hg-194	Pb-202	Bi-207	Bi-210m	Cm-241	

Less than 0.3 μCi (1×10^4 Bq)

Sr-90	Cd-113m	La-138	Hf-178m	Hf-182	Po-210	Ra-226	Ra-228
Pu-241	Bk-249	Es-254					

Less than 0.03 μCi (1×10^3 Bq)

Sm-146	Sm-147	Pb-210	Np-236	Cm-242	Cf-248	Fm-257	Md-258
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Less than 0.003 μCi (1×10^2 Bq)

Gd-148	Th-228	Th-230	U-232	U-233	U-234	U-235	U-236
U-238	Np-237	Pu-236	Pu-238	Pu-239	Pu-240	Pu-242	Pu-244
Am-241	Am-242m		Am-243	Cm-243	Cm-244	Cm-245	Cm-246
Bk-247	Cf-249	Cf-250	Cf-251	Cf-252	Cf-254		Cm-247

Less than 0.0003 μCi (1×10^1 Bq)

Ac-227	Th-229	Th-232	Pa-231	Cm-248	Cm-250
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* These activities were selected to yield a committed effective dose equivalent of 10 mrem (100 μSv) or less for a credible incident to a member of the general public.

FMSS RADIATION PROTECTION PROGRAM UNRESTRICTED RELEASE REQUIREMENTS	NO.: PP-8-902-1 (12/2013)
	PAGE: 1 of 5

1.0 PURPOSE

This project procedure describes the method of surveying equipment, materials, or vehicles for release for unrestricted use.

2.0 APPLICABILITY

This project procedure applies to all site personnel responsible for the unrestricted release of equipment and materials used in a Restricted Area. This procedure is not used for vehicles that are transporting radioactive materials. Procedure PP-8-810 is used for vehicles conveying radioactive materials. Vehicles conveying radioactive materials also must follow USDOT Regulation 49 CFR Part 173.

3.0 REFERENCES

- 10 CFR 20, "Standards for Protection Against Radiation"
- EM 385-1-80 "Radiation Protection" Manual, United States Army Corps of Engineers (USACE)
- "Site Safety and Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan"
- PP-8-805, "Radiological Surveys"

4.0 DEFINITIONS

CPM: Counts per minute

DPM: Disintegrations per minute

Equipment and Material: Equipment and material refers to any item used in a Restricted Area to support work activities (i.e., hand tools, heavy equipment, plastic, etc.).

LAW: Large Area Wipe (i.e., Masslinn)

Unrestricted Release: Release of equipment and / or material to the general public. The equipment and / or material is deemed to meet site release criteria for both total and removable contamination.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Ensures adequate staffing, facilities, and equipment are available to perform the survey tasks assigned to Radiation Protection (RP) personnel.
- Approves purchase or acquisition of equipment necessary to perform surveys.
- Ensures that surveys take place in appropriately posted areas.
- Reviews results of survey data as required to determine acceptability for release of items.

FMSS RADIATION PROTECTION PROGRAM UNRESTRICTED RELEASE REQUIREMENTS	NO.: PP-8-902-1 (12/2013)
	PAGE: 2 of 5

- Dispositions materials that cannot be released based on survey results.
- Investigates and initiates corrective actions for the improper release of radiologically contaminated material.

5.2 Radiation Protection Technician (RPT)

- Identifies equipment and material to be surveyed for unrestricted release.
- Performs and documents contamination surveys.
- Posts, secures and controls radioactive material that cannot be released.
- Releases material in accordance with this and implementing procedures.

5.3 Project Personnel

- Adheres to all policies, procedures and other instructions, verbal and written, regarding control and minimization of radioactive material and contaminated material.
- Reports any concerns about the control and minimization of radioactive material and contaminated material to supervision.
- Maintains good housekeeping at work sites and assists in preventing the build-up and spread of contamination.

6.0 PREREQUISITES

None.

7.0 PRECAUTIONS AND LIMITATIONS

None.

8.0 APPARATUS

- Alpha Detector
- Beta-Gamma Detector
- Portable Ratemeter / Scaler
- Scintillation or Gas-Flow Proportional Lab Alpha / Beta Counter
- Survey forms
- Cloth smears
- Masslinn™ type cloths

9.0 RECORDS

- Survey forms shall be completed in entirety. This includes attaching printouts, diagrams, or other supporting documentation, appending sequential page and survey tracking numbers, a review for completeness and accuracy, and appending the appropriate signatures of personnel performing the survey and / or analyzing samples.

FMSS RADIATION PROTECTION PROGRAM UNRESTRICTED RELEASE REQUIREMENTS	NO.: PP-8-902-1 (12/2013)
	PAGE: 3 of 5

- Once complete, the survey package shall be submitted to the RSO or designee, for final review and approval signature.
- Survey documentation shall be maintained according to established RP document control and retention requirements.

10.0 PROCEDURE

10.1 General Instructions

Prior to conducting any surveys, ensure that all survey instrumentation has been response checked, is in operating within control limits and has not been removed from service.

- Response checks shall be performed daily.
- Background measurements are to be taken prior to use at the point of use. The background count time shall be greater than or equal to the sample count time.
- Verify that the Minimum Detectable Activity (MDA) has been calculated for the background at the point of use and is less than the applicable site release criteria. Refer to PP-8-805, "Radiological Surveys," for the MDA calculation.
- Survey results are converted from counts per minute (cpm) to disintegrations per minute (dpm). A sample "cpm to dpm" calculation is attached for review and use at the end of this procedure.

10.2 Release of Items for Unrestricted Use

1. Surveys for both total and removable contamination shall be made in accordance with Section 10.3 (below) on all equipment, materials or vehicles which have either been in a Restricted Area or which may be potentially contaminated.
2. With RSO approval, removable contamination surveys may be disregarded, provided that direct survey measurements and instrument MDAs are below site removable contamination limits for release.
3. RP personnel will determine which items located outside a Restricted Area may be potentially contaminated based on their use, site history, or previous survey data. The potential for these objects to have become contaminated by airborne radioactive materials must be considered. This could include items that are used to support site activities, such as office equipment, cleaning devices, furniture, trailers, etc., even though direct contact may not have occurred.
4. Items which have a potential for internal contamination of inaccessible surfaces shall be evaluated by the RSO, or designee, prior to release.
5. All items to be released shall be surveyed in such a manner as to fully demonstrate that accessible surfaces comply with the surface contamination release criteria specified in PP-8-805, "Radiological Surveys."
6. Items that do not meet release criteria shall be decontaminated until release criteria is met or shall be disposed of as radiological waste.

FMSS RADIATION PROTECTION PROGRAM UNRESTRICTED RELEASE REQUIREMENTS	NO.: PP-8-902-1 (12/2013)
	PAGE: 4 of 5

7. Air intakes / filters on motorized equipment should be surveyed as an indicator of potential internal contamination. Notify the RSO or designee if air intake / filter surfaces indicate the presence of contamination. Contaminated air filters shall be removed and disposed of as radiological waste.
8. To the extent practicable, visible dirt and mud or other material shall be removed from surfaces prior to survey.
9. The RSO, or designee, shall review all survey data prior to the release from the Controlled Area.

10.3 Direct Surveys Scans and Static Measurements

1. Surfaces shall be dry and cleaned, to the extent practicable prior to performing direct alpha measurements.
2. The RSO may authorize the short-term relocation or staging of equipment / vehicles for direct measurements in any portion of the Controlled Area. This is provided that the item has been verified to be clean of removable contamination prior to removal from a Restricted Area and fixed contamination producing general area dose rates greater than 0.2 millirem per hour is not anticipated.
3. Alpha detectors should be placed within ¼-inch of the surface to be surveyed. Beta detectors should be placed within ½-inch of the surface to be surveyed. Use caution to not contaminate or damage the detector surface.
4. Perform a scanning survey of the item. Concentrate survey measurements on areas most likely to be contaminated. The fraction of the total area scanned is subjective, based on technician experience, an item's use history, and RSO guidance. Typically, the scan frequency is a minimum of 10% of accessible surface areas.
5. Obtain static measurements at locations with the highest potential for contamination. The number of survey points selected is subjective, based on technician experience, an item's use history, and RSO guidance.
6. Static measurement count times shall be appropriate for desired MDAs. Typical count times are one minute for digital scalers and until the meter reading stabilizes for analog rate meters.
7. Record and identify all locations surveyed on the appropriate survey form(s). The use of diagrams or sketches is recommended.
8. All measurements shall be reported in units of "dpm" unless otherwise directed by the RSO. Examples include "dpm/100 centimeters squared (cm²)" and "dpm/probe."

10.4 Removable Contamination Surveys

1. "Cloth" smears shall be used for smear surveys.
2. A notation (e.g., smear number, date, time, location, etc.) should be made on the smear envelopes to ensure proper smear tracking. Smears may also be numbered using a pen or marker prior to use.

FMSS RADIATION PROTECTION PROGRAM UNRESTRICTED RELEASE REQUIREMENTS	NO.: PP-8-902-1 (12/2013)
	PAGE: 5 of 5

3. Using moderate pressure, swipe an area of 100 cm² (4-inch square area or equivalent) of the surface at the selected location. Smear surveys should be performed at the same location that direct surveys were performed.
4. Large Area Wipes (LAW), also commonly referred to by the trade name "Masslinn," may be used to supplement smear surveys for removable contamination. The use of LAWs should be documented on the survey form with the notation "LAW" or equivalent.
5. Ensure each used swipe (i.e., smear or large area wipe) is handled, stored, and transferred in such a fashion as to prevent to loss of sampled material or cross-contamination with other personnel and other swipe samples.
6. Smear samples should be counted using available scintillation or gas-flow proportional laboratory counters, when practicable. Field instruments may be used for smear counting at the discretion of the RSO.
7. LAW samples may be counted using field instruments. The use of laboratory counters is inappropriate.
8. Removable contamination survey results shall be reported in units of "dpm" unless otherwise directed by the RSO. Examples include "dpm/100cm²" and "dpm/LAW."
9. Ensure all results are documented on the appropriate survey form. Lab printouts may be attached and referenced on the survey form.

10.5 Calculations

MDA and Sample Activity formulas are located in PP-8-805, "Radiological Surveys."

11. ATTACHMENTS

None

FMSS RADIATION PROTECTION PROGRAM GENERAL EMPLOYEE RADIATION TRAINING	NO.: PP-8-1101-1 (12/2013)
	PAGE: 1 of 2

1.0 PURPOSE

General Employee Radiation Training (GERT) is a module of the FUSRAP Maywood Superfund Site (FMSS) initial site orientation training. The purpose of this procedure is to provide consistent methodology for implementing GERT.

2.0 APPLICABILITY

GERT is applicable to Project Personnel who may enter the Controlled or Restricted Area and encounter radiological barriers, postings, or radioactive materials.

3.0 REFERENCES

- 10 CFR 19, "Notices, Instructions, and Reports to Workers: Inspections and Investigations."
- U.S. Nuclear Regulatory Commission, 10 CFR 20, "Standards for Protection Against Radiation."
- U.S. Army Corps of Engineers (USACE), EM 385-1-1 "Safety and Health Requirements Manual."
- PP-8-1102, "Radiation Worker Training (RWT)."

4.0 GENERAL

4.1 Discussion

Successful completion of the site orientation training that includes GERT.

Qualified individuals with a demonstrated knowledge of basic radiological concepts and the FMSS layout should perform the GERT module. The Radiation Safety Officer (RSO) approves GERT trainers.

4.2 Definitions

Controlled Area: An area under the control of FMSS management area to which access is limited by Project Management.

General Employee: Refers to any individual accessing FMSS to perform work, including Cabrera Services, Inc. (Cabrera) employees, Cabrera subcontract employees, or visitors who perform work for, or in conjunction with, FMSS.

GERT: GERT is generally provided to on-site administrative staff and vendors who frequent the Controlled Areas, but who seldom, if ever, enter a Restricted Area.

Radiation Worker: An individual who accesses any Restricted Area unescorted. Radiation Workers shall have successfully completed all requisite medical and training requirements for performing work in Restricted Areas as specified in this procedure and in PP-8-1102, "Radiation Worker Training (RWT)."

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

FMSS RADIATION PROTECTION PROGRAM GENERAL EMPLOYEE RADIATION TRAINING	NO.: PP-8-1101-1 (12/2013)
	PAGE: 2 of 2

5.0 RESPONSIBILITIES

The RSO is responsible for implementation of this Project Procedure and approval of course content and materials.

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

1. Trained emergency response personnel (Fire Department, Ambulance / EMT, Law Enforcement) responding to on-site emergencies are exempt from this training.
2. Delivery personnel (i.e., UPS, Federal Express, Airborne) making short visits into Controlled Areas are exempt from this training.
3. The RSO must approve and document all other exceptions to this training.

8.0 APPARATUS

Presentation Materials

9.0 RECORDS

The following form must be completed and submitted to Project Document Control:

- Training Attendance Roster, or equivalent.

10.0 PROCEDURE

10.1 Course Material and Training

1. At a minimum, the following topics shall be discussed during GERT: Fundamentals of Radioactivity, Prenatal Exposure Risks, basics of Cabrera's Radiation Protection Program, Site Specific Radiological Hazards / contaminants, As Low As Reasonably Achievable (ALARA) Concepts, Radiological Postings/Barriers, and Emergency Response / Evacuation Routes.
2. Provide each trainee with a copy of the course literature.
3. Give oral explanation of each overhead slide or handout topic.
4. Lecture on the associated concepts.
5. Answer any questions the trainees may have.

11.0 ATTACHMENTS

None

FMSS RADIATION PROTECTION PROGRAM RADIATION WORKER TRAINING (RWT)	NO.: PP-8-1102-1 (12/2013)
	PAGE: 1 of 4

1.0 PURPOSE

The purpose of this procedure is to provide consistent methodology for implementing Radiation Worker Training (RWT) at the FUSRAP Maywood Superfund Site (FMSS).

2.0 APPLICABILITY

RWT is applicable to ALL FMSS employees who perform work within Restricted Areas.

3.0 REFERENCES

- 10 CFR 19, "Notices, Instructions and Reports to Workers: Inspections and Investigations."
- U.S. Nuclear Regulatory Commission, 10 CFR 20, "Standards for Protection Against Radiation."
- U.S. Army Corps of Engineers (USACE), EM 385-1-1 "Safety and Health Requirements Manual."
- "Site Safety and Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan".
- PP-8-701, "Access Control."
- PP-8-1101, "General Employee Radiation Training."

4.0 GENERAL

4.1 Discussion

Successful completion of the RWT will qualify employees for unescorted access into Restricted Areas, provided other access requirements are met as specified in procedure PP-8-701, "Access Control".

Qualified individuals with a demonstrated knowledge of radiological concepts and the FMSS layout should provide RWT instruction. The Project Radiation Safety Officer (RSO) approves RWT Instructors.

4.2 Definitions

Controlled Area: An area under the control of FMSS management area to which access is limited by Project Management.

General Employee: Refers to any individual accessing FMSS to perform work, including Cabrera Services, Inc. (Cabrera) employees, Cabrera subcontract employees, or visitors who perform work for, or in conjunction with, FMSS.

Practical Factors: The "performance-based" portion of RWT that focuses on demonstration and evaluation of safe radiation worker practices. Particular emphasis is given to the donning and doffing of protective clothing and self-monitoring for radioactive contamination.

Radiation Worker: An individual who accesses any Restricted Area unescorted. Radiation Workers shall have successfully completed all requisite medical and training requirements for performing work in Restricted Areas as specified in Project Procedures PP-8-1101, "General Employee Radiation Training" and PP-8-1102, "Radiation Worker Training (RWT)," and in this procedure.

FMSS RADIATION PROTECTION PROGRAM RADIATION WORKER TRAINING (RWT)	NO.: PP-8-1102-1 (12/2013)
	PAGE: 2 of 4

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

5.0 RESPONSIBILITIES

The RSO is responsible for implementation of this procedure and approval of course content and materials.

6.0 PREREQUISITES

Prior to obtaining RWT qualification, individuals shall have submitted evidence of completion of other medical / training requirements established in the FMSS SSHP for access to Restricted Areas.

7.0 PRECAUTIONS AND LIMITATIONS

- RWT shall be required on an annual basis. Active site personnel may be granted up to a 90-day extension beyond the RWT anniversary date, with RSO approval.
- Individuals must have documented evidence of completing both academic and Practical Factors objectives before being allowed to work unsupervised in a Restricted Area.
- Personnel may be allowed to challenge the academic examination portion of this training by passing the examination.
- Annual re-qualification of the Practical Factors portion of RWT may be by observation of actual work practices.
- A minimum passing score on the RWT exam and Practical Factors is 80%.
- Trained emergency response personnel (Fire Department, Ambulance/EMT, Law Enforcement) responding to on-site emergencies are exempt from this training.
- The RSO may waive the classroom portion of RWT provided the individual is able to show documented proof of successful completion of an equivalent level of training from another facility during the previous 12-month period.
- RP technicians are exempt from this training.

8.0 APPARATUS

None

9.0 RECORDS

A copy of the RWT certificate or attendance roster should be placed with each employee's overall site training records.

10.0 PROCEDURE

10.1 RWT Classroom Training

- A. At a minimum, the following topics shall be discussed during RWT:
- Fundamental of Radioactivity

FMSS RADIATION PROTECTION PROGRAM RADIATION WORKER TRAINING (RWT)	NO.: PP-8-1102-1 (12/2013)
	PAGE: 3 of 4

- Prenatal Exposure Risks
 - Cabrera Radiation Safety Program
 - Site Specific Radiological Hazards / contaminants
 - As Low As Reasonably Achievable (ALARA) Concepts
 - Radiological Postings / Barriers
 - Emergency Response / Evacuation Routes
- B. Provide the trainees with a copy of the course materials and all pertinent training forms.
 - C. Present the course material, including overhead slides if available. Discussion of individual topics in handouts may be substituted for slides.
 - D. Lecture on the associated concepts.
 - E. Answer any questions the trainees may have.
 - F. Review the material with the trainees prior to administering the exam.
 - G. Administer the RWT exam.
 - H. The proctor will grade the test and review incorrect answers with the trainee.
 - I. Submit the completed exam to RP Document Control.

10.2 RWT Practical Factors Training

- A. At a minimum, the following topics shall be discussed as part of Practical Factors training:
 - Proper PPE donning and doffing procedures
 - Use of an Activity Hazard Analysis (AHA)
 - Recognition of postings
 - Utilization of ALARA concepts (time, distance, shielding)
 - Use of frisking equipment and proper frisking techniques
- B. Develop a mock-up area from which trainees may be evaluated. Include the following:
 - AHA
 - Radiological postings
 - Ropes / barriers
 - Radiological hazards
 - Whole body frisking instrument
 - In-use work areas may be used, with RSO approval, and provided that airborne generating activities are not underway.
- C. Introduce the practical training by relating it back to the academics the trainees have just completed.
- D. Explain what will be expected of each trainee.
- E. Demonstrate how to perform the tasks, talk about good practices while doing so.
- F. Allow the participants to practice as you coach.
- G. Proceed to the Mock-Up area and begin Practical Factors evaluation.

FMSS RADIATION PROTECTION PROGRAM RADIATION WORKER TRAINING (RWT)	NO.: PP-8-1102-1 (12/2013)
	PAGE: 4 of 4

H. Complete a Practical Factors Evaluation Form.

I. Review evaluation results with the trainee and forward the Practical Factors Form to RP Document Control.

11.0 ATTACHMENTS

None

FMSS RADIATION PROTECTION PROGRAM RADIATION PROTECTION TECHNICIAN (RPT) QUALIFICATION	NO.: PP-8-1103-2 (12/2013)
	PAGE: 1 of 6

1.0 PURPOSE

The purpose of this procedure is to provide consistent methodology for qualifying Radiation Protection Technicians (RPTs).

2.0 APPLICABILITY

This procedure applies to RPTs assigned to support the FUSRAP Maywood Superfund Site (FMSS) Project. Radiochemistry Lab technicians may also utilize this procedure for tracking of lab-related qualifications, as directed by the Radiochemistry Laboratory Manager. When used in this manner, the Radiochemistry Laboratory Manager will perform those functions identified for the Radiation Safety Officer (RSO).

3.0 REFERENCES

“Site Safety & Health Plan” (SSHP), Appendix A of the FMSS “Accident Prevention Plan”.

4.0 GENERAL

4.1 Discussion

Qualification is necessary to ensure that assigned personnel have documented evidence of the experience and / or training necessary to provide quality radiological protection support to the FMSS Project.

RPT Training shall be performed by qualified Senior RPTs with a demonstrated knowledge of the Radiation Protection Program (RPP) at the FMSS Project. The RSO approves RPT trainers.

Required Reading is used to maintain RPT awareness of new program documents and / or program changes affecting areas of technician responsibility.

4.2 Definitions

Junior RPT: An individual assigned to the project to perform administrative tasks, monitor control points, perform routine surveys, and assist Senior technicians with implementation of the RPP.

Qualification: The formal process of reviewing past work experience or demonstrating skill in the performance of a task or operation of an instrument to ensure understanding of RPP requirements and RPT responsibilities.

Senior RPT: An individual who meets the education and experience requirements for a RPT as defined by the FMSS SSHP and has been designated as a Senior Technician by the RSO.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

The RSO is responsible for implementation of this procedure and has overall authority for technician qualification.

5.2 Radiation Protection Technician (RPT) Trainer

The RPT trainers are responsible for qualifying RPTs according to the requirements of this procedure.

FMSS RADIATION PROTECTION PROGRAM RADIATION PROTECTION TECHNICIAN (RPT) QUALIFICATION	NO.: PP-8-1103-2 (12/2013)
	PAGE: 2 of 6

5.3 Radiation Protection Technician (RPT)

The RPTs are responsible for submitting required documentation of training and experience to the RSO for review prior to qualification.

6.0 PREREQUISITES

Prior to qualification, technicians shall have successfully met the Restricted Area access training and medical requirements identified in the SSHP.

7.0 PRECAUTIONS AND LIMITATIONS

- Junior RPTs and unqualified Senior RPTs shall perform tasks related to implementation of the RPP under the supervision of a qualified Senior technician. The level of supervision required is established by the RSO.
- At a minimum, a RPT must meet the following criteria prior to obtaining status as a “qualified” Senior RPT:
 1. Meet the experience / training criteria established in the SSHP.
 2. Complete qualification on the SSHP and RPP Implementing Procedures.
 3. Receive RSO Approval.

8.0 APPARATUS

None

9.0 RECORDS

- Completed RPT Qualification Records (i.e., Attachment 1 “Qual-Cards”) are maintained in individual employee training files.
- Completed RPT Required Reading Records (Attachment 2) are maintained in the Required Reading file.
- Typical RPT Qual-Cards and Required Reading Records are attached to this procedure. Field implemented versions may differ slightly from those pictured based upon project needs or editorial changes.

10.0 PROCEDURE

10.1 Qualification Process

- The trainee shall be provided with a Qual-Card and copies of the SSHP, applicable addenda, and RPP operating procedures for review.
- The trainer will discuss SSHP contents and RPP operating procedures with the trainee, as necessary. Emphasis should be placed on areas of technician responsibility and FMSS-specific protocols.
- The trainer or RSO will resolve any questions or concerns related to trainee review of program documents prior to qualification.
- In order to evaluate satisfactory comprehension, the trainer should discuss (D) the program document and / or observe (O) task performance prior to qualification. At a minimum, the observation (O) evaluation method should be used for instrument operations.

FMSS RADIATION PROTECTION PROGRAM RADIATION PROTECTION TECHNICIAN (RPT) QUALIFICATION	NO.: PP-8-1103-2 (12/2013)
	PAGE: 3 of 6

- The trainee and trainer complete a section of the Qual-Card for each program document reviewed by recording the following information:
 1. Specific program document or task;
 2. Trainee initials and date review completed;
 3. Trainer initials and date evaluation completed; and
 4. Method of evaluation (i.e., “D” or “O”).
- Upon completion of the minimum requirements as defined in Section 4.5.2, the Qual-Card may be submitted to the RSO for approval for Senior RPT Status.

10.2 Required Reading

- The RSO, or designee, shall maintain a required reading file for RPTs. Required reading should include new and revised site work instructions, work plans, and regulatory documents that impact areas of RPT responsibility. The RSO determines required reading requirements.
- RPTs review the required reading as directed by the RSO and acknowledge acceptance and understanding on the RPT Required Reading Record.

11.0 DOCUMENTATION

The RSO shall maintain records of technician experience, qualification status (i.e., Qual-Card), and Required Reading. These records shall be maintained according to Radiation Protection Document Control requirements.

12.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 FUSRAP Maywood Radiation Protection Technician Qual-Card

Attachment 2 RPT Required Reading Record

ATTACHMENT 1

FUSRAP MAYWOOD RADIATION PROTECTION TECHNICIAN QUAL-CARD					
	Technician:				
	Document Number	Document Title or Task Description	Review (Date/Init.)	Eval. by (Date/Init.)	Eval Method (D or O)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
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	RSO Approval				
<input type="checkbox"/>	Check if additional sheets attached				

ATTACHMENT 2
RPT REQUIRED READING RECORD

FUSRAP MAYWOOD RPT REQUIRED READING RECORD		Reviewers (Initial and Date Corresponding Block)									
REQUIRED READING ITEM	Start Date	<i>J. Cosgrove</i>	<i>T. Freeman</i>	<i>B. Miller</i>	<i>G. Moyer</i>	<i>G. Perry</i>	<i>B. Spillane</i>	<i>K. Thompson</i>	<i>W. Winner</i>		
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10											
RSO REVIEW											

FMSS RADIATION PROTECTION PROGRAM RADIATION PROTECTION TECHNICIAN (RPT) QUALIFICATION	NO.: PP-8-1103-2 (12/2013)
	PAGE: 6 of 6

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FMSS RADIATION PROTECTION PROGRAM CONTROL OF RADIATION PROTECTION RECORDS	NO.: PP-8-1200-2 (12/2013)
	PAGE: 1 of 4

1.0 PURPOSE

This project procedure defines the requirements for controlling Radiation Protection Program (RPP) records. It also establishes the requirements for review and temporary storage of these records at the FUSRAP Maywood Superfund Site (FMSS) prior to transmittal to Project Records.

2.0 APPLICABILITY

The requirements of this procedure are applicable to records generated by the FMSS Radiation Protection (RP) Group, and apply to all documents considered to be records.

3.0 REFERENCES

- U.S. Nuclear Regulatory Commission, 10 CFR 20 “Standards for Protection against Radiation.”
- “Site Safety and Health Plan” (SSHP), Appendix A of the FMSS “Accident Protection Plan”.

4.0 DEFINITIONS

Project Records: For the purpose of this procedure, “Project Records” refers to the approved records archive or document database.

Non-record: Non-record material includes those classes of documentary or other material that shall be disposed of without archival authority. Examples are copies of records transmitted to Project Records, paper copies of e-mail, and informal notes.

Records: For the purpose of this procedure, records shall be interpreted as radiation protection records. A record is considered to have been “generated” when it has been completed, signed (or initialed) by the generator, and completed required reviews. Examples of records are all survey forms and each original Activity Hazard Analysis (AHA).

Retention Period: The period of time that a record may be retained by the RP Group, prior to transmittal to Project Records.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Officer (RSO)

- Implements this procedure, and performs oversight activities to ensure compliance with the requirements of this document.
- Notifies the Project Manager of any condition(s) (e.g., storage capacity, staffing limitations, etc.) that limit the ability of the RSO to implement this procedure.
- Identifies member(s) of the Project team to act as Radiation Protection Records Coordinator(s).

5.2 Radiation Protection Records Coordinator (RC)

- Acts as the departmental contact for records.

FMSS RADIATION PROTECTION PROGRAM CONTROL OF RADIATION PROTECTION RECORDS	NO.: PP-8-1200-2 (12/2013)
	PAGE: 2 of 4

- Ensures that records are adequately controlled according to this procedure.
- Ensures that records are transmitted to Project Records in a timely fashion, as defined by this procedure.

5.3 Radiation Protection Group Personnel

- Complies with the requirement for this procedure.
- Protecting records in their possession from loss or damage.

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

None

8.0 APPARATUS

None

9.0 RECORDS

10.0 PROCEDURE

6.1 Radiation Protection Group Functions

- 6.1.1 All personnel assigned to the RP Group shall control records in accordance with applicable requirements of this procedure beginning when a record is first generated.
- 6.1.2 All new and revised FMSS RPP Procedures shall include a "Records" section that identifies records generated by implementation of this project procedure.
- 6.1.3 Records prepared in accordance with Project Procedures. Preparation of these documents shall conform to the following:
- Document content, including signatures, shall be:
- Legible and reproducible
 - Appropriate for the particular activity performed
 - Complete per the applicable requirements
 - Traceable to the activity or item to which it applies
- 6.1.4 If records are damaged (i.e., torn, lost, illegible, or incomplete), action shall be taken and documented to ensure that re-created records are as complete and accurate as possible. Re-created records shall be identified as copies and be signed and dated by the generator.

FMSS RADIATION PROTECTION PROGRAM CONTROL OF RADIATION PROTECTION RECORDS	NO.: PP-8-1200-2 (12/2013)
	PAGE: 3 of 4

6.2 Radiation Protection Records Coordinator (RC)

6.2.1 The RC shall:

- Review RP Group records for acceptability by ensuring the content of the record complies with this procedure. The RC shall review each record ensuring that the record is legible, complete, signed and dated, and that the record contains sufficient information to fulfill the intended purpose of the record.

NOTE

The RC is not responsible for the technical adequacy or correctness of the record.

- Coordinate appropriate corrective action with the RSO, or designee, when the condition of the records is not acceptable.
- Transmit completed records to Project Records, at a frequency established and communicated by the RSO.
- Ensure records packages scanned and/or transmitted electronically are complete (i.e., no missing pages) and processed at a sufficient image resolution to remain clearly legible while minimizing file sizes to the extent practicable.
- Notify the RSO of completed records packages transmitted to Project Records.

6.3 Control of Records

6.3.1 Records shall be controlled and properly maintained from the time the record is generated until it is transmitted to Project Records.

6.3.2 Records shall be stored in a controlled environment that protects the records from damage (i.e., winds, floods, fires, high and low temperatures and humidity and infestation of insects, mold, or rodents).

6.3.3 Each record shall be reviewed by the RSO, or designee, to ensure that:

- The record contains sufficient information to fulfill the intended purpose of the document.
- The content of the record is accurate and complete.

6.3.4 Records awaiting transmittal to Project Records shall be stored in a 1-hour fire-rated container, if possible.

6.3.5 Storage facilities or cabinets with confidential personal information shall be locked when unattended. Storage facilities for other documents should be locked when unattended, as is practicable.

6.3.6 Records that are in the process of being generated may be controlled by electronic storage, provided there is data back-up available.

FMSS RADIATION PROTECTION PROGRAM	NO.: PP-8-1200-2 (12/2013)
CONTROL OF RADIATION PROTECTION RECORDS	PAGE: 4 of 4

11.0 ATTACHMENTS

None

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL OCCURRENCE REPORTING	NO.: PP-8-1201-2 (12/2013)
	PAGE: 1 of 8

1.0 PURPOSE

This procedure provides instructions to uniformly identify, document, and investigate radiological deficiencies and incidents for determination of root causes and initiation of corrective actions.

2.0 APPLICABILITY

This procedure applies to all Project personnel covered by the FUSRAP Maywood Superfund Site (FMSS) "Site Safety & Health Plan" (SSHP).

3.0 REFERENCES AND COMMITMENTS

3.1 References

- U.S. Nuclear Regulatory Commission, 10 CFR 20, "Standards for Protection Against Radiation."
- U.S. Occupational Safety and Health Administration, 29 CFR 1910.1096(1), "Ionizing Radiation, Notification of Incidents."
- "Site Safety & Health Plan" (SSHP), Appendix A of the FMSS "Accident Prevention Plan".

3.2 Commitments

The Cabrera Services, Inc. (Cabrera) Project Certified Health Physicist (PCHP) or Radiation Safety Officer (RSO) shall notify the Site Safety and Health Officer (SSHO), Project Manager (PM), FMSS U.S. Army Corps of Engineers (USACE) Representative, the Project Occupational Health and Safety (OH&S) Manager, and the Assistant Secretary of Labor if a radiological occurrence meets the notification criteria established in 29 CFR 1910.1096(1) "Ionizing Radiation, Notification of Incidents." Additionally, the PCHP or RSO shall notify the PM and USACE Representative if a radiological occurrence meets the notification criteria established in 10 CFR 20, "Standards for Protection Against Radiation."

4.0 GENERAL

4.1 Discussion

Documentation and communication of radiological occurrences is necessary to ensure issues with the implementation of the FMSS Radiation Protection Program (RPP) are identified and resolved in a timely and professional manner. Radiological occurrences are documented to:

- Apprise management of radiological occurrences and any immediate and long-term corrective actions taken.
- Provide a mechanism for tracking and trending radiological occurrences at the management level.
- Provide a mechanism for triggering required notifications to Cabrera OH&S, the USACE, and appropriate regulatory authorities.

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL OCCURRENCE REPORTING	NO.: PP-8-1201-2 (12/2013)
	PAGE: 2 of 8

4.2 Definitions

Contributing Factors: Event(s) and factor(s) leading to an occurrence.

Critiques: Investigations of radiological incidents. Critiques are performed by a team assigned by the PM and/or the PCHP / RSO.

Major Deficiency: Willful or repeated occurrences involving poor radiological work practices or serious breakdowns in the effectiveness of the RPP. Major Deficiencies shall be documented on a Radiological Occurrence Record (ROR) and require follow-up investigation and corrective action by the RSO. Major deficiencies and RSO corrective actions will be initially communicated to the PM and SSHO.

Minor Deficiency: Accidental and isolated occurrences involving poor radiological work practices or minor/potential breakdowns in the effectiveness of the RPP. Minor deficiencies do not require regulatory reporting. A root cause and contributing factors are usually evident and further investigation and / or evaluation is not required. Corrective actions are usually performed on-the-spot and generally do not require follow-up action by the RSO. Project personnel document minor deficiencies on a ROR. Alternatively, minor deficiencies may be documented in field logbooks by RP provided the occurrence(s) are also communicated to the RSO on at least a weekly basis, either verbally or via summary observation report

Radiological Incidents: Radiological incidents are occurrences (usually initially classified as major deficiencies) that are determined by the RSO, PM, or SSHO [RR1] to require notification to one or more government agencies within a limited time period as required by laws and regulations. Radiological incidents require formal root cause investigations and critiques to be conducted by the Cabrera PCHP or Corporate RSO. Appropriate corrective actions must be taken to prevent recurrence.

Root Cause: The single top-level factor leading to an occurrence.

5.0 RESPONSIBILITIES

5.1 Project Manager (PM)

- Encourages and supports the radiological occurrence reporting process and any required corrective actions.
- Assists the RSO in evaluating Major Deficiencies for possible "Incident" reclassification.

5.2 Site Safety & Health Officer (SSHO)

- Encourages and supports the radiological occurrence reporting process and any required corrective actions.
- Assists the RSO in evaluating Major Deficiencies for possible "Incident" reclassification.

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL OCCURRENCE REPORTING	NO.: PP-8-1201-2 (12/2013)
	PAGE: 3 of 8

5.3 Project Certified Health Physicist (PCHP)

- Evaluates Major Deficiencies for possible “Incident” reclassification, when requested by the PM, RSO, or SSHO.
- Supports the RSO with the following actions associated with an Incident ROR:
 - Making formal notification to government agencies
 - Conducting root-cause investigations
 - Preparing exposure assessments
 - Preparing corrective action plans to minimize the potential for recurrence

5.4 Radiation Safety Officer (RSO)

- Evaluates and classifies radiological occurrences.
- Reviews immediate corrective action taken as being adequate, assigning ROR classification, and initiating any long-term corrective action required to resolve the ROR.
- Ensuring incident notification is performed in a timely manner.
- Denying access to Restricted Areas for any individual or organization with a demonstrated inability to comply with RPP requirements.

5.5 Radiation Protection (RP) Personnel

- Provides technical assistance to ROR initiators.
- Implements ROR-triggered corrective actions.

5.6 Project Personnel

- Initiating RORs to document occurrences related to the RPP.
- Providing as much information as possible about activities or conditions observed.
- Participates in a root cause / investigation team, as directed by the RSO.
- Complies with corrective actions issued by RP.

6.0 PREREQUISITES

None

7.0 PRECAUTIONS AND LIMITATIONS

The RSO should be consulted whenever there is a question about the required level of reporting to document a radiological deficiency/incident.

8.0 APPARATUS

None

9.0 RECORDS

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL OCCURRENCE REPORTING	NO.: PP-8-1201-2 (12/2013)
	PAGE: 4 of 8

- RP Personnel Logbooks and Deficiency Summary/Observation Reports
- Radiological Occurrence Report (ROR) and supporting documentation
- Radiological Occurrence Report Log

10.0 PROCEDURE

10.1 ROR Initiation

- A. Project personnel observing a radiological occurrence shall initiate a ROR (Attachment 1 - Section A).

NOTE

RP Personnel may document minor deficiencies in field logbooks provided they are summarized and communicated to the RSO in writing (e.g., e-mail report) on at least a weekly basis. This allows for the RSO to trend minor deficiencies for possible corrective actions while reserving the ROR for more serious issues requiring immediate Management action.

- B. Complete Section A of the ROR as fully as possible. This includes all available information regarding the occurrence, any immediate corrective actions taken, and the name(s) of individuals involved. RP will assist with ROR completion, as requested.
- C. Forward to the ROR to the RSO for review and disposition.

10.2 ROR Review, Classification, and Processing

The RSO shall:

- A. Review the ROR for completeness and seriousness of the occurrence.
- B. Interview the initiator of the ROR regarding the event.
- C. Assign a ROR classification (i.e., minor deficiency, major deficiency, or incident).
- D. Complete Section B of the ROR.
- E. Initiate any immediate/additional corrective actions required. This may include suspension of an activity, removal of Restricted Area access privileges, or any other appropriate action.
- F. If the ROR is classified as a "Major Deficiency", notify the PM as soon as possible of the occurrence and actions taken. If the PM or RSO identify a reasonable potential for a regulatory criteria exceedance the ROR will be upgraded to an "Incident".
- G. If the ROR is initially classified (or subsequently reclassified) as an "Incident", notify the PM, SSHO On-Site USACE Representative, PCHP, Cabrera Corporate Radiation Safety Officer.
- H. Assign a team, with support of the PCHP, to investigate, critique and perform root cause evaluations for "Incident" RORs. The investigation team should employ the following investigative techniques, as appropriate:

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL OCCURRENCE REPORTING	NO.: PP-8-1201-2 (12/2013)
	PAGE: 5 of 8

- Perform a visual survey of the area where the radiological event occurred to identify contributing environmental conditions.
 - Interview personnel involved.
 - Review procedures under which the job was performed.
 - Review the Activity Hazard Analysis(es) (AHAs) and radiation surveys in effect in the area.
 - Review training record and training material content.
 - Review As Low As Reasonably Achievable (ALARA) requirements and additional documentation relating to the occurrence.
 - Determine personnel exposure information.
- I. Upon any required investigation or root cause evaluation, the RSO and PCHP shall:
- Review the ROR and supporting documents.
 - Ensure all supporting documents are attached to the ROR.
 - Determine if the root cause evaluation or corrective actions are adequate.

10.3 ROR Formal Notification(s) and Tracking:

- The RSO or designee shall maintain a log of RORs and ensure that completed RORs are maintained in Project Records.
- The RSO shall periodically review the ROR Log to flag repeated occurrences involving:
 - The same individual.
 - The same work group.
 - The same location type of location.
 - The same or similar root causes.

11.0 ATTACHMENTS

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachments.

Attachment 1 Radiological Occurrence Report

Attachment 2 Radiological Occurrence Report Log

ATTACHMENT 1

FMSS RADIOLOGICAL OCCURRENCE REPORT		
SECTION A – TO BE COMPLETED BY THE INITIATOR		
PROPERTY/LOCATION		
OCCURRENCE DATE/TIME	APPLICABLE AHA/PROCEDURE(S)	
DESCRIBE THE OCCURRENCE		
<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>		
<input type="checkbox"/> ADDITIONAL SHEET(S) ATTACHED		
IMMEDIATE CORRECTIVE ACTIONS TAKEN		
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<input type="checkbox"/> ADDITIONAL SHEET(S) ATTACHED		
DATE/TIME RSO NOTIFIED	DATE/TIME REPORT COMPLETED	
INITIATED BY (NAME/SIGNATURE)		
SECTION B – TO BE COMPLETED BY THE RSO		
OCCURRENCE CLASSIFICATION		
<input type="checkbox"/> MINOR DEFICIENCY	<input type="checkbox"/> MAJOR DEFICIENCY	<input type="checkbox"/> INCIDENT <small>(See Notification Requirements)</small>
ADDITIONAL CORRECTIVE ACTIONS TAKEN/REQUIRED		
<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>		
<input type="checkbox"/> ADDITIONAL SHEET(S) ATTACHED		
ROR TRACKING NUMBER	RSO (NAME/SIGNATURE/DATE)	

FMSS RADIATION PROTECTION PROGRAM RADIOLOGICAL OCCURRENCE REPORTING	NO.: PP-8-1201-2 (12/2013)
	PAGE: 7 of 8

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**APPENDIX B
RESUMES AND TRAINING CERTIFICATES**

Chad T. Miller

Professional Qualifications

Mr. Miller has over eleven years of experience in multiple aspects of the environmental remediation and construction industry. His background includes extensive health and safety support, field management, and quality assurance for investigations and remediation projects under the Total Environmental Restoration Contract with the Baltimore and New York Districts of the U.S. Army Corps. of Engineers.

Currently, Mr. Miller is Health and Safety Manager on a Formerly Utilized Sites Remedial Action Program (FUSRAP) site located in Maywood, New Jersey. On this project, Mr. Miller performs safety inspections/audits, conducts daily safety briefings with site personnel, coordinates all aspects of Shaw's Health and Safety Procedures into daily site operations, and implement safety plans and specifications into daily activities to assure all contractual commitments, policies, and procedures are followed, and making corrective actions when necessary.

Throughout Mr. Miller's career in the environmental business, his resourcefulness, ideas, and approaches have enabled him to be an integral part of many successful projects, helping them to close safely on time and on budget.

Education

Bachelor of Arts, Geography, Millersville University, Millersville, Pennsylvania, 1995

Experience and Background

08/2006 - Present

Health and Safety Specialist III, Shaw Environmental & Infrastructure, Inc., Maywood, New Jersey, Shaw Environmental & Infrastructure, Inc., Federal EH&S, Maywood, New Jersey

Job Description: Responsibilities include providing health and safety support for client projects and office staff.

05/2002 - Present

Health and Safety Coordinator II, Shaw Environmental & Infrastructure, Inc., Mt. Arlington, New Jersey

Job Description: Responsibilities include providing health and safety support for client projects and office staff. Also responsible for quality assurance and quality control implementing plans and specifications for client projects.

The following is a summary of key projects:

Health and Safety Coordinator, Linde FUSRAP Site, 115871, USACE, Tonawanda, New York, \$129,700,000.00, 02/2006 - Present

Health and Safety Coordinator for the FUSRAP, Linde Site. The project, located within the Praxair Facility, in Tonawanda, NY, included engineering and construction necessary for remediation of more than 327,000 tons of low-level radioactive soil in and around the facility. Responsibilities include assisting management with implementing Shaw Safety Policies and Procedures into the daily activities.

Accomplishments:

Exceeded 2,500 days on the job without a lost time accident to date.

Health and Safety Coordinator, PPL, Martin's Creek Project, 117792, PPL, Martin's Creek, Pennsylvania, 12/2005 - 01/2006

Provided platform oversight and Health and Safety support for dive teams dredging and recapturing fly ash from the bottom of the Delaware River as part of the PPL, Martin's Creek Fly Ash Recovery effort.

Accomplishments:

Supported the successful Shaw team effort which restored the Delaware River bottom to its pre-spill state.

Health and Safety support, Hurricane Katrina Relief, FEMA, New Orleans, 10/2005 - 11/2005

Responsibilities included providing health and safety support for Hurricane Katrina relief during the FEMA Response effort in the Gulf Region.

Accomplishments:

Was part of a successful operation to get those displaced provided with temporary housing.



Shaw[®] Shaw Environmental & Infrastructure, Inc.

CERTIFICATE *of* COMPLETION

Presented To

Chad T. Miller

In Recognition of Having Successfully Completed the Prescribed Course of Study For

OSHA 30 Hour Construction Safety

OSHA Outreach Training Program for Construction Industry

I certify that the above trainee has completed this training course as given by Shaw E&I or one of its subsidiaries.

DON L. UNRUH, CIH, CSP
Manager, Internal Training Group

03/10/2005

EFFECTIVE DATE

Board of Certified Safety Professionals

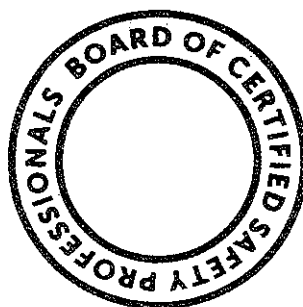
Upon the recommendation of the
Board of Certified Safety Professionals,
by virtue of the authority vested in it,
has conferred on

Chad T Miller

the credential of

Certified Safety Professional

and has granted the title as evidence of meeting the qualifications and passing
the required examination so long as this credential is not suspended or
revoked and is renewed annually and meets all recertification requirements.



June 14, 2012

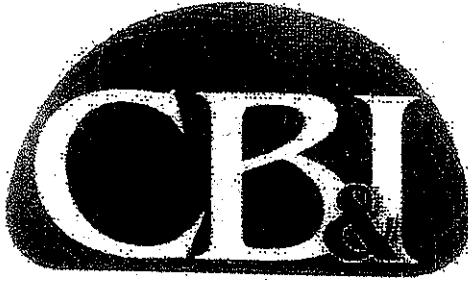
DATE ISSUED

23183

CERTIFICATION NUMBER

Carl W. Hub
BOARD PRESIDENT SIGNATURE

Monica H. D.
BOARD SECRETARY SIGNATURE



This certificate is awarded to

Chad Miller

for the successful completion of the course

Fall Hazard Recognition and Prevention

Hours: 4 Hours 0 Min Credits: 0

Completion Date: 5/23/2013

A handwritten signature in cursive script, appearing to read 'Virginia Barton', is written over a horizontal line.

Virginia Barton, Sr. Vice President
Quality, EHS, Regulatory Compliance,
Process Improvement



This certificate is awarded to

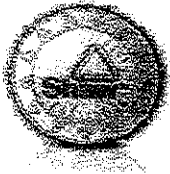
Chad Miller

for the successful completion of the course

8-Hour HAZWOPER Refresher

Hours: 8 Hours 0 Min Credits: 0

Completion Date: 1/29/2013



A handwritten signature in cursive script, reading 'Virgil L. Barton', is positioned above the printed name and title.

Virgil Barton, Sr. Vice President
Quality, EHS, Regulatory Compliance,
Process Improvement



Shaw[®] Shaw Environmental, Inc.
FUSRAP Maywood Superfund Site

Certificate of Training

Chad Miller

Has completed

Radiation Worker Training

February 27, 2013

Brian A. Miller

Radiation Safety Officer

American
Red Cross



This recognizes that
Chad Miller
has completed the requirements for
First Aid
conducted by
ARCNNJ Region
Date completed: *01/05/2012*
Valid for 2 year(s)

American
Red Cross



This recognizes that
Chad Miller
has completed the requirements for
CPR/AED-Adult
conducted by
ARCNNJ Region
Date completed: *01/05/2012*
Valid for 2 year(s)

redcross.org

Instructor's Signature

Jeffrey Fator

Chapter

ARC of Northern New Jersey Region

Holder's Signature

Chad Miller

Stock No. 656798

redcross.org

Instructor's Signature

Jeffrey Fator

Chapter

ARC of Northern New Jersey Region

Holder's Signature

Chad Miller

Stock No. 656798

Certificate of Completion

Chad T Miller
Shaw Group

Capital Safety hereby Certifies that the above named person has successfully completed the following training course based upon the fall protection requirements of OSHA, ANSI and CSA.

Competent Person Trainer - 5 Day 40 Hour

Jared Rossignol
Instructor

11/19/2010
Date

20006487
Serial #





CERTIFICATE OF COMPLETION

PRESENTED TO
Chad T. Miller

IN RECOGNITION OF HAVING SUCCESSFULLY COMPLETED

THE PRESCRIBED COURSE OF STUDY FOR
Hazardous Waste Supervisor
8 Hours

In compliance with 29 CFR 1910.120(e)(4)

September 11, 2000
Effective Date

Issued and Attested By 

1608-00-003



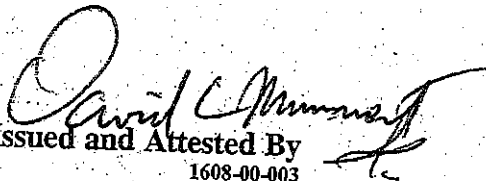
CERTIFICATE OF COMPLETION

PRESENTED TO
Chad T. Miller

IN RECOGNITION OF HAVING SUCCESSFULLY COMPLETED
THE PRESCRIBED COURSE OF STUDY FOR
Confined Space Entry Supervisor

In Compliance with 29 CFR 1910.146(g)

September 14, 2000
Effective Date


Issued and Attested By
1608-00-003



CERTIFICATE OF COMPLETION

PRESENTED TO
Chad T. Miller

IN RECOGNITION OF HAVING SUCCESSFULLY COMPLETED

THE PRESCRIBED COURSE OF STUDY FOR
Excavation Safety for the Competent Person
8 Hours

In compliance with OSHA 29 CFR 1926.65 (b)

September 13, 2000
Effective Date

Issued and Attested By

1608-00-053

Certificate of Completion

Chad Miller

has successfully completed all requirements of

**OSHA 1910.120
Hazardous Waste Operations and Emergency Response
40-Hour Training Course**

conducted by

Millersville University

December 1995



**Nicholas G. Patton, MS, CSP
Instructor**



EDMUND J. FORT

CONTRACTOR QUALITY CONTROL SYSTEMS MANAGER

Education

- Bachelor of Science, Liberal Arts/Management, Southern Vermont College, Bennington, Vermont, 2006 (Valedictorian)

Current Specialized Training

- USACE CQC, 2/28/2012
- 40-Hour OSHA HAZWOPER, 1987-current
- OSHA 8 Supervisor Safety Training
- OSHA Excavation Competent Person, 2004
- OSHA 10-Hour Construction Industry Safety
- OSHA 30-Hour Construction Industry Safety
- Site Safety Officer Training, (Shaw 2004)
- State of New York Department of Public Works, Protection of Underground Utilities, Albany, NY 2002
- Radiation Worker Training, Cabrera Services, 2007- Current
- Radiation Worker II, 2000 - Current

Summary of Experience

Mr. Fort is a Quality Control Systems Manager (CQCSM) with 28 years of experience in the remediation of contaminated sites and the mitigation of hazardous materials emergencies in the positions of Site Manager, Site Health and Safety Officer, and CQCSM . His current duties include monitoring site activities for compliance with project work plans, contract requirements, and applicable regulations through the implementation of the USACE's Three Phase Control System, the performance of site inspections, and materials and receipt inspections. Mr. Fort is also responsible for the generation of quality control report and the maintenance of project files.

As a Site Manager, Mr. Fort was also responsible for the generation and implementation of work plans, oversight of multidisciplinary personnel, monitoring site health and safety (H&S), reporting work progress, and client relations. His administrative capabilities included the outsourcing of goods and services, the review of bids and proposals, and financial oversight. Mr. Fort has directed work activities on a wide variety of projects including facility decontamination and demolitions (D&D); contaminated soil removal and stabilization; tank locating, cleaning, and removal; abandoned/buried drum and container sampling, handling and removal; hazardous materials sampling, bulking, packaging, and transportation and disposal (T&D); and the vacuum removal of dust and sludge. He has also acted as the designated site health and safety officer on many projects and has been an approved response manager in several U.S. Environmental Protection Agency (EPA) regions.



Key Projects

04/2011 – 07/2013

Contractor's Quality Control Systems Manager, North St. Louis County Vicinity Properties FUSRAP, USACE St. Louis District.

Monitored site activities for compliance with project work plans, contract requirements, and applicable regulations. Key duties included the implementation of the USACE's Three Phase Control System; inspection and testing of utilities installation and junction box construction (natural gas, steam, condensate, water compressed air, and oxygen service welds and connections); materials and receipt inspections; the generation of daily reports; and the maintenance of project files.

03/2010 – 04/2011

Contractor's Quality Control Systems Manager, North St. Louis County Vicinity Properties FUSRAP, USACE St. Louis District.

Monitored site activities for compliance with project work plans, contract requirements, and applicable regulations. Key duties included the implementation of the USACE's Three Phase Control System; performance of site inspections, materials, and receipt inspections; the generation of daily reports; and the maintenance of project files.

03/2010 – 10/2010

Site Health and Safety Manager, North St. Louis County Vicinity Properties FUSRAP, USACE St. Louis District.

Monitored site activities for compliance with the Site Safety and Health Plan, adherence to corporate health and safety policies and procedures, the USACE EM385-1-1, and applicable safety regulations. Duties as the SSHP were performed concurrently with the duties of the CQCSM between 03/2010 and 10/2010 on this project.

06/2009 – 09/2009 and 12/2009 – 03/2010

Contractor's Quality Control Systems Manager, Army Pulse Radiation Facility Decommissioning Project, Aberdeen Proving Grounds, Maryland, USACE Baltimore District.

Monitored site activities for compliance with project work plans, contract requirements, and applicable regulations. Key duties included the implementation of the USACE's Three Phase Control System; performance of site inspections, materials, and receipt inspections; the generation of daily reports; and the maintenance of project files.

09/2009 and 11/2009

CQCSM, CERCLA Removal Action, Safety Light Corporation Superfund Site, Bloomsburg PA, USACE Baltimore District

Monitored site activities for compliance with project work plans, contract requirements, and applicable regulations. Key duties included the implementation of the USACE's Three Phase Control System; performance of site inspections, materials, and receipt inspections; the generation of daily reports; and the maintenance of project files.



04/2008 – 06/2009

Site Health and Safety Manager, Cabrera Services, Inc., US Army/Lake City Army Ammunition Plant, Independence, Missouri

Mr. Fort acted as the Site's Health and Safety Officer and managed the waste stabilization process on this site. The contaminants and hazards of concern were depleted uranium, lead, and UXO items. Mr. Fort's general safety duties included but were not limited to employee and visitor training through site safety plan (SSHP) orientations, the generation and implementation of site specific JSAs, daily safety meetings, and site specific hazard communication orientations; air monitoring; hot work and excavation permitting; incident investigation; site inspections; total dust and personnel pump air sampling (for lead); and the electronic maintenance of the site's safety documents. As the site's sand stabilization oversight, Mr. Fort sampled treated sand, evaluated analytical results, tracked the status of waste piles, and controlled their movement and ultimate disposal. He also managed many of the site's basic administrative tasks (timesheets; expense reports; collection, scanning and transmission of delivery slips/receipts; etc.).

05/2007 – 04/2008

Cabrera Services, Inc., USACE, Painesville, Ohio

Mr. Fort provided technical assistance during the excavation and packing of soil impacted by various radiological contaminants. Duties included excavation oversight with laser level and the layout of polygons using predetermined coordinates and GPS units; soil packaging; water collection and filtration; tank cleaning; and health and safety oversight.

01/2006 – 12/2006

Lead Field Manager and Operations Manager, Shaw Environmental & Infrastructure, USCG, New Orleans and Southeastern Louisiana

Mr. Fort was responsible for the oversight of ten Construction Field Managers and their sub-contracted crews clearing commercial waterways throughout Southern Louisiana in the wake of hurricane Katrina. In this position a wide variety of duties were performed. These included waterway reconnaissance, working with vendors and the affected public to develop and implement innovative recovery plans in a dynamic environment, interface with the government client (US Coast Guard), liaison with local and state agencies, company representative at a weekly stakeholders meeting in Plaquemines Parish, and the review and audit of financial billing documents.

05/2002 – 12/2005

Project Superintendent, Shaw Environmental & Infrastructure, Inc., USACE Colonie FUSRAP, New York

Responsible for the generation and implementation of work plans, oversight of multidisciplinary personnel, monitoring site health and safety, reporting work progress, and client and union relations. Other duties include the outsourcing of goods and services and the review of bids and proposals. Specific site activities included dewatering, groundwater



treatment, the removal and stabilization of mixed wastes with an acid wash system, the management of soil piles, rail transportation of treated soils, backfilling, restoration, and site utility installation. The major contaminants of concern were U-238, Th-232, lead, copper, and arsenic.

01/2000 – 05/2002

Project Superintendent, IT Corporation (The Shaw Group, Inc. acquired substantially all of the operating assets

of The IT Group, Inc., on May 23, 2002), USACE FUSRAP, Colonie, New York

See above.

01/1997 – 01/2000

Project Superintendent/Response Manager, IT and OHM Corporation, US EPA, Hopkinton, Massachusetts

Worked as a Response Manager at various sites in EPA Regions I and II. Duties included the generation and implementation of work, safety, and sampling plans; client relations; the oversight of subcontractors; review of bids and proposals; and the review of financial billing documents. Specific project highlights include:

1999–Taunton MA: The removal, stabilization, and disposal of chromium containing tannery wastes from lagoons on a tidal river. Work activities included the excavation of sludge and soil; stabilization; transportation and disposal; soil sampling, control of dust, odors, and silt; and site restoration. Quantity of soil handled was 20,000 cubic yards.

1999–Beverly MA: Management and load out of 22,000 cubic yards of previously stabilized chromium containing wastes.

1999–Taunton MA: The installation of parking lot subgrade and curbing and the restoration at a previously remediated site.

1998–Gardner MA: Clean up and load out of debris from a large furniture warehouse after a fire at the facility.

1998–Bennington VT: Removal and disposal of 15,000 yards of soil contaminated with PCBs.

1998–Bars Mills ME: Oversight of the demolition of a large mill built over a hydro–electric dam on the Saco River.

1998–New Bedford MA: Installation of 4200 feet of six foot chain link fence topped by three strands of barb wire. The fencing was a continuation of a previous action to secure a former rail facility contaminated with PCBs and dioxins.

1998–New Rochelle NY: Disposal of several roll–offs containing PCB wastes and project demobilization.

1998–Rochester NY: Decontamination and partial interior demolition of a multi–unit residence contaminated with elemental mercury. This project involved intensive air sampling (both personal and area) and the removal and replacement of several building elements.

1997–North Haven CT: Vacuum removal of pesticide and herbicide dusts from a former



crushing facility. Over 30 yards of fine dust containing DDT, Dieldren, Silvex, and other compounds were removed. The entire three story building was gutted and all demolition debris and equipment disposed of as well. Work was performed entirely in level B with intensive personal and area air monitoring.

1997–Newtown CT: Installation of 2100 feet of eight foot high security fencing topped with three strands of barbed wire around a former aluminum smelting facility. Sampled, bulked, and disposed of many containers and drums left at this facility. Also removed spent pot-lining and alumina dusts with a vacuum truck.

1997–New Bedford Ma: Installation of the first phase of a six foot high security fence topped by three strands of barbed wire (4800 linear feet) around a former rail yard contaminated with PCBs and dioxin.

1997–Bridgeport CT: Sampling, bulking, and the disposal of the contents of approximately 500 drums, vats, and containers abandoned in a former plating facility. This work was performed entirely in level B.

09/1995 – 02/1997

Site Supervisor, OHM Corp., Plattsburg AFB, New York

Site Supervisor for a major tank and contaminated soil removal at Plattsburg AFB. Responsible for 5 crews involved in the excavation of contaminated soil, the removal of 153 underground and above ground storage tanks, oil/water separators, and septic systems throughout this former Air Force Base.

01/1995 – 09/1995

Supervisor, Tank Cleaning, Former Newport Naval Base, Middletown, RI, 01/1995 – 09/1995

Supervised the cleaning of nine 2.5 million gallon underground storage tanks (bunker oil).

05/1994 – 12/1994

Supervisor, Drum Removal, Norfolk Naval Base, Norfolk, VA

Managed the removal and sampling of buried drums, containers, and soil. Duties included the oversight of wetlands restoration subcontractor.

03/1994 – 04/1994

Supervisor, Diver Oversight, OxyChem, Tonawanda, NY

Oversaw subcontracted divers from a dive barge engaged in the hand dredging of dense, non-aqueous phase liquid (DNAPL) in the Niagara River.

01/1994 – 03/1994

Supervisor, Silt Removal, General Electric, Hudson Falls, NY

Supervised the final stages of the removal of polychlorinated biphenyl (PCB)-contaminated silt from abandoned raceways on the Hudson River.

11/1993 – 12/1993

Supervisor/Response Manager, Asbestos Collection and Staging, EPA, Stratford, CT



Supervised the collection and staging of asbestos and metals-containing wastes excavated at various locations in Stratford, CT. Primary duties included coordination of waste transportation among the sites, sampling, and soil packaging/staging.

03/1993 – 10/1993

Supervisor, Vacuum Recovery, Alcoa, Massena, NY

Project involved vacuum recovery (trailer-mounted units) of alumina and spent pot-lining dusts. Also cleaned and decommissioned dust collectors and process equipment.

06/1992 – 02/1993

Supervisor, Decontamination and Demolition (D&D) of a former resins manufacturing facility, Reichold

Chemical, Elizabeth, NJ

Performed stage two D&D of this former resins manufacturing facility (see 09/1989–06/1991).

03/1992 – 06/1992

Supervisor, Plating Facility D&D, Bennington, VT

Day shift supervisor for the D&D of a plating facility on the first floor of an operating factory. Project required intensive air handling to remove carbon monoxide (CO) while preventing the migration of lead-containing dusts. Tasks included asset tracking, controlled interior demolition, the vacuum removal of dusts, pressure washing, and the treatment of wash and dust suppression waters.

10/1991 – 03/1992

Supervisor, Lead Dust Removal, Boeing Helicopters, Philadelphia, PA

Supervised the night shift on a lead dust removal project. Work was conducted in the attic space between 120 and 135 feet above a live factory floor. Work activities included the vacuum removal of dusts (Vactor® trucks with manifold system) elaborate scaffold systems, safety nets, and the oversight of subcontracted scaffold carpenters and steel workers.

06/1991 – 09/1991

General Foreman, Cleanup of Former Toxic Substance Disposal Facility (TSDF), EPA, North Kingston, RI

Oversaw the collection, sampling, bulking, and disposal of over 5,000 drums and containers of various chemical wastes.

09/1989 – 06/1991

General Foreman, Decontamination and Demolition (D&D) of a former resins manufacturing facility, Reichold

Chemical, Elizabeth, NJ

Stage one of the D&D of this former resins manufacturing facility. Tasks included extensive tank cleaning (3,000–10,000 psi pressure washers/hot water washers, sand blasting, jackhammers), line draining and flushing, coldcutting, confined space entries, vacuum removal of wastewater, water treatment, and the oversight of asbestos removal and heavy demolition



subcontractors.

09/1988 – 09 1989

Foreman, Decontamination and Demolition (D&D) of a former pigments manufacturing facility, Glens Falls,

NY

Oversaw crews performing various tasks on the remediation of this site contaminated with heavy metals.

03/1988 – 10/1991

General Foreman, Foreman, Lead Recovery Technician

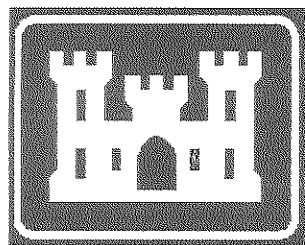
Various chemical emergencies in NJ, NY, and PA, Cleaned leaking drums in trailers, punctured and leaking railcars, oil spills on the land and water, abandoned drums, improperly disposed medical wastes, leaking pesticide drums at JFK airport, cyanide spill in a warehouse. Please note that these response dates overlapped with duties performed on fixed/planned projects. Clients included Conrail, Schenectady Chemical, the NJ DEP, Johnson and Johnson, American Standard, Hoechst Celanese, DuPont, UPS, and Exxon.

Foreman/Lead Recovery Technician, Various D&D Projects, Various Clients, East Windsor, NJ, 11/1985 –09/1988

Laborer and crew leader at various D&D projects and emergency responses in NY, NJ, and RI.

U.S. ARMY CORPS OF ENGINEERS

USACE LEARNING CENTER
HUNTSVILLE, ALABAMA



CERTIFICATE

E. Joseph Fort, Jr.

LRB-01-12-00010

has completed the Corps of Engineers and Naval Facility Engineering Command Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS - #784

Buffalo, NY

February 27-28, 2012

Buffalo District

Ryan Lenihan

Location

Training Date(s)

Instructional District/ NAVFAC

CQM-C Manager

Ryan Lenihan

ryan.c.lenihan@usace.army.mil

(716) 879-4397

Facilitator/Instructor

Email

Telephone

Facilitator/Instructor Signature

THIS CERTIFICATE EXPIRES FIVE YEARS FROM DATE OF ISSUE
CQM-C Recertification online course: <https://www.myuln.net>

Director, USACE Learning Center

Certificate of Completion

This certifies that

Edmund Fort

Has Successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance W/Federal OSHA Regulation 29 CFR 1910.120(e), (p) & (q)

And all State OSHA and EPA Regulations As Well

This course is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) issued by Safety Unlimited, Inc. (Accreditation # 044)

Julius P. Griggs

Julius P. Griggs
Instructor #892

130104527787

Certificate Number

1/4/2013

Issue Date



UNLIMITED, Inc.

OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley, CA 93063
888 309-SAFE (7233) or 805 306-8027 866-869-7097 (fax)
www.safetyunlimited.com

Proof of initial certification and subsequent refresher training is NOT required to take refresher training
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification



CERTIFICATE *of* COMPLETION

Presented To

Edmund J. Fort

In Recognition of Having Successfully Completed the Prescribed Course of Study for

HAZWOPER Equivalent Training

I certify that the above trainee has completed this training course as given by The IT Group or one of its subsidiaries.

03/01/1987

EFFECTIVE DATE

DON L. UNRUH, CIH, CSP
Manager, Internal Training Group



WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: Annual Exam
EXAM CLASSIFICATION: Periodic Examination

EMPLOYEE: Fort, Edmund J.
ID: 326
DATE OF EXAM: 09/24/2013
EXPIRATION DATE: 09/24/2014

COMPANY: Cabrera Services Inc.
POSITION: Quality Control Manager
LOCATION: Cabrera Services - East Hartford, CT
SITE:

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Does the employee have any limitations in the use of respirators in accordance with 29 CFR §1910.134?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

STATUS

- QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.
- QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:
- NOT QUALIFIED**
- DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS:

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Peter P. Greaney, M.D. Date: 09/30/13

Signature:



CABRERA SERVICES
RADIOLOGICAL • ENVIRONMENTAL • REMEDIATION

473 Silver Lane • East Hartford, CT 06118
Phone 860-569-0095 • Fax 860-569-0277
www.cabreraseservices.com

CERTIFICATE OF COMPLETION

This certificate is awarded to

JOE FORT
CABRERA SERVICES, INC.

*Who has successfully completed General Radiation Worker Training
in accordance with 10CFR19.12 and Cabrera Radiation Safety Procedure AP-009 "Training"
On May 7, 2013*

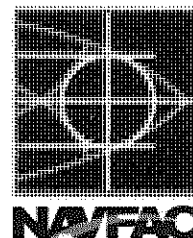
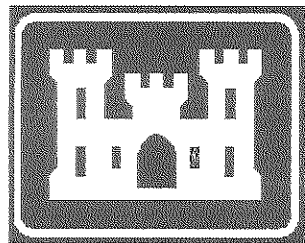
Cabrera Services, Inc.

Signature Paul H. Schwartz, MSPH, CIH, CSP
Corporate Health & Safety Manager

05/7/2013

U.S. ARMY CORPS OF ENGINEERS

USACE LEARNING CENTER
HUNTSVILLE, ALABAMA



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Director, USACE Learning Center



ROY RACINO

RADIATION SAFETY OFFICER

Education

- Bachelors of Arts, Sociology, 1978

Current Specialized Training

- NRRPT Certified
- IATA Certified
- DOT Certified
- Hazardous Materials Handling
- Hazardous Waste Management
- Radiation Worker II

Summary of Experience

Mr. Racino is a Radiation Safety Officer with over 21 years in radiation protection, personnel training, and radiation monitoring compliance.

Key Projects

02/2010 –2013

Senior Health Physicist , Linde FUSRAP Site Remediation, USACE Buffalo District.

Provided health physics support to Site RSO for radiological remediation of contaminated buildings, concrete pads, contaminated buildings, concrete pads, debris, and soils. Assisted in developing approach including terminating and relocating utilities, radiological assessment and removing a radiologically-contaminated underground utility tunnel, and evaluating radiological release of debris for offsite disposal in accordance with State regulations. Collected and evaluated site air data to prepare monthly air monitoring reports. Provided technical support for on-site gamma spectroscopy laboratory and counting instrumentation QC and operations. Performed independent review of dose and activity limit concentration derivations for Technical Data Packages for FSS of building surface survey units. Modified air monitoring database and reporting to more accurately determine occupational and public exposure from air sampling results and track for compliance with NESHAPS and USACE Tier 3 limits and ALARA.

12/20086– 03/2009

Radiation Safety Officer/Site Rad Lead, Safety Light Corporation Superfund Site, USACE Baltimore District

Executed a Rapid-Response project involving collecting, characterizing, re-packaging, and shipping high-radiation/high activity legacy wastes for storage in an offsite licensed facility and the subsequent demolition of 8 radiologically-contaminated site buildings and related T&D. Developed Radiation Protection Plan including strategy to control project exposures including containment, handling protocols, and exposure and airborne monitoring. Segregated, characterized, and stabilized high-rad wastes for continued storage onsite within a shielded enclosure. Monitored personnel exposure, and rotated staff to avoid



exposures. Conducted perimeter air monitoring to ensure public safety of nearby school. Modified inspection/dewatering/re-packaging protocols to achieve significant dose reduction for ALARA and mitigate potential safety hazards. Designed and constructed secure shielded facility for legacy high dose containers. Managed high dose activities at an active production facility to eliminate potential exposures to facility personnel and residences adjacent to the site boundaries.

04/20067- 06/2009

Senior Health Physicist/Project Manager, Painesville FUSRAP Site, USACE Buffalo District

Directed post-remedial MARSSIM FSS on a 30-acre former industrial site contaminated with uranium, thorium, and radium. Directed the design/implementation of additional site radiological characterization for previously unidentified areas of subsurface soils and process systems. Performed on-site lab O&M, air monitoring, and IDW management. Managed T&D for loading, manifesting, and transport of LLRW for offsite disposal. Prepared FSS Tech Data Packages for 30 survey units and the FSSR. Completed with zero safety incidents.

American
Red Cross



This recognizes that
Roy Racino
has completed the requirements for
Adult Pediatric First Aid/CPR/AED
conducted by
Mid-Hudson Valley Chapter
Date completed: **06/19/2013**
Valid for 2 year(s)

redcross.org

Instructor's Signature

Michael Roster

Chapter

PHSS Upstate NY Territory

Holder's Signature

Roy Racino

S70211

Stock No. 656798

American
Red Cross



This recognizes that
Roy Racino
has completed the requirements for
Adult Pediatric First Aid/CPR/AED
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Date completed: **06/19/2013**
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redcross.org

Instructor's Signature

Michael Roster

Chapter

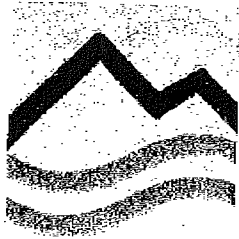
PHSS Upstate NY Territory

Holder's Signature

Roy Racino

S70211

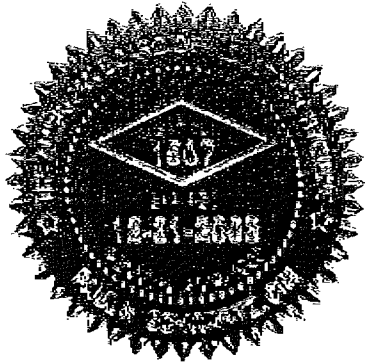
Stock No. 656798



CABRERA SERVICES, INC.

809 Main Street • East Hartford, CT 06108 • Phone 860-289-1885 • Fax 860-289-2261
www.cabreraseservices.com

CERTIFICATE OF COMPLETION



This certificate is awarded to

ROY RACINO
CABRERA SERVICES, INC.

*Who has successfully completed 40-Hour Hazardous Waste and Emergency Response Training
In compliance with 29 CFR 1910.120
Completed on March 13, 2002*

Cabrera Services, Inc.

Signature

Paul H. Schwartz, MSPH, CIH, CSP
Manager, Health and Safety

3/13/02



111 Maltese Drive
Middletown, NY 10940
Phone: (845) 342-4774 ext. 244
Fax: (845) 342-4385

MEDICAL CLEARANCE SUMMARY

ATTN: Paul Schwartz
Cabrera Services, Inc.
800 Main Street
East Hartford, CT 06108

Date: 05-02-13

Examinee: ROY RACINO

Exam No:

SSN:

Exam Date: 05-02-13

Employee ID: 138

Client: CABRERA SERVICES

Sex: male

STATUS VALID THRU

CLEARANCE

Per Hazardous Waste Operations and Emergency
Response Medical Requirements in accordance with
29 CFR 1910.120

Per Respirator Medical Evaluation Requirements in
Accordance with 29 CFR 1910.134

able to do light duty
per Dr. Guelcher -
see attached
D.C. Base

Sincerely,

AMANDA HANSEN, PA-R



CERTIFICATE OF COURSE COMPLETION

Roy R Racino

OSHA - 30 Hour Construction Industry Outreach Training Program

05/22/2009 10:27 CST

Student's Name

Course Title

Course Completion Date
MM / DD / YYYY

Certificate Number

Roy Racino
Student's Signature

30
Approved # of Hours

I hereby attest and certify that I personally took the above named safety lesson in accordance to Osha Campus guidelines. I further state that I have paid for the course and that I did not use another's work (Plagiarism). Students should retain certificates and refer to course instructions to receive official certification where necessary.

360training
Corporate Headquarters
13801 N. Mo-Pac, Suite 100
Austin, Texas 78727
tel: 888-360-8764
fax: 512-727-7683
email: support@360training.com



CABRERA SERVICES
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473 Silver Lane • East Hartford, CT 06118
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www.cabreraseservices.com

CERTIFICATE OF COMPLETION

This certificate is awarded to

ROY RACINO
CABRERA SERVICES, INC.

*Who has successfully completed General Radiation Worker Training
in accordance with 10CFR19.12 and Cabrera Radiation Safety Procedure AP-009 "Training"
On April 30, 2013*

Cabrera Services, Inc.

Signature Paul H. Schwartz, MSPH, CIH, CSP
Corporate Health & Safety Manager

04/30/2013

**APPENDIX C
APPLICABLE SAFETY PROCEDURES**



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

FOR

SAFE WORK STANDARDS

OP-511

Revision 1

Prepared by:

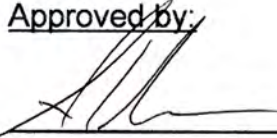


Sean Liddy, CSP
Occupational Health & Safety Manager

11-18-13

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

11/18/2013

Date

1.0 PURPOSE

This operating procedure (OP) demonstrates Cabrera Services Inc. (Cabrera) commitment to the establishment and maintenance of safe workplaces free from recognized hazards.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations.

3.0 DEFINITIONS

- 3.1 Safety Violation: Not following verbal or written safety policies, rules and /or safe operating procedures.
- 3.2 Safe Work Practices: The do's and don'ts in carrying out a task or using equipment, informing the worker about the hazards present and providing direction on how to safeguard against the hazard. Safe Work Practices are generally guidelines only.
- 3.3 Safe Job Procedures: Written step-by-step instructions for completing a specific task safely, including control measures and responding to emergency situations.
- 3.4 Discrepancy/Deficiency: An omission, a condition, or a situation that is in conflict with one or more procedures and/or one or more requirements of Cabrera's Health, Safety & Environmental (HS&E) standards.
- 3.5 Imminent Danger: An impending or threatening situation that, if left uncorrected, is likely to result in serious injury, property damage, or environmental impact.
- 3.6 Potentially Dangerous: Condition(s) that present a low potential for serious injury, property damage, or environmental impact. The condition(s) may or may not constitute a safety violation.
- 3.7 Stop Work Order: A directive to cease Cabrera-controlled work issued for failure to follow procedures, imminently dangerous situations/conditions, accumulation of safety violations, etc. The Stop Work Order will apply to Cabrera and its direct subcontractors placed at risk by those situations or conditions.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

4.1 Safe Operating Procedures

- 4.1.1 The specific safe work practices and procedures incorporated within the

Safety OP's (500 Series) have been developed in conjunction with employees and with input from those who have significant safety, health, and environmental experience.

- 4.1.2 Safe Operating Procedures have been developed to provide clear instruction regarding safe operations, documentation, and reporting requirements of staff as they pertain to a particular aspect of work.
- 4.2 Inspections and Audits - Senior Managers, Project Managers, and Supervisors shall conduct project audits and office inspections to evaluate safe work practices and potential safety violations.

5.0 EQUIPMENT

There is no equipment associated with this procedure.

6.0 RESPONSIBILITIES

- 6.1 All managers and supervisors - responsible for compliance with all SOP's and governmental requirements, and will be held responsible to prevent or bring any violations to the attention of the appropriate level of management for corrective actions as per Cabrera policies.
- 6.2 Senior Managers and Project Managers (Including field task managers, supervisors) - have overall responsibility for implementation of, and compliance with, this procedure.
- 6.3 Occupational Health & Safety (OH&S) Manager - provides guidance as to safe work standards, rules, requirements and guidelines.
- 6.4 Human Resource Manager - provides guidance and direction to managers and supervisors in implementing disciplinary procedures for safety violations (as defined in the Employee Handbook).
- 6.5 Employees - responsible for adhering to all Cabrera safe work standards, rules, requirements and instructions and to provide input, as appropriate.

Note: Any employee who wilfully disregards Cabrera or client safety standards, rules or requirements is subject to disciplinary action.

7.0 PROCEDURE

- 7.1 Rules for all Employees
- Work in a manner that will not put oneself, other personnel, equipment or facilities at risk.
 - Identify hazardous conditions and activities in the work environment consistent with the job and training.

- If a hazard cannot be eliminated, report it to the manager or supervisor promptly. If you fail to get resolution from on-site management, contact the OH&S Manager directly for assistance.
- Implement established control methods consistent with project procedures and/or training.
- Cooperate and comply with all Cabrera Policies and Safe Operating Procedures (OP 500 Series).
- Immediately report all acts of aggression, verbal or physical threats, assaults, sexual or other harassment to your supervisor or manager.
- Complete all safety training required for your job function or tasks.
- Follow appropriate dress codes and don prescribed PPE where necessary.
- Use or wear all personal protective equipment (PPE) devices or clothing required in accordance with manufacturers' instructions and training and/or procedures.
- Do not perform any work task or activity which you believe is unsafe. Inform your supervisor immediately.
- Immediately report all incidents (including near misses), injuries, property damage, spills, hazards, safety concerns and safety violations to your supervisor.
- Report all observed unsafe acts, conditions, or behaviors that compromise the safety of Cabrera employees, its clients, subcontractors, general contractors, or the public to your supervisor.
- Keep all personal work areas clean from debris and free of other hazards, including potential slip, trip and fall conditions.
- Operate all vehicles and mobile equipment in accordance with applicable regulations and accepted safe work practices.
- Do not use or operate any equipment, machine or device that may endanger you or another worker.
- Do not remove, damage, disable or make ineffective any protective safety, fire-fighting or first aid equipment or devices.
- Use only vehicles, equipment and tools that are in safe operating condition and maintained in accordance with manufacturer's specifications.
- Report, remove from service, or have repaired, any tool or equipment that is damaged, not working properly or may otherwise be hazardous if used.
- Complete all required safety equipment checklists as part of a pre-operational inspection process, prior to using equipment.
- Do not use any hand-held wireless device(s) (i.e. cell phones) while driving

a vehicle or performing other safety critical tasks such as, but not limited to, working near traffic or working with power tools.

- When travelling, working alone or working away from the office, particularly in remote areas, follow applicable call-in procedures.
- Firearms are prohibited on company property and project sites unless expressed permission is provided by management for the use in wildlife protection.
- Do not smoke in areas designated as “NO SMOKING”. Cabrera facilities are considered non-smoking environments.
- Do not use, sell or distribute, be under the influence, or have in your possession any controlled substances, drugs, or alcohol while performing work duties.

7.2 Project or Field Work

- Always report to the site supervisor before performing work on site to determine specific requirements for the site or project.
- Follow all safety requirements, including that of a client or prime contractor, as applicable.
- Use only designated project entrances, parking areas and facilities.
- Show or produce evidence of identification or required training if requested to gain entry to, or while on, a project.
- Obey all warning signs (e.g., “Do Not Enter,” “Eye, Hearing or Respiratory Protection Required,” “Permit Required Confined Space,” “Authorized Personnel Only”).
- Do not block, deface or remove any signage, barricade or fencing without approval.
- Keep passageways and work areas clean and free of debris and other non-needed materials such as hoses, cords, and other potential tripping hazards. Items that are not in use should be staged in a low activity area.
- Verify with the Project Manager that all required permits are in place prior to commencing work.
- Be aware of your surroundings, the work going on around and/or above you including contractor activities and the movement of motorized vehicles and equipment.
- Do not work alone when performing high risk or remote work; use the buddy system for safety when possible.
- Personal cameras, video recorders, and other photographic equipment shall not be permitted on site without the Project Manager and client’s

approval. Cell phones will not be used to take photographs or videos without approval for the client and project manager.

- Plan work tasks before beginning work and consider any hazards that may exist and how to avoid them through safe work practices or safe work procedures.

7.3 Stop Work Authority

It is Cabrera's policy and firm commitment that employees are expected to stop their work to prevent unacceptable exposure to workplace hazards, including unsafe conditions or worker behaviors, without fear of reprimand or reprisal.

Cases involving reprisal, reprimand, or any attempt to discourage the initiation of Stop Work Orders or reporting of unsafe or unhealthy conditions or situations within Cabrera should be immediately reported to the employee's Manager, Human Resources Representative, and OH&S Manager.

7.3.1 Authority

Cabrera's stop work authority applies to all work controlled by Cabrera, its employees, and Cabrera-controlled subcontractor work activities. All Cabrera personnel are authorized to stop work in the event of an identified unsafe condition. If the responsible organization fails to provide resolution, or if at any time their acts or failure to act cause substantial harm or imminent danger to the health and safety of project employees, the public, or the environment, Cabrera may issue an order stopping work in whole or in part. In the event that Cabrera issues a Stop Work Order, an order issued by Cabrera authorizing the resumption of work must be in place prior to restarting work.

In most cases, a Stop Work Order affects only those areas immediately involved in the hazardous or unsafe situation. Cabrera may issue a Stop Work Order for a portion of the work area(s) or for an entire work area when unacceptable risks exist that cannot be mitigated by reasonable engineering controls, administrative actions, or PPE. The Stop Work Order will remain in effect until the responsible organization resolves the problem(s) and brings the work area(s) to satisfactory conformance with established HS&E requirements. Work will not resume until appropriate corrective actions have been completed, ensuring that the condition has been rectified. The Stop Work Order will apply to Cabrera and its direct subcontractors placed at risk by the situations or conditions.

7.3.2 Identification of Stop Work Situations

Imminent Danger Situations

- Upon becoming aware of an imminently dangerous situation that Cabrera does not control, the employee should immediately inform the persons or entities in control of such imminently dangerous activities and his or her project manager about the situation. If the activities pertain to work that is controlled by Cabrera, then the employee may stop the work upon discovering an imminently dangerous situation and then immediately notify his project manager, who may determine the appropriate further action to be taken (including the issuance of a formal Stop Work Order).
- “Stopping work” for Cabrera-controlled work includes stabilizing an imminent danger situation to the extent that it can be left unattended for a prolonged period of time until the issue is resolved.
- The person requesting the work stoppage will notify the organization responsible for the work.
- The responsible organization will notify project/office management immediately of any stop work action(s) taken to rectify the situation.
- Failure to comply with any Stop Work Order in whole or in part may result in disciplinary action. A subcontractor employee’s failure to comply with any Stop Work Order may result in immediate removal from the project and/or office location.

Potentially Dangerous Situations

- Informal stop work interventions to correct minor conditions (e.g., to remind workers to put on their hard hats, safety glasses, etc.) do not require formal notification.
- If the minor condition cannot be corrected, a formal Stop Work Order must be issued and work must not be resumed until the situation has been eliminated.

Management-issued Stop Work Orders

Senior Management, Project Managers and/or the OH&S Manager may issue a formal Stop Work Order for Cabrera-controlled work in the following situations:

- Imminent danger exists involving the public or employee’s safety and health or damage to the environment, facilities, or property.
- Continuing work or equipment usage will result in significant repair, rework, or removal.

- A project, or any segment of the project, is executed improperly or is out of compliance with applicable regulations or standards.

7.3.3 Resuming Work

Work associated with the affected area or operation will not resume unless all corrective actions identified in the applicable Stop Work Order have been completed and closed.

All personnel affected by the Stop Work Order will be instructed on the corrective actions and preventative measures taken.

8.0 REFERENCES

None.

9.0 REQUIRED RECORDS

The completed Stop Work Order and any corrective action reports generated will be maintained at the project site for the duration of the project and placed in the closed project file.

10.0 ATTACHMENTS

Attachment A – Stop Work Order

Attachment A
Stop Work Order

OP 511 - Safe Work Standards



STOP WORK ORDER

This form must be completed if any of the following Criteria are met:

1. Imminent danger exists involving the public or employees' safety and health, the environment, facilities, or property.
2. Continuing work or equipment usage will result in significant repair, rework, or removal.
3. There is a discrepancy, deficiency, or potentially dangerous condition or act that is likely to cause an unsafe or unhealthy situation or an imminent danger situation.

***** All Stop Work Orders will be sent to the OH&S Manager for Review*****

Project Name:			
Project Manager:		Project #:	
Reported by:		Date/Time:	

Stop Work Order is the result of the following:

Inspection/Audit <input type="checkbox"/>	Environmental Impairment <input type="checkbox"/>	Injury/Incident <input type="checkbox"/>
Unsafe Condition <input type="checkbox"/>	Unsafe Behavior/Act <input type="checkbox"/>	Improper Scope of Work <input type="checkbox"/>
Other <input type="checkbox"/>		

Stop Work Order (Describe):

Return to Work

The above Stop Work Order issues/concerns have been corrected and documented. By signing below, I certify that the above Stop Work Order scenario has been corrected and work is safe to resume.

Title	Print Name	Signature
Individual/party issuing Stop Work Order:		
Project Manager:		
Sub-Contractor Supervisor (if applicable):		
OH&S Manager:		



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

FOR

**INCIDENT, NEAR MISS & OBSERVATION
REPORTING**

OP-512

Revision 1

Prepared by:



Sean Liddy, CSP
Occupational Health & Safety Manager

11-18-13

Date

Approved by:



Alan Solow
Chief Executive Officer

11/18/2013

Date

1.0 PURPOSE

To document and report all Health Safety & Environmental (HS&E) incidents in a timely and accurate manner, allowing Cabrera Services Inc. (Cabrera) to gather appropriate lessons learned from incidents and ensure that information for regulatory reports is generated and/or filed, as required for compliance.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations.

3.0 DEFINITIONS

3.1 Health Safety & Environmental (HS&E) Incidents - The following events or situations, as applied to Cabrera employees and/or Cabrera-controlled operations, are considered HS&E Incidents:

- Any injury to or illness (including pain and soreness) of an employee, that could be potentially work related or become aggravated by the work environment. This includes Cabrera subcontractors, temporary employees or third party contractors, performing work under the control of a Cabrera operation.
- Fire, explosion, or flash that is not an intended result of a remediation process, laboratory procedure, or other planned event.
- Any accidents involving company-owned, rented, or leased vehicles (including personal vehicles used for company business).
- Any failure to obtain a government permit or consent when required (including failure to obtain revisions before an existing permit or consent expires).
- Any breach of a numeric limit attached to a governmental permit or consent.
- Any failure to perform the obligations of a non-numeric requirement contained in a government permit or consent.
- Any notice of violation or notice of non-compliance received from a regulatory authority with enforcement powers.
- Property damage resulting from any Cabrera or subcontractor activity.
- Unexpected release or imminent release of a hazardous material.
- Unexpected chemical exposures to workers or the public.

- A safety, health or environmental complaint from the public regarding Cabrera activities that could result in adverse public media interest concerning Cabrera.
- Any inspection by a federal, provincial, or local safety, health, & environmental enforcement agency conducted for reasons of enforcement.

3.2 Serious HS&E Incident - Any HS&E Incident that meets/involves the following:

- Any amputation.
- Hospitalization for treatment (admission).
- Absence from work for more than 30 calendar days due to a work-related injury or illness.
- Any single event resulting in more than one employee requiring medical treatment.
- Any Health & Safety or environmental-related Consent Agreement/Order/Lawsuit or enforcement action seeking more than \$10,000 in damages or alleging criminal activity.
- Any spill or release of a hazardous material that is reportable to a government agency.
- Any Notices of Violation.

3.3 Near-Miss Incidents - Defined as an incident having the potential to cause injury, health effects, environmental impairment, or property damage as described in the above categories – but did not. For example:

- A crane drops its load during a lift – and nobody is hurt, no equipment is damaged.
- During a drilling operation, preclearance of the borehole reveals a previously unmarked underground utility line.
- Employee involved in motor vehicle incident in which there is no injury or damage to vehicle, or others.
- Unsafe condition that could have caused an incident if not corrected.

3.4 Observation – Observations are Near Misses that originate from a third party in which Cabrera is not directly contracted (Client or subcontractor relationship) or are conditions/behaviors observed by employees regarding safety. Observations may be positive (noting proactive measures/controls) or constructive (areas in

need of improvement) in nature. These are referred to as At-Risk Conditions or At-Risk Behaviors.

If an employee observes others working in an unsafe condition, it is the responsibility of the employee to temporarily Stop Work and discuss the situation with the affected parties. Unsafe behaviors or conditions should be discussed in a constructive manner and corrective actions implemented before work resumes. Examples of Observations are as follows:

- Cabrera employee observes and Incident or Near Miss of a third party contractor at a project site.
- Awareness of an equipment recall or incident that occurs at another similar worksite.
- Cabrera employee observes co-worker or subcontractor reviewing AHA prior to initiating new task (Positive Observation).
- Cabrera employee observes co-worker or subcontractor initiating proactive safety measures to prevent potential harm to personnel or environment (Positive Observation).
- Cabrera employee observes co-worker or subcontractor performing work in unsafe manner (At-Risk Condition or At-Risk Behavior) where there is perceived potential harm to employees, by-standards, or environment (Constructive Observation).

- 3.5 Lesson Learned - A learning experience originating from an Incident or near-miss that the affected group (i.e. project team, office staff, etc.) believes could have wide-ranging impacts throughout the organization.
- 3.6 Fatality – For the purposes of this procedure, the loss of life of any Cabrera employee, subcontractor personnel, client personnel or member of the general public that can be perceived to be related to work performed or controlled by Cabrera.
- 3.7 General Liability - Incidents where Cabrera could potentially be held financially responsible or legally accountable for damages as a result of an incident.
- 3.8 First Aid - Specific medical treatment defined to include the following:
- Using nonprescription medication at nonprescription strength.
 - Administering tetanus immunizations.
 - Cleaning, flushing or soaking wounds on the surface of the skin.

- Providing wound coverings such as bandages, Band-Aids™, gauze pads, etc.; or using butterfly bandages or Steri-Strips™.
- Administering hot or cold therapy.
- Providing any non-rigid means of support, such as elastic bandages, wraps, non-rigid back belts, etc.
- Temporary immobilization while transporting an accident victim (e.g., splints, slings, neck collars, back boards, etc.).
- Drilling of a fingernail or toenail to relieve pressure, or draining fluid from a blister.
- Providing eye patches.
- Removing foreign bodies from the eye using only irrigation or a cotton swab.
- Providing finger guards.
- Removing splinters or foreign material from areas other than the eye by irrigation, tweezers, cotton swabs or other simple means.
- Administering massages.
- Drinking of fluids for cooling or re-hydration.

3.9 Recordable Injury - Medical treatment beyond First Aid.

3.10 Lost Time Days - The total number of days the injured person accumulates before returning back to regular duties.

3.11 Lost Time Injury or Disease - A work-related injury or disease that has caused a worker to be absent from his or her regular work following the day that the injury or awareness of the disease occurred.

3.12 Restricted (Modified) Work - When an injury is medically treated, but the person is not able to return to regular duties, restricted duties are assigned based on the limitations of the injured person's ability to perform them (documentation may be required per regulatory requirements).

3.13 Restricted Work Days - The total number of work days the injured person accumulates before being able to return to regular duties.

3.14 Incident Report - Form used to document incidents. The form must be completed within 24 hours after an incident.

3.15 WC Carrier - Workers Compensation Insurance Carrier.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

- 4.1 All incidents, regardless of type or severity, shall be reported to the on-site supervisor immediately.
- 4.2 All incidents, regardless of type or severity, shall be reported to the OH&S Manager, by the supervisor, as soon as possible but no later than the end of the current work shift.
- 4.3 Completed Incident Reports shall be submitted to the OH&S Manager within 24 hours.
- 4.4 Fatalities and serious HS&E incidents shall be reported to the OH&S Manager as soon as reasonably possible but no more than two hours after the incident.
- 4.5 Where there is potential for criminal, civil or regulatory action against Cabrera or any of its employees or subcontractors, Senior Management shall be contacted prior to any external communication, correspondence, or meeting concerning any incident, governmental investigation, or environment impact.

5.0 EQUIPMENT

There is no equipment associated with this procedure.

6.0 RESPONSIBILITIES

6.1 Employees - Each employee involved in an HS&E incident will:

- Notify his/her supervisor immediately that an incident (including a near-miss) has occurred, the circumstances involved, the nature and extent of the injuries/illness, and whether medical treatment may be required.
- Except for emergency situations, affected employees are required to discuss their injury/illness status with their supervisor and OH&S Manager or Site Safety and Health Officer (SSHO) prior to obtaining medical treatment.
- Assist supervisor in completing appropriate reporting and investigation forms. If issues are raised regarding the content prepared in the Incident Report, contact the OH&S Manager for guidance.

6.2 Supervisors - In an incident involving an employee, supervisors will:

- Use the appropriate local emergency phone numbers listed in the site

specific safety and health plan and seek immediate medical care for the employee.

- Address any immediate corrective actions needed. Consult with the OH&S Manager if guidance is required.
- Call the OH&S Manager as soon as the situation is stabilized, but not later than the end of the current work shift.
- Complete the applicable forms (Cabrera Incident Report and applicable project/client specific forms) and email to appropriate Senior Manager (Director Level) and OH&S Manager within 24 hours of the incident.
- Notify the appropriate lead manager (i.e., manager responsible for personnel involved).
- As appropriate, initiate an Incident Investigation and Review per the requirements of OP-514, Incident Investigation and Review.
- Completion of any external reporting requirements (e.g., U.S. Coast Guard CG-3865 or EM 3394).
- Report all fatalities and/or serious HS&E incidents to the appropriate Senior Manager and OH&S Manager, as soon as reasonably possible, but no more than 2 hours after the incident.

6.3 Occupational Health & Safety (OH&S) Manager

- Coordinate with the appropriate staff for completion of an Incident Report.
- Upon notification of an incident, contact the supervisor to discuss the incident as well as short-term and long-term corrective actions.
- Engage the Cabrera Corporate Medical Provider for non-urgent medical guidance, if needed.
- Notify appropriate Senior Manager of the incident as soon as reasonably possible, but no more than two hours after the incident.
- As appropriate, initiate or assist an Incident Investigation and Review.

6.4 Incident Reporting Support Staff (e.g., Site Safety & Health Officer)

- Assist Supervisor to inform appropriate personnel that have not already been notified of incidents.

- Coordinate with OH&S Manager, or designee, for management of medical support.

7.0 PROCEDURE

Note: The following procedure is outlined in Attachment A, Incident Reporting Flowchart.

7.1 Initial Incident Response:

- Take control of the scene (get everyone's attention and cooperation).
- Provide first aid and/or call for emergency services.
- Control secondary incidents (e.g., ensure hazards are removed or controlled; issue a stop work order, if required).
- Identify and preserve evidence. In the event of a critical injury, the incident scene must be preserved for the potential site visit of a representative from the applicable government agency (**Note:** if you are unsure, err on the side of caution and leave the site intact).
- Report the incident to the immediate supervisor for implementing stop work orders or immediate corrective action, as required.
- The Supervisor calls the OH&S Manager to initiate internal reporting and obtain guidance, as necessary. If a manager or supervisor is not available, any Cabrera employee can make the call.
- The Supervisor completes the applicable reporting forms.

7.2 Fatality or Serious Health Safety & Environmental (HS&E) Incident Notification:

Any fatality or serious HS&E incident is to be directly reported as soon as practical (i.e., as soon as the site is secure and appropriate local emergency response is coordinated), but in no case more than two hours after the incident, to the OH&S Manager, and the appropriate Senior Manager (Director Level) as soon as reasonably possible, but no more than two hours after the incident.

Note: Voicemails and/or emails alone are not adequate to meet this requirement.

7.3 Hazardous Material Spill/Release, Permit Condition Notification:

Any HS&E incident involving release of a hazardous material/substance or

breach of a numeric or non-numeric permit/consent limit is to be reported using a direct communication method (face-to-face or phone call) as soon as possible, but not later than the end of the work-shift, to the OH&S Manager and appropriate Senior Manager (Director Level). Responsibility for this reporting belongs to the cognizant Program/Project manager.

7.4 Internal Reporting Procedures:

- The call (from the scene of the incident, if possible) to the OH&S Manager initiates the reporting procedures.
- For observations or near miss, a Near Miss/Observation Report needs to be completed within 24 hours and forwarded to the OH&S Manager.
- The employee involved in an incident shall complete the Incident Report with their supervisor within 24 hours following the incident.
- If the employee is unable to complete the report because of the severity of the injuries, the supervisor, in conjunction with another employee who witnessed the incident, should complete the report.
- If the employee is not comfortable submitting the report to their immediate supervisor or manager, they are encouraged to submit it to the OH&S Manager directly.

The Supervisor will contact the OH&S Manager to:

- Confirm that on-site corrective actions were implemented.
- Determine the need for HR involvement (for medical aid incidents, WC reporting, and modified work cases).
- Determine the need for review by Senior Management (Director Level or above).
- Identify and complete any other external reporting requirements (client specific), and;

The OH&S Manager must:

- Initiate an internal or external investigation of the incident, as necessary (Senior Management may request/oversee an external investigation).
- Review and sign the Incident Report. If no investigation is required, identify corrective actions that can be implemented within the Occupational Health & Safety Management System (OHSMS) (e.g., safe work practices, equipment, training, safety bulletins, policies or procedures) to safeguard against a recurrence of the incident.

7.5 External Reporting Procedures:

The manager signing the Incident Report, in conjunction with the OH&S Manager, will determine what (if any) external reporting obligations must be met. For example:

- Client Specific – HS&E requirements will vary for different clients and, therefore, client reporting will be handled on an individual basis by the manager(s) involved.
- Worker's Compensation – Human Resources (HR) will be responsible for working with the appropriate manager if the employee is off work for any length of time, if a modified work routine will be created for the individual, or if there are any long-term implications from the accident.

State requirements vary for different types of incidents. The OH&S Manager, in conjunction with the WC carrier, will ensure that appropriate State reporting has been completed, as applicable.

- For property damage with possible liability to the company, reporting will be completed and sent to the general liability insurance carrier.
- Fatalities or hospitalization of three or more employees must be called into the Occupational Safety & Health Administration (OSHA) within eight hours.

State or Its OH&S Governing Agency:

Reporting requirements, for an employer (Cabrera or representative) to the state (or its labor governing body), may vary slightly between jurisdictions throughout North America. Therefore, the following instructions can only be used as rough guidelines for determining whether or not a call should be made to the governing body:

- If a fatality or permanent injury is incurred;
- If the accident/incident involved a major structural failure or collapse of a building, bridge, tower, crane, hoist, temporary construction support system or excavation; or
- If the accident/incident involved the release of a hazardous substance above the Reportable Quantity.

Environmental Governing Agency:

Reporting requirements may vary between jurisdictions when an employer (Cabrera management/representative) reports to the jurisdictional governing body for chemical releases, damage to the environment or spill reporting.

Therefore, you must refer to the applicable jurisdictional legislation for the *de minimus* quantities to report based on the type of product spilled or released.

8.0 REFERENCES

None.

9.0 REQUIRED RECORDS

Incident Reports and supporting documentation are maintained in a secure file by the OH&S Manager and project staff.

The completed report and supporting documents relating to occupational injury and accidents must be retained for up to 30 years, depending on the classification of incident.

10.0 ATTACHMENTS

Attachment A – Incident Reporting Flowchart

Attachment B – Incident Report


Attachment C - Near Miss/Observation Report


Attachment A
Incident Reporting Flowchart

Incident Reporting Flowchart



Attachment B
Incident Report

<h1>OP 512 - INCIDENT REPORT</h1>		 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>	
<p>1. EMPLOYEE MUST REPORT ALL INCIDENTS TO THEIR SUPERVISOR <u>IMMEDIATELY</u>.</p> <p>2. REPORT THE INCIDENT TO THE APPROPRIATE SENIOR MANAGER AND OH&S MANAGER WITHIN 2 HOURS.</p> <p>3. COMPLETE FORM AND SUBMIT WITHIN ONE 24 HOURS FOLLOWING THE OCCURRENCE OF THE INCIDENT.</p>			
I. LOCATION INFORMATION			
INCIDENT ADDRESS/LOCATION:		DATE:	
		TIME:	
CLIENT NAME:		PROJECT NAME:	
SUPERVISOR (FIELD):		REPORT COMPLETED BY:	
II. DESCRIPTION OF INCIDENT			
TYPE OF OCCURRENCE: <input type="checkbox"/> INJURY/ILLNESS (SEC III) <input type="checkbox"/> MOTOR VEHICLE INCIDENT (COMPLETE SUPPLEMENT) <input type="checkbox"/> PROPERTY DAMAGE (SEC IV)			
<input type="checkbox"/> ENV DAMAGE/SPILL (SEC IV) <input type="checkbox"/> REGULATORY INSPECTION/NOV/CITATION (SEC V)			
<input type="checkbox"/> OTHER BE SPECIFIC			
DESCRIPTION OF EVENT: WHAT, WHEN, WHERE, WHY, HOW? ATTACHED NOTES/DIAGRAMS AS REQUIRED AND LIST ANY MACHINERY OR EQUIPMENT INVOLVED			
WERE THERE ANY WITNESSES OR OTHER PERSONS INVOLVED: <input type="checkbox"/> Yes <input type="checkbox"/> No			
IF YES, PLEASE PROVIDE NAMES AND CONTACT INFORMATION			
III. PERSONAL INJURY (COMPLETE FOR INJURY/ILLNESS ONLY)			
EMPLOYEE NAME:		EMPLOYEE NUMBER:	
WORK PHONE:		CELL PHONE:	
EMPLOYEE STATUS <input type="checkbox"/> FULL TIME <input type="checkbox"/> PART TIME <input type="checkbox"/> TEMP AGENCY <input type="checkbox"/> SUBCONTRACTOR <input type="checkbox"/> THIRD PARTY		HOME OFFICE ADDRESS:	
JOB TITLE/HIRE DATE:		Date Reported to Supervisor:	
TYPE OF INJURY: <input type="checkbox"/> FIRST AID (TREATED ON-SITE) <input type="checkbox"/> MEDICAL AID (TREATED BY PROFESSIONAL) <input type="checkbox"/> FATALITY			
DESCRIBE THE INJURY AND BODY PART AFFECTED: <i>BE SPECIFIC (I.E. RIGHT HAND, INDEX FINGER, BELOW FIRST JOINT)</i>			
WAS A DOCTOR OR HOSPITAL VISITED? <input type="checkbox"/> Yes <input type="checkbox"/> No		IF YES, WHEN:	
FIRST AID/MEDICAL TREATMENT RECEIVED:		FIRST AIDER/DOCTOR/HOSPITAL NAME:	
PROVIDER ADDRESS:		PHONE NUMBER:	

<h1>OP 512 - INCIDENT REPORT</h1>		 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>
IV. PROPERTY DAMAGE OR ENVIRONMENTAL RELEASE		
TYPE OF DAMAGE: <input type="checkbox"/> Cabrera PROPERTY <input type="checkbox"/> SUBCONTRACTOR PROPERTY <input type="checkbox"/> MAJOR STRUCTURAL FAILURE <input type="checkbox"/> MOTOR VEHICLE (REFER TO MVI SUPPLEMENT FOR GREATER DETAIL) <input type="checkbox"/> ENVIRONMENTAL RELEASE <input type="checkbox"/> OTHER:		
DESCRIBE THE SPECIFIC DAMAGE: RANK THE SEVERITY OF THE DAMAGE: <input type="checkbox"/> MINOR <input type="checkbox"/> SERIOUS <input type="checkbox"/> MAJOR		
WHERE CAN THE PROPERTY BE SEEN?		
PROPERTY OWNER NAME:		CONTACT INFORMATION:
IS THERE ANY POTENTIAL FOR CIVIL, CRIMINAL OR REGULATORY LIABILITY AGAINST Cabrera? <input type="checkbox"/> Yes <input type="checkbox"/> No <small>IF YES, DISCUSS WITH SENIOR MANAGEMENT AND OH&S MANAGER.</small>		
INDICATE WHO HAS BEEN NOTIFIED OF THE EVENT (E.G., OWNER/OPERATOR, STATE (US) OR GOVERNING BODY OF LABOUR, ETC?)		
V. REGULATORY INSPECTION/NOV/CITATION		
TYPE OF EVENT: <input type="checkbox"/> INSPECTION <input type="checkbox"/> NOV <input type="checkbox"/> CITATION		
DESCRIBE EVENT: <i>BE SPECIFIC</i>		
FINDINGS NOTED AT SITE <input type="checkbox"/> Yes <input type="checkbox"/> No		IF YES, WHAT:
NAME OF REGULATORY AGENCY		FOLLOW UP SCHEDULED:
CONTACT PERSON:		PHONE NUMBER:
VI. REVIEW AND ACCEPTANCE		
EMPLOYEE COMMENTS:		
EMPLOYEE NAME AND PHONE		SIGNATURE AND DATE
SUPERVISOR COMMENTS:		
SUPERVISOR NAME AND PHONE		SIGNATURE AND DATE
MANAGER COMMENTS:		
MANAGER NAME AND PHONE		SIGNATURE AND DATE
FOR OH&S MANAGER USE ONLY:		
NAME AND SIGNATURE:		DATE:
RECORDABILITY DETERMINATION <input type="checkbox"/> FIRST AID <input type="checkbox"/> RECORDABLE <input type="checkbox"/> RECORDABILITY UNDETERMINED <input type="checkbox"/> NON WORK <input type="checkbox"/> PROPERTY DAMAGE <input type="checkbox"/> GENERAL LIABILITY <input type="checkbox"/> VANDALISM		
COMMENTS:		

OP 512 - INCIDENT REPORT**MOTOR VEHICLE INCIDENT (MVI) SUPPLEMENT**

REMEMBER: STAY CALM. TAKE PICTURES OF INCIDENT SCENE (LICENSE PLATE, DAMAGES, ETC)
Do not admit liability, agree to pay for any damage or sign any document except as required by law.

ADMINISTRATIVE

VEHICLE TYPE: <input type="checkbox"/> FLEET <input type="checkbox"/> RENTAL <input type="checkbox"/> PERSONAL	JOB ACTIVITY AT TIME OF MVI:
DATE OF MVI: TIME OF MVI:	LOCATION OF MVI:
MANAGER:	NUMBER OF VEHICLES INVOLVED:

DRIVER INFORMATION

DRIVER:	PASSENGERS:	PASSENGERS:
DRIVER'S LICENSE:	STATE ISSUED:	EXPIRATION DATE:
INJURIES TO DRIVER:		
INJURIES TO PASSENGERS:		

VEHICLE INFORMATION

YEAR:	MAKE:	MODEL:
SERIAL/VIN #:	LICENSE PLATE #:	REGISTRATION #:
OWNER:	INSURANCE COMPANY:	POLICY #:
COMMERCIAL MOTOR VEHICLE : IF RENTED OR PERSONAL, CONTACT INFORMATION OF OWNER:		
RANK THE SEVERITY OF THE DAMAGE TO THE VEHICLE: <input type="checkbox"/> 0 - \$500 <input type="checkbox"/> \$500 - \$1000 <input type="checkbox"/> \$1000 - \$4000 <input type="checkbox"/> >\$4000		

DESCRIPTION OF DAMAGE TO THE BODY OF THE VEHICLE:

OTHER DRIVER/VEHICLE INFORMATION

YEAR:	MAKE:	MODEL:
SERIAL/VIN #	LICENSE PLATE #:	REGISTRATION #:
DRIVER'S NAME:	CONTACT INFO:	LICENSE #:
OWNER:	INSURANCE COMPANY:	POLICY #:

IF RENTED OR PERSONAL, CONTACT INFORMATION OF OWNER:

DESCRIPTION OF DAMAGE TO THE BODY OF THE OTHER VEHICLE:

INCIDENT DESCRIPTION

EXACT LOCATION OF MVI (HIGHWAY, INTERSECTION, EXACT ADDRESS, ETC.)?

OTHER PROPERTY DAMAGED:


DESCRIBE THE EVENTS LEADING UP TO AND THE INCIDENT (REPORT FACTS ONLY: SPEED OF VEHICLES, DIRECTION TRAVELLING, WEATHER CONDITIONS, ETC. DO NOT GIVE OPINIONS REGARDING CAUSE OF INCIDENT OR LOSS.):

DID THE POLICE ATTEND THE SCENE: Yes No CITATION ISSUED: Yes No To WHO:

POLICE :	CONTACT INFO:
----------	---------------

SUBMIT THIS MVI SUPPLEMENT WITH A COMPLETED INCIDENT REPORT TO THE APPROPRIATE MANAGER

Attachment C
Near Miss/Observation Report

<h1>OP 512 - Near Miss/Observation Report</h1>		 CABRERA SERVICES RADIOLOGICAL · ENGINEERING · REMEDIATION
Use this form to report Near Misses and Observation (Field or Office) Identification of such assists in development of proactive approaches to avoiding potential future incidents.		
LOCATION INFORMATION		
REPORT COMPLETED BY:		SUPERVISOR:
ADDRESS/LOCATION:		DATE:
		TIME:
CLIENT NAME:		PROJECT NAME:
DESCRIPTION OF NEAR MISS OR OBSERVATION		
DESCRIPTION OF EVENT:		
NEAR MISS POTENTIAL OUTCOME: <input type="checkbox"/> INJURY/ILLNESS <input type="checkbox"/> PROPERTY DAMAGE <input type="checkbox"/> ENV DAMAGE/SPILL <input type="checkbox"/> REGULATORY INSPECTION/NOV/CITATION <input type="checkbox"/> OTHER BE SPECIFIC		
POTENTIAL SEVERITY: <input type="checkbox"/> MINOR <input type="checkbox"/> SERIOUS <input type="checkbox"/> FATAL		
OBSERVATION TYPE: <input type="checkbox"/> POSITIVE <input type="checkbox"/> AT RISK CONDITION <input type="checkbox"/> AT RISK BEHAVIOUR <input type="checkbox"/> OTHER		
POTENTIAL CAUSES		
IMMEDIATE CAUSES: <input type="checkbox"/> PROCEDURES NOT FOLLOWED <input type="checkbox"/> USE OF TOOLS OR EQUIPMENT & VEHICLES <input type="checkbox"/> USE OF PROTECTIVE MEASURES <input type="checkbox"/> PROTECTIVE SYSTEMS <input type="checkbox"/> ENVIRONMENT/LAYOUT <input type="checkbox"/> INATTENTION/LACK OF AWARENESS <input type="checkbox"/> WORK EXPOSURE TO		
SYSTEM CAUSES: <input type="checkbox"/> WORK RULES/PROCEDURES <input type="checkbox"/> TOOLS AND EQUIPMENT <input type="checkbox"/> WORK PLANNING <input type="checkbox"/> ENGINEERING/DESIGN <input type="checkbox"/> PURCHASING, MATERIAL HANDLING/CONTROLS <input type="checkbox"/> CONTRACTOR SELECTION <input type="checkbox"/> PHYSICAL CAPACITY/CONDITION <input type="checkbox"/> MENTAL STATE <input type="checkbox"/> SKILL LEVEL <input type="checkbox"/> TRAINING/KNOWLEDGE <input type="checkbox"/> MGMT/SUPER/EMPLOYEE LEADERSHIP <input type="checkbox"/> COMMUNICATION <input type="checkbox"/> OTHER		
CORRECTIVE ACTION(S)		
WERE CORRECTIVE ACTIONS IMMEDIATELY IMPLEMENTED? <input type="checkbox"/> Yes <input type="checkbox"/> No		
CORRECTIVE ACTION: <input type="checkbox"/> CHANGE IN PROCEDURE <input type="checkbox"/> NEW STOP WORK TRIGGER IDENTIFIED <input type="checkbox"/> NEW TOOL/EQUIPMENT <input type="checkbox"/> DIFFERENT/NEW PPE <input type="checkbox"/> IMPROVED PLANNING <input type="checkbox"/> IMPROVED HOUSEKEEPING <input type="checkbox"/> ADDITIONAL/PROPER PERSONNEL <input type="checkbox"/> ADDITIONAL TRAINING/SKILLS <input type="checkbox"/> MODIFIED WORK BEHAVIOUR <input type="checkbox"/> OTHER		
ARE LONG-TERM CORRECTIVE ACTIONS REQUIRED? <input type="checkbox"/> Yes <input type="checkbox"/> No		
DESCRIBE:		
FOR OH&S MANAGER USE ONLY:		
ADDITIONAL CORRECTIVE ACTIONS (IF NECESSARY):		
CONFIRMATION: <input type="checkbox"/> REPORTING EMPLOYEE <input type="checkbox"/> SUPERVISOR AND/OR MANAGER		
NAME AND SIGNATURE:		DATE:



CABRERA SERVICES
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OPERATING PROCEDURE

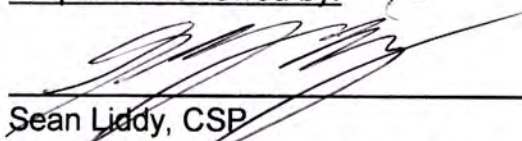
FOR

INCIDENT INVESTIGATIONS

OP-513

Revision 1

Prepared/Reviewed by:



Sean Liddy, CSP
Occupational Health & Safety Manager

11-18-13
Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

11/18/2013
Date

1.0 PURPOSE

This operating procedure (OP) establishes the processes to ensure a consistent approach for the internal investigation and reporting of Health, Safety & Environmental (HS&E) incidents.

This includes that a thorough Root Cause Analyses is performed on the incident and that outcomes of those analyses are acted upon in a timely fashion to prevent any reoccurrences. Furthermore, it ensures that Lessons Learned regarding HS&E incidents are developed and that information regarding such is shared throughout the organization.

2.0 APPLICABILITY

This procedure applies to all HS&E incidents that involve a Cabrera employee and/or HS&E incidents that involve operations/entities under the direct control of Cabrera.

3.0 DEFINITIONS

3.1 Lead Investigator - Manager responsible for the incident investigation, as established in Section 7.2.

3.2 Low/ High Potential - 'First Aid', 'Medically Treated Injuries', 'Modified Work' or 'Lost Time Injury' can often have the potential to be a 'Fatality' or 'Significant Injury' with disability if the circumstances would have been slightly different. For example, a 'Lost Time' incident due to a soft tissue injury would only be counted as a 'Lost Time' with 'Low Potential' for a 'Serious Injury', whereas a 'First Aid Incident' involving a remotely operated machine striking a worker and imparting a small cut would be counted as a 'First Aid Incident' with 'High Potential' for a 'Fatality' or 'Significant Injury'.

Any injury having the potential to be a 'Fatality' or 'Significant Injury' if the circumstances had been slightly different, must be counted as 'High Potential'; all others must be counted as 'Low Potential'.

When the exposure, probability and consequence of the hazard(s) creating the incident calculate to a High or Extreme Risk level, the incident must be counted as a High Potential; all others must be counted as Low Potential.

3.3 HS&E Incidents - A work-related event which is potentially harmful or damaging, and may cause personal injury, environmental impact, or loss, may impact the reputation of Cabrera or its clients resulting in an investigation by a regulatory agency or insurer.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

When Cabrera is required by contract to investigate and report findings related to HS&E incidents, the procedure to be followed must be detailed in the project plan and approved by the Occupational Health & Safety (OH&S) Manager and Cabrera Project Manager. Note - The basic requirements of this procedure must be satisfied, in addition to any client and/or contractual requirements, when the incident involves a Cabrera employee or other personnel under the direct control of Cabrera.

5.0 EQUIPMENT

There is no equipment associated with this procedure.

6.0 RESPONSIBILITIES

6.1 Project Managers & Supervisors - are responsible to:

Lead/participate in the formal Incident Investigation process as required by this procedure. Managers should consult with the appropriate Cabrera Senior Management before conducting any formal investigation of a serious HS&E incident or engaging in any discussion outside of Cabrera.

Schedule and conduct Incident Review calls as required.

6.2 Senior Managers - are responsible for the following:

Lead/Participate in formal Incident Investigation as required.

6.3 Occupational Health & Safety (OH&S) Manager - is responsible for the following:

Provide training on incident investigation techniques and tools to selected investigation teams.

Initiate an investigation for all Severity Level 3 and higher incidents as defined herein (Section 7.1) by contacting the responsible Lead Investigator (LI) and establishing the investigative team and deadlines.

Participate on investigation teams and Incident Review Calls.

Track and report on the status of all action items identified within final Incident Investigation Reports.

Keep/track final Incident Investigation Report for inclusion in permanent incident files.

6.4 Employees - involved in an HS&E incident must assist supervisor in

completing/ conducting appropriate incident investigations.

7.0 PROCEDURE

Step 1: Determine the need for an investigation – Section 7.1.

Step 2: Select appropriate investigation team – Section 7.2.

Step 3: Collect appropriate background information and facts surrounding the incident – Complete Attachment A, Incident Investigation Information Collection Guidelines.

Step 4: Complete Attachment B – Incident Investigation Categories Guidelines.

Step 5: When necessary, schedule and conduct Incident Review Call

Step 6: Complete Incident Investigation report – Attachment C

Step 7: When necessary, develop and complete Corrective Actions based on investigation findings and develop and distribute appropriate lessons learned for release throughout the organization.

7.1 Determining Need for Investigation

Below is a description of the different severity levels assigned to incidents, and the recommended incident investigation management response. Severity criteria are presented in the table below.

Severity Level 1 - An incident investigation should be considered and should be:

- Managed at site (office or project) by work group, and
- Involve the OH&S Manager for consultation.

Severity Level 2 - An incident investigation is required and should be:

- Managed at site (office or project) by work group
- Involve appropriate Senior Management (Director Level) for review and confirmation of findings and recommended corrective/preventative actions.
- Involve OH&S Manager for consultation and assistance in conducting the investigation and developing recommended corrective/preventative actions.

Severity Level 3 - An incident investigation is mandatory and must be:

- Managed by the Senior Management
- OH&S Manager must be involved in consultation and review.

High Potential incidents - Any incident deemed to be High Potential must be investigated regardless of the actual outcome. Senior Management must also be informed.

When determining whether an Incident should be investigated, please refer to the table below:

Note: Set out in the table below are the minimum requirements to be carried out for particular types of incidents. Investigations can be initiated by Senior Management to a stricter standard where required.

Severity Level		Health & Safety	Environment	Regulatory Notice	Commercial/ Brand Exposure	Near Miss
Actual Outcome	Potential Outcome					
1	LOW	First Aid Injury only	No environmental damage Environmental hazard identified Minor on site release of pollutant (non-reportable to gov't agency) that immediately remediated with no impact to the environment	Observation	Reputation loss from local staff No disruption to contract	Could have resulted in any Actual or Potential Severity Level 2.
		Medical Treatment and Other Cabrera Recordable Injuries/Illnesses Restricted Time Injury Lost Time Injury < 30 days	Onsite release of pollutant (non-reportable to gov't agency) that is immediately contained and remediated AND does not migrate offsite to land or waterways.	Observation Warning	Reputation loss from local staff Disruption to contract	Could have resulted in any Actual or Potential Severity Level 3.
3	HIGH	Cabrera Serious HS&E Incident Regulatory reportable incident	Onsite or offsite release of pollutant that causes land or water contamination requiring more than day of event remediation. Onsite or offsite release of pollutant that is reportable to a government agency	Fine Violation Corrective Action	Reputation loss to client Local or national media attention	Could have resulted in any Actual or Potential Severity Level 3.

7.2 Investigation Team Selection - An incident investigation can be triggered for any incident with the agreement from the relevant Senior Manager and OH&S Manager. The following points below dictate the composition of the investigation teams' dependent on the severity of the incident.

Severity Level 1 and Severity Level 2 Investigations (Actual or Potential) – Investigations shall be coordinated by the Project Manager (field-related incidents) and/or responsible supervisor/department manager (office-related incidents). The OH&S Manager shall provide technical assistance and support as requested. Investigations shall be conducted in accordance with Section 7.3. At the discretion of the responsible manager, recommended team members include:

- Project/Program Manager;
- Senior Manager (Director Level);
- OH&S Manager; and
- Subject matter experts.

Note: Incident review calls for all Severity Level 1 Incidents are at the discretion of the responsible project/office management and OH&S Manager. Review calls for Severity Level 2 Incidents are required.

Severity Level 3 (Actual or Potential) - Investigations shall be coordinated by the responsible Senior Manager and involve the Project Manager (field-related incidents) and/or responsible supervisor/department manager (office-related incidents). The OH&S Manager and appropriate subject matter experts shall provide technical assistance and support as requested by the Senior Manager.

Investigations must be performed under the direction of Senior Management and in compliance with the communication protocol presented in Section 7.5. Procedures for the investigation are outlined in Section 7.3

An investigation review teleconference call shall be held for any Fatality or Serious HS&E Incident. The purpose of the call will be to review the preliminary investigation report.

The investigation review conference call will be arranged by the appropriate Senior Manager. Timing for the call is no later than 10 calendar days following classification of the incident as a Fatality or Serious Incident by the OH&S Manager.

Required participants for the call will include:

- Lead Senior Management (CEO, COO, or designee);

- Legal Counsel;
- Responsible Supervisor or PM of the injured/involved employee;
- OH&S Manager and
- Other participants may include, at the discretion of the lead Senior Manager:
 - Relevant subject matter experts; or
 - Other relevant Cabrera employees, or board members.

Following the investigation review teleconference call, the lead Senior Manager, under the direction of legal counsel (retained), shall issue a final Investigation Report to the Cabrera Board of Directors, and OH&S Manager.

Corrective actions identified by the investigation process must be formally tracked to closure by the OH&S Manager.

7.3 Investigation Team Procedures – All Investigations

The team will follow an appropriate investigation technique (as agreed to by the lead investigator and OH&S Manager) to determine the following:

- Sequence of events leading up to the incident and steps followed immediately after the incident that may have had an impact on the final outcome.
- Identification of the People (Person), Environment, Tools/Equipment, and other factors involved in the incident; including evaluation of pertinent documents.
- Determination of direct cause(s) and root cause(s) using techniques agreed to by the lead investigator and OH&S Manager. (Note: Example root cause investigation tools include “5 Why’s”, TapRoot, Fishbone Diagram, etc.).

The Investigation Team will prepare a preliminary report, signed by the lead investigator, documenting all findings and recommended corrective actions within 10 calendar days following the incident unless otherwise agreed by the lead investigator and OH&S Manager. All Severity Level 3 communications and reports shall be prepared at the direction of legal counsel (retained) and shall be marked “Attorney Client Privileged Communication”.

The report format for all incidents will follow the sample template provided within this procedure.

Note: *Incident Review Calls* are designed to summarize the preliminary investigation findings and come to agreement on contributing factors, root causes and appropriate corrective actions. Direct participation by the employee(s) involved in the incident is not necessary and requires prior approval from the Senior Manager assigned to the incident review committee. Other members of the incident review committee will be at the discretion of the most Senior Manager involved in the investigation team.

7.4 Communication of Investigation Results

All written investigation reports (including drafts) must first be reviewed by Senior Management and the OH&S Manager.

Where appropriate based on the type, severity and/or scope of the incident, a formal "Safety Alert" should be prepared by the lead investigator and OH&S Manager. The Alert will include a brief description of the incident, root causes, and corrective actions, and be communicated to the most appropriate audience (i.e., field, office, all).

Action items and corrective actions identified by the investigation teams will be tracked to completion by the responsible OH&S Manager. Additionally, the results will be utilized by the OH&S Manager to develop appropriate alerts and/or reports and to improve existing procedures.

Where required by local legislation and/or regulation or contract requirements, final incident investigation reports shall be provided to the Safety & Quality Council for information, and dissemination.

7.5 Communication protocol about a Severity Level 3 incident

It is important that communication within Cabrera be carefully managed following a Severity Level 3 incident.

It is preferable for any initial communications (i.e., communication which occurs within the first hour after an incident occurring) from Cabrera employees, or contractor or subcontractor personnel to be conducted by telephone, with Senior Managers on the line to avoid confusion and unnecessary documentation. If you witness a serious incident, you should contact your project manager or direct supervisor by telephone immediately. The direct supervisor will then notify the OH&S Manager, or if not available, the appropriate Senior Manager (Director Level).

In some cases, it will be appropriate for a Severity Level 3 incident response and investigation to be carried out under legal professional privilege. This will occur where Cabrera contemplates actual or anticipated legal proceedings arising from an incident and is seeking legal advice on its position. Where an investigation is conducted under legal professional privilege, it is important to

ensure that all communication is also copied to the identified Cabrera Senior Manager and is marked "Attorney-Client Work-Product Privilege".

Before creating any written documentation relating to a Severity Level 3 incident, Cabrera employees should contact the Cabrera Project Manager (PM) or Direct Supervisor to ascertain how communication should be handled in relation to that particular incident.

Cabrera employees should also be aware that all written communication (including emails) and documents created as a result of the incident can be obtained by State and government agencies, such as Occupational Health & Safety Administration (OSHA), Environmental Protection Agency (EPA), Department of Transportation (DOT), etc. as well as the client and injured third parties and used to form part of an investigation into the incident. For this reason, Cabrera employees should always record factual information only and avoid speculation as to the cause of an incident in any documentation. Verbal communication related to the incident should also be restricted to those persons who have a role related to the investigation and limited to the identification of facts, not speculation as to fault.

8.0 REFERENCES

- OP 512, Incident Reporting

9.0 REQUIRED RECORDS

Incident Reports and supporting documentation are maintained in a secure file by the OH&S Manager and project staff.

The completed report and supporting documents relating to occupational injury and accidents must be retained for up to 30 years, depending on the classification of incident.

10.0 ATTACHMENTS

Attachment A – Incident Investigation Information Collection Guidelines

Attachment B – Incident Investigation Categories Guidelines

Attachment C – Incident Investigation Report

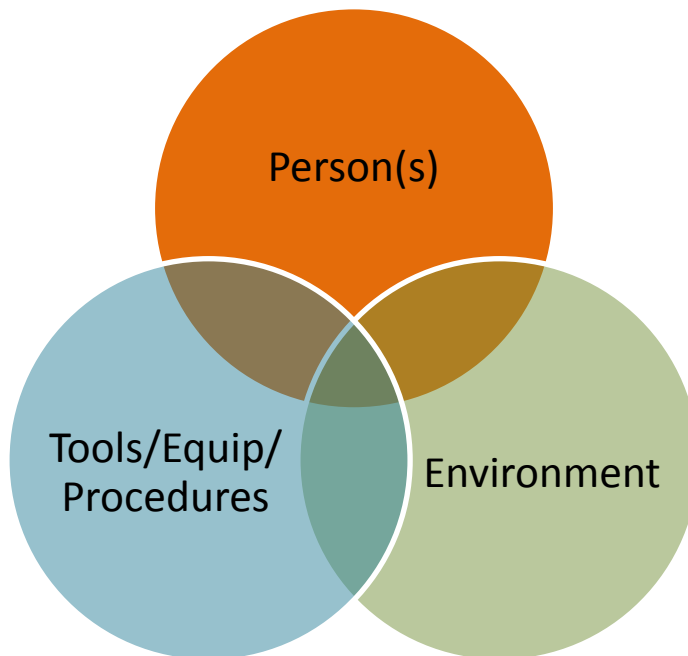
Attachment A
Incident Investigation
Information Collection Guidelines



Incident Investigation Information Collection Guidelines

- Determine Investigation Team (i.e., those to be involved in conducting the investigation).
- Gather documentation/information as soon as possible to avoid 'decay' of information.
- Interview appropriate personnel to confirm event FACTS and reveal causal factors.
- Prepare a timeline to ensure EXACT event details understood.

Focus on relationship between the person(s), the work environment, and the tools/equipment/procedures that led to occurrence of the incident.



Incident Investigation Information Collection Guidelines

Use the prompt boxes below to ensure information is collected from all available sources

Person(s)	Review personnel records (work history, training, time sheets, medical etc.) as required. Try to identify all the people who might have information about the event and get statements from them as soon as possible. Interview people individually away from distractions. If possible interview them at the scene of the Event to confirm at the scene information.	
Ask Interviewees:	<ul style="list-style-type: none"> Fully describe work and conditions leading up to the Event. Fully describe the Event sequence – start to finish. Note anything unusual observed prior to Event (sights, sounds, etc.). What was your role in the Event sequence? What conditions influenced the Event (weather, time, equip, etc.) How did people influence the Event (actions, emergency response, etc.) What do you think caused the Event? How do you think the Event could have been prevented? List other possible witnesses. Any additional comments/observations 	Determine: <ul style="list-style-type: none"> Were those involved in the Event experienced in the task? Had they been adequately trained? Are they physically capable of conducting the task? What was the status of their health? Was fatigue a factor? Were they under stress or time pressures (work or personal)?

Environment	Examine the scene of the Event for information and to help understand the nature of the task being conducted and the local environmental conditions. The physical environments, especially sudden changes to that environment, are factors that need to be identified. The situation at the time of the Event is important, not the "usual" conditions. Management holds the legal responsibility for the safety of the workplace and the workforce. The role of supervisors and management must always be considered as environmental factors in an Event investigation.	
Determine:	<ul style="list-style-type: none"> What were the weather conditions? Was housekeeping a problem? Was it too hot or too cold? Was noise a problem? Was there adequate light? Were toxic or hazardous gases, dusts, or fumes present? 	<ul style="list-style-type: none"> Who had the responsibility for control over the site? Were safety rules communicated /understood by all employees? Were they being enforced? Was there adequate supervision? Had hazards been previously identified? Were unsafe conditions corrected? Was regular maintenance of equipment carried out? Were regular safety inspections carried out? Any changes to equipment, environment, people or procedures.

Tools, Equipment, Procedures	Examine equipment involved in the Event looking at the condition of tools/equipment, anything that may have changed or be out of the ordinary (e.g., abnormal stress, modifications, substitutions, distortions, fractures, etc.). Identify any design flaws, mismatched components or confusing labelling or marking. Ensure that the equipment was appropriate for the task.	
	Review the task that was being conducted. Examine work procedures, scheduling of the work to see whether they contributed to the Event. Examine the availability, suitability, use and supervisory requirements of procedures.	
Determine:	<ul style="list-style-type: none"> Was there an equipment failure? What caused it to fail? Was the machinery poorly designed? Were hazardous substances involved? Were they clearly identified? Was a less hazardous substance possible and available? Was the raw material substandard in some way? Should personal protective equipment (PPE) have been used? Was the PPE used? Were the appropriate tools and materials available? Were they used? Was lockout used when necessary? Were safety devices working properly? 	<ul style="list-style-type: none"> Was a safe work procedure used? Was the procedure followed? Were written procedures available? Was an AHA conducted as part of the planning prior to the task? Was the AHA reviewed by the appropriate persons? Had conditions changed to make the normal procedure unsafe? Was a STOP WORK invoked? Had procedures been developed to overcome previously identified hazards?

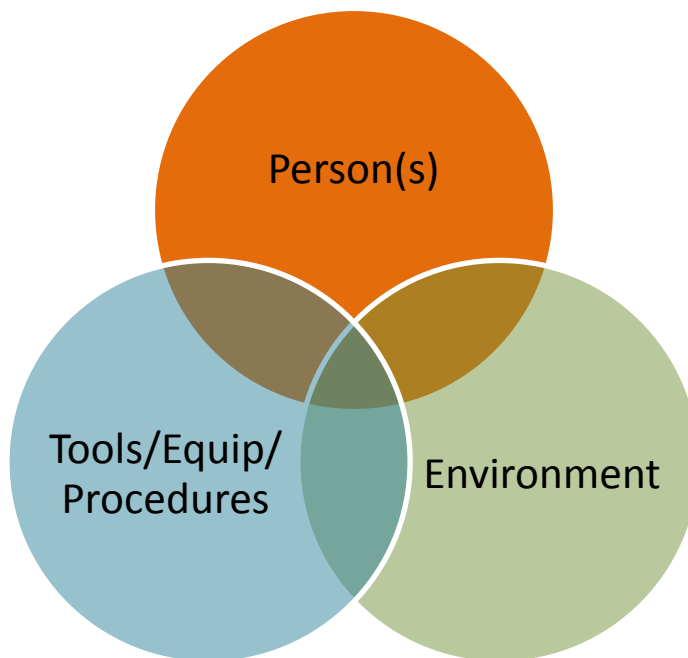
Attachment B
Incident Investigation
Categories Guidelines



Incident Investigation Categories Guidelines

- Determine what 'defenses' failed to prevent the event from occurring.
- Determine what 'human', 'conditional' and 'task' factors contributed to the incident.
- Determine what PROCESS (Systems) can be improved to prevent recurrence.
- Team to devise CORRECTIVE ACTIONS.
- Initiate CORRECTIVE and PREVENTATIVE ACTIONS.

Focus on relationship between the person(s), the work environment, and the tools/equipment/procedures that led to occurrence of the incident.



Incident Investigation Categories Guidelines

- 1) Check off conditions below that were related to this event.
- 2) Copy each condition into Part B of the Incident Investigation Report.

ABSENT / FAILED DEFENSES			
Defenses are those factors that are designed to detect and protect the overall system from the results of human or technical failures, that is, they are the "last minute" protection measures designed to avoid or mitigate an outcome. Identify the Defense factors that allowed the outcome to occur.			
Check question: Does the item describe the equipment, work process, control measure, detection system, procedure or attribute which normally prevents this Event or limits the consequences?			
Questions:	Event Facts: (Tick One)	Questions:	Event Facts: (Tick One)
<u>DF01</u> Protection systems?	<input type="checkbox"/> Absent/Failed <input type="checkbox"/> Not Applicable	<u>DF05</u> PPE?	<input type="checkbox"/> Absent/Failed <input type="checkbox"/> Not Applicable
<u>DF02</u> Warning systems?	<input type="checkbox"/> Absent/Failed <input type="checkbox"/> Not Applicable	<u>DF06</u> Safety Device Ops?	<input type="checkbox"/> Absent/Failed <input type="checkbox"/> Not Applicable
<u>DF03</u> Guards or barriers?	<input type="checkbox"/> Absent/Failed <input type="checkbox"/> Not Applicable	<u>DF07</u> Other?	<input type="checkbox"/> Absent/Failed <input type="checkbox"/> Not Applicable
<u>DF04</u> Escape systems?	<input type="checkbox"/> Absent/Failed <input type="checkbox"/> Not Applicable		

INDIVIDUAL / TEAM ACTIONS			
Identify the individual/team actions that contributed to or caused the Event. These are the errors or violations that led directly to the Event. They are typically associated with personnel having direct contact with the equipment, such as operators or maintenance personnel. They are always committed 'actively' (someone did or didn't do something) and have a direct relation with the Event.			
Check question: Does the item tell you about a potential error or violation of a standard or procedure made in the presence of or contributing to a hazard?			
Questions:	Event Facts: (Tick One)	Questions:	Event Facts: (Tick One)
<u>IT01</u> Supervision?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A	<u>IT07</u> Horseplay?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A
<u>IT02</u> Operating Authority?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A	<u>IT08</u> Materials Handling?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A
<u>IT03</u> Operating speed?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A	<u>IT09</u> Hazard Recog. Perception?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A
<u>IT04</u> Equipment use?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A	<u>IT10</u> Risk Management	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A
<u>IT05</u> PPE Use?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A	<u>IT11</u> Other	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A
<u>IT06</u> Procedural Compliance?	<input type="checkbox"/> Error/Violation <input type="checkbox"/> N/A		

TASK / ENVIRONMENTAL CONDITIONS

Identify the Task/Environmental conditions that contributed to the Event. These are the conditions in existence immediately prior to, or at the time of the Event. These are the conditions that directly influence human and equipment performance in the workplace. These are the circumstances under which the errors and violations took place and can be embedded in task demands, the work environment, individual capabilities and human factors.

Check question: Does this item describe something about the task demands, work environment, individual capabilities or human factors that promoted errors / violations or undermined the effectiveness of system's Defenses?

Questions:		Event Facts: (Tick One)		Questions:		Event Facts: (Tick One)	
HF01	Complacency/Attitude/Motiv'n	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW01	Changed Conditions	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF02	Drugs/Alcohol Influence	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW02	Work Procedures	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF03	Fatigue	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW03	Permit to Work (Avail/Suit.)	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF04	Time/Production Pressures	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW04	Routine/Non-routine Task	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF05	Peer Pressure	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW05	Tools/Equipment/Materials	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF06	Physical/Mental Capability	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW06	Training	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF07	Physical/Mental Stress	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW07	Housekeeping	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF08	Distraction/ Pre-occupation	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW08	Weather Conditions	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF09	Competency/Experience./Skill	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW09	Congestion, Access	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF10	Inadequate communications	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW10	Surface Gradient/Conditions	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF11	Tolerance of Violations	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW11	Lighting	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF12	Change of Routine	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW12	Temperature	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF13	Other Human Factor	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW13	Noise	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A
HF14	Task Planning/ Preparation	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A	TW14	Gas, Dust, Chemical or Fumes	<input type="checkbox"/> Contributor	<input type="checkbox"/> N/A


ORGANIZATIONAL / SYSTEM FACTORS

Identify the Organizational Factors that contributed to the Event. These are the underlying organizational factors which produce the task / environmental conditions that affect performance in the workplace. These may include fallible management decisions, processes and practices.

Check question: Does this item identify a standard Organizational Factor present before the Event and which resulted in the task / environmental conditions or allowed those conditions to go un-addressed?

Questions:		Event Facts: (Tick One)		Questions:		Event Facts: (Tick One)	
S01	Hardware	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A	OS07	Maintenance Management	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A
S02	Training	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A	OS08	Design	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A
OS03	Organizational Structure	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A	OS09	Risk Management	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A
OS04	Communication	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A	OS10	Management of Change	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A
OS05	Incompatible Goals	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A	OS11	Contractor Management	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A
OS06	Procedures	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A	OS12	Other Org./System Factor	<input type="checkbox"/> Contributing	<input type="checkbox"/> N/A

Attachment C
Incident Investigation
Report

OP 513 - Incident Investigations		 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>	
Incident Investigation Report			
Refer to Incident Investigation Guidelines and Categories to complete this form. Attach the original Incident Report and a "Why? Tree" Analysis as an attachment to this completed form. Ensure Part A contains adequate information to relay the exact timeline of events.			
PART A: Incident Investigation (Severity Level 1,2 and 3 incidents to complete)			
Incident Severity Rating (Level 1-3)		Actual	Potential
Incident Date	Time of Incident	Dept.	
Project (if applicable)		Office (if applicable)	
Who was involved (employee, contractor, and 3rd party?)			
Client notified? Yes <input type="checkbox"/> No <input type="checkbox"/> <small>(attach documentation of contract requirement)</small>	Name		
	Contact No.		
Description of Incident (<i>Who, what, where, how</i>)			
Timeline attached?		<i>(Attachment 1)</i> <input type="checkbox"/>	
Original Incident form attached?		<i>(Attachment 2)</i> <input type="checkbox"/>	
Details of Injuries/Damage/Impact (Nature and extent of injuries/damage)			
Immediate Action Taken			
Corrective Actions Recommended (If actions are accepted transfer into Part C)			
Was there a risk assessment tool in use at the time of the event?			
AHA <input type="checkbox"/>	SSHP <input type="checkbox"/>	APP <input type="checkbox"/>	Operating Procedure <input type="checkbox"/> None <input type="checkbox"/>
Has the risk assessment tool been updated to reflect this incident?			
Yes <input type="checkbox"/> No <input type="checkbox"/>	List:		
Is there an existing procedure to control this event?			
Yes <input type="checkbox"/> No <input type="checkbox"/>	List:		
Was this procedure in use at the time of the incident?			
Yes <input type="checkbox"/> No <input type="checkbox"/>	Explain:		
Photographs (Insert photographs or diagrams below or at end of report)			

Part B: Incident Investigation (Must be completed for all Severity Level 3 Incidents) – use Incident Investigation Guidelines and Categories for guidance in classifying the categories below.			
Absent/Failed Defenses	Individual or Team Factors	Task/Environmental Conditions	Organizational Factors

Part C: Corrective Actions Implemented (Must be completed for all Corrective Actions (CA))			
All Recommendations must include a timeframe for implementation and a person responsible. Add rows as required.			
CA #	Recommendations	Person Responsible	Completion Date

Part D: Key Learning’s (What should the organization learn and pass on from this event?)

Person Completing this Form (Contact for further information)			
Name		Position	
Date		Contact No.	
Email	@cabreraservices.com	Status of investigation	Initial / Final
List Investigation Team Members			

Reviewed by (Compulsory only for Level 3 Incidents)			
Name	Senior Manager	Signature	Date
Title			
Name	OH&S Manager	Signature	Date
Title			
Name	Project Manager/ Supervisor	Signature	Date
Title			

ATTACHMENT 1 – Copy of Incident Report

ATTACHMENT 2 – Why? Tree Analysis



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

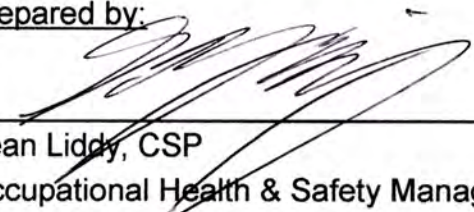
FOR

HAZARDOUS MATERIALS COMMUNICATION

OP-517

Revision 1

Prepared by:

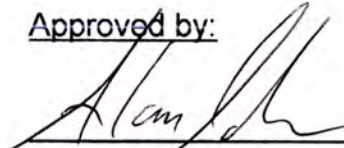


Sean Liddy, CSP
Occupational Health & Safety Manager

10-18-13

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

11/18/2013

Date

1.0 PURPOSE

This Operating Procedure (OP) establishes a Hazard Communication Procedure so that Cabrera employees are informed of the hazards of the chemicals to which they may be exposed in the course of their work by way of container labeling and other forms of warning, Safety Data Sheets (SDS), and employee training.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations.

3.0 DEFINITIONS

A complete list of definitions can be found in their entirety in the Department of Transportation hazardous materials regulations, the, and the International Air Transport Association (IATA) Dangerous Goods Regulations.

- 3.1 Acute Effect – An adverse effect on the human body with immediate onset of symptoms.
- 3.2 Article - A manufactured item: (1) which is formed to a specific shape or design during manufacture; (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and, (3) which does not release or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.
- 3.3 Carcinogen - Those chemicals appearing in any of the following reference sources are established as carcinogens for hazard communication purposes:
 - 3.4 National Toxicology Program (NTP) - Annual Report on Carcinogens.
 - 3.5 International Agency for Research on Cancer (IARC) Monographs, Volumes 1-34. Note - The Registry of Toxic Effects of Chemical Substances published by NIOSH indicates whether a substance has been found by NTP or IARC to be a potential carcinogen.
- 3.6 Chemical Name - The scientific designation of a substance in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry or the system developed by the Chemical Abstracts Service.
- 3.7 Chronic Effect - An adverse effect on the human body with symptoms which develop slowly over a long period of time or which frequently recur.
- 3.8 Combustible Liquid - Any liquid having a flash point at or above 100°F (37.8°C) but below 200°F (93.3°C), except any mixture having components with flash points of 200°F (93.3°C), or higher, the total volume of which makes

up 99% or more of the total volume of the mixture.

- 3.9 Common Name - Any designation or identification such as code name, code number, trade name or brand name used to identify a substance other than by its chemical name.
- 3.10 Container - Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank or the like that contains a hazardous chemical. For purposes of this Safety Operating Procedure (SOP) and Occupational Safety and Health Administration (OSHA) standard, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle are not considered to be containers.
- 3.11 Establishment - Any separate and distinct Cabrera office, laboratory or other company facility.
- 3.12 Exposure - Any situation arising from work operations where an employee may ingest, inhale, absorb through the skin or eyes or otherwise come into contact with a hazardous substance.
- 3.13 Flammable - A substance that falls into one of the following categories:

Flammable Aerosol: An aerosol that when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening or flashback (a flame extending back to the valve) at any degree of valve opening;

Flammable Gas: A gas that at ambient temperature and pressure:

Forms a flammable mixture with air at a concentration of 13% of volume or less; or

Forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit.

Flammable Liquid: Any liquid having a flash point below 100°F (37.8°C), except any mixture having components with flash points of 100°F (37.8°C) or higher, the total of which make up 99% or more of the total volume of the mixture.

Flammable Solid: A solid, other than a blasting agent or explosive as defined in 8 CFR 5237(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change or retained heat from manufacturing or processing or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard.

- A chemical shall be considered to be a flammable solid if, when tested

by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

3.14 Flash Point - Minimum temperature of a liquid at which it gives off sufficient vapors to form an ignitable mixture with the air near the surface of the liquid or within the container used.

3.15 Hazardous Chemical - Those chemicals appearing in any of the following reference sources are established as hazardous chemicals for hazard communication purposes:

29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, OSHA.

For operations within the state of California, the list of hazardous substances prepared by the California Director of Industrial Relations pursuant to Labor Code Section 6382. The concentrations and footnotes, which are applicable to the list, shall be understood to modify the same substance on all other source lists or hazard determinations set forth in § 8 CCR 5194(d)(3)(B) and (d)(5)(D).

3.16 Hazardous Substance - A hazardous chemical or carcinogen, or a product or mixture containing a hazardous chemical or carcinogen provided that:

The hazardous chemical is 1% or more of the mixture or product or 2% if the hazardous chemical exists as an impurity in the mixture; or

The carcinogen is 0.1% or more of the mixture or product.

Manufacturers, importers and distributors will be relied upon to perform the appropriate hazard determination for the substances they produce or sell.

The following materials are not covered by the Hazard Communication Standard:

- Any hazardous waste as defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 USC 6901 et seq.) when subject to regulations issued under that act by the Environmental Protection Agency.
- Tobacco or tobacco products
- Wood or wood products. Note: Wood dust is not exempt since the hazards of wood dust are not “self-evident” as are the hazards of wood or wood products
- Consumer products (including pens, pencils, adhesive tape) used in the work place under typical consumer usage

- Articles (i.e. plastic chairs)
 - Foods, drugs, or cosmetics intended for personal consumption by employees while in the work place
 - Foods, drugs, cosmetics in retail store packaged for retail sale
 - Any drug in solid form used for direct administration to the patient (i.e., tablets or pills)
- 3.17 Hazardous Substance Inventory (HSI) - A listing of all chemicals stored or used at an office or project site. Note that the HSI may be imbedded in a project Health and Safety Plan.
- 3.18 Immediate Use - Means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.
- 3.19 Material Safety Data Sheet (MSDS), or Safety Data Sheets (SDS) - A material safety data sheet prepared pursuant to state and federal regulations, OSHA Form 174 and Canada regulations (Controlled Products regulations, schedule 1).
- 3.20 SDS Administrator - The individual designated by the Office Manager to maintain the additional establishment-specific HSI and the SDS binder required if that establishment uses or stores hazardous substances.
- 3.21 National Fire Protection Association (NFPA) - A system of categories, colors and numbers was created to provide basic hazard information. It enables firefighters and other emergency personnel to easily decide whether or not to evacuate an area or proceed with emergency control operations. The three principal categories of identification are Health, Flammability and Instability. A numerical range of "0 to 4" indicates the severity of the hazard. A "4" indicates the most severe and a "0" indicates a minimal hazard.
- 3.22 Mixture - Any solution or intimate admixture of two or more substances which do not react chemically with each other.
- 3.23 Reactivity - A measure of the tendency of a substance to undergo chemical reaction with the release of energy.
- 3.24 Solubility - The ability of substance to blend and mix uniformly with another.
- 3.25 Specific Gravity (density) - Ratio of the weight of a substance to the weight of the same volume of another substance. As used in this directive, specific gravity or density refers to the weight of substance as compared to the weight of an equal volume of water.

- 3.26 Vapor Density - The weight of a vapor-air mixture resulting from the vaporization of a volatile liquid at equilibrium temperature and pressure conditions, as compared with the weight of an equal volume of air under the same conditions.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

All employees have a right to, and should, know the properties and potential hazards of substances to which they may be exposed.

Should Cabrera assign employees that do not read and speak English to tasks with chemical exposures, communications will be provided in the language understood by that employee.

The procedure applies to the use of any hazardous substances which are known to be present in the workplace or on the job site in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

5.0 EQUIPMENT

There is no equipment associated with this procedure.

6.0 RESPONSIBILITIES

- 6.1 Occupational Health and Safety (OH&S) Manager - Audits offices and project sites to assure that they maintain an establishment-specific HSI. Audits to assure that if an establishment-specific HSI is required, that SDSs are available for each substance listed on the HSI. The OH&S Manager will provide interpretation of SDSs and hazard information for HMIS labels/NFPA labels and other information to assist in training employees. The OH&S Manager will also provide hazard communication training to employees and file documents of this training and review SDS for adequacy of completion to meet the OSHA standard and returning them to supplier, if necessary.
- 6.2 Office Managers - Have an operations-specific, written hazard communication program which, at a minimum, describes how the requirements of this Procedure and the OSHA requirements for labels and other forms of warning, material safety data sheets, and employee information and training will be met. Appoint an SDS administrator for their establishment if they store or use hazardous substances. Confirm, if required, that the SDS Administrator maintains an HSI for their establishment. Confirm that SDS are available for all substances listed on their establishment's HSI. Confirm that a copy of this Procedure and the site-specific SDS are available to all employees. Employees shall be instructed in the location of this Procedure and the SDS. Confirm that all employees in their office affected by the HAZCOM standard are provided with the appropriate training, including new employees.

- 6.3 Project Managers (field task managers, supervisors) - Confirm that all employees under their supervision have received the initial and periodic training required by this OP prior to assigning employees to tasks involving the use of, or potential exposure to hazardous substances. Notify employees of hazardous substances covered by this OP that are used in their work area. Determine the potential fire, toxic, or reactivity hazards which are likely to be encountered in the handling or utilization of a hazardous substance and communicate this information to their affected employees, before any are permitted to work with it. Confirm that an SDS is available for each hazardous substance used, or potentially encountered, in the work areas or on the project job sites that are under their supervision. Notify subcontractors (working for Cabrera) of any hazardous substances that are used or stored by Cabrera to which the subcontractor's employees may be exposed. Notify clients or property owner/operators of chemicals brought onto their property by Cabrera or its subcontractors. Request SDSs from all subcontractor organization for the relevant chemicals they bring onto a Cabrera controlled site.
- 6.4 Employees - Confirm that they have received appropriate hazard communication training prior to working with materials that fall under the standard. Have reviewed appropriate SDSs and know how to work with that material safely. Provide a copy of all SDSs received to the SDS Administrator at their facility. Verify that an SDS is available in their work area for each hazardous substance that they use. Confirm that containers of hazardous substances that they use are properly stored and labeled.

7.0 PROCEDURE

7.1 Hazardous Waste Exemption

Hazardous wastes are excluded from the state and federal Hazard Communication standards. However, employees who handle or are otherwise exposed to hazardous wastes are covered by the requirements of the Occupational Health & Safety Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 – Hazardous Waste Operations And Emergency Response. This standard requires that:

- Employees receive 40-hour initial and 8-hour annual training; and that
- Information on the hazards of hazardous wastes be documented in a Site-Specific Safety & Health Plan (SSHP) and communicated to all employees in site-specific briefing on-site training required by the standard.

Therefore, HAZWOPER projects are not required to comply with the requirements of this SOP as they relate to the hazardous wastes that are present at those project sites.

7.2 Hazardous Substance Inventory (HSI)

Establishment-Specific HSI

- If an establishment uses or stores hazardous substances, an establishment-specific HSI must be maintained.
- If it is determined that an office-specific HSI is needed, the Office Manager shall assure that one is developed and maintained by someone appointed as the establishment's SDS Administrator.
- The content of the office-specific written inventory shall be updated as new hazardous substances are procured for, or removed from, the establishment and shall be verified by the OH&S Manager through regular inspections of the establishment.
- In order to meet the 30-years-after-employment-termination record retention requirement, the office-specific HSIs shall be treated as a permanent record.

7.3 Safety Data Sheets (or SDS)

Establishment-Specific SDS Inventory

- If it is determined that an establishment is required to maintain an establishment-specific HSI, SDSs for those specific hazardous substances must be maintained on file at that establishment.
- The OH&S Manager shall audit the local office program for SDS request and maintenance and report deficiencies to the appropriate management level, as necessary, to assure compliance with this OP.

Field Project Sites and Client Facilities

- The Project Manager and/or the Site Safety & Health Officer shall access or obtain, and maintain copies of SDS from:
 - All Cabrera subcontractors bringing chemicals onto the project site; and
 - The client, for all of the client's chemicals to which Cabrera or its subcontract employees are potentially exposed.

Employee Access to SDSs

SDSs should be maintained at the local establishment that uses that hazardous substance. Copies of the SDS should be made available to the

employee upon request to the office's SDS Administrator.

Field Access to SDSs

When hazardous substances are brought into the field, the user must assure that a copy of the SDS for that substance accompanies it and is available at the field location where it is to be used.

SDSs for Cabrera Products

It is unlikely that Cabrera activities would create a chemical for which a new SDS were needed. If such a chemical were created, the OH&S Manager shall work with the appropriate operations groups to draft, review, and publish the new SDS.

Content of the Safety Data Sheet

The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products. As of June 1, 2015, the HCS will require new SDSs to be in a uniform format, and include the section numbers, the headings, and associated information under the headings below:

- Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
- Section 2, Hazard(s) identification includes all hazards regarding the chemical; required label elements.
- Section 3, Composition/information on ingredients includes information on chemical ingredients; trade secret claims.
- Section 4, First-aid measures includes important symptoms/effects, acute, delayed; required treatment.
- Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.
- Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.
- Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.
- Section 8, Exposure controls/personal protection lists OSHA's

Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

- Section 9, Physical and chemical properties lists the chemical's characteristics.
- Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.
- Section 11, Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.
- Section 12, Ecological information*
- Section 13, Disposal considerations*
- Section 14, Transport information*
- Section 15, Regulatory information*
- Section 16, Other information, includes the date of preparation or last revision.

*Note: Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 through 15 (29 CFR 1910.1200(g)(2)). SDSs that do not contain this information shall be returned to the distributor or manufacturer to be updated.

Trade Secrets

- Some hazardous substance suppliers may claim the information requested on SDSs is proprietary and not provide the information.
- When SDSs supplied indicate that proprietary information has been withheld, the OH&S Manager will either obtain the necessary information to make a hazard assessment or reject the material for use.

7.4 Labeling

OSHA has updated the requirements for labeling of hazardous chemicals under its Hazard Communication Standard (HCS). As of June 1, 2015, all labels will be required to have pictograms, a signal word, hazard and precautionary statements, the product identifier, and supplier identification. A sample revised HCS label, identifying the required label elements, is shown below. Supplemental information can also be provided on the label as needed.

Sample HCS Label

SAMPLE LABEL	
<p>CODE _____ Product Name _____</p>	<p>Product Identifier</p>
<p>Company Name _____ Street Address _____ City _____ State _____ Postal Code _____ Country _____ Emergency Phone Number _____</p>	<p>Supplier Identification</p>
<p>Keep container tightly closed. Store in a cool, well-ventilated place that is locked. Keep away from heat/sparks/open flame. No smoking. Only use non-sparking tools. Use explosion-proof electrical equipment. Take precautionary measures against static discharge. Ground and bond container and receiving equipment. Do not breathe vapors. Wear protective gloves. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling. Dispose of in accordance with local, regional, national, international regulations as specified.</p> <p>In Case of Fire: use dry chemical (BC) or Carbon Dioxide (CO₂) fire extinguisher to extinguish.</p> <p>First Aid If exposed call Poison Center. If on skin (or hair): Take off immediately any contaminated clothing. Rinse skin with water.</p>	<p>Precautionary Statements</p>
<p>Hazard Pictograms</p>	
<p>Signal Word Danger</p>	
<p>Highly flammable liquid and vapor. May cause liver and kidney damage.</p> <p>Hazard Statements</p>	
<p>Supplemental Information</p> <p>Directions for Use _____ _____</p> <p>Fill weight: _____ Lot Number: _____ Gross weight: _____ Fill Date: _____ Expiration Date: _____</p>	

Containers of hazardous substances used or stored in each Cabrera establishment must be labeled, tagged or marked with the following information:

- Identification of the hazardous substance(s)
- Appropriate hazard warnings
- Name and address of the manufacturer, importer or other responsible parties
- Safe Handling Instructions
- Statement that an SDS is available for the product

Labels on containers shall not be removed or defaced. Labels or other forms of warning shall be legible, in English and prominently displayed on the container.

Any failure to have the appropriate labeling information on a container at any time will be cause to suspend use of the product until the container is properly labeled.

Carcinogen Labeling

Chemicals which have been indicated as positive or suspect carcinogens by either OSHA, American Conference of Governmental Industrial Hygienists (ACGIH), the International Agency for Research on Cancer (IARC) (World Health Organization), or the National Toxicology Program (NTP) will be considered to be carcinogenic for purpose of the OP. Those chemicals identified as being “known to be carcinogenic” by NTP must have carcinogen warnings on the label and information on the SDSs.

Stationary Process Containers

If there is stationary process equipment within a work area, signs, placards, process sheets, batch tickets, operating procedures, or other such written materials may be used in lieu of fixed labels on the containers, as long as the alternative method conveys the appropriate hazard information. The written materials shall be readily accessible to the employees in the work area.

Portable Containers

Portable containers of hazardous substances need not be labeled when the substance is transferred from labeled containers and is intended for immediate use by the employee who performs the transfer.

Containers of hazardous substances transferred from labeled containers and not intended for the immediate use of the employee performing the transfer shall be labeled with the chemical name and a hazard warning label in accordance with the Sample HCS Label.

7.5 Chemical Storage

Hazardous chemicals are to be stored in their original, labeled containers with the lids securely closed and taped if possible. Flammable and combustible materials must be stored in fire impervious cabinets in designated stockroom areas. Chemicals must be stored in compliance with instructions provided on their labels, SDS, or the manufacturer’s specifications.

All hazardous chemicals must be stored in a manner that prevents spillage and leakage which would expose people or the environment to the chemical.

Hazardous chemicals shall not be stored with foods or beverages. Food and beverages shall not be consumed in areas where hazardous chemicals are used or stored.

7.6 Chemical Use in Offices

In general, hazardous substances should not be taken into office areas,

conference rooms, or break areas. If this general requirement is infeasible, contact the OH&S Manager for guidance.

General exceptions to this rule are the following:

- Liquid paper
- Toner
- Cleaners
- Isobutylene calibration gas
- pH calibration solutions for instruments

7.7 Employee Information and Training

Each Cabrera employee who handles or is exposed to hazardous substances must be provided information and training on hazardous substances in their work area.

- At the time of their initial assignment
- Whenever a new hazard is introduced into their work area

At a minimum, the training requirements apply to personnel in the following job categories:

- All personnel who perform field work that involves the use of, or potential exposure to, hazardous substances
- Laboratory Employees

Initial Training Content






The Initial Training will provide instruction in the following:

- Methods and observations that may be used to detect the presence or release of a hazardous substance in the work area (such as personal monitoring, visual appearance or odor of hazardous substances being released, etc.);
- The physical and health hazards of substances in the work area and measures and procedures implemented to protect employees;
- The details of this hazard communication procedure including an explanation of the labeling system and the SDS, and how the

employee can obtain and use appropriate hazard information

- Pictograms: As of June 1, 2015, the Hazard Communication Standard (HCS) will require pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

HCS Pictograms and Hazards

<p>Health Hazard</p>  <ul style="list-style-type: none"> • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity 	<p>Flame</p>  <ul style="list-style-type: none"> • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides 	<p>Exclamation Mark</p>  <ul style="list-style-type: none"> • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
<p>Gas Cylinder</p>  <ul style="list-style-type: none"> • Gases Under Pressure 	<p>Corrosion</p>  <ul style="list-style-type: none"> • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals 	<p>Exploding Bomb</p>  <ul style="list-style-type: none"> • Explosives • Self-Reactives • Organic Peroxides
<p>Flame Over Circle</p>  <ul style="list-style-type: none"> • Oxidizers 	<p>Environment (Non-Mandatory)</p>  <ul style="list-style-type: none"> • Aquatic Toxicity 	<p>Skull and Crossbones</p>  <ul style="list-style-type: none"> • Acute Toxicity (fatal or toxic)

The Initial Training will also inform the employee of the following:

- Any operations in their work area in which hazardous substances are present

- Location and availability of this written hazard communications procedure
- Their right to personally receive information regarding hazardous substances to which they may be exposed
- Their right to have their physician receive information regarding hazardous substances to which they may be exposed
- Their right against discharge or other discrimination (in California) due to the employee's exercise of rights afforded pursuant to provisions of the California Hazardous Substances Information and Training Act

Periodic Training and Training for Non-Routine Tasks

Additional training will be provided to employees who have received initial training whenever:

- A new hazardous substance is introduced into their work area
- A new or revised SDS is received, which indicates significantly increased risks to employee health as compared to those stated on the previous SDS
- Non-routine tasks are performed, which will potentially result in exposure to hazardous substances, or exposure under circumstances, which were not addressed during initial training

Supervisors, in coordination with the OH&S Manager, shall provide such training through an explanation of the information on the contents of the SDS for that substance.

When training their employees, supervisors shall explain:

- Any health hazards associated with use of the substance or mixture
- Proper precautions for handling
- Necessary personal protective equipment or other safety precautions to prevent or minimize exposure
- Emergency procedures for spills, fire, disposal, and first aid

For most projects involving field work, this periodic training requirement will be facilitated through the implementation of the SSHP that has been developed for the project.

Documentation of Initial and Periodic Training

All training required by this OP shall be documented at the time it is performed by having the employee sign a copy of a training attendance sheet.

7.8 Chemical Usage

Prior to using any chemical, an Activity Hazard Analysis (AHA) shall be completed by the employees assigned to use the chemical. The analysis will identify the hazards associated with the tasks to be performed and prescribe the Personal Protective Equipment (PPE) to be used.

7.9 Office Specific Written Program

Each office or location using or storing hazardous materials will develop a written office/ location-specific Hazardous Substance Inventory. If the local office decides to implement the requirements of the standard in any way that differs from this procedure, they shall verify the changes with the OH&S Manager, document the changes, and communicate the differences to all affected employees.

8.0 REFERENCES

- 29 CFR 1910.1200
 - 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, OSHA.

9.0 REQUIRED RECORDS

A HSI shall be prepared for each Cabrera location (project and/or office) where hazardous substances are kept, stored, or used. The HSI will be periodically reviewed (minimum every 12 months) and updated with materials, locations, and quantities.

10.0 ATTACHMENTS

Attachment A – Site Specific Hazardous Substances Inventory

Attachment A
Site Specific
Hazardous Substance Inventory

OP 517 - Hazardous Materials Communication



SITE SPECIFIC HAZARDOUS SUBSTANCES INVENTORY (HSI)

A complete inventory, including location and quantities of specified materials, must be kept, and regularly updated. Cabrera relies on the information contained in SDSs as permitted by the OSHA Hazard Communication Standard (29CFR1910.1200) and does not perform independent hazard determinations.

LOCATION INFORMATION

OFFICE/PROJECT NAME:	OFFICE/PROJECT MANAGER:
ADDRESS/LOCATION:	DATE:
	TIME:
RESPONSIBLE PERSON:	HSI ATTACHED: <input type="checkbox"/> Yes <input type="checkbox"/> No

SAFETY DATA SHEETS (SDS)

Attach copies of all SDSs to the back of this HSI. SDSs not on-hand, that are requested by employees, will be requested of suppliers within seven days by letter. The Responsible Person (SDS Administrator or SSHO) will be responsible for keeping this HSI updated. All subcontractors will be required to provide information on any chemicals used at this site.

SITE SPECIFIC PROCEDURES FOR COMPLIANCE (IF NECESSARY):

EMPLOYEE TRAINING VERIFICATION

INITIAL ON BOARDING AT OFFICE SITE SPECIFIC ORIENTATION (SSHP ACKNOWLEDGMENT) PERIODIC THRU AHA REVIEW
 PERIODIC THRU 8-HR REFRESHER OTHER BE SPECIFIC

HAZARDOUS SUBSTANCE INVENTORY

PRODUCT NAME	QUANTITY	LOCATION



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

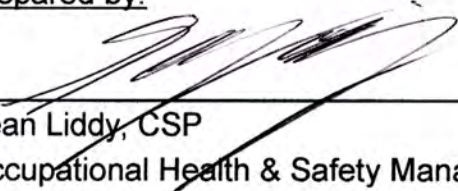
FOR

HOUSEKEEPING

OP-518

Revision 1

Prepared by:

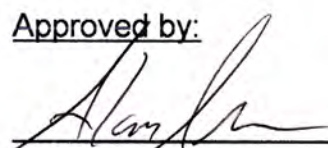


Sean Liddy, CSP
Occupational Health & Safety Manager

11-18-13

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

11/18/2013

Date

1.0 PURPOSE

This Operating Procedure (OP) establishes Cabrera Services Inc. (Cabrera) work practices as well as personal hygiene and work site sanitation standards necessary to establish and maintain proper housekeeping.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations (field and office).

3.0 DEFINITIONS

None.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

At all times, work areas will be kept free of dirt and debris that may affect the safety of Cabrera personnel and visitors.

5.0 EQUIPMENT

There is no equipment associated with this procedure.

6.0 RESPONSIBILITIES

- 6.1 Office / Site Manager - are responsible for the procedure's implementation and the details of addressing housekeeping policy within the office and at the job site. Additional, site specific housekeeping requirements, may apply to individual job sites which would be addressed through the site specific health and safety plans.
- 6.2 Project Manager (and/or Field Task Manager, Supervisor) - is responsible for the procedure's implementation and the details of addressing housekeeping policy within the construction/demolition worksite.
- 6.3 Occupational Health & Safety (OH&S) Manager - will monitor, assess, and report as necessary on project housekeeping when visiting locations.
- 6.4 Employees - are responsible for reporting any areas of concern to the Office Manager or Site Supervisor for prompt resolution as well as for maintaining worksites that are free from debris, clutter, and slipping or tripping hazards.

7.0 PROCEDURE

7.1 General Housekeeping

All work areas shall be kept clean to the extent that the nature of the work

allows.

Every work area shall be maintained, so far as practicable, in a dry condition. Where wet processes are used, drainage shall be maintained and platforms, mats, or other dry standing places shall be provided, where practicable, or appropriate waterproof footwear shall be provided.

Protruding objects or placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. Personnel will use a reasonable amount of effort to keep slip, trip, and fall hazards to a minimum.

Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal.

At no time will debris or trash be intermingled with contaminated PPE or materials used inside of the exclusion zone.

Material and equipment must be placed, stacked, or stored in a stable and secure manner. Stacked material or containers must be stabilized as necessary by interlocking, strapping, or other effective means of restraint to protect the safety of workers.

An area in which material may be dropped, dumped, or spilled must be guarded to prevent inadvertent entry by workers or protected by adequate covers and guarding.

Floors, platforms, ramps, stairs, and walkways available for use by workers must be maintained in a state of good repair and kept free of slipping and tripping hazards. If such areas are taken out of service, the employer must take reasonable means for preventing entry or use.

Hazardous areas not intended to be accessible to workers must be secured by locked doors or equivalent means of security and must not be entered unless safe work procedures are developed and followed.

7.2 Smoking, Eating, and Drinking

Eating and drinking will be permitted in designated areas at Cabrera project sites and as specified on client sites.

Smoking will be permitted only in areas designated in compliance with applicable local laws, regulations, legislation, and ordinances, by the Field Supervisor and situated in locations that are not in the immediate vicinity of activities associated with work site activities. Additionally, Field Supervisor will designate each smoking area giving primary consideration to those personnel who do not smoke. Proper disposal containers that allow for adequate

extinguishing of lit cigarettes will be provided.

Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).

Site personnel will first wash hands and face after completing work activities and prior to eating or drinking.

7.3 Water Supply

Water supplies will be available for use on site and will comply with the following requirements:

Potable Water: An adequate supply of drinking water will be available for site personnel consumption. Potable water can be provided in the form of approved well or city water, bottled water, or drinking fountains. Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.

Non-potable Water: Non-potable water will not be used for drinking purposes. Non-potable water may not be used for hand washing or other personal hygiene activities but may be used for other types of cleaning activities. All containers/supplies of non-potable water used will be properly identified and labeled as such.

7.4 Toilet Facilities

Toilet facilities will be available for site personnel and visitors. Should subcontractor personnel be located on-site for extended periods, it may become necessary to obtain temporary toilet facilities. Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

A minimum of one toilet will be provided for every 20 site personnel, with separate toilets maintained for each sex, except where there are less than five total personnel on site. For mobile crews where work activities and locations permit use of nearby toilet facilities (e.g., gas station, or rest stop), on site facilities are not required.

7.5 Washing Facilities

Hand and Face: Site personnel will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday.

Personal Cleaning Supplies: Cleaning supplies at project sites will consist of

soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacterial gels, wipes, etc.).

7.6 Clothing and Personal Protective Equipment (PPE)

All PPE will be kept clean at all times and maintained in accordance with the manufacturers, Cabrera's, and applicable regulatory, legislative, or provincial requirements.

7.7 General Work Areas

At all times work areas will be kept free of dirt and debris that may impact the environment and the safety of site personnel and visitors. All trash receptacles will be emptied regularly (minimum weekly or as needed basis).

7.8 Break Areas and Lunchrooms

Site personnel will observe the following requirements when using break areas and lunchrooms at Cabrera project sites:

- All food and drink items will be properly stored when not in use.
- Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation.
- Perishable foods will be refrigerated whenever possible.
- All waste food containers will be discarded in trash receptacles.
- All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times.
- Refrigerators used to store food items will be maintained at 45 degrees Fahrenheit and emptied of all unclaimed food items weekly. Refrigerators used to store food will be labeled as such so that only food and drinks are stored within the refrigerator. Radiological and environmental samples will not be stored in refrigerators where food is stored.
- Routine cleaning of refrigerators will also be performed on a regular basis (minimum weekly or as needed basis).

7.9 Vermin Control

Every enclosed workplace shall be constructed, equipped, and maintained, so far as reasonably practicable, to prevent the entrance or harborage of rodents, insects, and other vermin.

A continuing and effective extermination program shall be instituted where the presence of rodents, insects, or other vermin is detected. In leased offices, the office POC or senior manager shall take responsibility to coordinate with the landlord to ensure effective measures are instituted.

7.10 Office Areas

Office areas are to be kept neat and orderly. The following general rules apply to prevent injuries and to maintain a professional workplace appearance.

All aisles, emergency exits, fire extinguishers, etc., will be kept clear (a minimum of three feet of either side) of material storage (temporary and permanent) at all times.

Storage areas will be maintained in an orderly manner at all times. When supplies are received, the supplies will be stored properly.

Spills will be promptly cleaned up and resulting waste will be disposed of properly.

All waste receptacles will be lined with a plastic trash bag to avoid direct contact with waste during disposal. Employees will use gloves when handling waste and may use a compaction bar to compress waste when necessary.

Keep file and desk drawers closed when possible to avoid injuries. Open only one file drawer at a time to prevent tipping of file cabinets.

At the end of the business day, consideration by the Office Manager and individual employees should be made for turning off or at a minimum placing all office equipment in a low-energy consuming mode—e.g., lighting, coffee makers, small kitchen appliances, portable heaters, printers, copiers, plotting equipment, computer workstations, Computer Aided Design (CAD) equipment, and other equipment. All space heaters should be unplugged at the end of the day to ensure that they have been turned off.

Use of any small appliance within an office shall meet the requirements specified within leasing agreements.

Around your workstation:

- Do not stack excessive amounts of papers or other material on shelves to reduce possibility of shelf overload or falling items.
- Tidy up your workstation for a few minutes at the end of each day.
- Paperwork that is not currently needed should be filed appropriately.

- Refrain from storing items on the floor as they may become falling or tripping hazards.

In public areas of the office:

- All walkways, aisles, and corridors are considered fire escape routes and will be kept clear of obstructions.
- Maintain chairs in good repair.
- Keep rugs clean, in good repair, and free of tripping hazards.
- Place paper cutter blade in closed and locked position.
- Tie back all loose clothing when using paper shredder.
- Close drawers completely after every use.
- Clean up spills immediately.
- Pick up objects that may have been left on the floor by others.
- Report loose carpeting, damaged flooring, or other obstructions that are present in walkways.
- Areas in front of electrical panels will be kept clear and free of debris and materials storage for a minimum distance of 36 inches, or approximately 1 meter.

A number of measures can be used to prevent and control poor lighting conditions in the work environment:

- Regular maintenance of the lighting system should be carried out to clean or replace old bulbs and faulty lamp circuits.
- A light-colored matte finish on walls, ceilings, and floors to reduce glare is recommended.
- Whenever possible, office workers should not face windows, unshielded lamps, or other sources of glare.
- Adjustable shades should be used if workers face a window.
- Diffused light will help reduce shadows. Indirect lighting and task lighting are recommended, especially when work spaces are separated by dividers.

- Task lamps are very effective in supplementing general office lighting for those who require or prefer additional lighting. Some task lamps permit several light levels.

7.11 Property Grounds

The grounds surrounding Cabrera-leased facilities are an extension of the workplace. The property manager is responsible for grounds maintenance and for keeping the grounds neat and orderly for employees and visitors to enjoy. The following general rules shall apply:

- All trash will be discarded only in the waste containers provided.
- Employees shall park only in the designated assigned area.
- The facility's maintenance department will be responsible for grounds keeping (mowing, trimming, etc.) as needed. Maintenance will also establish procedures for ice/snow removal, when necessary, prior to operations each day.

8.0 REFERENCES

- 29 CFR 1926.25, Housekeeping
- 29 CFR 1926.27, Sanitation
- 29 CFR 1910, Subpart E, Means of Egress
- 29 CFR 1910.141, Sanitation
- OP 511, Safe Work Standards

9.0 REQUIRED RECORDS

None.

10.0 ATTACHMENTS

None.



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

FOR

MANUAL LIFTING

OP-519

Revision 1

Prepared by:



Sean Liddy, CSP
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11-18-13

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

11/18/2013

Date

1.0 PURPOSE

This Operating Procedure (OP) provides the requirements for use when performing manual materials handling activities (e.g., lifting/handling of items or materials).

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations.

3.0 DEFINITIONS

- 3.1 Manual Materials Handling - Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.
- 3.2 Team Handling - Team handling occurs when more than one person is involved during the lift.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

Employees shall not attempt to lift items/objects that are outside of their comfort range at any time. Since each employee's physical capabilities are different, there is no set weight limit on lifting, but generally, attempts to lift object greater than 50 lbs in weight should be avoided by all employees.

5.0 EQUIPMENT

Dollies, carts, come-alongs' and/or rollers should be used whenever possible to provide mechanical assistance when making/performing a lift.

6.0 RESPONSIBILITIES

- 6.1 Office Manager or Point of Contact (POC) - will effectively implement the procedure, providing resources as required, and providing direction on proper lifting/handling techniques.
- 6.2 Project Manager, Field Site Managers, or designee (Site Safety & Health Officer, SSHO) - will effectively implement the procedure, providing resources as required, and providing direction on proper lifting/handling techniques.
- 6.3 Occupational Health & Safety (OH&S) Manager - will assist in identifying activities with a high potential for lifting/handling strains/injuries as well as the associated mitigation strategies and training on proper lifting/manual materials handling techniques.
- 6.4 Employees - are responsible for reviewing and following the Safe Work Practices listed in this procedure.

7.0 PROCEDURE

7.1 Mechanical Controls

Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials.

Mechanical assistance will be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists.

Objects to be moved will be secured to prevent falling and properly balanced to prevent tipping.

7.2 Administrative Controls

When significant, sustained lifting work is required, it is desirable to rotate employees to spread the work load among several people and thereby avoid fatigue.

Rotation is not simply performing a different job but instead is performing a job that utilizes a completely different muscle group from the ones that have been overexerted.

7.3 General

Before Performing a Lift:

1. Check to see if mechanical aids such as hoists, lift trucks/dollies, or wheelbarrows are available.
2. Do not lift if you are not sure that you can handle the load safely.
3. Confirm that, based on your own physical capabilities and medical limitations, you can lift the load without overexertion. Get help with heavy or awkward loads.
4. Confirm that the load is "free" to move.
5. Check that the planned destination of the load is free of obstacles and debris.
6. Confirm that the path to the planned destination of the load is clear. Grease, oil, water, litter, and debris can cause slips and falls.
7. Particular handling and lifting techniques are needed for different kinds

of loads or materials being handled (for example, compact loads, small bags, large sacks, drums, barrels, cylinders, and sheet materials like metal or glass).

General Tips for Lifting

Prepare for the lift by warming up the muscles.

Make certain that your balance is good. Feet should be shoulder width apart, with one foot beside and the other foot behind the object that is to be lifted.

Bend the knees; do not stoop. Keep the back straight, but not vertical. There is a difference. Tucking in the chin straightens the back.

Grip the load with the palms of your hands and your fingers. The palm grip is much more secure. Tuck in the chin again to make certain your back is straight before starting to lift.

Use your body weight to start the load moving, then lift by pushing up with the legs. This makes full use of the strongest set of muscles.

Keep the arms and elbows close to the body while lifting.

Carry the load close to the body. Do not twist your body while carrying the load. To change direction, shift your foot position and turn your whole body.

Watch where you are going!

To lower the object, bend the knees. Do not stoop. To deposit the load on a bench or shelf, place it on the edge and push it into position. Confirm that your hands and feet are clear when placing the load.

7.4 Engineering Controls

Material handling tasks should be designed to minimize the weight, range of motion, and frequency of the activity.

Alter the task to eliminate the hazardous motion and/or change the position of the object in relation to the employee's body—such as adjusting the height of a pallet or shelf.

Work methods and stations should be designed to minimize the distance between the person and the object being handled.

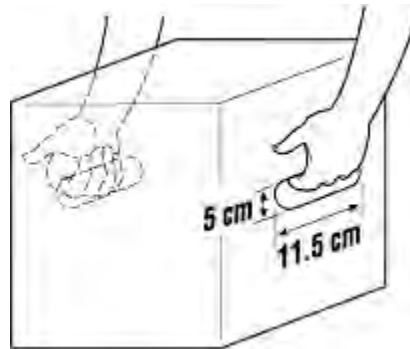
High-strength push-pull requirements are undesirable, but pushing is better than pulling. Material handling equipment should be easy to move, with handles that can be easily grasped in an upright posture.

Workbench or workstation configurations can force people to bend over. Corrections should emphasize adjustments necessary for the employee to remain in a relaxed upright stance or fully supported seated posture. Bending the upper body and spine to reach into a bin or container is highly undesirable. The bins should be elevated, tilted, or equipped with collapsible sides to improve access.

Repetitive or sustained twisting, stretching, or leaning to one side are undesirable. Corrections could include repositioning bins and moving employees closer to parts and conveyors.

Store heavy objects at waist level.

Whenever possible, utilize hand holds or other lifting attachments on objects being handled:



Use the “hook grip” on loads with cut-out handholds.

Curl your fingers around the edge.

Do not hold the load with your fingertips.

Use containers with handles located more than halfway up the side of the container.

Use the “ledge grip” to handle regularly shaped objects without handles.



Use vacuum lifters to handle sheet materials or plates.

Hold the object with hands placed diagonally.

Wear gloves where practical.

7.5 Specific Handling Techniques

The following guidance will be used when performing manual materials handling for various types of materials.

Square or Rectangular Objects

Place one foot slightly in front of the other.

Squat as close to the object as possible.

Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.

Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight, and tuck in the chin.

Test to confirm that the object is loose from floor and will lift without snagging.

Straighten the legs, keeping the backbone straight, pull the object into the body, and stand up slowly and evenly without jerking or twisting.

If turning or change of direction is required, turn with feet without twisting the torso and step in the direction of travel.

To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object and the surface on which the object is set.

Cylindrical Objects

When lifting or moving round or cylindrical objects, the objects should be rolled wherever possible to avoid muscle strain or injury. Rolling must be controlled by chute, tagline, or other means of limiting acceleration. Workers must not be positioned downhill from rolled objects. Use of the legs for pushing and tagline control of rolled objects must be stressed.

Cylindrical objects, such as drums that must remain upright, are to be handled manually by slightly tilting the object, using the legs for control, and balancing the object on the bottom edge. The handler then walks beside the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus maintaining balance and a steady, controlled, forward motion. Motion must be controlled so that ceasing to walk and moving the hands will stop forward motion.

Use carts or tracks to transport cylinders. Make sure that two people transport a cylinder if carts cannot be used, use lifting straps to improve grip.

Technique for one person lifting a cylinder onto a platform:

- Roll the cylinder to within 3 feet of the platform.
- Position the forward foot around the cylinder, the back foot about 1 foot behind the cylinder.
- Bend knees slightly.
- Place one hand on the valve protective cap, the other hand underneath the cylinder about 1 foot from the ground.
- Tilt the cylinder onto the thigh of the back leg.
- Balance the cylinder on the thigh by pressing down with the back hand while lifting the cylinder with the forward hand.
- Extend both knees to initiate forward movement of the cylinder and continue by pushing up and forward with the arms until the cylinder is located on the platform.
- Climb on the platform.
- Straddle the cylinder at the valve end.
- Grasp the valve protective cap of the cylinder with both hands between the thighs.
- Lean forward and straighten the knees to set the cylinder upright.

Bags and Sacks

The best way to handle a bag depends on its size, weight, and how far it is to be carried. When lifting, remember to:

- Straddle the end of the bag.
- Bend the hips and knees.
- Keep the back straight.
- Grasp the bag with both hands under the closer end. Keep elbows inside the thighs.

- Lean forward, straightening the knees to set the bag upright.
- Readjust the straddle position moving feet closer to the bag.
- Readjust the grasp, with one hand clasping the bag against the body and the other under it.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Thrust the bag up with the knee while straightening the body.
- Put the bag on the shoulder opposite the knee used to thrust the bag up.
- Stabilize the bag on the shoulder.
- Move off without bending sideways.
- Avoid unloading a bag from the shoulder directly to floor level. Use an intermediate platform or get help from a coworker.
- Stand close to the platform.
- Place one foot in front of the platform.
- Bend hips and knees.
- Keep the back straight.
- Ease the bag off the shoulder and put it upright on the platform.
- Pull the bag slightly over the edge of the platform.
- Stand close to the platform with the bag touching the chest.
- Clasp the bag against the body with one hand, the other hand holding bottom of the bag.
- Step back.
- Bend hips and knees, keeping back straight.
- Ease the bag onto the floor.

Bulkier sacks are easier to carry on your back. Lift the sack onto your back from a platform:

- Move the sack to the edge of the platform.
- Put your back against the sack.
- Grasp with both hands on the upper corners of the sack.
- Ease the sack onto the back, bending hips and knees before taking the weight.
- Keep the back straight
- Stand up and straighten the hips and knees.
- Stabilize the sack.
- Move away without bending sideways.

Two-person handling of a sack:

- Position one person on either side of the sack.
- Squat with one foot balancing behind the sack.
- Keep back straight.
- Grasp with the outer hand on the upper corner, the other hand holding the bottom of the sack.
- On one person's command:
 1. Stand up and straighten the hips and knees.
 2. Move toward the stack.
 3. Put the sack on the stack.

Sheet Materials

When lifting sheet materials:

- Stand close to the pile of sheets in a walking stance.
- Grasp sheet firmly at the midpoint of its long side with the closer hand.
- Pull sheet up and toward the body.
- Change grip using your other hand and put your fingers on top of the sheet.

- Pull sheet up to the vertical position and to the side until one half is off the pile.
- Grasp the lower edge of the sheet with the free hand and support the hand by placing it on your knee.
- Stand up without bending or twisting body.

Whenever moving sheet materials, be cognizant of wind conditions.

To carry sheets:

- Use drywall carts to carry sheet materials.
- Get help from another person where carts are not available.
- Apply carrying handles for manual carrying.
- Always use gloves and carrying handle for glass and other materials with sharp edges.
- Use team lifting and carrying where other solutions are inappropriate.
- Remember that the combined strength of the team is less than the sum of individual strength.
- Select team members of similar height and strength when possible
- Assign a leader to the team.
- Determine a set of commands to be used such as "lift," "walk," "stop," and "down." Make sure that everyone knows what to do when they hear the command.
- Follow the commands given by the team leader.
- Practice team lifting and carrying together before attempting the task.

Material Storage

When storing materials on site:

- Store materials at a convenient height safely away from edges so as not to create a potential fall hazard
- Leave the lowest shelf unused if necessary.

- Use vertically mobile shelves to avoid bending and overhead reaching.
- Use bin racks for storing small items.
- Store heavy and frequently used materials at waist height.
- Do not store materials at floor level.
- Use hand trucks with elevating devices in storage and loading areas.
- Use trucks with a tilting device to avoid bending.
- Use elevating platforms to avoid overhead reaching.

8.0 REFERENCES

- OSHA Technical Manual:
http://www.osha.gov/dts/osta/otm/otm_vii/otm_vii_1.html
- National Safety Council: www.nsc.org

9.0 REQUIRED RECORDS

None.

10.0 ATTACHMENTS

None.



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

FOR

DRIVER & VEHICLE SAFETY

OP-520

Revision 1

Prepared by:

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11-18-13

Date

Approved by:

Alan Solow, CHP
Chief Executive Officer

11/18/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the procedures to be used to reduce the risks to which Cabrera employees are exposed to while driving, reduce the number/frequency of driving-related incidents and injuries, minimize the potential harm to members of the public; and improve overall safety performance.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations.

3.0 DEFINITIONS

- 3.1 Authorized Driver – Individual employees who have completed the recommended driver safety training course and who possess a valid driver's license applicable for the type of vehicle required for specific work tasks.
- 3.2 Incident - An incident, for the purposes of this procedure, is a vehicle collision or other event where personal injury or property damage occurs, or a citation is issued while on Cabrera business. This may also include acts of theft, vandalism, and criminal mischief. Circumstances for citations to be considered as incidents include, but are not limited to, an instance where the citation results in the restriction or suspension of the employee's ability to legally operate a vehicle, a governmental motor vehicle agency assigning points to the employee's license, or the employee receives a citation where Cabrera insurance is provided as proof of insurance at the time of issuance.
- 3.3 Local Laws - All signs, postings, laws, regulations, ordinances and codes applicable for the jurisdiction in which the motor vehicle is being operated.
- 3.4 Operating Under the Influence (OUI) - OUI is the operation of any vehicle on company business under the influence of alcohol, drugs, medications, or other substances capable of inducing an altered mental state and/or impairing physical and mental judgments such that the influence of said substances produces impairment in violation of governmental laws for the location of the impairment.
- 3.5 Spotters - Extra personnel that may provide guidance when maneuvering in close and/or complex situations in order to avoid the occurrence of an incident.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

- 4.1 Only Authorized Drivers shall operate a motor vehicle (rental or Cabrera owned/leased) while on Cabrera business.
- 4.2 Drivers are prohibited from using hand-held electronic devices or "texting" while operating a motor vehicle while on Cabrera business. If drivers require

use of such devices, they shall drive to a safe location where they can park to perform these activities. The only exception to this prohibition is the use of a “hands-free” cell phone where local laws allow use and where weather and traffic conditions permit. In general, it is Cabrera’s policy to discourage use of all two-way communication devices while operating motor vehicles.

- 4.3 Seat belts shall be worn by all occupants whenever the vehicle is in motion.
- 4.4 The number of passengers shall not exceed the manufacturer’s specifications for the vehicle.
- 4.5 Loads shall be secured and shall not exceed the manufacturer’s specifications and legal limits for the vehicle.
- 4.6 Motorcycles, boats, and off-road vehicles may not be operated on company business unless:
 - Specific approval is provided by the Supervisor.
 - A hazard analysis is completed.
 - Required training and license is in place.
- 4.7 Staff inexperienced in two-way radio communication protocols and/or driving on gravel roads shall get on-site training from experienced personnel.
- 4.8 Headlights or daytime running lights will be used at all times.

5.0 EQUIPMENT

Motor Vehicles: rental, personal, or Cabrera owned/leased.

6.0 RESPONSIBILITIES

- 6.1 Senior Management - will be responsible for the following:
 - Confirming employees are informed and follow the provisions of this procedure.
 - Providing a copy of this procedure to any employee who will be driving a Cabrera owned, leased or personal vehicle for company business.
- 6.2 The Occupational Health & Safety (OH&S) Manager - will be responsible for the following:
 - Receiving, and filing in the Learning Management System (LMS), a copy of the Driver’s Acknowledgement Form signed by the employee along with a copy of the employee’s Driver License (for Cabrera leased

or owned vehicles).

6.3 Employees - will be responsible for the following:

- As an Authorized Driver, employees are responsible for following this procedure including participating in required training, following all applicable laws while operating a vehicle and reporting all vehicle incidents and/or traffic summonses to their supervisor.
- Immediately report any change or limitation to his or her Driver's License to his or her supervisor and make the required modifications to their verification.
- Verify that the vehicle has appropriate registration and carries at least the minimum limits of automobile third party liability insurance required by the state where the vehicle is registered and obtain confirmation that the insurance includes unrestricted business use coverage.
- Be alert and avoid fatigue

In addition, employees operating Cabrera Owned or Leased Vehicles will be responsible for the following:

- Before being able to drive a Cabrera owned or leased vehicle and as periodically requested, employees will provide a Motor Vehicle Driving Record (Driver's Abstract report).
- Inspect the vehicle for any damages and deficiencies and report any items found prior to driving the vehicle.
- Verify that a current proof of insurance certificate and vehicle registration are in the vehicle before driving it.

7.0 PROCEDURE

7.1 General

When accessing any pickup truck box, staff will:

- Step up into the box to avoid excess reaching and strain and;
- Use three point contact getting in and out of the truck box (avoid jumping off the tailgate).
- Be familiar with all client rules and regulations when on their sites. The employee may be required to leave their keys in the ignition or to display a vehicle pass.

- When parking, it is recommended that employees back into the parking spot.

7.1.1 Before Vehicle Operation

Prior to driving the vehicle, adjust rear view mirror, side mirrors, driver's seat and head restraint as needed for clear driving ease.

Fasten the seat belt and have all passengers fasten their seat belts before the vehicle goes into motion. . Keep belts fastened while the vehicle is moving or the engine is running.

Familiarize oneself with the location of the vehicle controls/interior, including lights, turn signal, overhead lights, gauges, radio, etc.

Monitor weather reports for the travel route.

Check for the correct functioning of:

- Parking Brake--holds against slight acceleration
- Foot Brake--holds, stops vehicle smoothly
- Clutch and Gearshift--shifts smoothly without jumping or jerking
- Steering--moves smoothly
- Lights—Daytime Running lights, headlights, warning lights, and turn signals operational
- Dash Control Panel--all lights and gauges operational
- Moving Parts--no strange noises
- Windshield Wipers
- Horn--operational
- Hydraulic systems--no evidence of leaks and systems operate smoothly

7.1.2 During Vehicle Operation

Maintain a safe distance when travelling behind other vehicles. Minimum safe distances vary dependent upon speed, and can be calculated by counting the seconds from when the leading vehicle passes a stationary object, to when the following vehicle approaches the same object. Minimum time/distance is 2 seconds, but recommended that distance increase at a rate of 1 second for

every 10 miles per hour (mph) of speed.

Confirm the area behind your vehicle is clear prior to and while reversing a vehicle. Use a spotter when possible.

When parking the vehicle on the edge of a roadway, turn on the four-way indicators (hazard lights) prior to leaving the vehicle.

Observe extra caution in and around emergency and construction zones.

Avoid unattended rest areas, when possible, and especially at night.

If the vehicle breaks down and another person stops to assist, do not leave the vehicle. Ask the person to call the police for assistance.

Contact the police to help those with car trouble instead of stopping to assist.

When possible, staff should have a car mechanic change or repair a flat tire. If staff must change a tire, they must adhere to the manufacturer's specifications and observe all proper lifting technique and safety procedures.

7.1.3 If Vehicle is to be Left Unattended

- Turn the ignition off, remove the key and set the emergency brake (if parked on an incline).
- Lock and secure the vehicle.
- Secure equipment and property in a locked trunk or tool chest.
- Do not leave keys in an unattended vehicle.

7.1.4 Staff shall Drive Defensively

The driver should use another person to guide them in backing up if they do not have a clear view of where they are going, or the movements of other vehicles and people.

Tools and other items shall not be left loose in the passenger compartment of a vehicle.

Road Rage:

Road rage is a dangerous driving situation that can occur and should be avoided whenever possible, and NEVER instigated. Do not get drawn into a confrontation. Avoid any confrontational eye contact.

The driver should be aware of all vehicles around them, paying frequent

attention to the vehicle's mirrors.

Get out of the way. Even if the other motorist is speeding, it is safest not to make a point by staying in your lane. The other driver may be dealing with an emergency situation.

Unless it is necessary to use the horn as an alert, do so sparingly.

If someone is following you after an on-the-road encounter, drive to a public place or to the nearest police station and seek assistance.

Attempt to note the offender's license plate number and write it down as soon as possible.

Report any aggressive driving to the police immediately. This action may aid in preventing further occurrences by the same driver.

7.1.5 Winter Driving

Clear snow from all exterior vehicle surfaces.

Avoid using cruise control on icy roads.

Accelerate and brake gently to reduce skids or spinouts.

Wear winter clothing that does not restrict movement, vision or hearing.

Where required, have snow chains for the vehicle and be familiar with their installation.

Use extra caution while driving during hazardous winter conditions.

Avoid sudden changes of speed or direction to reduce possibility of skidding.

Drivers should always leave extra distance (additional time/distance as calculated above) between their vehicle and the vehicle ahead of them. Stopping on ice takes about eight times the distance that it takes on dry pavement.

Carry suitable warm clothing and emergency equipment during the winter months. Temperatures can plunge rapidly.

Be aware of icy patches on the road bridges and intersections that are especially prone to ice patches.

Be familiar with the skid control procedures for the type of vehicle being driven (i.e., front, rear or four-wheel drive).

7.1.6 Gravel Roads and Remote Locations

Prior to getting in the vehicle, inspect the vehicle and have any required maintenance performed before leaving for the job site.

Prior to driving on a road with an assigned radio frequency, the passenger will test the two-way radio to confirm that the proper radio frequency is set, and that the transmission is being received clearly by other traffic. The passenger will operate the two-way radio.

Drivers will maintain appropriate speed for the road and weather conditions.

Headlights will be used at all times.

Drivers will respect established roadway protocol, drive defensively, and respect intersections and traffic signals/signage.

4WD options will be utilized at the discretion and comfort level of the driver. If road conditions are questionable even for 4WD use, the road will not be traveled and either another route located or the work postponed until road conditions improve.

7.1.7 Off-road

If inexperienced, seek supervisory advice and training.

Vehicles should only be driven off roads after all other options (ATV's, etc.) have been considered.

Prior to driving off-road check to see that the vehicle is in good operating condition and your tires are properly inflated. Realize the limitations of your vehicle and do not become over confident.

Seat belts should be kept fastened at all times and all loose objects in the vehicle securely fastened to prevent them from becoming projectiles.

Drive according to the ground conditions. Speed and power are not required in rough off-road driving. In many cases with manual transmissions, letting the clutch out slowly and allowing the vehicle to crawl over obstacles in the lowest gear is the best scenario.

Learn to read the surrounding terrain. Monitor the ground conditions ahead of the vehicle -- it is essential to know what to expect from the ground being driven on. Be aware of weather conditions in your area and cautious when encountering unusual conditions such as dust storms, stormwater and flood waters, etc.

When slowly traversing difficult areas of soft ground, try to keep the vehicle in

motion. Once stopped it will be far more difficult to get it going again. If the vehicle becomes stuck, do not spin the wheels, as it will only dig in further or deeper until the vehicle chassis rests on the ground. Try to go slowly backwards in the vehicle's own tracks, as these have been previously compressed by the vehicle. In most cases this will be successful. If not, place appropriate material (wooden planks, mats, branches, etc.) under the wheel to improve traction.

Before driving over rough terrain, the terrain should be inspected on foot first.

When climbing hills ALWAYS go straight up or down. Know what is on the other side of the hill before going up. At the base of the hill the driver should apply more power. Ease up on the power while approaching the top and before going over the crest. If the vehicle stalls on the ascent, back straight down the hill in reverse. For downhill travel in a vehicle with manual transmission, always use the lowest gear, and do not disengage the clutch to allow the vehicle to coast. If the vehicle is equipped with an automatic transmission, use low range and the lowest drive setting. NEVER drive a hill at an angle.

If the hill is very steep and you do not feel confident that your vehicle can make it up, then do not attempt it.

When driving through water, always consider the maximum wading depth of the vehicle. The air intake must always be kept clear of water. Driving through water should always be done slowly to keep the bow wave low. In addition, slow speed prevents a hot engine from suffering tension cracks by sudden contact with cold water. Check the brakes after leaving water.

Prior to returning to the road, do a vehicle inspection to confirm the vehicle is road worthy.

7.2 Cabrera Owned or Leased Vehicles

The granting of driving privileges for Cabrera owned or leased vehicles shall include the following:

- Having the appropriate qualifications.
- Having a good driving record.
- Complying with the procedures set out in this section and with applicable Safe Work Practices.

An employee's driving privileges for company business may be removed at any time should Cabrera determine that these criteria are not being met.

Perform pre-operation inspections.

Arrange for preventive maintenance services for the vehicle and maintain it in sound mechanical condition.

Do not operate the vehicle if unsafe or if conditions exist that would result in vehicle damage.

Do not use the vehicle for any unofficial use including personal business unless specific permission is given from the Supervisor.

Transport only persons on Cabrera related business or those persons receiving transportation as a prescribed service.

Do not pick up hitchhikers.

Do not use the vehicle for transportation to or from work or park at a residence overnight unless approved by the employee's Supervisor.

Do not smoke or allow anyone else to smoke in the vehicle.

Be responsible for any damage caused by abuse.

Secure the vehicle when left unattended.

Upon request, the HR Representative will provide a copy of the employee's driving report to Cabrera's insurance carrier.

An employee will be deemed to have an unsatisfactory driving record if, during the immediately preceding three (3) years, the employee has had their Driver's License suspended or revoked, or has had more than two (2) minor convictions, or a major conviction, or more than one (1) at fault claim, or more than six (6) demerits points for driving violations.

To maintain driving privileges, Cabrera may also require the employee to take a defensive driver course at Cabrera's expense.

If the employee's driving privileges are revoked and their position requires the use of a vehicle for business, Cabrera may, at its discretion, attempt to identify a suitable alternative position for which use of a vehicle is not required and which is consistent with the employee's skills and Cabrera's operating needs.

Cabrera reserves the right to require employees to take in-car driver training should driving conditions, performance or their driving record warrant it.

7.3 Vehicle Maintenance

Vehicles shall be fit for purpose and shall be maintained in a safe working

order, with seat belts fully functional. This applies to all vehicles owned or leased by Cabrera and to personally-owned vehicles used for company business.

7.4 Safety Equipment

The following suggested items should be kept in all vehicles used for company business in remote project locations:

- First Aid kit, appropriate to the work and crew size, or per regulations.
- Emergency equipment (e.g. flares, flashlight, blanket, etc.) based on conditions.

Safety helmets shall be worn by the driver and passengers of all-terrain vehicles, snowmobiles and other similar types of vehicles when used for company business and/or as required by local laws.

7.5 Driver Fitness

Drivers are responsible for being appropriately licensed, trained and medically fit to operate the vehicle.

Cabrera employees operating vehicles on business shall be alert and not operate a vehicle when fatigued.

7.6 Driver Impairment

Drivers shall not operate a motor vehicle while under the influence of alcohol or drugs, or any other substance or medication that impairs their ability to drive.

7.7 Vehicle Incident

In the event of a traffic accident while on Cabrera business, an employee **MUST** follow the Incident Reporting Procedures, including seeking assistance, reporting the incident to the appropriate authority, completing and submitting the required forms.

Testing for Alcohol and/or Drugs – See the Cabrera Employee Handbook and refer any questions to the HR Department. In the event that a police/regulatory officer responding to a vehicle incident administers field and/or laboratory impairment testing, Cabrera reserves the right to obtain copies of such testing results for inclusion in the incident report and consideration in a subsequent incident investigation.

7.8 Investigation Process – refer to OP 514, Incident Investigation and Review.

Consequences if determined to be at “fault” – taking a Defensive Driving Training course shall be among the considerations as a corrective action. The OH&S Manager can advise as to the availability of such training.

In addition, the employee will:

- If requested, provide police and other driver(s) with their liability insurance information.
- Do not operate a damaged vehicle if its safety is questionable, its operating condition is illegal by applicable laws or its condition is such that further damage would result from its operation.
- If requested, provide and discuss the completed draft Incident Report form with Senior Management.
- If the employee receives a Summons, Complaint or other legal document relating to a traffic incident, note the date, time, place and method of delivery and immediately forward the original documents to their direct supervisor.
- **THE EMPLOYEE SHOULD NOT ADMIT LIABILITY, AGREE TO PAY FOR ANY DAMAGE OR SIGN ANY DOCUMENT EXCEPT AS REQUIRED BY LAW.** Statements made in haste or anger may be legally damaging.

In the event of an accident, the supervisor must follow the procedures set out in OP 513, Incident Reporting for reporting the accident.

7.9 Traffic Citations

The employee is personally responsible for payment of any fines for moving violations and parking citations incurred while driving any vehicle on Cabrera business.

7.10 Vehicle Insurance

For information about insurance carried by Cabrera for Cabrera owned or leased vehicles and any questions about insurance the employee may have as to business use of employee-owned vehicles, please contact John Chamber, Chief Financial Officer.

8.0 REFERENCES

- OP 513, Incident Reporting


9.0 REQUIRED RECORDS

A completed Drivers Acknowledgment Form will be completed by employee driving a Cabrera owned, leased/rented vehicle for Cabrera business purposes and a copy forward to the OH&S Manager for inclusion into the LMS.

10.0 ATTACHMENTS

Attachment A – Driver Acknowledgment Form

Attachment A
Driver Acknowledgment Form

OP 520 - Driver & Vehicle Safety		 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>	
Driver's Acknowledgement Form			
IF YOU DRIVE ON COMPANY BUSINESS, YOU MUST READ THIS PROCEDURE, ACKNOWLEDGE THE STATEMENT BELOW AND RETURN A COMPLETED COPY OF THIS PAGE TO THE OH&S MANAGER.			
NOTE: It is not a requirement to provide copies of your driver license or proof of insurance as an attachment to this form. Supervisors are responsible for reviewing and confirming these documents are valid and accurately represented herein.			
Drivers Information			
Employee Name (Print):		State of Issuance:	
Driver's License #		Expiration Date	
<p>I acknowledge that I have read the attached Procedure and understand that it contains important information about employee use of motor vehicles for business purposes. I agree to adhere to the requirements set forth in the Procedure.</p> <p>As a condition of driving a vehicle on company business, I will present my Driver's License and proof of insurance for validation purposes to my Supervisor as witnessed below.</p> <p>In addition to completing this form, I understand that the company may run a Motor Vehicle Driving Record report and provide this report to my Supervisor.</p> <p>I understand that I must notify Cabrera immediately if there is any change in the status of my Driver's License and Cabrera reserves the right to terminate my driving privileges and any associated benefits at any time, for any reason, in its sole discretion.</p> <p>I understand that Cabrera may require me to participate in a defensive driving course at Cabrera's expense in order to continue my driving privileges.</p> <p>This Procedure and my signed Acknowledgement are intended to and shall supplement the terms of my employment relationship with Cabrera.</p>			
Date:		Employee Signature:	
I confirm that the Driver's License number and expiry date set forth above are consistent with the employee's Driver's License.			
Date:		Supervisor Name:	
		Supervisor Signature:	



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

FOR

FIRST AID & MEDICAL SERVICES

OP-531

**Revision 1
October 2013**

Prepared by:

Sean Liddy, CSP
Occupational Health & Safety Manager

11-18-2013

Date

Approved by:

Alan Solow, CHP
Chief Executive Officer

11/18/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the procedures to ensure employees receive timely and appropriate First-Aid and emergency medical support when an injury or illness occurs in the working environment. It also provides guidance in regard to basic first aid kit supplies for each fixed office or project location (field) and provides guidance for minimizing or controlling exposure to Blood Borne Pathogens.

2.0 APPLICABILITY

This procedure applies to all CABRERA employees and operations.

3.0 DEFINITIONS

- 3.1 AED - Automated external defibrillator or AED is a portable electronic device that automatically diagnoses the potentially life threatening cardiac arrhythmias of ventricular fibrillation and ventricular tachycardia in a patient. The AED is able to treat the patient through defibrillation, the application of electrical therapy which stops the arrhythmia. This allows the heart to re-establish an effective rhythm, which is essential for resuscitation of a patient in full cardiac arrest.
- 3.2 Blood - Human whole blood; human blood components such as plasma or platelets; and human blood products such as clotting factors.
- 3.3 Bloodborne Pathogens (BBP) - Pathogenic microorganisms that are present in human blood and that can infect and cause disease in people who are exposed to blood containing these pathogens; including but not limited to hepatitis B virus (HBV), human immunodeficiency virus (HIV), hepatitis C, malaria, syphilis, babesiosis, brucellosis, leptospirosis, arboviral infections, relapsing fever, Creutzfeldt-Jakob disease, human T-lymphotrophic virus Type I, and viral hemorrhagic fever.
- 3.4 Emergency Medical Services (EMS) - A type of emergency service dedicated to providing out-of-hospital acute medical care, transportation to definitive care, and other medical transport for patients with illnesses and injuries who are unable to transport themselves to the care facility.
- 3.5 Exposure Control Plan - A plan that addresses the requirements applicable to specific CABRERA projects and activities designed to eliminate or minimize employee exposure. The Exposure Control Plan may be incorporated into the project Site Safety & Health Plan (SSHP). The Exposure Control Plan shall include:
- Exposure determination.

- Evaluation of circumstances surrounding exposure incidents.
 - Accessibility to all potentially affected employees.
 - Methods of compliance.
 - Note that in the State of California this plan shall also address exposures to airborne pathogens.
- 3.6 First Aid Provider - A first aid provider responds as a “Good Samaritan.” They use a limited amount of equipment to perform initial assessment and provide immediate life support and care while awaiting arrival of emergency medical services.
- 3.7 First Responder - A designated individual who uses a limited amount of equipment to perform initial assessment and intervention, and is trained to assist other emergency medical services.
- 3.8 Occupational Exposure (Exposed) - Reasonably anticipated skin, eye mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties. Employees will be considered to be potentially exposed, even though they are using the universal precautions specified for the project.
- 3.9 Other Potentially Infectious Materials - Body fluids and tissues including: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, amniotic fluid, saliva, and any other body fluid that is visibly contaminated with blood. When it is difficult or impossible to differentiate between body fluids, all body fluids should be treated as if they are potentially infectious.
- Note that in the State of California airborne pathogens are also considered infectious materials.
- 3.10 Parenteral - Refers to piercing the skin barrier (cuts, abrasions, human bites).
- 3.11 Regulated Waste - (1) liquid or semi-liquid blood or other potentially infectious materials; (2) contaminated items that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed; (3) items that are caked with dried blood or other potentially infectious materials and are capable of being released during handling; (4) objects contaminated with blood that can pierce the skin; and (5) pathological and microbiological wastes containing blood or other potentially infectious materials.
- 3.12 Site Safety & Health Plan (SSHP) - A document prepared for a specific project that details the hazards, precautions, emergency planning, medical, and training requirements for that project.

- 3.13 Source Individual - An individual, typically one who has been injured, whose blood or saliva has come in contact with another individual, typically one who has rendered first aid or Cardio Pulmonary Resuscitation (CPR) to the injured party.
- 3.14 Universal Precautions - All body fluids and materials potentially contaminated by body fluids will be considered to be infectious unless the fluids were from the person performing the clean up or decontamination activities. All employees coming in contact with another person's body fluids shall assume that the fluids are infectious and shall wear prescribed Personal Protective Equipment (PPE).
- 3.15 Third Party Medical Services Provider - CABRERA Medical Consultant Provider.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

4.1 Potential Exposure Situations

Because of the nature of CABRERA'S work, it is very unlikely that employees will come in contact with BBP, however; there are a few activities within CABRERA where occupational exposures to blood or other potentially infectious materials are of concern. These activities include:

- Investigations of properties that received regulated wastes.
- Site visits or audits at Treatment Storage and Disposal (TSD) Facilities where medical waste is handled.
- Site visits or audits at medical or health care facilities.
- The provision of first aid or CPR to CABRERA, subcontractor, or client personnel.

Although CABRERA offers first aid and CPR training opportunities to its employees on a regular basis, providing such aid is not a specified job duty of every employee and would be considered under the "Good Samaritan Act". First aid trained employees who perform a "Good Samaritan" acts which result in an exposure incident may not technically constitute "occupational exposure", as defined by the OSHA BBP standard.

CABRERA chooses to provide training, PPE, and post-exposure medical follow-up to any first aid and/or CPR -trained employee who renders first aid in the office or during field activities.

Any employee that may be required by a client contract to be designated to provide emergency first aid should be identified in project planning documents. As such, an exposure control plan should be incorporated under the

requirements of OSHA 29 CFR 1910.1030 "Occupational Exposure to Bloodborne Pathogens".

4.2 Unforeseen Exposure Situations

Occasionally, potentially infectious materials are encountered during a project where none was expected. When this happens, the work shall be stopped, employee training conducted, and an exposure control plan prepared prior to resuming activities with potential exposures.

5.0 EQUIPMENT

5.1 First Aid Kits

It is required that all CABRERA project or field sites maintain adequate first aid kits in convenient and accessible locations as appropriate and in accordance with applicable regulations for the specific location. Where the eyes or body of a person may be exposed to injurious materials, suitable facilities shall be provided within the work area for rinsing the material from eyes and off of skin.

All field sites (including vehicles) must be equipped with a complete first aid kit appropriate to the number of staff, location of the work, and job task, as dictated by SSHP and applicable laws and regulations. Staff working away from the vicinity of a first aid kit shall carry a personal first aid kit.

A log to track usage and a monthly inspection form should be included with the first aid kit.

The Site Safety & Health Officer (SSHO) identified for each individual project site, or local administrator or Safety & Quality Council (SQC) representative within each office, will be responsible for the inspection of first aid kits for their offices and/or assigned projects, including all vehicles.

Entries into the log are to be made by each employee that takes something from the kit. Employees are to indicate if the items were taken as a result of a work related incident and whether an Incident Report was completed. During the monthly inspection, the responsible person is to initial next to each entry which indicates there was a workplace exposure to verify the status of the affected employee.

The first aid equipment and supplies must be maintained in a clean, dry and serviceable condition, contained in a material that protects the contents from the environment, and clearly identified as first aid equipment and supplies.

AED's, where provided, must be maintained in optimal working condition. AED's will be inspected monthly by a properly trained and qualified employee. At a minimum, the AED manufacturer's recommended service schedule is to

be followed; records of all servicing and testing is to be maintained. Only staff who have a valid first aid training certificate (which includes instruction on the use of an AED), and who have reviewed all manuals and DVD training resources which accompany the machine, may use an AED.

Below is a list of recommended first aid kit contents. The type of project and the number of employees can alter this list. The list below is for approximately 25 employees in an office environment:

- Gauze pads - sterile – 4" x 4" (10)
- Large wound dressing – 5x9" or 8x10" (2)
- Eye patch (3)
- Band-aids (25)
- Elastic bandage – 3" (2)
- Roller gauze – 3" (2)
- Triangular bandage (2)
- Cold pack (2)
- Gloves – non-latex (6 pair minimum)
- Antiseptic wipes for wound care (6)
- Packets of burn cream, antibiotic ointment, sting relief wipes (6 each)
- Scissors (1 pair)
- Tweezers (1 set)
- Analgesic packets of 2 (acetaminophen, ibuprofen) (12) depending on policy
- Eye flush – 4 oz (1)
- Adhesive tape – (1 roll)
- Waterless hand sanitizer (Purell) (1 bottle)
- CPR pocket mask or Microshield (1)
- First aid guidelines and emergency contact instructions

5.2 Universal Precautions Kits

In those work areas where there is the potential for exposure to infectious materials, a universal precaution kit shall be readily available. The kit shall permit the clean-up, neutralization, transportation, and disposal of up to 1 liter of blood or body fluids. The kit shall contain the following items at a minimum:

- Safety shield/mask combination
- Liquid proof apron
- Medical-grade vinyl/nitrile gloves
- Liquid solidifier/deodorizer
- Pickup scoop with scraper
- Red biohazard waste bag with tie
- Germicidal solution with dry wipe
- Antimicrobial hand wipe
- ID tag
- Instructions for use

5.3 Personal Protective Equipment

All body fluids and materials potentially contaminated by body fluids will be considered to be infectious unless the fluids were from the person performing the clean up or decontamination activities. All employees coming in contact with another person's body fluids shall assume that the fluids are infectious and shall wear prescribed PPE.

PPE such as Tyvek coveralls, shoe covers, and gloves will be provided to all field team members involved in site activities where regulated wastes may be present. The specific PPE requirements will be identified in the Site-specific SSHP. PPE will be provided to affected employees at no cost to the employee.

6.0 RESPONSIBILITIES

- 6.1 Senior Management - Responsible for supporting the assessment of office and field employees in the need for first aid, CPR and/or AED training and making training available to employees who require the training. Support the Occupational Health and Safety (OH&S) Manager in efforts to prevent occupational and non-occupational exposures to BBP and see that all recommendations made by the OH&S Manager are implemented
- 6.2 Occupational Health & Safety (OH&S) Manager - Responsible for the review project-specific Exposure Control Plans (normally part of the SSHP) prior to the initial project mobilization, at least annually for continuing projects, and whenever necessary to reflect changes in conditions, modified tasks or procedures that affect occupational exposure to BBP. Confirm that site-specific training is conducted for all employees working at sites where regulated wastes were disposed or for employees who may be occupationally exposed while working at a facility that handles regulated wastes. Consult with the Third Party Medical Services Provider regarding all BBP exposure

incidents. Review all incident reports and arrange for post-exposure follow-up testing with a local medical providers including recommendations on how to prevent an incident from recurring. Maintain training records and post-exposure follow-up information.

- 6.3 Local Office Admin and/or SQC Representative - Responsible for conducting monthly inspections of first aid kits; follow-up with employees who used first aid kits to assess individual Work Related purposes. Inform office/location manager of any discrepancies between usage log and actual contents of kit. Order replacement supplies and re-stock first aid kits as needed.
- 6.4 Site Safety & Health Officers (Field Based Project Sites) - Responsible for conducting monthly inspections of first aid kits and follow-up with employees who used first aid kits to assess individual Work Related purposes Inform office/location manager of any discrepancies between usage log and actual contents of kit. Order replacement supplies and re-stock first aid kits as needed.
- 6.5 Employees - Responsible for completing entry into first aid kit log for items used. Contact supervisor and assist with the completion of the Incident Report. Use all PPE and universal precautions required to prevent exposure to infectious materials

7.0 PROCEDURE

7.1 First-Aid

Each project and office location shall maintain a first-aid kit in accordance with the requirements in this procedure and appropriate regulatory agencies (reference 29 CFR 1910.151; 29 CFR 1926.50, local/state regulations). In general, this requires the presence of an individual with current training in first-aid (Red Cross or equivalent) unless the following conditions can be satisfied:

- On projects where accidents resulting from suffocation, severe bleeding or other life threatening injury or illness can be anticipated , professional medical provider response times of 3-4 minutes are expected.
- In other circumstances where a life-threatening injury is an unlikely outcome of an accident, a longer response time of up to 15 minutes is acceptable.

Each office and project location shall post a current list of qualified first-aid providers and a list of emergency telephone numbers to access local medical emergency care providers. Only personnel with current training in first-aid shall provide such services unless done so in consultation with a professional medical provider.

7.2 Local Medical Services

Each construction/field project and permanent/project office shall identify a suitable local medical facility to treat work-related injuries/illnesses. Where required by local workers' compensation laws, multiple facilities shall be identified and communicated to employees. The OH&S Manager can be contacted to provide a listing of potential facilities.

7.3 Employee Medical Treatment (Work Related)

When employees require immediate medical attention as the result of a work-related injury/illness, transportation must be provided to the doctor's office, clinic, or hospital. Employees shall not be permitted to drive their own vehicle unless authorized by the project and/or office manager.

Each construction/field project shall make appropriate arrangements with the local emergency service providers prior to start of construction/field activities to ensure appropriate transportation can be provided in the event of an emergency. These arrangements include establishment of a suitable project address and emergency service access point (i.e. location to meet emergency personnel) responder.

Critical Injury Treatment

In all cases, critical injuries must be immediately referred for professional medical attention. The manner in which the referral is accomplished, and the person responsible for the referral, should be clearly defined in either a project safety plan and/or an office Emergency Management Plan (refer to OP 516, Emergency Management Planning). Critical injuries/illnesses include, but may not be limited to, the following:

- Loss of consciousness
- Unexplained chest pain
- Breathing difficulty
- Uncontrollable bleeding
- Fractured bones
- Suspected internal injuries
- Suspected exposure to chemical/biological hazard
- Second or third degree thermal or chemical burns (i.e. any blistering)
- Electrocutation
- Unexplained change in mental state following an injury (may indicate shock or other internal injuries)

Non-Critical Injury Treatment

When a work-related incident results in a non-critical injury/illness, the primary objective is to provide timely and appropriate medical services to diagnose and treat the injury/illness. Options available to the employee and project/office management in these situations include the following:

- First-aid treatment and/or review by a qualified first-aid provider
- First-aid treatment and/or review by a qualified first-aid provider followed by a referral to the Third Party Medical Service Provider
- Immediate referral to local medical service provider

Additional support for the employee and managers in these situations can also be obtained from the OH&S Manager.

7.4 Medical Treatment Authorization

Prior to leaving a project or office site for medical services related to a non-critical injuries/illness, the OH&S Manager must be contacted. The OH&S Manager will assist by calling the designated clinic ahead of the employees arrival to facilitate any paperwork requirements to ensure the employee receives prompt treatment upon arrival.

When employees are unable to make contact prior to being treated (i.e. urgent symptoms, unable to make phone contact, etc) they must notify their supervisor at the start of the next scheduled workday. It is the employee's responsibility to provide a "return to work" (OP 533, Modified Duty) or equivalent slip from the treating physician regardless of the extent of treatment.

Under no circumstances will individuals be permitted to return to full- or modified-duty status without appropriate medical clearance. This requirement must be conspicuously posted at all project/office locations and discussed during initial orientation and referenced frequently during safety meetings.

7.5 Employee Medical Treatment (Non-Work Related)

Employees who are injured or become ill due to non-work related factors resulting in three or more days of absence from work must provide their supervisor with a written medical release that indicates no work restrictions upon return to work. Any medical release that requires restrictions on the employee's ability to perform any or all of their normal job functions must be reviewed by the Human Resources Representative prior to the employee returning to work status.

Employees sustaining any non-work related injuries/illnesses that could affect

their ability to perform their normal job functions or place other employees at risk shall conform to the above requirements regardless of the number of days of absence.

Prior to conducting field work, the employee must discuss these requirements, in addition to other required PPE, with their Project Manager.

7.6 Postings

The location of first aid kits will be conspicuously posted at all office and field project sites. At field project sites, and other locations where 911 may not be readily available, the first aid kit should be posted along with applicable emergency contact, and hospital route information for the location.

7.7 Training

Required training shall be conducted by the Red Cross or equivalent. First Aid and CPR training will be renewed every two years. Additionally, annual training may be required for personnel who have access to AED. Employees will receive AED training for the device(s) which they may use; training certification will be renewed annually. Specific training may also be considered for such topics including wilderness survival and rescue for employees performing work in remote locations where access by EMS is limited by extreme terrain. Additionally, working in foreign countries where security is a real safety concern, employees may be subject to supplemental safety training provided by others.

While employees may be trained in First Aid, they are under no obligation to provide first aid. In the event that there is a requirement for an assigned first responder as part of their job duties, this should be identified in the project planning documents and applicable training applied.

First Aid/CPR Training may be required for the following employees:

- As required in accordance with applicable regulatory and project requirements;
- Employees conducting field work with reasonable risk for life threatening injuries where EMS are not accessible within four (4) minutes; and
- Employees conducting field work in remote areas that are not accessible by EMS within the regulatory or legislative requirement.

7.8 Tetanus Vaccinations

Public health guidelines indicate people should receive a tetanus booster every 10 years.

It is recommended that employees contact their personal physician to obtain tetanus boosters as part of their routine personal health monitoring and preventative care.

CABRERA will provide for tetanus vaccinations/boosters in the event that an employee is injured during a work-related activity and the treating (occupational) physician recommends that a booster be administered.

7.9 Blood Borne Pathogens

As there is potential for exposure to blood borne diseases, it is necessary for anyone who may render first aid and CPR to be aware of the hazards associated with contact with human blood and certain body fluids. CABRERA'S Blood Borne Pathogen (BBP) procedure is designed to protect personnel from exposure to potentially infectious organisms found in human blood and other body fluids.

Providing Assistance to Injured Employees

In the case of an emergency, the first aid attendant should immediately call for Emergency Services such as 911 and then provide injured workers with a level of care within the scope of the attendant's training, objectively record observed or reported signs and symptoms of injuries and exposures to contaminants, and refer for medical treatment beyond the scope of the attendant's training.

Reporting Exposure Incidents

All incidents in which an employee has been exposed to blood or other potentially infectious materials shall be reported to the employee's Supervisor and to the OH&S Manager. An Incident Report shall be completed by the Supervisor and after reviewing the report, the OH&S Manager will provide recommendations, when appropriate, for preventing recurrence of the incident.

The following are examples of exposure incidents that shall be brought to the attention of the OH&S Manager so that prompt and appropriate medical follow-up can be initiated:

- Injury (piercing, puncturing, or cutting of the skin) with a sharp object contaminated with blood or a potentially infectious material.
- Contact of an open cut, skin abrasion, dermatitis, and the mucous membranes of the eyes, mouth, or nose with blood or potentially infectious material. This would include providing unprotected, mouth-to-mouth CPR.
- Touching a contaminated object or surface and transferring the

infectious material to your mouth, eyes, nose, or open skin.

Once notified, the OH&S Manager will in turn discuss the incident with the Third Party Medical Services Provider and/or medical provider and make arrangements for an evaluation. Prompt medical attention is important in the event of an exposure incident. If the incident occurs in the field, the employee will either be asked to visit the local hospital or if he/she chooses, return immediately to the office to visit a CABRERA local medical provider.

CABRERA will rely on the professional judgment of its Third Party Medical Services Provider and/or local medical providers in the event of an exposure incident. Evaluations and follow-up procedures will be provided according to the recommendations of the United States Public Health Service (USPHS), current at the time these evaluations take place. Minimally, a post-exposure evaluation and follow-up will include the following elements:

- Documentation of the route(s) of exposure
- Circumstances under which the exposure incident occurred
- Identification and documentation of the source individual in the case of first aid or emergency medical treatments
- Collection and testing of source individuals and exposed employee's blood for HBV and HIV serological status as soon as feasible and upon consent
- Post-exposure vaccination when medically indicated, as recommended by the USPHS
- Counseling, if necessary
- Evaluation of reported illnesses

Housekeeping

Other than through the provision of first aid or CPR, there is no potential for occupational exposure to blood or other potentially infectious materials within any of the CABRERA offices. Therefore, the housekeeping requirements and requirements for warning signs and labels contained in the OSHA BBP standard are not applicable to our office operations.

When working at a site where regulated wastes have been disposed of, the specific housekeeping and warning sign requirements will be prescribed by the client and/or in the SSHP.

When working at a client's facility, CABRERA will assume the facility is in complete compliance with all the requirements of the BBP Standard and will observe all housekeeping requirements, wear required PPE, and acknowledge all warning signs and labels as specified in the client's plan.

Regulated Waste

Any regulated waste generated by CABRERA as a result of first aid activities or clean-up of potentially infectious material will be collected in sealed, watertight containers and disposed of according to the Host Employer's BBP program or transported to a local fire station or hospital for proper disposal.

Material Decontamination

Any areas or equipment that are contaminated by potentially infectious material will be decontaminated using a 10% solution of household bleach.

Employee Training

All personnel who will work on projects which involve potential contact with regulated wastes will be required to attend a training class prior to the start of the project and annually for continuing projects.

Either of the following two sources of employee training will be used to educate employees on the hazards of exposure to BBPs:

- The local chapter of the American Red Cross or other recognized training provider.
- In-house training program

Training sessions will review the following:

- Requirements of OSHA's BBP Standard
- Review of CABRERA'S BBP Procedure (this document)
- Situations within organization that may involve exposure to BBP
- Bloodborne diseases and symptoms of disease
- Means of transmission
- Work practice controls to reduce risk
- Use of personal protective equipment to reduce risk
- Incident reporting

Procedure and Plan Review

This procedure will be reviewed at least annually and whenever necessary to reflect new or modified tasks and procedures within CABRERA which may affect occupational exposure to BBP.

8.0 REFERENCES

Title 29, Code of Federal Regulations, Sections 1910.151, 1910.266(i) (7), 1910.1030(g) (2) and 1926.50

United States: OSHA 29 CFR 1910.1030 "Occupational Exposure to Bloodborne Pathogens"

United States Army Corp of Engineers, EM-385-1-1, Section 3, Medical and First Aid Requirements.

OP 513, Incident Reporting

OP 516, Emergency Management Planning

OP 533, Modified Duty

9.0 REQUIRED RECORDS

The following documents shall be filed in the project/office safety file and copied to the OH&S Manager for each work-related incident requiring first-aid and/or medical services:

- Completed Incident Report
- Physician's First Report of Injury (When Required)
- Employer's First Report of Injury (When Required- Supplied by Workers' Comp. Insurance Carrier)
- Follow-up Reports from Treating Physician (When Required)
- Documentation of coordination between CABRERA and emergency services providers

The following documents shall be posted as required:

- List of medical services facilities and emergency telephone numbers
- List of qualified first-aid providers

The OH&S Manager will maintain records and provide copies to the Third Party Medical Services Provider. Records maintained in accordance with this Procedure will include BBP exposure incidents, post-exposure follow-up, vaccination status, and training for all employees with potential occupational exposure. Medical records will be maintained in the office of the Third Party Medical Services Provider for the term of employment plus 30 years. Training and incident investigation documents shall be maintained by the OH&S Manager for the term of employment or 3 years whichever is longer.

Employees may request and obtain copies of their medical records from the Third Party Medical Services Provider.

If CABRERA ceases to do business, CABRERA shall notify the OSHA Area Director, at least 3 months prior to the disposal of the medical records and, if required by the Director to do so, transmit them to the OSHA Area Director within that 3-month period.

10.0 ATTACHMENTS

Attachment A – First Aid Kit Inspection Form

Attachment A
First Aid Kit Inspection Form

OP 531 - First Aid & Medical Services



FIRST AID KIT INSPECTION FORM

A complete inventory, including quantities of supplies used, must be kept, and regularly updated on minimum of a monthly basis. Employees that take items from the first aid kit are required to complete this log, and notify the SSHO of the reason (personal or work related) and initiate the Incident Reporting process if necessary.

LOCATION INFORMATION

OFFICE/PROJECT NAME:		OFFICE/PROJECT MANAGER:	
ADDRESS/LOCATION:		DATE:	
		TIME:	
FIRST AID KIT ID:		FIRST AID KIT LOCATION:	

FIRST AID KIT USAGE LOG

EMPLOYEE NAME	DATE	ITEMS USED	QUANTITY USED	PERSONAL USE	*WORK** RELATED
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
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				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>

*****IF WORK RELATED, EMPLOYEE MUST REPORT INCIDENT TO SSHO AND COMPLETE INCIDENT REPORT*****



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

FOR

SAFETY MEETINGS

OP-555

**Revision 1
October 2013**

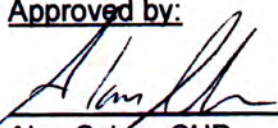
Prepared by:



Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013
Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013
Date

1.0 PURPOSE

This operating procedure (OP) establishes the requirements for conducting and documenting meetings on topics that are designed to promote Health Safety & Environmental (HS&E) awareness and to facilitate discussion regarding hazards and risks associated with the task(s) to be performed. This OP also serves to reinforce the organizations commitment to Safety as a Core Value by facilitating discussions on safety at the beginning of meetings/discussions.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations in the performance of services directed and controlled by Cabrera.

3.0 DEFINITIONS

- 3.1 Meeting - For purposes of this procedure, meeting will be defined as any face-to-face, teleconference, WebEx and/or videoconference meeting that is led by a Cabrera employee and involves five (5) or more participants for the purpose of discussing safety related topics. Exception - training events/classes/courses are excluded from the definition of meeting.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

None.

5.0 EQUIPMENT

There is no equipment associated with this procedure.

6.0 RESPONSIBILITIES

- 6.1 Occupational Health and Safety (OH&S) Manager - Provides assistance to Project Managers (PMs) by making training materials available and providing spot-checks of proper documentation.
- 6.2 Senior Managers - Shall ensure that PMs of projects within their areas of responsibility are conducting and properly documenting safety meetings in accordance with requirements of this OP. In addition, Senior Managers will be responsible for ensuring that a Safety Moment is conducted at the beginning of every meeting that involves five or more participants.
- 6.3 Project Managers (field task managers, supervisors) - Shall ensure that all employees and personnel under the control of Cabrera (e.g., subcontractors, temporary agency employees) assigned to projects within their areas of responsibility participate in project initiation/kick-off meetings, special situation meetings, activity hazard analyses reviews, on-site safety inspections, and

supplemental training meetings. In addition, Project Managers will be responsible for ensuring that a Safety Moment is conducted at the beginning of every meeting that involves five or more participants.

7.0 PROCEDURE

7.1 Safety Moment

A safety moment is defined as any communication that involves the sharing of thoughts, ideas, helpful tips and/or technical updates related to the safety of our staff, facilities and/or the environment in which we operate. A safety moment can be delivered by the safety moment leader as a monologue, presentation and/or a discussion based on a particular topic or provocative question.

The meeting leader shall make certain that a safety moment is listed as the first item of business on the meeting agenda and either lead the safety moment or assign this responsibility, in advance, to another participant.

Any meeting participant may volunteer to lead the safety moment by advising the meeting leader. All meeting participants have the responsibility and authority to remind the meeting leader that a safety moment is required in the event she/he begins the meeting without meeting this requirement.

7.2 Safety Orientation

All project employees will attend a project-specific safety orientation and training session prior to the start of any project.

The PM, site supervisor, or Site Safety and Health Officer (SSHO) will conduct the meeting based on project specifics (e.g., location, unique hazards and risks, client requirements, etc.). The depth/level of training will be commensurate with the job function(s) to be performed.

Site visitors will receive general orientation and task-specific training. At a minimum, employee orientation and training will consist of the items listed below:

- Identification of hazards associated with the individual's job function and responsibilities
- Specific safety procedural instruction needed to perform his or her required job function or task
- Content of the Site Safety and Health Plan (SSHP) and any associated Activity Hazard Analyses (AHA(s))

Safety Orientations will be documented using the SSHP (or client required equivalent safety planning document) Acknowledgment Form located within (last section) every document.

7.3 Preparatory Meetings

A Preparatory Meeting will be conducted prior to the start of field operations for a specific task, or Definable Feature of Work (DFW). These meetings generally cover all aspects of the work to be performed (schedule, budget, Quality Control/Assurance), but also cover safety. Discussion points for this meeting regarding the safety protocols will come from the project-specific HS&E documentation (e.g., SSHP, AHA, etc.). The meeting will involve representatives from all organizations with a direct contractual relationship with Cabrera on the job site. Safety topics for this meeting will include:

- Communication to all participants regarding on site HS&E responsibilities and authority
- Establishing safety points of contact for each organization and phase of work
- Communication of organizational HS&E performance expectations
- Identification of significant project HS&E issues, risks, and solutions
- Coordination of organizational HS&E conflicts and interactions.

Review of applicable safety related information from Preparatory Meetings will be documented using the Acknowledgment section of the applicable AHAs for the given tasks. The sing-in sheets for the meeting may also be used to support the acknowledgment process.

7.4 Periodic (Tailgate/Toolbox) Safety Training Meetings

Periodic safety training meetings, typically referred to as Tailgate or Toolbox Safety Meetings, will be scheduled and conducted throughout the duration of the project. These meetings will be conducted on a daily basis on all HAZWOPER projects and at a minimum of a weekly basis on all non-HAZWOPER sites.

Meetings shall give project personnel an opportunity to maintain a high degree of safety awareness through timely and quality safety education. Meeting time will be used to discuss specific safety topics and obtain employee feedback.

Safety meetings will be conducted by the PM, Site Supervisor or SSHO and supplemented by lead persons of the various crafts represented at the site (e.g., electrician, heavy equipment operator, foreman, inspector, resident

engineer, etc.).

Topics for discussion will include HS&E hazards noted during routine and non-routine work situations and an explanation of job safety procedures unique to the project. The PM and SSHO will monitor safety meetings to ensure that subject matter is properly presented.

All periodic safety meetings will be documented using the Tailgate/Toolbox Safety Meeting Form (Attachment A). Sign-in of every meeting participant is required to ensure proper accountability and to meet Cabrera project recordkeeping requirements. All signed copies of the field forms and project plans must be placed in the appropriate project folder.

HS&E and environmental considerations will be discussed at every project meeting. Project level safety meeting requirements are as follows:

- All on-site personnel must review and acknowledge the form or plan at a “tailgate” or “toolbox” meeting
- Any new or previously unidentified hazards must be documented on the form or plan as a Revision and acknowledged with initials by all on-site staff
- The Project Safety Plan must be reviewed regularly as required and documented on the plan

7.5 Supplemental Training Meetings

The PM, Site Supervisor or SSHO will implement worker training on general safety topics as part of routine on-site training activities.

7.6 Timing of Meetings

Change in Scope/Activity– Conducted for all Cabrera staff and site personnel with a direct contractual relationship with Cabrera to discuss changes to scope or a new phase of work.

Periodic – Conducted at a regular, recurring frequency of not less than one per week.

Daily – Daily safety discussions as part of daily routine project coordination meetings. Daily meetings are required for HAZWOPER activities and other activities as identified in the SSHP. Daily safety discussions will involve representatives from all organizations with a direct contractual relationship with Cabrera on the job site. Daily meetings may be conducted in the morning or other time that is convenient using the form in Attachment A..

Significant Personnel Turn-over – Conducted at the start of any workday where a new organization begins work on site or when more than 25 percent of the day's work force is new to the site.

Post-Incident – Conducted at the start of the work day following the occurrence of a significant incident as defined in OP 512, Incident Reporting.

All special situation safety meetings listed above will include review of applicable AHA for the scope of services to be performed.

Daily safety discussions not otherwise required by HAZWOPER or the project safety plan should be documented.

8.0 REFERENCES

- 29 CFR 1926.21, Safety Training and Education, Subpart C, General Safety & Health Provisions
- 29 CFR 1910.120, HAZWOPER
- United States Army Corp of Engineers, EM-385-1-1, 2008, Section 01.B, Indoctrination and Training.

9.0 REQUIRED RECORDS

All meetings that generate formal minutes shall document the safety moment leader and topic.

Safety meeting forms generated throughout the course of a project will be maintained with the project files.

10.0 ATTACHMENTS

Attachment A – Tailgate/Toolbox Safety Meeting Form

Attachment A
Safety Meeting Form

OP 555 - Safety Meetings



TAILGATE/TOOLBOX SAFETY MEETING FORM

SIX QUESTIONS FOR SUCCESS – Take two minutes to think through and answer these questions:

1. What are we about to do?
2. What equipment are we going to use?
3. Have I/we been trained to use this equipment?
4. Have I/we been trained to do this job?
5. How can I/we be hurt?
6. How can I/we prevent this incident?

If you and your team aren't prepared to do the assigned work, STOP WORK, and take time to properly prepare.

Project Information

This sign-in log documents the topics of the safety meeting and individual attendance. Personnel who perform work operations onsite are required to attend and acknowledge their ability to ask questions and receipt of such briefings daily. Please provide a brief narrative of the selected topics as applicable to the Project in the comment box (ex. Name of AHA reviewed).

PROJECT NAME & LOCATION

PROJECT NO.

DATE/TIME

WEATHER CONDITIONS

Topic

Discussion – check one

Today's Scope of Work (All tasks)	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Access / Egress / Slips, Trips, & Falls	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Schedule / New Work / Scope Changes	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Smoking, Eating, & Drinking	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Reviewed Procedures, AHA, etc.	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Washroom / Facilities Location	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Emergency Action Plan & Procedures	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Heat/Cold Stress	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Communications Protocol	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Exclusion Areas Barricades / Cones	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Required PPE	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Required Permits, Passes, Keys, etc.	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Required Monitoring / Instruments	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Decon Procedures / IDW Mgmt.	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Site Control / Work Zones / Security	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Eqpmt. Inspections/Safety Checklists	<input type="checkbox"/> yes <input type="checkbox"/> n/a

OTHER/COMMENTS:

Safety Meeting Attendees

Print Name

Signature

OP 555 - Safety Meetings



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Safety Meeting Leader

Name of Meeting Leader

Signature



CABRERA SERVICES
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OPERATING PROCEDURE

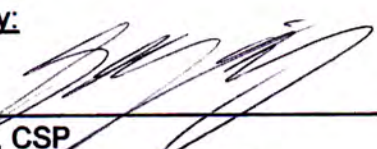
FOR

PROJECT SAFETY INSPECTIONS

OP-556

**Revision 1
October 2013**

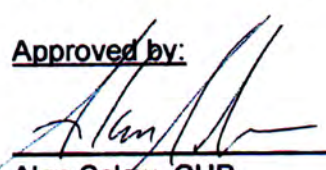
Prepared by:



Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013
Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013
Date

1.0 PURPOSE

This operating procedure (OP) establishes the procedure for Cabrera employees to perform and document site safety inspections, and to implement appropriate corrective actions designed to minimize risk and enhance operational Health Safety & Environmental (HS&E) performance.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations in the performance of services directed and controlled by Cabrera.

3.0 DEFINITIONS

- 3.1 Health Safety & Environmental (HS&E) Self-Inspection (Walkthrough) - Informal walkthrough by Project Managers and/or designated project HS&E staff, including the Site Safety and Health Officer (SSHO) of work areas, project offices, storage areas, and other operations. Depending on the scope of work, pace of operations, and types and severity of physical and/or chemical hazards, self-inspections will be conducted on a frequent but not less than a weekly basis.
- 3.2 HS&E Inspection - A systematic review of operations, procedures, equipment and records in order to identify, evaluate, document, and report actual or potential safety, health and/or environmental risks or hazards. An inspection is normally less formal and less consuming from a time and resources standpoint to conduct than is an audit. This does not apply to inspections from regulators (see OP 557, Regulatory Inspections).
- 3.3 Corrective Action - Actions assigned to an identified deficiency to remove, resolve or reduce the HS&E risk (documented using Corrective Action Form in OP 502).
- 3.4 HS&E Records - Information and documentation related to HS&E aspects of the program, project, or other operations unit, including but not limited to:
- Site Safety & Health Plans (SSHP) acknowledgement sheets
 - Activity Hazard Analyses (AHA) acknowledgment sheets
 - Project Initiation, Kick-off, Orientation or other Safety Meeting sign-off sheets
 - HS&E training attendance and course completion records
 - Medical surveillance records

- Exposure monitoring records
- Equipment calibration records

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

All managers and supervisors have the responsibility to comply with Cabrera HS&E Operating Procedures and regulatory requirements, and are accountable to prevent or bring any violations to the attention of the appropriate level of Senior Management for corrective actions.

5.0 EQUIPMENT

There is no equipment associated with this procedure.

6.0 RESPONSIBILITIES

- 6.1 Senior Managers - Shall provide training and technical guidance to operations in support of the requirements of this OP and to assure a viable HS&E inspection program is effectively implemented.
- 6.2 Project Managers (field task managers, supervisors) - Shall schedule, conduct and/or actively participate in project safety inspections, and report results as necessary to the Occupational Health and Safety (OH&S) Manager. They will provide Inspectors access to HS&E records, equipment, and work areas as appropriate.
- 6.3 OH&S Manager - Shall provide training and technical guidance to operations in support of the requirements of this OP and to assure a viable HS&E inspection process is effectively implemented.
- 6.4 Employees - Shall cooperate with OH&S Manager, and if requested, participate in site inspections.

7.0 PROCEDURE

Active, ongoing project sites will be inspected weekly, or at a frequency determined by the Project Manager and/or OH&S Manager, to meet the local regulations or client needs.

On oversight projects where Cabrera has or shares the responsibility for project safety, the on-site Cabrera supervisor will coordinate with the Contractor's HS&E officer to provide observations to the Contractor.

Unscheduled or unannounced inspections may be requested by the OH&S Manager in response to project incidents such as a work-related injury or illness, significant near-miss, regulatory agency inquiry or inspection, or HS&E-related employee report of unsafe condition or similar issue.

Self-Inspection (Walkthrough) - Walkthrough self-inspections include identifying and correcting HS&E compliance issues, housekeeping or material storage issues, life and fire safety violations, deficiencies with mobile equipment, or other adverse conditions or unsafe behaviors. Use of a structured checklist is not required for walkthroughs, however; issues will be documented and corrective action will be taken (on the spot, where feasible) when hazards, compliance violations, and/or other deficiencies are observed.

8.0 REFERENCES

- OP 502, OHSMS Assessment & Auditing, Corrective Action Form

9.0 REQUIRED RECORDS

- HS&E Inspections will be documented to the project file using the attached Project Safety Inspection Report (Attachment A). The checklist can be modified locally to reflect specific site operations.
- Items noted as deficient and in need of corrective action should be tracked using the Corrective Action Form located as Attachment A in OP 502, OHSMS Assessment and Auditing.
- Completed inspection reports forms will be maintained in the Project Review file with findings provided to the OH&S Manager for lessons learned and areas for improvement.

10.0 ATTACHMENTS

Attachment A – Project Safety Inspection Report

Attachment A
Project Safety Inspection Report

OP 556 - Project Safety Inspections



Project Safety Inspection Report

Project Name:		Inspection Date:	
Project Number:		Inspector/SSHO:	
Project Manager:		Client:	

Site Safety Plan	YES	NO	NA
1. Is a site safety plan posted on site or accessible to all employees?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Have potential hazards been described to employees on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Are manufacturer safety data sheets available for review by employees on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Is there a designated SSHO on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Are employees aware and knowledgeable of the results of potential exposures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Site Posters	YES	NO	NA
Are the following documents posted in a prominent and accessible area?			
6. Cabrera Safety Policy and Guiding Principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. OSHA Job Safety and Health Protection (or state-OSHA equivalent)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Equal Employment Opportunity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medical and First Aid	YES	NO	NA
9. Are first aid kits accessible and identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Are emergency eye wash and safety showers available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Are daily logs for first aid present and up to date?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Are first aid kits inspected weekly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Site Set Up	YES	NO	NA
13. Are work zones clearly defined?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Are support trailers located to minimize exposure from a potential release?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Is general housekeeping up to Cabrera standards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personal Protective Equipment	YES	NO	NA
16. Have levels of personal protection been established?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Do all employees know their level of protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Are respirators used, decontaminated, inspected, and stored according to standard procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Have employees been fit-tested?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

20. Is defective personal protective equipment tagged?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Does compressed breathing air meet CGA grade "D" minimum?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Are there sufficient quantities of safety equipment and repair parts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire Prevention	YES	NO	NA
23. Is smoking prohibited in flammable storage areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Are fire lanes established and maintained (where applicable)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Are flammable dispensing systems grounded and bonded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Are proper receptacles available for storage of flammables?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Has the local fire department been contacted to inform of work ops?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Welding and Cutting	YES	NO	NA
28. Are fire extinguishers present at welding and cutting operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Are confined spaces, such as, tanks, pipelines, and trenches, tested prior to cutting and welding operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Are hot work permits available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Are proper helmets, aprons & gloves available for welding/cutting ops?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Are welding and machines properly grounded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Are oxygen and fuel gas cylinders stored a minimum of 20 feet apart?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Are only trained personnel permitted to operate welding/cutting equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hand And Power Tools	YES	NO	NA
35. Are defective hand and power tools tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Is eye protection available and used when operating power tools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Are guards and safety devices in place on power tools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Are power tools inspected before each use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Are non-sparking tools available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Motor Vehicles	YES	NO	NA
40. Are vehicles inspected before each use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Are personnel licensed for the equipment they operate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Are unsafe vehicles tagged and reported to supervision?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. Are vehicles shut down before fueling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. When backing vehicles, are spotters provided (when necessary)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Plans	YES	NO	NA
45. Are emergency telephone numbers posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. Have emergency escape routes been designated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. Are employees familiar with site-specific emergency signals?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Materials Handling	YES	NO	NA
48. Are materials stacked and stored as to prevent sliding or collapsing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49. Are flammables and combustibles stored in non-smoking areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50. Is machinery braced when personnel are performing maintenance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
51. Are tripping hazards labeled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52. Are semi-trailers chocked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
53. Are fixed jacks used under semi-trailers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
54. Are riders prohibited on materials handling equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55. Are cranes inspected as prescribed and logged?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
56. Are OSHA-approved manlifts provided for the lifting of personnel?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57. Are all containers labeled as to contents?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58. Are flammable liquids stored in approved safety cans?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hazardous Waste/Environmental Compliance	YES	NO	NA
59. Are hazardous wastes stored in DOT approved containers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
60. Is hazardous waste stored in a secure area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
61. Are hazardous waste containers labeled and dated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
62. Are waste container dates outdated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
63. Is a contingency plan on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
64. Is there a preparedness and prevention plan in effect?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

65. Are warning signs posted where required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
66. Have the project's environmental hazards been assessed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
67. Has a reg. permit needs assessment been completed for the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire Protection	YES	NO	NA
68. Has a fire warning system been established?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
69. Do employees know the location and use of all fire extinguishers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
70. Are fire extinguishers marked and inspected weekly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
71. Are combustible materials segregated from open flames?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electrical	YES	NO	NA
72. Are warning signs exhibited on high voltage equipment (>250 V)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
73. Is electrical equipment and wiring properly guarded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
74. Are electrical lines, extension cords, and cables guarded and maintained in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
75. Are extension cords kept out of wet areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
76. Is damaged electrical equipment tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
77. Have underground electrical lines been identified by proper authorities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
78. Has a positive lock-out system been established by the project electrician?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Slings And Chains	YES	NO	NA
79. Are damaged slings, chains, and rigging tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
80. Are slings inspected before each use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
81. Are slings padded or protected from sharp comers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
82. Do employees keep clear of suspended loads?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compressed Gas Cylinders	YES	NO	NA
83. Are breathing air cylinders charged only to prescribed pressures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
84. Are like cylinders segregated in well ventilated areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
85. Is smoking prohibited in cylinder storage areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

86. Are cylinders stored secure and upright?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
87. Are cylinders protected from snow, rain, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
88. Are cylinder caps in place before cylinders are moved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
89. Are fuel, gas, and O2 cylinders stored a min. of 20 feet apart?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ladders and Scaffolding	YES	NO	NA
90. Are ladders/scaffolds placed on a flat, firm surface?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
91. Are ladders/scaffolds planks free of mud, ice, grease, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
92. Are ladders/scaffolding inspected before each use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
93. Are defective ladders or scaffold parts taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
94. Does scaffold height exceed 4 times the width or base dimension?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
95. Does scaffold planking overlap a minimum of 12 inches?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
96. Does scaffold planking extend over end supports 6" to 18"?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Walking and Working Surfaces	YES	NO	NA
97. Are access ways, stairways, ramps, and ladders clean of ice, md, snow or debris?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
98. Do ladders exceed maximum lengths?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
99. Are ladders used in passageways, doors, or driveways?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
100. Are broken or damaged ladders tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101. Are metal ladders prohibited in electrical service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102. Are stairways and floor openings guarded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
103. Are safety feet installed on straight and extension ladders?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
104. Is general housekeeping up to Cabrera standards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105. Are support trailers accessible for emergency vehicles?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106. Is the site properly secured during and after work hours?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy Equipment	YES	NO	NA
107. Is heavy equipment inspected as recommended by the manufacturer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
108. Is defective heavy equipment tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
109. Are project roads and structures inspected for load capacities and proper clearances?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
110. Is heavy equipment shut down for fueling and maintenance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Excavation	YES	NO	NA
111. Are the sides of excavations sloped or shored to properly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
112. Are guardrails or fences placed around excavations, near pedestrian or vehicle thoroughfares?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
113. Prior to opening excavations, are utilities located and marked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
114. Are ladders used in trenches over 4 feet deep (when entered)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
115. Is material excavated placed a minimum of 3 ft from the trench?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Confined Spaces	YES	NO	NA
116. Have employees scheduled to be part of the confined space entry team been trained to the level of their responsibilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
117. Are confined space permits available on project site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
118. Is a confined space entry procedure on the project site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personnel Decontamination	YES	NO	NA
119. Are decontamination stations set up in the site contamination reduction zone(s)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
120. Are waste receptacles available for contaminated clothing / PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
121. Are steps taken to contain liquids used for decontamination?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
122. Have decontamination steps and procedures been covered by the site supervisor or acting site safety officer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
123. Are personnel using utility knives or FOBKs to doff PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
124. Is all personal protective equipment and respiratory equipment being cleaned on a daily basis (when applicable)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspection Summary			
Comments:			
I have reviewed this inspection checklist with the safety inspector/SSHO, fully understand the recommendations and will make every attempt to immediately implement the appropriate corrective actions:			
Project/Field Site Manager _____			Date _____



CABRERA SERVICES
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OPERATING PROCEDURE

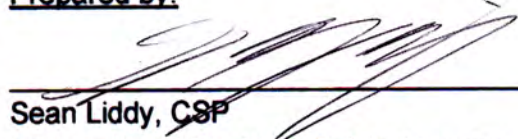
FOR

RESPIRATORY PROTECTION

OP-562

**Revision 1
October 2013**

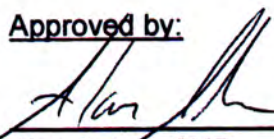
Prepared by:



Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013
Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013
Date

1.0 PURPOSE

This operating procedure (OP) is to establish methods that Cabrera will use to prevent employee exposure to hazardous airborne contaminants via the usage of Air Purifying Respirators (APRs) and other methods to supply breathing air to employees working in oxygen-deficient, or highly toxic, atmospheres.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations.

3.0 DEFINITIONS

- 3.1 Air-purifying respirator - A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.
- 3.2 Approved - Equipment tested and listed by the Bureau of Mines, jointly by the Mining Enforcement and Safety Administration (MESA), and the National Institute for Occupational Safety and Health (NIOSH), or jointly by the Mine Safety and Health Administration (MSHA) and NIOSH.
- 3.3 Assigned protection factor (APF) - The ratio of the ambient concentration of an airborne substance (outside the respirator) to the concentration of the substance inside the respirator. NIOSH defines this as 10 for an approved half-face respirator and 50 for an approved full-face respirator.
- 3.4 Atmosphere-supplying respirator - A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, including supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.
- 3.5 Breakthrough - The first perception of an odor, taste or irritation experienced while wearing an air purifying respirator. Breakthrough is generally an indication that the filter cartridges are saturated and are no longer filtering out the contaminant. Breakthrough can also be an indication of an improperly functioning respirator.
- 3.6 Confined space - An enclosure, such as a storage tank, process vessel, boiler, silo, tank car, pipeline, tube, duct, sewer, underground utility vault, tunnel, or pit, that has limited means of egress and poor natural ventilation and that may contain hazardous contaminants or be oxygen deficient.
- 3.7 Canister or cartridge - A container that has a filter, sorbent, or catalyst, or a combination of these items and that removes specific contaminants from the air passing through the container.

- 3.8 Demand respirator - An atmosphere-supplying respirator that admits breathing air to the face piece only when a negative pressure is created inside the face piece by inhalation.
- 3.9 Emergency situation - Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may, or does, result in an uncontrolled significant release of an airborne contaminant.
- 3.10 Employee exposure – A employee that is exposed to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.
- 3.11 End-of-service-life indicator (ESLI) - A system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.
- 3.12 Escape-only respirator - A respirator intended to be used only for emergency exit.
- 3.13 Filter or air purifying element - A component used in respirators to remove solid or liquid aerosols from the inspired air.
- 3.14 Filtering face piece (dust mask) - A negative pressure particulate respirator with a filter as an integral part of the face piece or with the entire face piece composed of the filtering medium.
- 3.15 Fit factor - A quantitative estimate of the fit of a particular respirator to a specific individual, typically estimating the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.
- 3.16 Fit test - The use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)
- 3.17 Helmet - A rigid respiratory inlet covering that also provides head protection against impact and penetration.
- 3.18 Hazardous atmosphere - Any atmosphere, either immediately or not immediately dangerous to life or health, that is oxygen-deficient or that contains a toxic or disease-producing contaminant exceeding the legally established permissible exposure limit (PEL) or, where applicable, the Threshold Limit Value (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH).
- 3.19 High efficiency particulate air (HEPA) filter - A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and

P100 filters.

- 3.20 Hood - A respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.
- 3.21 Immediately dangerous to life or health (IDLH) - An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.
- 3.22 Loose-fitting face piece - A respiratory inlet covering that is designed to form a partial seal with the face.
- 3.23 Maximum use concentration (MUC) - The protection factor (PF) of an approved respirator assembly times the permissible exposure limit (PEL).
 $MUC = PF \times PEL$
- 3.24 Negative pressure respirator (tight fitting) - A respirator in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator.
- 3.25 Oxygen deficient atmosphere - An atmosphere with an oxygen content below 19.5% by volume.
- 3.26 Powered air-purifying respirator (PAPR) - A respirator that contains a blower that passes ambient air through an air-purifying component. Air-purifying respirators may be half-face (covering the nose and mouth) or full-face (covering the eyes, nose, and mouth).
- 3.27 Physician or other licensed health care professional (PLHCP) - An individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the health care services required by paragraph (e) of this section.
- 3.28 Positive pressure respirator - A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.
- 3.29 Program administrator - The individual that has the responsibility to verify full compliance with this OP and determines the need for medical evaluations or any other additional medical attention in regards to the use of a respirator.
- 3.30 Pressure demand respirator - A positive pressure atmosphere-supplying respirator that admits breathing air to the face piece when the positive pressure is reduced inside the face piece by inhalation.
- 3.31 Qualitative fit test (QLFT) - A pass/fail fit test to assess the adequacy of

respirator fit that relies on the individual's response to the test agent.

- 3.32 Quantitative fit test (QNFT) - An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.
- 3.33 Respiratory inlet covering - That portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a face piece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.
- 3.34 Self-contained breathing apparatus (SCBA) - An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.
- 3.35 Service life - The period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.
- 3.36 SSHP - Site Safety & Health Plan
- 3.37 Supplied-air respirator (SAR) or airline respirator - An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.
- 3.38 Tight-fitting face piece - A respiratory inlet covering that forms a complete seal with the face.
- 3.39 User seal check - An action conducted by the respirator user to determine if the respirator is properly sealed to the face.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

None.

5.0 EQUIPMENT

Respiratory Protection Equipment, to include APRs, PAPRs, SARs, and SCBAs.

6.0 RESPONSIBILITIES

- 6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Verify compliance with the measures set forth in this procedure.

Verify that only those employees who are medically qualified, properly trained, and fit tested are assigned to respirator work.

Verify that respirators are provided, repaired, or replaced as may be required

due to wear and deterioration.

6.2 Occupational Health & Safety (OH&S) Manager shall -

Monitor compliance with the various aspects of this procedure.

Provide technical assistance regarding respirator selection and use.

Support respirator training and fit testing.

Determine the need for medical evaluations or any other additional medical attention related to the use of a respirator.

6.3 Employees - shall:

Use the provided respiratory protection in accordance with instructions and training received.

Guard against damage to the respirator.

Immediately report any malfunction of the respirator to his/her supervisor or other responsible person.

7.0 PROCEDURE

7.1 Medical Surveillance

No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that he/she is physically able to perform the work while using the required respirator.

Prior to wearing a respirator, employees will complete an initial baseline medical surveillance examination performed by a PLHCP in accordance with the requirements of OP 532, Medical Surveillance.

Employees who continue to use respiratory protection will receive an annual medical surveillance examination.

Additional medical examinations will be provided to employees who wear respirators if/when:

- An employee reports medical signs or symptoms that are related to ability to use a respirator
- A PLHCP, supervisor, or the OH&S Manager determines that an employee needs to be reevaluated
- Observations made during fit testing and program evaluation, indicates

a need for employee reevaluation; or

- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature, etc.) that may result in a substantial increase in the physiological burden placed on an employee

All medical surveillance examinations shall occur during normal working hours; shall be convenient, understandable, and confidential; and the employee will be given the opportunity to discuss results with examining physician.

7.2 Training

Project staff that may be exposed to a hazard will be oriented to the hazard and the controls prior to beginning work.

Atmospheric testing will be carried out by someone trained in the use, calibration, and interpretation of the test equipment.

Employees who may be required to use a breathing apparatus shall be properly trained in the operation, maintenance, cleaning and storage of the apparatus.

All staff will receive an orientation to the hazards on the job site as well as initial Site Safety Orientation training which outlines appropriate PPE requirements.

Employees who wear respiratory protection must receive training before they are assigned to a task that requires the use of respiratory protection.

Retraining shall be administered annually, and when the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or
- Any other situation arises in which retraining appears necessary to verify safe respirator use

Frequency of Training

All employees who may have the need to wear respiratory protection are required to participate in Cabrera's internal training, primarily through HAWOPER refresher trainings.

Cabrera's OH&S Manager will conduct respirator training classes, as necessary, for those who may need to wear respiratory protection but did not participate in HAZWOPER training classes.

Basic Respirator Training

Respirator training classes will include, at a minimum, the following:

- Instruction in the nature of the respiratory hazards, whether acute, chronic, or both, and a description of potential health effects if the respirators are not used or are used improperly
- Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator
- The limitations and capabilities of the respirator
- Proper fitting, including demonstrations and practice in wearing, adjusting, determining the fit of, and performing a user seal check each time respirator is donned
- How to inspect, put on, use and remove the respirator
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions
- The procedures for maintenance, cleaning and storage of the respirator
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators
- The general requirements of the OSHA Respiratory Protection Standard

7.3 Respirator Selection

The type of respirator most commonly used by Cabrera employees is a cartridge type air purifying respirator (APR). Many different types of APRs exist, and field staff should always fit test an APR prior to use.

Employees will be provided with the selection from at least two providers (i.e. MSA and North). Prior to fit testing, the employee shall be allowed to pick the most comfortable respirator from the brands offered.

7.4 Fit Testing Procedures

A respirator that doesn't fit properly will not provide adequate protection.

Four types of tests can be used:

1. **Positive Pressure Sealing Check:** Close off the exhalation valve and exhale gently. The fit is satisfactory if a slight positive pressure can be built up inside the face piece for a full 10 seconds without detecting any outward leakage of air between the sealing surface of the face piece and the wearer's face.
2. **Negative Pressure Sealing Check:** Close off the inlet opening of the cartridges by covering them with the palm of the hands. Inhale gently and hold breath for at least 10 seconds. The face piece should collapse slightly with no detection of inward leakage of air into the face piece.
3. **Isoamyl Acetate Test (banana oil test):** A tube or bottle of banana oil is held in front of and around the mask. The fit is adequate if the wearer does not detect the odor of bananas. During the test, the wearer should be demonstrating movements that approximate a normal working situation, including deep breathing, side-to-side and up-and-down head movements, and talking.
4. **Irritant Smoke Test (Stannic Chloride Test):** The procedure is similar to that of the banana oil test except that an irritant smoke is used. The wearer of the mask will cough (involuntary reaction) if he/she detects the irritant smoke in the mask.

7.4.1 Fit Testing Frequency

After receiving the proper medical clearance, employees must be fit tested prior to initial use, and at a frequency no less than once every 12 months for the same respirator. A separate fit test must be conducted for any new/different respirator used by an employee.

Additional fit tests will be performed:

- Whenever there is an indication that changes in the employee's physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- If the employee notifies his/her supervisor or the OH&S Manager that the fit of his/her respirator is unacceptable

7.4.2 Fit Testing Records

A written record of each fit test performed must be maintained in the employee's health and safety records (Attachment A).

7.5 Interference with Gas-Tight Seal

Respiratory protection can only be worn when it can be determined that there is no obstruction of contact between the wearer's skin and the sealing surfaces of the mask whatsoever. Such obstruction can include facial hair, head hair, and the temple bars of eye glasses.

Respirator wearers cannot be afforded protection from hazardous airborne contaminants when conditions prevent a complete gas-tight face seal.

Although eyeglass temple bars will interfere with the formation of a gas-tight face seal in the case of full-face respirators, this problem is correctable by use of internally mounted spectacle kits. Management and supervisors shall verify that employees under their supervision who regularly wear eyeglasses, and who will require the use of a full-face respirator, are provided with appropriate spectacle kits at company expense.

The use of contact lenses in hazardous atmospheres or in operations involving intense heat, molten metals or the potential for chemical splash shall be prohibited.

Because facial hair (even beard stubble) will interfere with a gas-tight seal, employees shall be required to be clean-shaven whenever the use of respiratory protection is specified.

Respiratory Protection will only be assigned to those employees without physical obstructions to a gas-tight face seal to jobs that may require the use of respiratory protection. Candidates for employment shall be made aware that their versatility may be limited if they cannot wear a respirator and that this can affect their job assignments.

7.6 Specification of Proper Level of Respiratory Protection

The OH&S Manager or his/her designated and qualified representative is responsible for specifying the proper selection and use of all respiratory protective devices, including half-face and full-face air purifying respirators, airline respirators, and self-contained breathing apparatus. This information is generally specified as part of the written Site-Specific Safety & Health Plan (SSHP).

Employees engaged in activities not covered by a SSHP must consult with the OH&S Manager to determine the proper equipment prior to use. Whenever

appropriate, exposure levels will be measured to verify that the actual use conditions are within the limitations of the approvals specified by NIOSH/MSHA for the selected respirator.

7.6.1 Conditions Required for Air-Purifying Respirator (APR) Use

Air-purifying respirators (APR) shall only be specified for use when it can be determined that the following conditions exist:

- The oxygen concentration is greater than 19.5%
- The contaminant is known and its concentration can be quantified
- The airborne contaminant concentration is below its IDLH
- A canister or cartridge is available which is approved for the contaminant
- The contaminant concentration is below the concentration for which the canister is approved
- The contaminant concentration is below the Maximum Use Concentration (MUC) of the respirator

In all cases where OSHA has specified that a particular respirator be used (asbestos, formaldehyde, benzene, arsenic, lead, etc.), that respirator, or one providing equal or better protection, shall be specified.

APR Filter and Chemical Cartridges

An adequate supply of the following cartridges shall be maintained in stock at each location where respiratory protective equipment is used:

- High efficiency particulate air (HEPA) filter cartridges
- Organic vapor cartridges; and
- Combination HEPA/acid gas/organic vapor cartridges

Change Out Schedule

Filter cartridges shall be changed out whenever an increase in breathing resistance is detected by the user.

When available, chemical cartridges that are equipped with end-of-service life indicators (ESLI) shall be utilized. In those cases, cartridges should be changed when end of service is indicated by the ESLI.

In the absence of cartridges equipped with an ESLI, employees shall change chemical cartridges on the following schedule:

- Immediately if breakthrough is perceived
- In accordance with the change out schedule developed by the OH&S Manager in the SSHP; and
- After each day's use

The change out schedule will be based upon the anticipated contaminant concentration, environmental conditions, employee work rate, and the specific data provided by manufacturer.

When powered air-purifying respirators (PAPRs) are worn, the same rules apply with the exception that filter cartridges should be changed when airflow through the filter elements decreases to an unacceptable level, as indicated by the manufacturer's test device.

7.6.2 Conditions Requiring Use of Air-Supplying Respirators

Air-supplying respirators will be specified for use when it has been determined that any of the following conditions exist:

- The oxygen concentration is less than 19.5%
- The contaminant is unknown or its concentration cannot be quantified
- The airborne contaminant concentration is above its IDLH
- An air-purifying respirator canister or cartridge that removes the contaminant is not available
- The contaminant concentration is above the concentration for which an air-purifying canister or cartridge is approved; or
- The contaminant concentration is above the Maximum Use Concentration (MUC) of a full face air-purifying respirator

No employee may engage in an operation requiring the use of an air-supplied respirator unless the OH&S Manager has reviewed the operation and approved its use.

The determination of the type of air-supplying respirator (i.e., SCBA, air-line, demand, pressure demand, etc.) which is appropriate for the job, outside standby persons, communication, proper training and equipment, notification procedures, and necessary action all require planning. Mandatory equipment

including SCBA or SAR with auxiliary air supply & emergency escape, and appropriate retrieval equipment or equivalent rescue means, will be made by the OH&S Manager, in conjunction with the Project Manager, at the time of review. The need for any additional precautions (i.e., equipment specific training, on-site support, etc.) will also be determined.

Minimum Procedures for IDLH atmospheres

One employee or, when needed, more than one employee shall be located outside the IDLH atmosphere. This employee shall be responsible for communicating with the employees in the IDLH atmosphere, alerting rescue services if needed, and restricting entrance to the IDLH area by untrained and unapproved persons.

Visual, voice, or signal line communication shall be maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.

The employee(s) located outside the IDLH atmosphere shall be trained and equipped to provide effective emergency rescue or to initiate onsite rescue services if needed.

If on-site rescue services are to be used, the Site Safety & Health Officer (SSHO) shall confirm that the service is available to respond prior to any employees entering the IDLH area.

Employee(s) located outside the IDLH area and/or on-site rescue services shall be equipped with:

- Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either
- Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or
- Equivalent means for rescue where retrieval equipment would create a hazard to the workers in the IDLH area

7.7 Breathing Air Quality

Compressed air used for respiration shall be of high purity and shall meet, as a minimum, the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Specification G-7.1 (ANSI Z86.1).

Oxygen shall NOT be used as a source of breathing air at any time in open-circuit SCBAs or air-line respirators.

Compressor Supplied Breathing Air

All compressors used for filling SCBA air cylinders or for supplying air-line respirators shall be equipped with the following safety and standby devices:

- The compressor intake shall be located to verify that only respirable (uncontaminated) air is admitted. This requires attention to the location of the compressor intake with respect to compressor engine exhaust, chemical storage or use areas, and suitable intake screening or filtration.
- Alarms to indicate compressor failure (such as low-pressure air horns, etc.) shall be installed in the system
- A receiver of sufficient capacity to enable the respirator wearer to exit from a contaminated atmosphere shall be provided

If an oil-lubricated compressor is used to supply breathing air, it shall be equipped with both of the following devices:

- A continuous reading carbon monoxide monitoring system set to alarm should the carbon monoxide concentration exceed 10 ppm; and
- A high temperature alarm which will activate when the discharge air exceeds 110% of the normal operating temperature in degrees Fahrenheit
- An in-line purifying filter assembly to remove oil, condensed water, particulates, odors, and organic vapors shall be used in conjunction with the air compressor

Routine inspection and maintenance of the air compressor and air compressor components shall be performed.

Compressed Air Cylinders

Breathing air cylinders shall be legibly identified with the word AIR by means of stenciling, stamping, or labeling as near to the valve end as practical.

Cylinders shall be stored and handled to prevent damage to the cylinder or valve.

Cylinders shall be stored upright with the protective valve cover in place and, in such a way (e.g. supported with substantial rope or chain in the upper one

third of the cylinder, or in racks designed for this purpose) as to prevent the cylinder from falling.

Cylinders shall not be dropped, dragged, rolled, or allowed to strike each other or to be struck violently. Cylinders shall never be exposed to temperatures exceeding 1250 F. Cylinders with visible external damage, evidence of corrosion damage, or exposure to fire shall not be accepted or used.(i.e. taken out of service)

Only cylinders within current hydrostatic test periods shall be used. Steel cylinders must be hydrostatically tested every five years and fiberglass wrapped aluminum cylinders must be tested every three years.

Compressed Air Cylinder Systems for Air-Line Respirators

Compressed air cylinder systems used to supply air-line respirators shall be equipped with low pressure warning bells (e.g., Scott Pak-Alarm) or similar warning devices to indicate air pressure in the manifold below 500 psi. When such systems are used, one employee shall be assigned as safety standby within audible range of the low pressure alarm.

Air-line hose couplings shall be incompatible with outlets for other gas systems to prevent inadvertently supplying air-line respirators with non-respirable gases or oxygen.

The air pressure at the hose connection to air-line respiratory equipment shall be within the range specified in the approval of the equipment by the manufacturer.

Compressed Air Cylinder Systems for Recharging SCBAs

When a cascade system is used to recharge SCBA air cylinders, it shall be equipped with a high pressure supply hose and coupling rated at a capacity of at least 3000 psi.

Escape/Egress Units

Escape/egress unit respirators are intended for use in areas where escape with a short-term (5 minutes) air supply is necessary.

They may be used as adjuncts to airline pressure demand respirators as a backup air supply or as independent emergency devices in areas where respiratory protection is not normally required.

Appropriate training shall be conducted and documented prior to assigning employees to tasks or locations subject to the use of these respirators.

Escape/egress units (5 minutes) shall never be used to enter a hazardous

atmosphere or as primary standby respirators for confined space entry.

7.8 Respirator Inspection, Cleaning, Maintenance, and Storage

When respirator use is required, only properly cleaned and maintained NIOSH/MSHA approved respirators shall be used.

Inspection

Respirators should be inspected before and after each use. Those for emergency use should be inspected once per month.

All connections, including gaskets, o-rings should be checked for damage and tightness. Worn or broken parts should be removed from operation.

The face piece should be inspected for cracks and rubber or elastomer parts should be checked for deterioration and pliability.

All respirators shall be inspected routinely by the user before, during, and after each use. Defects shall be reported to supervision. No defective respirator shall be issued or worn.

Routinely used respiratory equipment shall be inspected by an individual qualified by experience or training to do the work.

Cleaning and Maintenance

Respirator face piece assemblies shall be cleaned and sanitized after each day of use in accordance with the requirements specified herein.

Respiratory equipment shall not be passed from one person to another until it has been cleaned and sanitized.

Respiratory equipment shall be maintained according to manufacturer's instructions.

Where respirators are assigned to individual employees, management shall verify compliance with cleaning and maintenance requirements by periodic inspection and field audits of respiratory equipment.

Respirators must be cleaned after each use and then placed into a clean, sealed bag for storage.

Prior to cleaning, the filters, cartridges, or canisters must be removed and discarded.

The respirator should then be inspected for any damaged parts (repair should only be done by trained personnel with the proper tools) and cleaned with a

hot water/mild detergent solution.

In field situations, a pre-moistened towelette (recommended to use respirator manufacturer's brand) can be used. The mask should then be rinsed with clean warm water and dried.

Alcohol should never be used to clean masks as it can damage the face pieces and rubber parts.

Storage

Store clean respirators so that they are protected from dust, excessive moisture, damaging chemicals, temperature extremes and direct sunlight. They should be placed in a sealed plastic bag and stored in the original box.

When not in use, respirator facepieces shall be placed in clean Ziploc-style bags and stored to protect against dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals.

7.9 Hygiene

Employees must leave the work area to wash, change cartridges, or if they detect breakthrough or resistance.

7.10 Program Evaluation

The OH&S Manager will conduct evaluations of the workplace as necessary to verify that the provisions of the current written program are being effectively implemented and that it continues to be effective.

The OH&S Manager will regularly (i.e., during annual training) consult employees required to use respirators to assess their views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include but are not limited to:

- Respirator fit (including the ability to use the respirator without interfering with effective workplace performance)
- Appropriate respirator selection for the hazards to which the employee is exposed
- Proper respirator use under the workplace conditions the employee encounters; and
- Proper respirator maintenance

7.11 Costs

The costs for training, medical examinations, fit testing, respirators, and cleaning materials should be considered as operational costs.

8.0 REFERENCES

- 29 CFR 1910.134, Respiratory Protection
- 29 CFR 1926.103, Respiratory Protection
- 29 CFR 1910.1020, Access to Employee Exposure and Medical Records
- OP 532, Medical Surveillance

9.0 REQUIRED RECORDS

- Medical Records - Medical records under this section will be maintained at a minimum in accordance with 29 CFR 1910.1020 – Access to Employee Exposure and Medical Records.
- Fit Test Records - Fit test records will include the name of the employee tested; the type of fit test performed; the specific style, make, model, and size of the respirator tested; the date of the test; and the pass/fail results for QLFTs or QNFT test documentation (i.e., strip charts).
- Training Records - Respiratory protection training records will be maintained by the employee with copies provided to the OH&S Manager. On-site records of training and fit testing will be maintained as necessary. For situations where training is required by and provided by clients, copies of training records shall be maintained by the OH&S Manager.

10.0 ATTACHMENTS

Attachment A – Respiratory Protection Fit Test Protocols

Attachment B – Respiratory Protection Equipment Maintenance & Inspections

Attachment A
Respiratory Protection
Fit Test Protocols

Fit Testing Protocol

1.0 Selection

The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits the user.

Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension, and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction does not constitute the subject's formal training on respirator use, because it is only a review.

The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape and if fitted and used properly will provide adequate protection. The instructor will assist with the respirator selection as needed.

2.0 Comfort

The test subject shall be instructed to hold each chosen face piece up to the face and to eliminate those that obviously do not give an acceptable fit.

The more acceptable face pieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort.

If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Position of the mask on the nose
- Room for eye protection
- Room to talk
- Position of mask on face and cheeks

3.0 Fit Test Criteria

The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed
- Adequate strap tension, not overly tightened
- Fit across nose bridge

- Respirator of proper size to span distance from nose to chin
- Tendency of respirator to slip
- Self-observation in mirror to evaluate fit and respirator position

The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described herein or those recommended by the respirator manufacturer that provide equivalent protection. User seal checks are not substitutes for qualitative or quantitative fit tests.

Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side to side and up and down slowly while taking in a few slow deep breaths. Another face piece shall be selected and retested if the test subject fails the user seal check tests.

The test shall not be conducted if there is any hair growth between the skin and the face piece sealing surface, such as stubble beard growth, beard, mustache, or sideburns that cross the respirator sealing surface. Any type of apparel that interferes with a satisfactory fit shall be altered or removed.

If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

Face Piece Positive and/or Negative Pressure Checks

Positive Pressure Check

Close off the exhalation valve and exhale gently into the face piece.

The face fit is considered satisfactory if a slight positive pressure can be built up inside the face piece without any evidence of outward leakage of air at the seal.

For most respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replace it after the test.

Negative Pressure Check

Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the face piece collapses slightly, and hold your breath for 10 seconds.

The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand and therefore may not pass the negative pressure check this way.

The test can be performed however, by covering the inlet opening of the cartridge with a thin latex or nitrile glove.

If the face piece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

Manufacturer's Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures, provided the manufacturer's procedures are equally effective.

4.0 Exercise Regimen

Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use and that could interfere with respirator fit.

General Test Exercises

The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the Controlled Negative Pressure (CNP) method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the test environment, in the following manner:

Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the “Rainbow Passage”, count backward from 100, or recite a memorized poem or song.

Rainbow Passage. “When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.”

Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT.)

Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

Normal breathing. In a normal standing position, without talking, the subject shall breathe normally (this is the same as the first test).

Each test exercise shall be performed for one minute except for the grimace exercise, which shall be performed for 15 seconds.

The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test and the fit test must be repeated.

5.0 Qualitative Fit Test (QLFT) Protocols

General

Cabrera will ensure that persons administering QLFT are able to calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

Cabrera will ensure that that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

Irritant Smoke (Stannic Chloride) Protocol

This qualitative fit test uses a person’s response to the irritating chemicals released in the “smoke” produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

General Requirements and Precautions:

- The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).
- Only stannic chloride smoke tubes shall be used for this protocol.
- No form of test enclosure or hood for the test subject shall be used.
- The smoke can be irritating to the eyes, lungs, and nasal passages.

The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

Sensitivity Screening Check

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

The test operator shall break both ends of a ventilation smoke tube containing stannic chloride and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute or to an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

Irritant Smoke Fit Test Procedure

The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

The test subject shall be instructed to keep his/her eyes closed.

The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the face piece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

If the person being tested has not had an involuntary response and/or has not detected the irritant smoke, the test exercise will proceed.

The General Test Exercises (Section 4.0) shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

If the person being fit tested reports detecting the irritant smoke at any time, the test has failed. The person then repeats the entire sensitivity check and fit test procedure.

Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

If a response is produced during this second sensitivity check, then the fit test is passed.

6.0 Quantitative Fit Test (QNFT) Protocols

General

Cabrera will confirm that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly, and ensure that test equipment is in proper working order.

Cabrera will ensure that QNFT equipment is kept clean and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

Ambient Aerosol Condensation Nuclei Counter (CNC) Quantitative Fit Testing Protocol

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount TM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device installed on the respirator to allow the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor.

The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator, and a minimum fit factor pass level of at least 500 is required for a full face piece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

Portacount Fit Test Requirements

Check the respirator to make sure the sampling probe and line are properly attached to the face piece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) according to the manufacturer's instructions.

Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to don and wear the respirator properly.

Check the following conditions for the adequacy of the respirator fit: chin properly placed; adequate strap tension, not overly tightened; fit across nose bridge; respirator of proper size to span distance from nose to chin; tendency of the respirator to slip; self-observation in a mirror to evaluate fit and respirator position.

Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting face piece, try another size of the same model respirator, or another model of respirator.

Follow the manufacturer's instructions for operating the Portacount and proceed with the test.

The test subject shall be instructed to perform the exercises in General Test Exercises (Section 4.0).


After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

Portacount Test Instrument

The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

Since the pass or fail criterion of the Portacount is user programmable, the test operator shall confirm that the pass or fail criterion meet the requirements for minimum respirator performance.

A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

OP 562 - Respiratory Protection		 CABRERA SERVICES <small>RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION</small>	
Record of Fit Test			
Employee Name:		Date of Testing:	
Location:		Respirator Manufacturer:	
Method & Testing Agent:		Respirator Type(s):	
Qualitative Test Agent(s): IAA <input type="checkbox"/> Smoke <input type="checkbox"/>		Quantitative Test Device:	
Test Exercise	Pass / Fail	Test Exercise	Pass / Fail
Sensitivity Check		Normal Breathing	
Deep Breathing		Turning Head (side to side)	
Moving Head (up/down)		Rainbow Passage*	
Bending Over		Normal Breathing	
<p><i>*Rainbow Passage. "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."</i></p>			
Successful Respirator Fit Determined: <input type="checkbox"/> Yes <input type="checkbox"/> No			
<p>I certify that I have been tested with the respirator(s) listed above. I have also had the opportunity to ask questions and those questions have been answered to my satisfaction. I also understand that the above fit test is voided if respirator limitations are not followed or the respirator is not worn or if conditions (e.g., facial hair) prevent a good face seal.</p>			
Employee Signature:		Date:	
Signature of Tester:		Date:	

Attachment B
Respiratory Protection
Equipment Maintenance & Inspections

Equipment Maintenance & Inspections

1.0 Requirements

These procedures are general in nature. The cleaning recommendations provided by the manufacturer may be used for the respirators used by their employees, provided such procedures are as effective as those listed here.

Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth (i.e., confirm that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user).

2.0 Procedures for Cleaning Respirators

Remove filters, cartridges, or canisters. Disassemble face pieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

Wash components in warm (43°C [110°F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (synthetic, not wire) brush may be used to facilitate the removal of dirt.

Rinse components thoroughly in clean, warm (43°C [110°F] maximum), preferably running water. Drain.

When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

- Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43°C (110°F); or
- Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43°C (110°F); or

Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.


Rinse components thoroughly in clean, warm (43°C [110°F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

Components should be hand dried with a clean, lint-free cloth or air-dried.

Reassemble face piece, replacing filters, cartridges, and canisters where necessary.

Test the respirator to ensure that all components work properly.

After the fit test, wipe down the respirator with a sanitary swab.

OP 562 - Respiratory Protection		 CABRERA SERVICES <small>RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION</small>	
Respiratory Equipment Inspection Form			
Date:		Inspected by:	
Air Purifier Unit #:			
		N/A	Pass
		Fail	
Examine Face Piece for:			
Excessive dirt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracks, tears, holes, or distortion from improper storage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inflexibility (stretch and massage to restore flexibility)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracked or badly scratched lenses in full face pieces	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incorrectly mounted full-face piece lens or broken or missing mounting clips	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lens sealed properly in receptacle, retaining clamp secured	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracked or broken air-purifying element holder(s), badly worn threads or missing gasket(s) (if appropriate)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Examine the Head Straps or Head Harness for:			
Breaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss of elasticity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Broken or malfunctioning buckles and attachments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excessively worn serrations on the head harness that might permit slippage (full face pieces only)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tears in headband at cradle attachment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Examine the Inhalation and Exhalation Valves for:			
Foreign material, such as detergent residue, dust particles, or human hair under the valve seat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracks, tears, or distortion in the valve material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improper insertion of the valve body in the face piece	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracks, breaks, or chips in the valve body, particularly in the sealing surface	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Missing or defective valve cover	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Examine the Air Purifying Elements for:			
Incorrect cartridge, canister, or filter for the hazard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incorrect installation, loose connection, missing or worn gaskets, or cross-threading in the holder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expired shelf life date on cartridge or canister	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Defects Noted:			
Unit Deemed Suitable for Use		<input type="checkbox"/> Yes	<input type="checkbox"/> No



CABRERA SERVICES
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OPERATING PROCEDURE

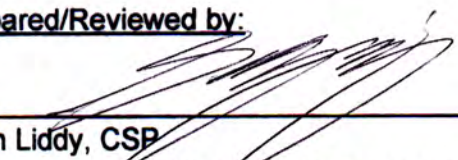
FOR

HEAT STRESS

OP-563

**Revision 1
October 2013**

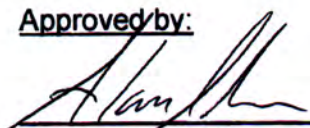
Prepared/Reviewed by:



Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013
Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013
Date

1.0 PURPOSE

This operating procedure (OP) establishes the methods to help employees recognize the symptoms of heat stress-related illnesses and recommends controls to take appropriate corrective actions.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations.

3.0 DEFINITIONS

- 3.1 Acclimated - Workers who have physiologically adapted to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures with minimal stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat and much of its benefit may be lost if exposure to hot environments is discontinued for a week.
- 3.2 Chemical Protective Clothing (CPC) - Apparel that is constructed of relatively impermeable materials intended to act as a barrier to physical contact of the worker with potentially hazardous materials in the workplace. Such materials include:
- Tyvek coveralls (all types)
 - Polyvinyl chloride (PVC) coveralls
 - Rain suits
- 3.3 Unacclimated - Workers who have not been exposed to hot work conditions for one week or more or who have become heat-intolerant due to illness or other reasons.
- 3.4 Heat Cramps - A form of heat stress brought on by profuse sweating and the resultant loss of salt from the body.
- 3.5 Heat Exhaustion - A form of heat stress brought about by the pooling of blood in the vessels of the skin and in the extremities.
- 3.6 Heat Rash - A heat-induced condition characterized by a red, bumpy rash with severe itching.
- 3.7 Heat Stress - The combination of environmental and physical work factors that constitute the total heat load imposed on the body.
- 3.8 Heat Stroke - The most serious form of heat stress, which involves a profound disturbance of the body's heat regulating mechanism.

- 3.9 Sunburn - Is caused by unprotected exposure to ultraviolet light that is damaging to the skin. The injury is characterized by red painful skin, blisters, and/or peeling. This condition if not addressed may cause more severe problems.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

Employees working in extreme heat or sun for extended periods of time away from a shelter or vehicle must not work alone.

Employees shall not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the American Conference of Government Industrial Hygienist (ACGIH) Standard.

Clothing corrections shall be applied in accordance with the heat stress and strain section of the ACGIH Standard.

5.0 EQUIPMENT

Supplies used in support of this OP may include the following items:

- Sunblock (min 30 SPF)
- Wide-brimmed hard hats
- Shade tents
- Drinking water
- Water coolers
- Air conditioned vehicle or office

6.0 RESPONSIBILITIES

6.1 Project Managers responsibilities:

Evaluate the need for heat stress prevention measures and incorporate as appropriate into the Site Safety & Health Plan (SSHP).

Implement heat stress prevention measures, as applicable, at each work site.

Develop/coordinate a work-rest schedule, as applicable.

Ensure heat stress hazard assessments/evaluations were completed for the planned activities.

Assign personnel that are physically capable of performing the assigned tasks.

Ensure that personnel are properly trained in the recognition of heat stress-related symptoms.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide heat stress awareness training.

Assist project teams that are developing the appropriate work-rest schedules.

Conduct/support incident investigations related to potential heat stress-related illnesses.

6.3 Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned employees.

Ensure that employees have been trained on the recognition of heat stress-related illness.

Ensure that adequate supplies of appropriate fluids are readily available to employees.

Ensure that a proper rest area is made available. This may include the use of portable tents to provide temporary shade.

Conduct heat stress monitoring, as applicable.

Implement a work-rest schedule.

Ensure that first aid measures are implemented if heat stress symptoms are identified.

Ensure that personnel are physically capable of performing the assigned tasks and are not in physically compromised conditions.

Report all suspected heat stress-related illnesses.

6.4 Employees' responsibilities:

Observe each other for the early symptoms of heat stress-related illnesses.

Maintain an adequate intake of available fluids.

Be familiar with heat stress hazards, predisposing factors, and preventative measures.

Report to work in a properly vested and hydrated condition.

Report all suspected heat stress-related illnesses to the SSHO and/or FSM.

7.0 PROCEDURE

7.1 Controls

If employees are, or may be exposed to heat stress, the Field Site Manager (FSM) or designee (SSHO) shall:

- Conduct a heat stress assessment to determine the potential for hazardous exposure of workers, and;
- Develop and implement a heat stress exposure control plan.

The project team shall implement engineering controls (e.g., shelters, shading, cooling devices, etc.) to reduce the exposure of employees to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.

If engineering controls are not practicable, the supervisor shall reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.

The supervisor shall provide and maintain an adequate supply of cool, potable water close to the work area for the use of a heat exposed worker.

If an employee shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant, if available, or by a physician.

Heat stress can be a significant field site hazard, especially for workers wearing CPC. The workforce will gradually work up to a full workload under potentially stressful conditions to allow for proper acclimation.

Site personnel shall be instructed in the recognition of heat stress symptoms, the first aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. Workers must be encouraged to immediately report any heat stress that they may experience or observe in fellow workers. Supervisors must use such information to adjust the work-rest schedule to accommodate such problems.

Wherever possible, a designated break area should be established in an air conditioned space, or in shaded areas where air conditioning is impractical. The break area should be equipped to allow workers to loosen or remove protective clothing, and sufficient seating should be available for all personnel. During breaks, workers must be encouraged to drink plenty of water or other

liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.

7.2 Symptoms and Treatment

Workers who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin), shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.

Anyone exhibiting symptoms of heat stroke (red, dry skin, or unconsciousness) must be taken immediately to the nearest medical facility, taking steps to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).

Severe heat stress (heat stroke) is a life-threatening condition that must be treated by a competent medical authority.

Heat Stress-related Illness Symptoms

There are three stages of heat-related illness:

1. Heat Cramps

First stage of heat-related illness

- Heat cramps are painful muscle cramps caused by over-exertion in extreme heat
- Muscle spasms, and
- Pain in the hands, feet, and abdomen

2. Heat Exhaustion

Heat exhaustion is the second stage. Symptoms include:

- Cool, moist, pale, flushed or red skin
- Heavy (profuse) sweating
- Headache
- Nausea or vomiting
- Dizziness, fainting

- Exhaustion
- Mood changes (irritable, or confused/can't think straight)
- Pale, cool, moist skin

3. Heat Stroke

Heat stroke is the third and final stage.

Heat exhaustion can sometimes lead to heat stroke, which is more severe and can be fatal. Heat stroke requires emergency treatment. Heat stroke happens when you stop sweating and your body temperature continues to rise, above 102°F (38.9 °C) often to 105°F (40.5°C) and above. Symptoms of heat stroke include:

- Vomiting
- A decreased alertness level or complete loss of consciousness
- High body temperature (sometimes as high as 105°F (40.5°C))
- Skin may still be moist or the victim may stop sweating and the skin may be red, hot, and dry
- Rapid, weak pulse
- Rapid, shallow breathing
- Red, hot, usually dry skin
- Lack of or reduced perspiration
- Nausea
- Dizziness and confusion
- Strong rapid pulse
- Coma

Recommended Treatment for Heat Stress-related Illnesses

Heat Cramps Treatment:

- Apply manual pressure to cramped muscles gently stretching the cramped muscle(s) and hold the stretch for about 20 seconds, then gently massage the muscle. Repeat these steps if necessary.

- Take more frequent breaks and drink more water
- Move victim to a cool place, shaded if possible
- Seek medical attention if symptoms are not alleviated or if more serious problems are indicated

Heat Exhaustion Treatment:

- Move out of the sun to a cool, shaded (if possible) location and drink lots of water, a little at a time
- Remove or loosen tight clothing and elevate feet
- If you are nauseated or dizzy, lie down
- Administer drinks of cool water and fan to cool
- Seek medical attention immediately

Heat Stroke Treatment, or if a person's temperature exceeds 102°F (38.9 °C):

- Call for immediate medical help and then try to lower the temperature as quickly as possible
- Apply cool (not cold) water to the person's whole body using a wet sheet if possible then fan the person
- Stop cooling if the person's temperature appears to come down; be careful not to overcool
- Do not give aspirin or acetaminophen to reduce the temperature
- Treat as a true medical emergency Seek medical help immediately
- Reduce body temperature quickly
- If available, use cold packs under arms, neck, and ankles
- Protect from injury during any convulsion
- Ensure that the person's airway is open
- Transfer to a medical facility immediately

7.3 Prevention

All staff working in extreme heat or sun should understand the following

guidelines for preventing and detecting heat exhaustion and heat stroke.

- If you experience heat exhaustion or heat stroke you must immediately seek shelter and water
- Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently
- Try to schedule work for the coolest part of the day, early morning and evening
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun
- Avoid sudden changes of temperature; air out a hot vehicle before getting into it
- If you take diuretics, ask your doctor about taking a lower dose during hot weather
- On a normal day, drink 8 to 10 8-ounce glasses of water per day. Continue to drink even more if you are working or exercising in hot weather.
- Avoid caffeine and alcohol as they increase dehydration

7.4 Personal Protective Equipment

Wear a hat and light-colored, loose-fitting clothing to reflect the sun.

Apply sunscreen to exposed skin (SPF 30 or greater, follow directions on label).

Wear sunglasses with UV protection.

Pack extra water to avoid dehydration (try freezing water in bottles overnight to help keep the water cooler for longer during the day).

7.5 Establishment of Work Rest Schedules

The prevention of heat stress is best performed through supervisor observation of employees and routine heat stress awareness training activities. However, it is also necessary to implement a work routine that incorporates adequate rest periods to allow workers to remove protective clothing, drink fluids (vital when extreme sweating is occurring), rest and recover. The frequency and length of work breaks must be determined by the work supervisor based upon the ambient temperature, amount of sunshine, humidity, the amount of physical labor being performed, the physical condition

of the workers (e.g., acclimated/not), and personal protective clothing being used.

Cabrera permits the use of either of two techniques to initially determine an appropriate daily work-rest schedule. These methods are:

1. Wet Bulb Globe Thermometer (WBGT) Method: This method is preferred, if a WBGT meter is available.
2. Adjusted Temperature Method: This method should be used only if WBGT data is not available.

Either procedure will provide the work supervisor with a recommended routine; however, adjustments to this routine may be required to accommodate the specific daily conditions at the work site.

WBGT Work-Rest Schedule Guidelines

Table 1, the Non-CPC Activities WBGT Chart, is intended for use where personnel are not utilizing CPC. Where workers are required to utilize CPC, Table 2, the CPC Activities WBGT Chart, will be used.

WBGT readings are compared directly with the values the applicable WBGT Chart for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest frequency.

Table 1 - Non-CPC Activities WBGT Chart

Work-Rest Regimen	WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	85°F (29.4°C)	81°F (27.2°C)	78°F (25.6°C)	
75% Work – 25% Rest	86°F (30°C)	83°F (28.3°C)	81°F (27.2°C)	
50% Work – 50% Rest	88°F (31.1°C)	85°F (29.4°C)	83°F (28.3°C)	81°F (27.2°C)
25% Work – 75% Rest	90°F (32.2°C)	87°F (30.6°C)	86°F (30°C)	85°F (29.4°C)

Modified from ACGIH's 2002 *Threshold Limit Values for Chemical Substances and Physical Agents*, for acclimatized workers

Table 2 - CPC Activities WBGT Chart

Work-Rest Regimen	WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	74°F (23.3°C)	70°F (21.1°C)	67°F (19.4°C)	
75% Work – 25% Rest	75°F (23.9°C)	72°F (22.2°C)	70°F (21.1°C)	
50% Work – 50% Rest	77°F (25°C)	74°F (23.3°C)	72°F (22.2°C)	70°F (21.1°C)
25% Work – 75% Rest	79°F (26.1°C)	76°F (24.4°C)	75°F (23.9°C)	74°F (23.3°C)

Modified from ACGIH's 2002 *Threshold Limit Values for Chemical Substances and Physical Agents*, for acclimatized workers

Adjusted Temperature Work-Rest Schedule Guidelines

This method can be utilized where WBGT data is not available, and requires only that the ambient temperature be known. Adjustment factors are applied to the ambient temperature to account for departures from ideal conditions (sunny conditions, light winds, moderate humidity and a fully acclimated work force). The adjustments will be made by addition or subtraction to the ambient temperature reading, or changes in table position, as indicated in Table 3. Adjustments are independent and cumulative, all applicable adjustments should be applied. The result is the Adjusted Temperature, which can be compared with the values in Table 4 for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest schedule.

Table 3 - Temperature Adjustment Factors

Time of Day	
Before daily temperature peak*	+2°F (+1.11°C)
10 am – 2 pm (peak sunshine)	+2°F (+1.11°C)
Sunshine	
No clouds	+1°F (+0.56°C)
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F (-1.67°C)
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F (-2.78°C)
Cloudy (>7/8 cloud cover)	-7°F (-3.89°C)
Indoor or nighttime work	-7°F (-3.89°C)
Wind (ignore if indoors or wearing CPC)	
Gusts greater than 5 miles per hour at least once per minute	-1°F (-0.56°C)
Gusts greater than 10 miles per hour at least once per minute	+2°F (+1.11°C)
Sustained greater than 5 miles per hour	-3°F (-1.67°C)
Sustained greater than 10 miles per hour	-5°F (-2.78°C)
Humidity (ignore if wearing CPC)	
Relative Humidity greater than 90%	+5°F (+2.78°C)
Relative Humidity greater than 80%	+2°F (+1.11°C)
Relative Humidity less than 50%	-4°F (-2.23°C)
Chemical Protective Clothing (CPC)	
Modified Level D (coveralls, no respirator)	+5°F (+2.78°C)
Level C (coveralls w/o hood, full-face respirator)	+8°F (+4.45°C)
Level C (coveralls with hood, full-face respirator)	+10°F (+5°C)
Level B with airline system	+9°F (+5.56°C)
Level B with SCBA	+9°F (+5.56°C) and right one column**
Level A	+14°F (+7.78°C) and right one column ²
Other	Specified in the HASP
Miscellaneous	
Unacclimated work force	+5°F (+2.78°C)
Partially acclimated work force	+2°F (+1.11°C)
Working in shade	-3°F (-1.67°C)
Breaks taken in air conditioned space	-3°F (-1.67°C)

*This adjustment accounts for temperature rise during the day. If the temperature has already reached its daytime peak, ignore.

**Locate the proper column based on work rate, then move one column to the right (next higher work rate) before locating the corresponding adjusted temperature.

Table 4 - Work-Rest Schedule Based on Adjusted Temperature

Work-Rest Regimen	Adjusted Temperature			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
No specified requirements	< 80°F (22.67°C)	< 75 (23.88°C)	< 70 (21.11°C)	< 65 (18.33°C)
15 minute break every 90 minutes of work	80°F – 90°F (22.67°C) - (32.22°C)	75 – 85 (23.88°C) - (29.44°C)	70 – 80 (21.11°C) - (22.67°C)	65 – 75 (37.77°C) - (23.88°C)
15 minute break every 60 minutes of work	>90 – 100 (32.22°C) - (37.77°C)	> 85 – 95 (23.88°C) - (35°C)	>80 – 85 (22.67°C) - (23.88°C)	>75 – 80 (23.88°C) - (22.67°C)
15 minute break every 45 minutes of work	>100 – 110 (37.77°C) - (43.33°C)	>95 – 100 (35°C) - (37.77°C)	>85 – 90 (23.88°C) - (32.22°C)	>80 – 85 (22.67°C) - (23.88°C)
15 minute break every 30 minutes of work	>110 – 115 (43.33°C) - (46.11°C)	>100 – 105 (37.77°C) - (40.55°C)	>90 – 95 (32.22°C) - (35°C)	>85 – 90 (23.88°C) - (32.22°C)
15 minute break every 15 minutes of work	>115 – 120 (46.11°C) - (48.88°C)	>105 – 110 (40.55°C) - (43.33°C)	>95 -100 (35°C) - (37.77°C)	>90 – 95 (32.22°C) - (35°C)
Stop Work	>120 (48.88°C)	>110 (43.33°C)	>100 (37.77°C)	>95 (35°C)

Note: Time spent performing decontamination or donning/doffing CPC should not be included in calculating work or break time lengths.

7.6 Work-Rest Schedule Practices

Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.

Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 oz. per hour during the work shift; fluid replacement at frequent intervals is most effective.

The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.

If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.

Additional salt is usually not needed and salt tablets should not be taken.

Replacement fluids should be cool, but not cold.

Breaks will be taken in a cool, shaded location, and any impermeable clothing

should be opened or removed.

Dry clothing or towels should be made available to minimize chills when taking breaks.

Manual labor will not be performed during breaks, other than paperwork or similar light tasks.

Other controls that may be used include:

- Scheduling work at night or during the cooler parts of the day (6 am–10 am, 3 pm–7 pm)
- Erecting a cover or partition to shade the work area
- Wearing cooling devices such as vortex tubes or cooling vests beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

7.7 Evaluating the Work-Rest Schedule's Effectiveness

Once a work-rest schedule is established, the work supervisor must continually evaluate its effectiveness through observation of workers for signs/symptoms of heart stress. Measurement of each worker's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate, and is accomplished as follows:

- At the start of the workday each worker's baseline pulse rate (in beats per minute – bpm) is determined by taking a pulse count for 15 seconds and multiplying the result by four or an automated pulse count device may be utilized
- Worker pulse rates can then be measured at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria
- Each worker's maximum heart rate at the start of any break should be less than $[180 \text{ minus worker's age}] \text{ bpm}$. If this value is exceeded for any worker, the duration of the following work period will be decreased by at least 10 minutes.
- At the end of each work period all workers' heart rates must have returned to within +10% of the baseline pulse rate. If any worker's pulse rate exceeds this value, the break period will be extended for at least 5 minutes, at the end of which pulse rates will be re-measured and the end-of-break criteria again applied.

Use a clinical thermometer or similar device to measure the oral/ear temperature at the beginning (before drinking liquids) and end of each break period and apply the following criteria:

- If the oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period
- If the oral temperature still exceeds 99.6°F (36.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third

Use of an automated or similar blood pressure device will be used to assess each employee's blood pressure at the beginning and at the end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- If the blood pressure of an employee is outside of 90/60 to 150/90, then the employee will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be re-measured and the end-of-break criteria again applied

All physiological monitoring of heat stress will be documented using the attached Heat Stress Monitoring Log.

7.8 Training

Project staff and their supervisors that may be exposed to the hazard will be oriented to the hazard and the controls prior to work commencing.

Those personnel potentially exposed to heat stress will receive training including, but not limited to:

- Sources of heat stress, influence of personal protective clothing, and importance of acclimatization
- How the body accommodates heat
- Recognition of heat-related illness symptoms
- Preventative/corrective measures
- Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress
- All employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress

- First aid procedures for heat stress-related illnesses

8.0 REFERENCES

- 29 CFR 1910. 132, General Requirements
- OSHA Technical Manual (OTM), Section 3, Chapter 4, Heat Stress
- ACGIH's 2002 Threshold Limit Values for Chemical Substances and Physical Agents
- OP 512, Incident Reporting

9.0 REQUIRED RECORDS

- Heat Stress Monitoring Logs will be kept with project files.

10.0 ATTACHMENTS

Attachment A – Heat Stress Monitoring Log

Attachment A
Heat Stress Monitoring Log

OP 563 - Heat Stress



Heat Stress Monitoring Log

The purpose of this form is to track entry into hot zones wearing chemically protective clothing and monitor employees for heat stress-related illness. It is the responsibility of the foreman or supervisor-in-charge to ensure that each person entering the hot zone completes the required information. Vital signs must be taken by a competent person.

Project Name:			Foreman/Supervisor:						Work/Rest Schedule¹:			IN (min)		OUT (min)		
Date:	Water Provided²		Acclimated³		Initial Vitals⁴		Vital Signs and Time In/Out⁵									
Employee Name	Yes	No	Yes	No	Vitals	In	Out	Vitals	In	Out	Vitals	In	Out	Vitals	In	Out
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	P			P			P			P		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BP			BP			BP			BP		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temp			Temp			Temp			Temp		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	P			P			P			P		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BP			BP			BP			BP		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temp			Temp			Temp			Temp		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	P			P			P			P		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BP			BP			BP			BP		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temp			Temp			Temp			Temp		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	P			P			P			P		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BP			BP			BP			BP		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temp			Temp			Temp			Temp		

- Section 7.5 provides specific details on how to develop a work-rest schedule.
- Each employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
- A worker is "acclimated" if he/she has worked in a hot environment for at least 7 to 10 consecutive days. If a worker is acclimated, check "Yes." If a worker is not acclimated, check "No" and reduce the "Min In" by 50 percent for that employee until the 7- to 10-day period is reached.
- "Vitals" refers to employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work operations in the hot zone. Each time the employee exits the hot zone, vitals must be taken and evaluated for heat stress criteria. Section 7.7 provides specific instructions for taking and evaluating employee vital signs.
- Body temperature vital signs will be recorded in °F.



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OPERATING PROCEDURE

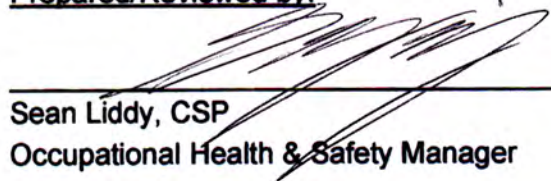
FOR

HEARING CONSERVATION

OP-565

**Revision 1
October 2013**

Prepared/Reviewed by:

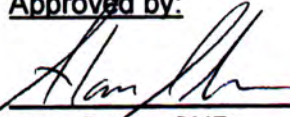


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes procedures to confirm that personal noise exposure remains within acceptable limits and presents the requirements of an acceptable hearing conservation procedure.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Decibel (dB) - Logarithmic unit of measurement of sound level.
- 3.2 dBA - A-weighting is used to measure hearing risk and for compliance with OSHA and MSHA regulations that specify permissible noise exposures in terms of a time-weighted average sound level or daily noise dose.
- 3.3 dBC - C-weighting is used in conjunction with A weighting (the dBA and dBC levels are compared) for certain computations involving computation of hearing protector attenuation such as use of the NRR.
- 3.4 Action Level - An eight-hour, time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently; a noise dose of 50 percent.
- 3.5 Standard Threshold Shift (STS) - When one's hearing threshold has changed (relative to the baseline audiogram) an average of 10 dB or more at 2000, 3000, or 4000 Hz in either ear.
- 3.6 Noise Reduction Rating (NRR) - The measure, in decibels, of how well a hearing protector reduces noise, as specified by the United States Environmental Protection Agency (USEPA) .

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

None.

5.0 EQUIPMENT

Ear plugs and ear muffs.

Sound monitoring equipment (specific equipment identified with SSHP).

6.0 RESPONSIBILITIES

- 6.1 Project Managers responsibilities:

Implement the hearing conservation procedure.

Confirm that a hazardous noise assessment/evaluation has been conducted for specific operations as determined in Site Safety & Health Plan (SSHP) and/or Activity Hazard Analysis (AHA).

Confirm that a hazardous noise assessment/evaluation is conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.

Implement engineering controls to reduce noise levels when such measures are considered feasible and when required by regulation or site specific work plan.

Purchase, monitor, and replenish for employees' use, a supply of hearing protection devices with a minimum Noise Reduction Rating (NRR) of 26 dBA.

Confirm that individuals included in hearing conservation measures receive training and that the training meets the criteria outlined in this procedure.

Investigate and implement corrective action to all reports of nonconformance with this procedure, including reports of standard threshold shifts or employees' failure to wear hearing protectors in designated areas.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide access to initial and refresher hearing conservation training.

Inform employees of noise monitoring results when full-shift noise exposure is at or above the action level.

Designate areas and tasks where employees' exposure is at or above the action level.

Conduct noise monitoring, as applicable, and support hazardous noise assessment/evaluation efforts.

6.3 Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Maintain an awareness of the noise levels in work areas for which he/she is responsible.

Place warning signs in areas where sound levels would require the use of hearing protectors.

Request that a hazardous noise assessment/evaluation be conducted when a change in equipment, procedures, or personnel may increase employee

exposure to noise.

Confirm that all employees are aware of the requirements for hearing protection for any designated area or task.

Enforce the use of hearing protection by employees in designated areas and for designated tasks.

6.4 Employees' responsibilities:

Comply with the requirements of the Hearing Conservation procedure.

Wear hearing protection devices in designated areas or for designated tasks.

Inspect and maintain hearing protection devices.

Report any suspected change(s) in noise levels in work area (s) to supervisor.

Report to supervisor any signs or symptoms experienced that could be the result of overexposure to noise..

Participate in audiometric testing and hearing protection training when required.

7.0 PROCEDURE

7.1 Hearing protection will be mandatory for all employees exposed to 85 dBA for eight hours and for all employees exposed to 85 dBA for any period of time who have experienced an STS.

7.2 Hearing protection will be mandatory for all employees working in any area that has not been evaluated for noise exposure and the ambient noise level in the area is such that you must raise your voice to have a normal conversation with someone less than four feet from you and/or when within 25 feet of an operating piece of heavy equipment.

7.3 Hearing protection will be mandatory for all employees who work on or near heavy equipment unless personal dosimetry or other techniques have been used to document actual exposure.

7.4 Requirements

The requirements of this procedure apply to all locations/facilities/projects where employee noise exposure may equal or exceed 50 percent of the allowable noise dose or Permissible Exposure Limit (PEL). Table 1 provides information relative to the current PEL for noise exposure expressed as a time-weighted average.

Table 1 - Permissible Exposure Limit

SOUND LEVEL (dBA)	TIME (hours)
85	8
90	4
95	2
100	1
105	0.5
110	0.25
115	0.125

Table 2 provides information relative to the Action Level (or 50 percent allowable noise dose) expressed as a time-weighted average. The action levels outlined in the table below and PELs described in Table 1 are calculated without regard to the protection afforded by the use of hearing protectors.

Table 2 - Action Levels for Hearing Conservation

SOUND LEVEL (dBA)	TIME (hours)
85	4
90	2
95	1
100	0.5
105	0.25
110	0.125
115	0.0625

7.5 Audiometric Testing

Personnel with exposure greater than the action level may be enrolled in medical surveillance and undergo a baseline audiogram. Thereafter, annual audiograms will be compared with the baseline exam.

Enrolled employees will receive audiograms during their exit physicals.

When a Standard Threshold Shift (STS), as identified by Cabrera's Medical Consultant, is noted between the last valid baseline and the annual audiogram, the following steps will be taken:

- A retest will be conducted within 30 days to confirm the STS. The employee will not be exposed to workplace/hobby noise for 14 hours or will be provided with adequate hearing protection prior to testing.

- If the STS persists, ear protection will be upgraded to one with a greater NRR. The minimum NRR will be 26 dBA
- The employee will be counseled and Cabrera will obtain information regarding the employee's possible noise exposure away from the workplace or existing ear pathology
- Qualified medical personnel will review the audiograms. This group will determine the need for a medical referral.
- The employee will be notified in writing by either the OH&S Manager or Medical Provider of the STS, within 21 days of determination, as required by regulation
- The employee's supervisor will be notified of the shift in hearing threshold

If the employee who has experienced a STS is exposed to 85 dBA for eight hours or 80 dBA for 12 hours, mandatory use of ear protection is required.

7.6 Monitoring of Noise Levels

As deemed necessary by the OH&S Manager, or by the site SSHO, Cabrera will periodically monitor personal and area noise levels using noise dosimetry and/or sound level meters.

7.7 Hearing Protectors

Selection of appropriate hearing protectors must be based on actual or anticipated exposure levels. At a minimum, hearing protectors must provide a level of protection that brings actual or anticipated exposure below the PEL established for the time period shown in the table above.

The following table is meant to assist in determining which type of hearing protection device(s) to use.

Comparison of Hearing Protection	
Ear Plugs	Ear Muffs
<p>Advantages:</p> <ul style="list-style-type: none"> • small and easily carried • convenient to use with other personal protection equipment (can be worn with ear muffs) • more comfortable for long-term wear in hot, humid work areas 	<p>Advantages:</p> <ul style="list-style-type: none"> • less attenuation variability among users • designed so that one size fits most head sizes • easily seen at a distance to assist in the monitoring of their use

<ul style="list-style-type: none"> • convenient for use in confined work areas 	<ul style="list-style-type: none"> • not easily misplaced or lost • may be worn with minor ear infections
<p>Disadvantages:</p> <ul style="list-style-type: none"> • requires more time to fit • more difficult to insert and remove • require good hygiene practices • may irritate the ear canal • easily misplaced • more difficult to see and monitor usage 	<p>Disadvantages:</p> <ul style="list-style-type: none"> • less portable and heavier • more inconvenient for use with other personal protective equipment • more uncomfortable in hot, humid work area • more inconvenient for use in confined work areas • may interfere with the wearing of safety or prescription glasses; wearing glasses results in breaking the seal between the ear muff and the skin and results in decreased hearing protection

Care and Use

- Follow the manufacturer's instructions
- Check hearing protection regularly for wear and tear
- Replace ear cushions or plugs that are no longer pliable
- Replace a unit when head bands are so stretched that they do not keep ear cushions snugly against the head
- Disassemble ear muffs to clean
- Wash ear muffs with a mild liquid detergent in warm water, and then rinse in clear warm water. Sound-attenuating material inside the ear cushions must not get wet.
- Use a soft brush to remove skin oil and dirt that can harden ear cushions
- Squeeze excess moisture from the plugs or cushions and then place them on a clean surface to air dry

7.8 Training

All employees with potential exposure above the action levels established in Table 2 of this procedure or who otherwise utilize any type of hearing protector will participate in hearing conservation training.

The initial and subsequent annual hearing conservation training will address, at a minimum, the following topics:

- The effects of noise on hearing, recognizing hazardous noise, and symptoms of overexposure to hazardous noise
- When and/or where hearing protectors are required to be worn
- The purpose of hearing protectors
- The advantages, disadvantages, and effectiveness of various types of protectors
- Instructions on how to select, use, fit, and care for hearing protectors
- The purpose of audiometric testing, including an explanation of the test procedures
- Hearing Conservation Procedure requirements and responsibilities

Hearing protection training is conducted biannually for all affected employees or more frequently for employees who do not properly use hearing protectors or otherwise fail to comply with this policy.

7.9 Site Specific Hearing Conservation Procedure

When required, Site Specific Hearing Conservation Procedures will consist of the information (minimum) provided in Attachment A.

8.0 REFERENCES

- ACGIH, Threshold Limit Values (TLV) and Biological Exposure Indices (BEI) booklet; published by ACGIH, Cincinnati, Ohio, 2011.

9.0 REQUIRED RECORDS

- Noise exposure measurement records will be retained for three years at the project/facility
- Audiogram records will be retained in the employee's medical records as per Cabrera's Medical Surveillance Procedure for a period as directed by regulation or Cabrera's Medical Provider
- Employee training session documentation will be retained for the duration of employment

10.0 ATTACHMENTS

Attachment A - Site Specific Hearing Conservation Procedure

Attachment A
Site Specific Hearing Conservation Procedure

Site (Project)

1.0 Monitoring

Monitoring will consist of (*check those that apply*):

- Noise Dosimetry Sound Level Meter Survey

Specific instrumentation to be used is (make/model):

Make	Model

and will be calibrated at a frequency of and documented in the .

Monitoring strategy is as follows (*list all equipment and activities on site that may involve sound pressure levels above 80 dBA and an explanation of the strategy to document actual exposures*):

Area/Equipment	Monitoring Strategy

Where areas or equipment are not clearly identified, all monitoring will be documented utilizing an illustrated layout (*attach form developed for the specific site*). Monitoring frequency will be in accordance with the strategy outlined above and when the following changes in site conditions/activities occur:

Change of Conditions
1.
2.
3.
4.
5.

2.0 Employee Notification

All site employees exposed above the regulated action level (85 dBA – 8 hour TWA) will be notified of the monitoring results by *(insert name/title)* at an interval not to exceed after completion of monitoring.

Notification shall be written, with a copy to the OH&S Manager. Documentation of employee notifications and corresponding signatures of notified employees will be kept in the site health and safety logbook/files.

3.0 Observation of Monitoring

All employees affected by the monitoring, or a designated employee representative, shall be given the opportunity to observe noise monitoring procedures. This will be achieved by:

4.0 Audiometric Testing Requirements

Personnel who perform field activities where noise exposure above action levels is expected are required to participate in audiometric testing. Additionally, any subcontractors performing work where noise levels exceed action levels will be required to provide documentation that they participate in an audiometric testing that meets the applicable regulations.

Documentation of participation in testing will be maintained by and will be located at .

5.0 Hearing Protectors and Estimating Attenuation

A selection of suitable hearing protectors will be made available to all employees who are expected to have 8-hour TWA noise exposures above 85 dBA. The types anticipated to be available include:

Protection Type	Attenuation

Hearing protector attenuation will be evaluated by _____ for specific noise environments according to the following method prior to determining their suitability for use:

1.
2.
3.

The following site personnel will be required to wear hearing protectors during specific activities and the results of site-specific monitoring conducted in accordance with this procedure. *(This section can be completed after monitoring, if necessary).*

Employee Name	Activity Type	Type of Protection

Hearing protectors will be properly fitted by _____ upon initial distribution to site workers.

Training in the use and care of hearing protectors shall be conducted by _____ during the initial site-specific health and safety training. Training contents shall meet the requirements set forth in this procedure and the applicable regulations.

Hearing protectors will be distributed by _____ from the storage location at the _____.

6.0 Access to Information and Training Materials

All information required by regulation to be made available to the employees will be posted by *(insert name/title)* _____ at the _____.

Local Occupational Health and Safety Regulations will also be kept on site.

7.0 Recordkeeping

Records required by Cabrera’s Hearing Conservation Procedure shall be completed by _____ and shall be maintained at the _____ and placed on permanent file at the _____ for the minimum duration required by the standard. Employees can access their individual records by contacting _____.



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE


FOR

HAND & POWER TOOLS

OP-566

**Revision 1
October 2013**

Prepared by:

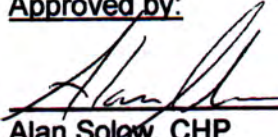


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Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes requirements for manually-operated hand and power tools and equipment use, handling and storage.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

None.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

The use of Fixed Blade Open Knives (FBOKs) is prohibited. FOBKs are tools that have an exposed, prominent, sharp-edged blade that is fixed or can be locked into a fixed position. Examples of FOBKs include pocket knives, multi- tool or Leatherman®, hunting knives, sheetrock knives, and standard utility knives.

If an Activity Hazard Analysis (AHA) shows that a FOBK is the safest and most appropriate tool for a specific task then a FOBK can be used if the Occupational Health & Safety (OH&S) Manager agrees with the determination and gives approval by signing the AHA. Hazards associated with the use of a FOBK should be included in the hazard analysis and the person completing the task must have knowledge of the proper use of the FOBK to prevent injury to self and others.

No employee shall use any hand tool, unless they are familiar with the use and operation of the equipment or have received specific instruction on its use and operation.

Employees who use hand and power tools and are exposed to the hazards of falling, flying, abrasive, and splashing objects, or to harmful dusts, fumes, mists, vapors, or gases must be provided with the appropriate personal protective equipment (PPE) to prevent unnecessary exposure and/or injury .

All tools will be used in accordance with manufacturer's specifications.

5.0 EQUIPMENT

Hand and power tools used during field operations.

6.0 RESPONSIBILITIES

6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Each Manager/Supervisor must ensure that all aspects of this procedure are followed and adhered to on all projects sites and locations.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Employees' responsibilities:

Employees shall not work with any tool that they are not familiar with without first obtaining training associated with that equipment. In addition, employees must follow the manufacturer's guidance and/or recommendations for its use. It is recommended that modifications to the equipment not be performed without first consulting the OH&S Manager and/or FSM/SSHO and the manufacturer.

7.0 PROCEDURE

7.1 Basic Safety Rules

- Keep all tools in good condition with regular maintenance.
- Use the right tool for the job.
- Examine each tool for damage before use and do not use damaged tools.
- Operate tools according to the manufacturers' instructions.
- Provide and use the appropriate PPE..
- All electrical connections for hand and power tools must be suitable for the type of tool and the working conditions (wet, dusty, flammable vapors).
- When a temporary power source is used, a ground-fault circuit interrupter should be used.
- Eye protection is required, and head and face protection is recommended for employees working with pneumatic tools. If unsure about eye, head and face protection, contact the OH&S.
- Screens or other protective measures must be set up to protect nearby

workers and others from being struck by flying fragments around chippers, riveting guns, staplers, air drills or similar equipment. The site safety officer will establish safe work zones as necessary.

- Compressed air guns should never be pointed toward anyone.
- A chip guard must be used when compressed air is used for cleaning.
- Use of heavy jackhammers can cause fatigue and strains. Heavy rubber grips reduce these effects by providing a secure handhold.
- Workers operating jackhammers must wear safety glasses and safety shoes that protect them against injury if the jackhammer slips or falls. A face shield also should be used. If unsure about eye, head and face protection, contact the OH&S.
- Noise hazard associated with pneumatic tools. Working with noisy tools such as jackhammers requires proper, effective use of appropriate hearing protection.

7.2 Hazard Prevention Sharp Objects

Employees, when using saw blades, knives, or other tools, should direct the tools away from aisle areas and away from other employees working in close proximity. Tools should always be used in a safe manner.

Knives and scissors must be sharp; dull tools can cause more hazards than sharp ones. A dull blade will require more force to cut, increasing the likelihood of slipping.

Safe cutting tools (tools with covered to retractable blades) should be used for cutting materials (FBOKs are prohibited). There are a variety of tools that provide safe and effective cutting and some are specially designed for a particular task or material; therefore, it may be necessary to possess a few different types of cutting tools to complete a task. The safety cutting tools should be maintained and inspected prior to use as with any other hand tool. Comply with the manufacturer's instructions for proper use and safe storage. Proper PPE (hand, face and eye protection) should be worn at all times during use. Contact the OH&S Manager for assistance in purchasing the right tool for the task.

Always keep body parts (i.e., fingers) away from the cut line, and ensure that the material being cut is on a sturdy surface (vise, tailgate, etc.) and not against a body part (i.e. cutting rope against your leg). Always pull the knife; never push the knife (the blade may break, and the momentum could cause the body to come into contact with broken blade). Pre-plan the cut path, and be sure the path is away from the body in the event the blade moves from the

desired cutting path.

Cracked or otherwise damaged saw blades must be removed from service.

Wrenches must not be used when jaws are sprung to the point that slippage occurs.

Impact tools such as drift pins, wedges, and chisels must be kept free of mushroomed heads.

The wooden handles of tools must not be splintered.

Iron or steel hand tools may produce sparks that can be an ignition source around flammable substances. Where this hazard exists, spark-resistant tools made of non-ferrous materials should be used where flammable gases, highly volatile liquids, and other explosive substances are stored or used.

7.3 Hazard Prevention of Power tools

Precautions

Never carry a tool by the cord or hose.

Never yank the cord or the hose to disconnect it from the receptacle.

Keep cords and hoses away from heat, oil, and sharp edges.

Disconnect tools when not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.

Keep all people not involved with the work at a safe distance from the work area.

Secure work with clamps or a vise, freeing both hands to operate the tool.

Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.

Maintain tools with care; keep them sharp and clean for best performance.

Follow instructions in the user's manual for lubricating and changing accessories.

Be sure to keep good footing and maintain good balance when operating power tools.

Wear proper apparel for the task. Loose clothing, ties, or jewelry can become caught in moving parts.

Inspect all cords and connector before using.

Remove all damaged portable electric tools from use and tag them: "Do Not Use."

Use GFCI protected receptacles or cord adapters during use of power tools.

Guards

The exposed moving parts of power tools need to be safeguarded. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded.

Machine guards, as appropriate, must be provided to protect the operator and others from the following:

- Point of operation
- In-running nip points
- Rotating parts
- Flying chips and sparks

Safety guards must never be removed when a tool is being used. Portable circular saws having a blade greater than 2 inches (5.08 centimeters) in diameter must be equipped at all times with guards.

An upper guard must cover the entire blade of the saw.

A retractable lower guard must cover the teeth of the saw, except where it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work position.

7.4 Operating Controls and Switches

The following hand-held power tools must be equipped with a constant-pressure switch or control that shuts off the power when pressure is released: drills; tappers; fastener drivers; horizontal, vertical, and angle grinders with wheels more than 2 inches (5.08 centimeters) in diameter; disc sanders with discs greater than inches (5.08 centimeters); belt sanders; reciprocating saws; saber saws, scroll saws, and jigsaws with blade shanks greater than 1/4-inch (0.63 centimeters) wide; and other similar tools.

These tools also may be equipped with a "lock-on" control, if it allows the worker to also shut off the control in a single motion using the same finger or fingers.

The following hand-held power tools must be equipped with either a positive “on-off” control switch, a constant pressure switch, or a “lock-on” control:

- Disc sanders with discs 2 inches (5.08 centimeters) or less in diameter
- Grinders with wheels 2 inches (5.08 centimeters) or less in diameter
- Platen sanders, routers, planers, laminate trimmers, nibblers, shears, and scroll saws; and jigsaws, saber and scroll saws with blade shanks a nominal 1/4-inch (6.35 millimeters) or less in diameter.

It is recommended that the constant-pressure control switch be regarded as the preferred device.

Other hand-held power tools such as circular saws having a blade diameter greater than 2 inches (5.08 centimeters), chain saws, and percussion tools with no means of holding accessories securely must be equipped with a constant-pressure switch.

7.5 Electrical Shock Caution

Electrical shocks, which can lead to injuries such as heart failure and burns, are among the major hazards associated with electric powered tools. Under certain conditions, even a small amount of electric current can result in fibrillation of the heart and death.

An electric shock also can cause the user to fall off a ladder or other elevated work surface and be injured due to the fall.

To protect the user from shock and burns, electric tools must have a three-wire cord with a ground and be plugged into a grounded receptacle, be double insulated, or be powered by a low-voltage isolation transformer.

Three-wire cords contain two current carrying conductors and a grounding conductor. Any time an adapter is used to accommodate a two-hole receptacle, the adapter wire must be attached to a known ground.

The third prong must never be removed from the plug.

Double-insulated tools are available that provide protection against electrical shock without third-wire grounding. On double insulated tools, an internal layer of protective insulation completely isolates the external housing of the tool.

It is recommended that a GFCI protected outlet or cord adapter is used.

7.6 Electric Tools General Practice

Operate electric tools within their design limitations as specified by the

manufacturer.

Use gloves and appropriate safety footwear when using electric tools.

Store electric tools in a dry place when not in use.

Inspect cords and plugs daily before use.

Do not use electric tools in damp or wet locations unless they are approved for that purpose.

Keep work areas well lighted when operating electric tools. Ensure that cords from electric tools do not present a tripping hazard and are kept up/out of damp/wet locations.

In the construction industry, employees who use electric tools must be protected by ground-fault circuit interrupters or an assured equipment-grounding conductor program.

7.7 Pneumatic Tools (powered by compressed air)

There are several dangers associated with the use of pneumatic tools. First and foremost is the danger of getting hit by one of the tool's attachments or by some kind of fastener the worker is using with the tool.

Pneumatic tools must be checked to see that the tools are fastened securely to the air hose to prevent them from becoming disconnected.

A short wire or positive locking device attaching the air hose to the tool must also be used and will serve as an added safeguard.

If an air hose is more than 1/2-inch (12.7 millimeters) in diameter, a safety excess flow valve must be installed at the source of the air supply to reduce pressure in case of hose failure.

In general, the same precautions should be taken with an air hose that are recommended for electric cords, because the hose is subject to the same kind of damage or accidental striking, and because it also presents tripping hazards.

When using pneumatic tools, a safety clip or retainer must be installed to prevent attachments such as chisels on a chipping hammer from being ejected during tool operation.

Pneumatic tools that shoot nails, rivets, staples, or similar fasteners and operate at pressures more than 100 pounds per square inch (6,890 kPa - kilopascal), must be equipped with a special device to keep fasteners from being ejected, unless the muzzle is pressed against the work surface.

Airless spray guns that atomize paints and fluids at pressures of 1,000 pounds or more per square inch (6,890 kPa) must be equipped with automatic or visible manual safety devices that will prevent pulling the trigger until the safety device is manually released.

7.8 Liquid Fuel Tools (operated with gasoline)

The worker must be careful to handle, transport, and store gas or fuel only in approved flammable liquid containers, according to proper procedures for flammable liquids.

Before refilling a fuel-powered tool tank, the user must shut down the engine and allow it to cool to prevent accidental ignition of hazardous vapors.

When a fuel-powered tool is used inside a closed area, effective ventilation and/or proper respirators such as atmosphere-supplying respirators must be utilized to avoid breathing carbon monoxide.

Noise hazards associated with gasoline engines must be mitigated by proper hearing protection.. Ear Plugs, ear muffs or a combination of the two must be used to protect workers from excessive noise levels.

Fire extinguishers must also be available in the area.

7.9 Hydraulic Power Tools (fluid run)

The fluid used in hydraulic power tools must be an approved fire resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed. The exception to fire-resistant fluid involves all hydraulic fluids used for the insulated sections of derrick trucks, aerial lifts, and hydraulic tools that are used on or around energized lines. This hydraulic fluid shall be of the insulating type.

The manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.

All jacks—including lever and ratchet jacks, screw jacks, and hydraulic jacks—must have a stop indicator, and the stop limit must not be exceeded. Also, the manufacturer's load limit must be permanently marked in a prominent place on the jack, and the load limit must not be exceeded.

A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up. Put a block under the base of the jack when the foundation is not firm, and place a block between the jack cap and load if the cap might slip.

To set up a jack, make certain of the following:

- The base of the jack rests on a firm, level surface;
- The jack is correctly centered;
- The jack head bears against a level surface; and
- The lift force is applied evenly.

Proper maintenance of jacks is essential for safety. All jacks must be lubricated regularly. In addition, each jack must be inspected according to the following schedule:

- For jacks used continuously or intermittently at one site—inspected at least once every 6 months;
- For jacks sent out of the shop for special work—inspected when sent out and inspected when returned; and
- For jacks subjected to abnormal loads or shock—inspected before use and immediately thereafter.

7.10 Training

Instruction in the proper use, safe handling, and maintenance of tools will be provided to employees unfamiliar with the tool.

7.11 Personal Protective Equipment

Lockout devices (padlocks, multiple lock hasps, tags), gloves appropriate to the task, safety-toed boots, as required, hard hats and eye & face protection, as required.

7.12 Inspections

All tools must be inspected prior to each use. Any tool that is defective or has missing parts must not be used. Every broken or defective tool must be tagged or identified as such. Tagged tools will be returned to your supervisor for repair or replacement. Tagged tools will be immediately removed from service.

All tools must be inspected to manufacture's specifications according to tool rests and guard adjustment tolerances. All tools will be inspected to ascertain that all safety devices are present and functioning properly.

8.0 REFERENCES

- 29 CFR 1926, Subpart I, Tools, Hand and Power
- 29 CFR 1910, Subpart P , Hand and Portable Powered Tools and Other Hand-Held Equipment
- OP 567, Electrical Safety

9.0 REQUIRED RECORDS

None.

10.0 ATTACHMENTS

None.



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE


FOR

ELECTRICAL SAFETY

OP-567

Revision 1
October 2013

Prepared by:

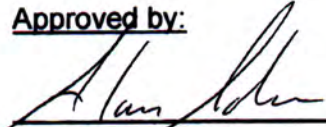


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the requirements to minimize and control electrical hazards in the workplace.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Circuit Protective Device - A load-rated switch, circuit breaker, or other device specifically designed as a disconnecting means for opening, reversing, or closing of live circuits.
- 3.2 Energized Electrical Equipment - Electrically connected to or having a source of voltage.
- 3.3 Ground Fault Circuit Interrupter (GFCI) - An electrical device that protects the users of all devices connected to it from electrical shock. The GFCI is part of the circuit or device in use and continuously measures the current in that circuit. If a leakage of current is detected, as in the case of an electrical short circuit, the circuit is opened at the GFCI and current cannot flow beyond the GFCI.
- 3.4 Hazardous Atmospheres - Areas that contain or may contain explosive or flammable atmospheres require specific electrical precautions. The United States Occupational Health & Safety Administration (OSHA) regulates the use of electrical devices in explosive atmospheres according to National Electrical Code criteria and classifications for hazardous atmospheres.
- 3.5 Portable Electric Equipment - Cord-and plug-connected equipment and extension cords.
- 3.6 Qualified Persons - Individuals who have specific and documented training to avoid the hazards of working on or near energized electrical equipment and have been specifically permitted to work on or near exposed energized and parts.
- 3.7 Shock Hazard - A dangerous situation associated with the possible release of energy caused by contact or approach to live parts.
- 3.8 Unqualified Persons - Individuals with little or no training to avoid the hazards of energized electrical parts or equipment.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

As a general rule, employees should not work on exposed, energized systems with a potential greater than 50 volts. This work should be subcontracted to a qualified licensed electrician (Qualified Person).

Electrical outlets utilized to supply power for electrical equipment during field operations shall be of the three-wire grounding type. Whenever possible, they should be tested for correct polarity and adequacy of the ground with a circuit analyzer. If it is determined that the outlet is incorrectly wired or inadequately grounded, it should not be used.

GFCI devices will be in place between the equipment and power source for all temporary circuits unless protected by an assured equipment grounding program as defined in this procedure

5.0 EQUIPMENT

Only tools and testing or protective equipment approved by ANSI/ASTM for the relevant voltage rating will be used when working on energized electrical systems. All tools and testing or protective equipment will be visually inspected prior to use to confirm that the protection systems associated with the tool or equipment are not damaged or impaired and that diagnostic meters and tools are configured properly. Any tool or testing or protective equipment suspected of being compromised will be immediately taken out of service and will be tagged for disposal.

6.0 RESPONSIBILITIES

6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Determining if potential exposure to electrical hazards exist for the project.

The Manager or Supervisor will determine the appropriate safe guards to be put in place to protect employees.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Employees' responsibilities:

Employees will stop work if workers, other than Qualified Persons, are exposed to live electrical systems at unknown voltages or potentials greater than 50 volts.

Employees shall not open electrical panels unless they are a Qualified Person.

7.0 PROCEDURE

7.1 General Requirements for Use of Electricity

Personnel who meet the requirements of a Qualified Person and have been specifically designated as such in the project health and safety plan may set up temporary circuits up to 240 volts. Maintenance or installation of circuits over 240 volts will require professionally trained personnel (i.e. professional electricians).

All electrical panels, lines, equipment, and facilities are to be considered energized unless confirmation that they are de-energized can be obtained from a Qualified Person or electrician.

All work on de-energized systems will be performed using established Hazardous Energy Control procedures. Lockout devices will be used to prevent the operation/energizing of equipment or circuits during maintenance or other work. Tagout devices will be used only where it is not feasible to use a lockout device.

Insulated tools and electrical handling equipment shall be inspected prior to use to confirm that their protective properties are not damaged. Damaged equipment will be tagged "DAMAGED" and removed from service.

7.2 Distribution System Setup

Only qualified personnel shall perform electrical wiring or connections.

Under no circumstances shall electrical lines be routed through doorways, hatches, windows, or other openings where lines could be crimped, bent, or cut.

Electric lines crossing work areas, personnel, or vehicular traffic areas shall be either fastened securely overhead (at a height that provides safe clearance for work operations), or protected by a cover capable of withstanding the imposed loads without creating a trip hazard.

Circuit breakers shall be labeled to indicate their use.

All circuit breaker panels shall be kept covered when not in use.

A fuse puller shall be used to remove cartridge fuses where one or more energized circuits are present.

All live parts of electrical equipment operating at 50 volts or more shall be properly guarded against accidental contact, which includes:

- Limit access to the equipment to qualified employees only.

- Unqualified Persons shall remain at least one meter (three feet) from exposed, energized systems managed by the Qualified Person(s). This distance shall be nine meters (10 feet) for systems with a potential greater than 240 volts.
- Label using the proper accident prevention sign, stating DANGER as well as the voltage of the equipment
- Provide a conductor of the amp rating of not less than the rating of the circuit breaker or fuses protecting that circuit
- Confirm that a bare conductor or earth return is not used for any temporary circuit
- Confirm that all electrical wiring is protected from physical damage by covering and by not placing it in a location where it can be crimped or cut, etc

7.3 Extension Cord Use

Extension cords and electrical connections on handheld and other power tools will be inspected prior to use for cuts, kinks, frayed wires, etc. If any deficiency is noted, the equipment will be tagged "DAMAGED" and removed from service. Manufacturer-installed insulated electrical cords will not be repaired or spliced.

Extension cords are to be kept clean, free of kinks, and protected from oil, hot or sharp surfaces, and chemicals. Extension cords are not to be placed across aisles, through doors, through holes in a wall, or in areas where the cord may be damaged or create a tripping hazard. Extension cords will be appropriate for the specific task and environment.

Extension cord sets for use in field operations should be of the three-wire grounding type and should be designed for hard or extra-hard use. This type of cord will typically utilize insulated wires within an outer insulated sleeve. Examples of such cord include the type marked S, ST, SO, STO, SJ, SJO, or SJTO. Molded wire (flat) cord sets should not be used in field situations. The cord will minimally be rated for the intended current (e.g., heavy duty extension cords are often available in both 15 and 20 amp versions).

Use of extension cords is allowed only for temporary installations not to exceed 90 days (e.g., decorations).

Extension cords shall be provided with a plug cap that is either molded to the cord or equipped with a cord clamp to prevent strain on the terminal screws.

Extension cords shall not be fastened with staples or otherwise hung in a

manner that could damage the outer jacket or insulation.

Extension cords shall be inspected prior to each use to confirm that there is no damage or defects. Defective cords shall not be used.

Extension cords used with grounding-type equipment (e.g., three-prong plug) shall contain a grounding-type conductor (have three prongs to accept the ground plug). If an adapter is used to accommodate a three-wire cord to a two-hole receptacle, the adapter wire will be attached to a known ground. The third prong shall never be removed from the plug.

Electrical cords shall not be removed from a receptacle by pulling on the cord line.

Employees' hands shall not be wet when plugging and unplugging cord and plug connected equipment and extension cords. The outlet box for portable extension cords for outdoor use shall be weatherproof and shall be maintained in good condition.

Ground fault circuit interrupters shall be used for all nonpermanent wiring needed for construction purposes or when working in wet or moist areas or onboard ships.

Extension cords used in potentially wet locations shall be approved for use in those locations by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation (e.g., F.M., UL, etc.).

Grounding-type equipment (e.g., three-prong plugs) shall not be modified to mate to incompatible outlets (e.g., cut off grounding prong to fit two prong outlets).

7.4 Portable Electrical Equipment

Double-insulated, portable, industrial-type electrical tools meeting the requirements of the National Electrical Code (NEC) are authorized for use (ground wire not required). Where this type of tool is used, the equipment will be distinctly marked.

Portable electrical tools not provided with special insulating or grounding protection are not for use in damp, wet, or otherwise conductive locations (e.g., by persons standing on the ground or on metal floors).

All portable electrical appliances and equipment with non-current-carrying metal parts to which personnel may be exposed shall be grounded by a continuous conductor of adequate capacity from the device to a grounded receptacle. The SSHO shall resolve any question of whether or not a particular

appliance should be grounded.

Manufacturer-installed guards shall not be tampered with, modified, or removed. These guards will be in place and utilized during operation of equipment.

The dimension of the working space in the direction of access to energized parts in switchboards, control panels, fused switches, circuit breakers, panel boards, motor controllers, and similar equipment that requires examination, adjustment, servicing, or maintenance while energized shall not be less than 36 inches deep and 30 inches wide or the width of the equipment, whichever is greater.

Portable electrical equipment shall be handled in a manner that will not cause physical damage to the equipment.

Portable electrical equipment shall not be carried by the cord.

Cords shall not be used to raise or lower equipment.

Disconnect portable electric equipment when not in use, before servicing, and when changing accessories such as blades, bits, and cutters.

Portable electric equipment used in potentially wet locations shall be approved for use in those locations by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation (e.g., F.M., UL, etc.).

Portable electric equipment and extension cords used in areas exposed to gases, fumes, vapors, liquids, or other agents having a deteriorating effect shall be approved for use in those locations.

Portable electric equipment used in areas in which hazardous concentrations of flammable gases or vapors exist shall be approved for use in those locations.

After a circuit is de-energized by a circuit protective device, the circuit may not be manually reenergized until it has been determined that the equipment and circuit can be safely energized.

7.5 Temporary Lights/Task Lights

A temporary light shall not be suspended by the cord unless the cord and light are designed for suspension.

Temporary lights shall be equipped with bulb protectors unless they are installed at least 7 or more feet overhead.

7.6 Ground Fault Protection

OSHA standard 1926.404(b)(1) requires “ground fault protection” on construction sites. The standard allows two different approaches to providing the required protection for employees from electrical ground faults. Either GFCIs are to be used with temporary receptacles, or an “assured equipment grounding conductor program” is to be established in which plug-connected electrical equipment, extension cords, and temporary receptacles are tested on a periodic basis.

Ground Fault Circuit Interrupters

A GFCI is an electrical device that is designed to prevent electrocution from electrical leakage. It is designed to measure the difference in amperage between the “hot” wire and the “neutral” wire in a circuit. Under ideal conditions, the amperage should be the same in both wires. If there is electrical leakage (a ground-fault), the amperages will be different. If the difference is more than a predetermined amount, the GFCI “trips” and stops the flow of electricity.

GFCIs may trip from many causes:

- Electrical leakage in the tool from internal defects
- Electrical leakage in the extension cord from damaged insulation or from normal leakage in long runs of cords
- Moisture in the air or cords lying in water or on moist dirt
- Too many tools on one GFCI circuit
- Electromagnetic interference from two-way radios or from power transmission lines
- Faulty wiring of the GFCI into the circuit
- Defective GFCI

Any such tripping will require the problem to be corrected before the protected circuit can be re-set.

All 120-volt, single phase, 15 and 20 ampere temporary receptacles shall be protected with “approved” GFCIs. “Approved” means listed by Underwriters Laboratories.

There are several types of GFCIs.

1. A combination circuit breaker and GFCI that is installed in place of the ordinary circuit breaker
2. A receptacle containing a built-in GFCI
3. A portable GFCI that plugs into a receptacle and allows the extension cord or tool to be plugged into the GFCI
4. A portable unit containing several GFCI protected receptacles

GFCIs contain a test button and a reset button. Each GFCI needs to be tested prior to use and on a periodic basis depending upon the manufacturer's recommendations (at a minimum monthly).

Assured Equipment Grounding Conductor Program

If an assured equipment grounding conductor program is to be used instead of GFCIs to provide ground fault protection, the program shall be governed by the following requirements.

Temporary receptacles shall be electrically grounded in accordance with the temporary wiring requirements of the NEC.

Extension cords shall be three-wire cords containing an equipment grounding conductor (ground wire).

Electrical equipment that is plugged into a receptacle or extension cord (portable electrical tools, bench grinders, electric heaters, etc.) shall have a ground wire properly attached to the non-current-carrying metal parts of the equipment. (Double-insulated tools have no ground wire and are therefore exempt from these testing and recording requirements but still need to be inspected for defects.)

The Field Site Manager and/or Supervisor are required to designate one or more competent persons (SSHO) to administer this testing and recording program.

Periodic testing of all plug connected equipment, all extension cords, and all temporary receptacles is to be conducted at the following times:

- Before a new item (equipment, cord, or receptacle) is put into use
- After any repairs to the item
- After any incident in which the item may have been damaged.
- Within 3 months of the last test. (An exception is allowed in the Standard in which extension cords, and temporary receptacles, which

are fixed in place and are not exposed to damage, may be tested every 6 months.)

The purpose of the test is to determine the following:

- Temporary Receptacles—to be sure that the receptacle is grounded
- Extension Cords—to be sure that the ground wire is connected to the proper terminal at each end and that the ground wire is continuous throughout the length of the cord
- Plug Connected Equipment—to be sure that the ground wire is connected to the proper terminal and to the non-current carrying metal parts of the equipment and that the ground wire is continuous from the equipment to the plug

The tests may be conducted using the following instruments:

- A receptacle tester may be used to test receptacles and to test extension cords when plugged into a receptacle
- A continuity tester, or a volt-ohm meter, may be used to test equipment and to test extension cords when not plugged into a receptacle

Records must be kept to show which items have passed the test and when the test was conducted. These records may be either written inspection logs, combined with a color coding system using colored tape attached to the item, or some other effective means of identification of the inspected device/cord.

Color coding shall be used in the following manner:

- After a plug-connected piece of equipment or an extension cord has passed the test, colored tape is to be placed around the cord near the plug. After a temporary receptacle has passed the test, colored tape is to be placed on the cover plate.
- Any set of colors may be used, with the exception of black, or silver. Use the following colors for the test periods.
 - January, February, March White
 - April, May, June Green
 - July, August, September Red
 - October, November, December Orange

The tests administered every three months are to begin on the first working day of each quarter. Testing and color coding are to be continued until all items covered by this program have been tested. The test administered every six months, for those receptacles and extension cords needing only semi-annual testing, are to be color coded using the quarterly color current at the time of the semi-annual test.

A visual inspection of plug-connected equipment, extension cords, and temporary receptacles is to be made by the user before each use. The purpose of the visual inspection is to look for damage or defects that could affect the safe use of the item. (Exception: extension cords and temporary receptacles that are fixed in place and not exposed to damage are not required to be given a daily visual inspection, but it is a good idea to do the daily visual inspection anyway.)

Equipment, cords, or receptacles showing damage or defects that could affect its safe operation are not to be used. This applies not only to the visual inspection before each use but also applies to any evidence of damage observed any time during use. Damaged items are to be taken out of service and are not to be used until properly repaired and retested.

Equipment covered by this program is not to be used until the equipment has been tested and color coded according to the requirements of this program.

A copy of this program is to be kept at the worksite.

7.7 Personal Protective Equipment/Work Practices

Nonconductive hardhats shall be worn when there is danger of head injury from electric shock or burns due to exposure to energized parts.

Jewelry shall not be worn when working around or with energized parts.

Insulated tools shall be used to work with energized parts. Tools that have insulation that might be damaged (e.g., rubber handles) shall be inspected prior to each use to confirm the insulation is not damaged.

Eye protection with side shields shall be worn when working with energized parts.

Rubber mats, non-conductive shields, or protective barriers shall be used as needed to protect employees from electrical hazards.

Appropriate insulating gloves shall be worn to pick up or unplug connections that are in highly conductive areas, such as in water.

Do not plug in or unplug electric equipment with wet hands.

8.0 REFERENCES

- 29 CFR 1926, Subpart K, Electrical
 - 1926.404(b)(1), Ground Fault Protection
- 29 CFR 1910, Subpart S, Electrical
 - 1910.303, General
- National Fire Protection Association (NFPA) 70, National Electric Code, 70E, Standard for Electrical Safety in the Workplace.

9.0 REQUIRED RECORDS

If using the assured grounding program, the designated Competent Person for project site (SSHO or designee) shall maintain all inspection records with the project files.

10.0 ATTACHMENTS

None.



CABRERA SERVICES
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OPERATING PROCEDURE

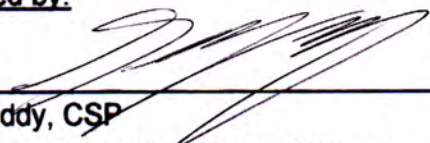
FOR

LADDER SAFETY

OP-568

**Revision 1
October 2013**

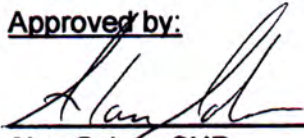
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12/19/2013
Date

1.0 PURPOSE

This operating procedure (OP) establishes the minimum requirements for Cabrera to use, handle, and store ladders.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Stepladder - A self-supporting portable ladder that is non-adjustable in length, with flat steps and a hinged design for ease of storage. It is intended for use by one person.
- 3.2 Single Ladder - A non-self-supporting portable ladder that is non-adjustable in length, consisting of one section. It is intended for use by one person.
- 3.3 Articulated Ladder - A portable ladder with one or more pairs of locking hinges which allow the ladder to be set up in several configurations such as a single or extension ladder, with or without a stand-off, a stepladder, a trestle ladder, scaffold or work table.
- 3.4 Extension Ladder - A non-self-supporting portable ladder that is adjustable in length. It consists of two or more sections that travel in guides or brackets arranged so as to permit length adjustment. It is intended for use by one person.
- 3.5 Fixed Ladder - A non-self-supporting ladder that is non-adjustable in length is permanently attached to a structure and has a Pitch ranging from 60 degrees to 90 degrees from the horizontal. The Preferred Pitch of a Fixed Ladder is between 75 degrees and 90 degrees from the horizontal. A Fixed Ladder is considered to be of "Substandard Pitch" if it is installed at an angle between 60 degrees and 75 degrees from the horizontal. Fixed Ladders having a Pitch greater than 90 degrees are not allowed.
- 3.6 Job-Made Ladder - A custom, made-to-fit ladder specific to a job situation during construction, demolition or other project-specific operation. The primary purpose of the job-made ladder is to provide access to or egress from a work area. They are not intended to serve as a workstation. They are temporary in nature and serve only until a particular phase of work is completed or until permanent stairways or Fixed Ladders are ready for use. They are not to exceed 24-feet in working length. In the event the required ladder length exceeds 24-feet, then two or more separate Job-Made Ladders are to be used in conjunction with platforms that are protected with railings. Job-made ladders must be in full compliance with local regulations.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

Compliance with American National Standards Institute (ANSI) A14.1, ANSI A14.3 and applicable state regulations is also required.

Use only heavy duty construction grade ladders of an approved standard.

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Implementation of this procedure for supervised employees.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Employees' responsibilities:

Apply appropriate precautions and work practices in their use of ladders and stairways.

7.0 PROCEDURE

7.1 General -The following are minimum requirements for the use and care of ladders.

Ladders will be formally inspected and documented using the Ladder Inspection Form in Attachment A. The inspections will be performed by the designated Competent Person for Ladder Safety on the project site. Inspections will be performed prior to the ladder being placed in service, and at a minimum frequency of every three months thereafter.

Ladders shall be inspected before use and if defective, removed from use.

Ladders will be maintained in good condition at all times. Those that are defective in any way will be removed from service and tagged with an "unsafe equipment" tag until made safe for use or destroyed.

Ladders purchased for use on project sites will be appropriate for industrial applications (Class 1-A). Light-duty household ladders are not acceptable.

Ladder safety climbing devices may be used in lieu of cage protection on fixed

ladders of unbroken length of 20 feet (6meters) in height. Landing platforms are not required in these cases except at regular step-off points. All ladder safety devices will be compatible with the ladders with which they are used.

Fixed ladders will be installed wherever regular access by ladder is necessary.

Ladders having metal parts (other than hardware) will not be used where potential electrical hazards exist unless they bear a manufacturer's label that indicates:

- The ladder complies with ANSI 14.5
- It is approved for electrical use

Job-made ladders will be constructed in accordance with 1926.1053(a)(1). Reference ANSI A14.4-1979 - Safety Requirements for Job-Made Ladders for additional information.

All personnel involved in the use of ladders on the project will be instructed in the requirements of this procedure.

Standard ladders will not exceed the following limits:

- Stepladders – 20 feet (6m)
- Single ladders – 30 feet (9m)
- Extension ladders (2 section) – 49 feet (15m)
- Extension ladders (more than 2 sections) – 66 feet (20m)

7.2 Step Ladders

The stepladder must be in good condition and the right ladder class/grade for the job to be performed. Only use stepladders on clean, even surfaces, free of obstructions and debris.

The platform and top step of ordinary types of stepladders will not be used as steps. Do not work from the top two steps of a stepladder. The pail shelf is not to be used as a step.

Only use a stepladder in the fully opened position with the spreader bars locked.

Do not use stepladders as supports for scaffolds or as a straight ladder.

Stepladders may be used as a work platform, however do not over reach while on a stepladder. Climb down and move the ladder to a new position.

7.3 Extension Ladders

Extension ladders are to be used for access to a higher level only, not as a work platform.

Ladders must be tied off. Use polypropylene ropes on extension ladders that may be exposed to corrosive chemical. Keep both metal and wooden ladders away from electrical sources.

Where a ladder is used for regular access and egress between levels, platforms should be provided at each landing area. The landing areas at both ends of the ladder must be clear of debris and other materials.

The ladder should be set at the proper angle of one (1) horizontal length to every four (4) vertical lengths.

7.4 Ladder Types

The United States Occupational Health & Safety Administration (OSHA) and ANSI have established “duty ratings” for portable ladders which identifies the conditions under which the ladder can be safely used (ratings affixed to side rail label). The following table generally describes these ratings:

TYPE	MAX WORK LOAD	RATED USE
Type IAA	375 lbs (170kg)	Super Heavy Duty
Type IA	300 lbs (136kg)	Extra Heavy Duty
Type I	250 lbs (113kg)	Heavy Duty Industrial
Type II	225 lbs (102kg)	Med. Duty Commercial
Type III	200 lbs (91kg)	Light Duty Household

7.5 Use of Ladders

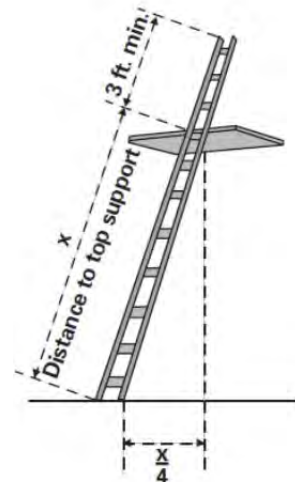
Use the appropriate type of ladder for the job.

Straight ladders will be tied, blocked, and equipped with safety shoes, or otherwise secured to prevent displacement.

Set the ladder at the proper angle of 1 horizontal to every 3 to 4 vertical.

The top of the ladder should extend 3 feet (1 meter) above the access level and rest on a surface of ample strength to support the load of the ladder and other applied loads.

Always visually inspect ladders prior to use. Broken or



damaged ladders must not be used. Ladders with loose, broken or missing rungs, split side rails, or other defects must be tagged out and removed from service.

Do not paint or use painted wooden ladders as paint may hide unsafe wear and tear.

Only one person shall be on a ladder at any time.

Always face the ladder when ascending or descending.

Always maintain three points of contact with the ladder (i.e., two hands and one foot or two feet and one hand).

Prior to using any ladder, ensure that your footwear is free of mud, snow, grease or other slippery materials.

Check for overhead electrical conductors prior to setting up a ladder. Ensure that ladders do not come into contact with or encroach upon the minimum safe distances from energized electrical conductors. Do not use metal ladders or wire-reinforced wooden ladders in proximity to energized power lines or electrical equipment. When working near electrical equipment use only wood or fiberglass ladders approved for that use.



3-Point Contact

Single and extension ladders must be equipped with non-slip safety feet, tied off at the top and bottom, or otherwise secured to prevent “kicking out” or slipping.

Ladders should be set up on a firm level surface. If the base is to rest on soft, uncompact or rough soil, a mud-sill must be used to stabilize the ladder.

Ladders will not be placed on boxes, barrels, or other unstable bases to form longer sections.

A ladder will not be placed in front of a door opening toward the ladder unless the door is blocked open, locked, or guarded. Ladders projecting into passageways or doorways where they can be struck by personnel, moving equipment, or materials must be protected by barricades or guards.

Ladders must not be used horizontally as substitutes for scaffold planks, runways or other service for which they have not been designed.

Workers must ensure that their bodies are kept between the side rails of the ladder. Extending beyond the side rails or straddling a space between a ladder and another object will reduce the stability of the ladder. Three-point contact should be maintained or fall protection used if reaching outside of ladder rails.

No type of work requiring the use of both hands will be performed on a ladder over 6 feet (1.8m) from the ground or floor unless a safety harness is worn and the safety lanyard is secured to a substantial overhead anchorage point. Note: For General Industry, the height limit is reduced to 4 feet (1.2m).

Never carry materials, tools or other objects when ascending or descending from a ladder. Hoist lines or other appropriate methods should be used to transport materials from one work surface to another.

Ladders will not be spliced together to form longer sections.

At no time will a worker stand or sit on the top two rungs of any ladder.

7.6 Care of Ladders

Ladders will be handled with care and not be subjected to abuse or misuse.

Immediate inspection and appropriate maintenance is required of any ladder exposed to fire, subjected to damaging chemicals, involved in a fall or collision, or which has become coated with oil or grease.

When not in use, ladders will be stored where they are protected from potential damage caused by collision, temperature, moisture, etc. Users will return ladders to the proper storage location when the job is completed.

7.7 Construction or Industrial Stairs

Verify stairs meet local regulations.

Always face the stairs when ascending or descending steep industrial stairs.

Caution must be exercised while using crossovers on conveyor systems. The conveyor system must be locked out and de-energized prior to use of the crossover unless other preventive measures have been established that provide an equal or greater degree of protection.

All parts of stairways, including the treads and landings, will be free of hazardous projections, such as protruding nails, etc.

Slippery conditions on stairways will be eliminated.

Handrails will be 30 to 34 inches (76 to 86centimeters) above stairway treads and free from protruding nails and splinters.

The uprights will be not less than 2 inches by 4 inches, spaced not more than 8 feet (2.4meters) apart and properly anchored.

The rail cross-section will be not less than 2 inches by 4 inches or equivalent.

Railings and toe boards will be installed around stairwells.

Sufficient illumination on all stairways, providing at least 5 foot candles of light on the steps, will be maintained.

All lamps providing stairway illumination will be substantially guarded either mechanically or by location.

Stairways and landings will be kept clear of debris, loose material, and equipment not in use.

Stairways, until permanently enclosed, will be guarded on all open sides with stair railings. Open sides of stairway landings, porches, balconies, and similar locations will be guarded with standard railings. (Vertical height of 42 inches (107cm) nominal from upper surface of top rail to floor, platform, runway, or ramp level.) The top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp. The ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.

Before permitting foot traffic, stairways on which treads and/or landings are to be filled in later with concrete or other material will be fitted with secured wooden pieces to cover the entire tread and/or landing area, and supported to prevent undue deflection.

Temporary treads and/or landings will be replaced when worn below the level of the metal nosing.

On all structures of two or more floors (20 feet (6meters) or more) in height, stairways, ladders or ramps must be provided for employees during the construction periods. Stairways must meet the following requirements:

- Rise height and tread width must be uniform throughout any flight of stairs including any foundation structures used as one or more treads of the stairs.
- Temporary stairs must have a landing not less than 30 inches (76 centimeters) in the direction of travel at every 12 feet (3.7 meters) of vertical rise.
- Metal landings must be secured in place before filling. Debris and other loose materials will not be allowed on, under, or at approaches and landings to stairways.
- Slippery conditions on stairways will be eliminated as soon as possible after they occur.

- Spiral stairways will not be permitted except for special limited usage and secondary access situations where it is not practical to provide a conventional stairway.

Where doors or gates open directly on a stairway, provide a platform that extends at least 20 inches (50 centimeters) beyond the swing of the door.

7.8 Personal Protective Equipment

Personal fall protection equipment must be worn when working above the regulated height in your location.

8.0 REFERENCES

- 29 CFR 1926, Subpart X, Ladders
- 29 CFR 1910, Sections 24 through 27
- Americans National Standards Institute (ANSI)
 - A14.1-2000 Ladders - Wood - Safety Requirements
 - A14.2-2000 Ladders - Portable Metal - Safety Requirements
 - A14.3 -1992 Ladders - Fixed - Safety Requirements
 - A14.3-2002 Ladders - Fixed - Safety Requirements
 - ANSI A14.4-1979 - Safety Requirements for Job-Made Ladders
 - A14.5-2000 Ladders - Portable Reinforced Plastic - Safety Requirements

9.0 REQUIRED RECORDS

- Completed Ladder Inspection Forms will be kept with project files.

10.0 ATTACHMENTS

Attachment A – Ladder Inspection Form

Attachment A
Ladder Inspection Form

OP 568 - Ladder Safety



Ladder Inspection Form

Competent Person for the site must inspect/document each ladder when it is put into service, every three (3) months, using this form. Ladders must be inspected prior to each use by the employee.

Project Name:	Project Number:	Project Location:
----------------------	------------------------	--------------------------

Date:	Inspection Completed By:
--------------	---------------------------------

Inspection Criteria		ANSI/CSATYPE 1 OR TYPE 1A CERTIFICATION OR EQUIVALENT	PROPER HARDWARE (BRACES, RIVETS, SPEADERS, NUTS, BOLTS, FEET)	CRACKS IN WOOD, METAL, OR FIBERGLASS	ROT OR DECAY	ADEQUATE PRESERVATIVE TREATMENT FOR WOOD LADDERS	RIGIDITY	SPLINTERING OF SIDERAILS OR STEPS	CONDITION OF STEPS	CORROSION OF HARDWARE OR METALRUNGS (INTERIOR/EXTERIOR)	DENTS OR BENDS	CONDITION OF EXTENSION ROPES AND PULLEYS	SAFETY FEET	TIE-OFF ROPES ATTACHED TO ALL STRAIGHT, EXTENSION, AND STEP LADDERS
Yes – Acceptable, Meets Standards	No – Unacceptable, not in compliance													
Ladder Number	Ladder Location													



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

FOR

CONFINED SPACES

OP-582

Revision 1
October 2013

Prepared by:

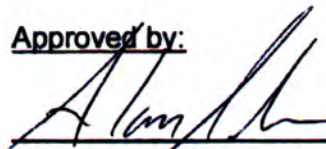


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes requirements for employees who participate in entries into confined space/limited egress (CS/LE) locations.

2.0 APPLICABILITY

This procedure applies to all Cabrera employees and operations.

3.0 DEFINITIONS

- 3.1 Asphyxiant - An airborne substance that can cause suffocation. Simple asphyxiants (e.g., carbon dioxide, nitrogen, argon, etc.) physically displace oxygen from the atmosphere; chemical asphyxiants (e.g., carbon monoxide, hydrogen cyanide, etc.) prevent the body from utilizing oxygen in the atmosphere.
- 3.2 Attendant - An individual who is stationed outside of a permit-required confined space in order to monitor authorized entrants and to initiate emergency response if necessary.
- 3.3 Class 1, Division 1 Approved - Approval given to equipment that has been approved for use where ignitable concentrations of flammable gases, vapors, or liquids are present within the atmosphere under normal operation conditions. This equipment is also considered intrinsically safe.
- 3.4 Confined Space - A space that:
- Is large enough and so configured that an employee can physically enter and perform assigned work
 - Has limited or restricted means for entry or exit
 - Is not designed for continuous human occupancy
- 3.5 Competent Person - The designated individual who evaluates the hazards in the space and confirms the controls and procedures outlined in the plans and permits; makes site specific modifications to protect human safety and health
- 3.6 Entrant - Individual(s) who enters into the CS/LE to perform the task(s) as defined in the entry permit and mitigation/control procedures.
- 3.7 Entry - The action by which a person passes through an opening into a confined space. Entry is considered to have occurred as soon as any part of the body breaks the opening of a confined space.
- 3.8 Entry Permit - A written or printed document that outlines the controls and

documents the conditions of the entry \ the during the confined space work.

- 3.9 Entry Supervisor - An employee responsible for determining if acceptable entry conditions are present, for authorizing entry into a permit-required confined space, for overseeing entry operations, and for terminating entry.
- 3.10 Hazardous Atmosphere - One or more of the following atmospheres that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness:
- Oxygen concentrations below 19.5% or above 23.5%
 - Flammable atmospheres (concentrations \geq 10% of the lower explosive limit)
 - Toxic environments (concentrations $>$ than the permissible exposure limit)
- 3.11 Non-Permit Required Confined Spaces (NPRCS) - Spaces that do not contain or, with respect to atmospheric hazards, do not have the potential to contain any hazard capable of causing death or serious physical harm. These spaces do not require specific entry procedures. No additional level of protection needed to assure safe entry and exit.
- 3.12 Hot Work - Any task that may produce a spark or source of ignition (e.g., welding, cutting, etc.). Hot work activities have separate permitting requirements.
- 3.13 Immediately Dangerous to Life or Health (IDLH) - The National Institute for Occupational Safety and Health (NIOSH) exposure limit for the airborne concentration of a substance that can cause death, serious or irreversible health consequences, or inability to escape within 30 minutes.
- 3.14 Inerting - Displacement of the atmosphere by a nonreactive gas (i.e., nitrogen) to such an extent that the resulting atmosphere is nonflammable.
- 3.15 Lower Explosive Limit (LEL) - The lowest concentration of a flammable gas/vapor in air which will ignite.
- 3.16 Oxygen-deficient - An atmosphere with an oxygen concentration that is less than 19.5%.
- 3.17 Oxygen-enriched - An atmosphere with an oxygen concentration that is greater than 23.5%.
- 3.18 Permit-Required Confined Space (PRCS) - A confined space that exhibits one

or more of the following properties:

- Contains or has a potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section
- Contains any other recognized serious safety or health hazard.

3.19 Physical Hazard - A nonchemical hazard that may cause cuts, abrasions, suffocation, crushing, trauma, hearing loss, burns, drowning or radiant energy effects (e.g., welding).

3.20 Upper Explosive Limit (UEL) - The highest concentration of a flammable gas/vapor in air that will ignite.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

All confined spaces will be considered permit-required by default in the absence of a previous classification by the owner or Cabrera Competent Person.

5.0 EQUIPMENT

Confined Space Entry equipment may consist of ventilation equipment (fans, blowers), retrieval devices (tripods, harnesses), atmospheric monitoring equipment (4 gas meter) or other material/equipment deemed necessary to protect human health and safety during confined space entry work.

6.0 RESPONSIBILITIES

6.1 Project Managers and Field Site Managers (or designee, e.g. Site Safety & Health Officer, SSHO):

Assess site-specific conditions and establish alternative procedures as needed to eliminate the need for entering confined spaces.

Consult with the Occupational Health and Safety (OH&S) Manager regarding project-specific requirements for confined space entries.

Inform the field team about the client's or facility's requirements for confined space entries. Provide training and support safety meetings to reinforce requirements

Verify that only trained, authorized employees work in or near confined spaces.

Ensure that written Confined Space Entry Procedures and permits are prepared for each entry and are available for review if necessary

Assign an Entry Supervisor to be in control of all activities associated with the confined space.

Verify compliance with the measures set forth in this procedure.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Entry Supervisor:

Assess the risks prior to entry and establish/modify the work plan accordingly. Coordinate with OH&S / Project Manager regarding any modifications to existing work plan.

Notify the OH&S Manager prior to entry into a confined space to review the planned activity, circumstances, and Confined Space Permit.

Verify what conditions exist.

Verify that all participants (entrants and attendant) are adequately trained for the work that is to be performed.

Conduct a tailgate training session at the location of the confined space, reviewing all entries in the Permit with all attendants and entrants.

Confirm that the air within the confined space is tested with an appropriated air monitoring instrument.

Confirm that all air test results are documented on the Permit form.

Verify that the workers involved with the confined space work and any confined space emergency response are properly trained (first aid etc.) and are experienced with the equipment procedures, etc.

Verify that a rescue team equipped with retrieval equipment and trained in confined space entry rescue is available if needed. A rescue team may be the local Fire Department or a client's Emergency Rescue Squad or the construction project's emergency response team. Emergency rescue capability must be established in the permit process and must include emergency contact numbers.

Prior to the entry taking place, notify the emergency rescue service of the time, location, and duration of work in the confined space.

Confirm that appropriate means of communication are ensured (in place and operable) for the entry team. Communication can be verbal, hand signals, radio, or telephone.

Confirm that any process lines, piping, electrical systems or other structures that could affect the safety or health of entrants in a confined space have been isolated and secured (e.g. blanking, blocking, lockout-tagout, etc.) prior to initiating the confined space entry.

Verify that fresh air ports, man-ways, and other access-ways are opened during the entire operation. V

When forcing air into a confined space to facilitate the proper entry condition, ensure that fresh air is continuously forced into the confined space prior to and during work within a permit-required confined space. Air will not be exhausted from a space. The objective is that the forced air will be sufficient to maintain a space safe for entry. Monitor ambient air conditions as required.

Make sure that appropriate safety equipment is selected and used by all entrants based on the physical and health hazards that exist.

Cancel the entry permit at any time based on a change in monitored conditions or perceived hazards.

Serve as an attendant if needed.

Review the Confined Space Entry Permit after completion of the work to evaluate the process.

6.4 Attendant:

The attendant must remain outside the confined space at all times. The attendant must not leave the post unattended at any time. If the attendant needs to leave his position, entrants must be called out of the confined space or another qualified attendant must take the position and assume the appropriate attendant responsibilities. The attendant is responsible for following the Confined Space Entry Permit and will:

- Confirm that correct names of all entrants are listed on the permit
- Confirm that all applicable parts of the permit are completed before allowing any employee to enter the space
- Confirm that all equipment going into the confined space (e.g., tools and protective equipment) is in safe operating condition. It is prohibited for compressed gas bottles (e.g., burning and welding) to be brought into a confined space. All gas lines brought into access ways shall be

protected from sharp edges.

- Confirm that all entrants have received any special instructions for the work to be performed before entering into the space
- Maintain communication with entrants either visually, verbally, or through the use of hand signals or radio
- Interrupt work and evacuate any/all entrants in the event of a newly developed dangerous condition, when signs of entrant stress or fatigue are noticed, or when the attendant needs to leave the post and cannot be replaced by another attendant.
- Summon rescue and other services during an emergency
- Warn any unauthorized persons not to enter a Permit Confined Space.

6.5 Entrants:

Know the emergency action plan and be able to recognize the potential for real hazards associated with the Confined Space. Refer to the Permit and ask the Entry Supervisor or SSHO if a question arises.

Know how to use the personal protective equipment (PPE) required for entry or rescue.

Know how to exit the confined space as rapidly as possible without help whenever:

- The attendant orders an evacuation
- Any alarm from a continuous monitor/detector sounds
- The entrant(s) recognizes the warning signs of exposure to hazardous substances that could be found in that confined space, including physical conditions such as fatigue

Be aware of the toxic effects or symptoms of the hazardous materials that could be encountered in the confined space.

Know how to relay an alarm to the outside attendant and to attempt self-rescue immediately upon becoming aware of hazardous conditions.

Understand any modification of normal work practices that are necessary for permit-required confined space work.

6.6 Employees shall:

Refrain from making any attempt to enter a confined space without first meeting the requirements of this OP and receiving authorization for entry from the entry supervisor.

Avoid areas where other employees are working in confined spaces.

7.0 PROCEDURE

All confined spaces under the control of Cabrera will be identified, evaluated, and classified on Attachment A- (Confined Space Identification Log, or equivalent). The identification log shall be updated as required, at a minimum annually. An identification log shall be prepared for each project site containing confined spaces to which employees are exposed.

7.1 Labeling/Signage

All permit-required confined spaces under Cabrera control will be labeled so that employees are adequately warned of the potential for hazardous conditions. Labeling is not required under the following circumstance:

- The spaces are easily recognizable, numerous, and widely spaced (e.g., storm sewer manholes). Employees will be instructed that these constitute confined spaces during required training. However, these locations will be included on the inventory.
- A complete inventory has been developed; all personnel have been trained in the use of the inventory, and the workers consult the inventory prior to performance of any work that may require entry into a confined space.

When non-permit-required confined spaces require the implementation of confined space entry procedures because of specific work operations (e.g., painting, welding), all entry points will be labeled or identified by signs to alert all employees of the existence of the hazardous conditions. These labels or signs will be removed only when the hazard no longer exists (e.g., complete curing of the paint).

7.2 Classification of Confined Spaces

For each identified confined space, an evaluation to determine the nature and extent of all possible hazards to entrants must be conducted. Consideration will be given to the following types of hazards:

- The presence of possible airborne contaminants at concentrations exceeding established occupational exposure limits (PELs)
- The presence of any physical hazards (e.g., electrical shock,

mechanical injury, etc.)

- The presence of flammable or explosive conditions
- The presence of any potential for rapid flooding or engulfment
- Configurations/positioning that may cause an entrant to become trapped
- Initial classification as either a PRCS or NPRCS

The evaluation will be documented using Attachment B (Confined Space Hazard Assessment Form). A copy of this evaluation will be maintained in the project files.

Wherever the confined space is controlled by a client or a third party, the controlling entity should be contacted to provide the information necessary to complete the evaluation. However, if Cabrera personnel are required to enter a confined space owned or controlled by others, the final evaluation will remain the responsibility of responsible Cabrera manager.

Non-permit-required confined spaces can be designated only by a Certified Safety Professional (CSP), Certified Industrial Hygienist (CIH)/Registered Occupational Hygienist, or Professional Engineer (PE) after review of the space(s), historical monitoring data, and other factors (e.g., injuries that have occurred). Therefore, all confined spaces will be considered permit-required unless specifically designated as a non-permit-required space, in writing, on the approved confined space inventory listing.

7.3 PRCS-Specific Entry Procedures

To protect employees during PRCS entries, site-specific PRCS entry procedures will be developed for each PRCS. Each entry procedure will specify:

- The identity of the PRCS(s) to which the procedure applies
- The potential hazards associated with the entry operation/PRCS
- Pre-entry planning:
 - Required air monitoring equipment and procedures;
 - Required ventilation procedures (as applicable);
 - Required lockout/tagout procedures (as applicable);
 - Required emergency response/extraction equipment;

- Rescue agency notification requirements (as applicable);
- Required pre-entry monitoring procedures and applicable at-entry re-classification criteria;
- Air monitoring procedures during entry;
- PPE requirements during entry.

Specific entry procedures can be documented by following this procedure and by completing an Activity Hazard Analysis (AHA) in combination with a completed Confined Space Hazard Assessment and Confined Space Permit.

7.4 PRCS Entry Permits

A PRCS Entry Permit is required to be completed for each individual PRCS entry operation (Exception: Multiple entries of an individual PRCS during a single work shift can be covered by a single Permit). The Permit provides the means for documenting:

- The identities and roles/duties of all individuals involved in the entry operation
- Equipment used for performance of the entry (monitoring instruments, extraction equipment, etc.)
- Pre-entry and operational monitoring results
- Communications protocols between Entrants, Attendants, and rescue services
- Lockout/Tagout procedures
- PPE for specific tasks (refer to the AHA for the task)
- Other relevant workplace conditions or events related to the entry operation (e.g., vault isolation procedures)

The Permit also provides the documented basis for reclassification of any PRCS as non-permit-required (for purposes of the particular entry operation) based upon pre-entry monitoring procedures. Each Permit will be signed and authorized by the Entry Supervisor. At the completion of the entry operation, the Permit will be filed as part of the project records.

A copy of the Confined Space Entry Permit is included in Attachment C.

7.5 PRCS Pre-Entry Procedure:

Prior to the start of the entry operation, the Entry Supervisor will assign individuals on the entry team to the following jobs:

- Entrant: The person entering the PRCS
- Primary Attendant: The person dedicated only to assisting the entrant, observing the entry operation, and maintaining communications with the entrant throughout the entry procedure
- Secondary Attendant for Rescue Procedures: An additional trained employee who is assigned either to specific support of the entry operation or to work nearby and to assist with a potential rescue operations in the event of an accident. This person can perform other duties unrelated to observing the entry.

The Entry Supervisor is responsible for ensuring that the individuals assigned to each job are properly trained and fully understand their duties and responsibilities prior to initiating the entry operation. The Entry Supervisor will review the entry procedure with all team members prior to the work. The Entry Supervisor will also verify the availability of locally accessible rescue services.

Additional requirements for Pre-Entry Planning include the following:

- Select the appropriate equipment to measure the potential hazards. Select a multi gas meter capable of measuring oxygen, combustible gas (%LEL), and other hazardous gases.
- Determine the acceptable values for the hazardous conditions being measured based on the equipment in use and the field calibration method. The safe working, background or ambient air concentration levels are:
 - Oxygen (O₂): 19.5% - 23.5%
 - Lower explosion limit: <10%
 - Hydrogen sulfide (H₂S): ≤10 ppm
 - Carbon monoxide (CO): ≤25 ppm
 - Other toxic chemicals: contact the OH&S Manager

Ensure that all of the air monitoring equipment is functioning properly and have been calibrated in accordance with the applicable standards.

Personnel trained in accordance with this procedure shall perform field verification of equipment as follows:

- Calibrate combustible gas meters using appropriate span gas for the detectors to be used. (This span gas calibration shall be performed daily and as needed)
- Check detector tube pumps for leakage using the manufacturer's procedures
- Calibrate photo ionization detectors (PID) using isobutylene or other material in accordance with the manufacturer's directions
- Calibrate any other instrumentation to be used in accordance with manufacturer's directions.

Set up barricades and signage around the space being entered as required.

Set up required fall arrest, retrieval, or rescue systems.

Institute required lockout/tagout procedures (i.e. electrical, steam, liquid flow-pipe blanking).

Ensure that a second person (trained as entry attendant) is available and assists in the set up procedures.

Agree upon a means of communication between the entrant and the attendant. (The attendant is not authorized to perform rescue involving entry into the space unless he/she is trained for rescue and another entry attendant replaces him/her prior to the attempt to rescue).

Verify a means to contact emergency rescue services for further assistance.

Complete the Confined Space Entry Permit.

The Entry Supervisor shall also:

- Have the attendant verify the completion of the required actions
- Sign the Permit upon verification of completed actions
- Maintain the Permit at all authorized entry sites until completion of the entry

7.6 PRCS Entry Procedure

Test the atmosphere around the confined space access door or cover to ensure that no flammable conditions exist prior to the door or cover being removed. Note: Always check for oxygen levels first if the meter does not measure simultaneously. Low oxygen levels can cause LEL readings to be incorrect.

Don any required PPE.

Carefully remove any access doors or covers.

Upon removal of the access cover/door, test the immediate atmosphere using remote testing procedures to ensure that the immediate atmosphere is safe. If any of the parameters being tested are outside the safe working level, do not enter.

If necessary, use ventilation equipment to either remove the contaminant(s) or to correct the oxygen-deficient atmosphere.

If the initial test(s) are within allowable safe working levels, slowly enter the space, continually testing the atmosphere in front and to the sides.

In stratified atmospheres (i.e., vertical entries), test 4 feet in advance of the direction of travel. The entrant's travel speed must allow for adequate instrument response time.

Test the entire area where work is to be performed prior to performance of any work.

While performing the work, place the direct read instruments in a location that will not interfere with the work, will allow for continual monitoring, and will enable the entrant to detect alarms that may be activated. Alarm individual instruments as necessary to detect any changes in the ambient air concentrations.

Upon work completion, retrieve all equipment / instruments and leave the space.

7.7 PRCS Exit Procedure

Replace all access covers.

Ensure that all signs are visible and legible.

Remove all lockout/tagout equipment.

Note on the Permit any problems encountered while in the confined space.

Finish the Permit and turn it in to the Entry Supervisor.

The Entry Supervisor will inspect the Permit for completion and will investigate any noted problems. Actions taken to correct noted problems will be discussed with all authorized entrants and attendants for future implementation.

The completed Permit will be maintained on file as required in this section.

7.8 Non-permit-required Confined Space (NPRCS) Entry Procedure

Persons entering this type of space only need to complete a confined space entry permit, to remain vigilant about conditions in the space, to remember that if any condition changes or if hazards are introduced into the space (e.g. welding/cutting operations) the classification and entry procedures in the space may change.

NPRCS Entry Procedure

When entrance covers are removed, guard the opening to prevent an accidental fall through the opening and to protect each employee working in the space from foreign objects entering the space.

Check the atmosphere with the gas detector for Oxygen, LEL, and other hazardous gases (e.g. Methane, H₂S, and CO) in the same order prior to entry into the space.

Record the measured conditions on the permit and do not allow entry if detected levels are above safe working levels.

Proceed with entry and work with caution.

NPRCS Post Entry Procedures

The following post-entry procedures must be followed after the completion of a non-permit-required confined space entry:

- Replace all access covers
- Ensure all signs are visible and legible
- Remove all lockout/tagout equipment, if applicable
- Note any problems encountered while in the space on the Permit
- Finish the Permit and submit it to the Entry Supervisor

The Entry Supervisor shall inspect the Permit for completion and investigate any noted problems. Actions taken to correct noted problems shall be discussed with all authorized entrants and attendants for future implementation.

The completed Permit shall be maintained in record for annual review.

7.9 Alternate Entry Procedures

Under certain conditions, alternative entry procedures may be used. The

OH&S Manager may prescribe alternate procedures if justified.

7.10 Rescue Services

In the event of a change in the confined space environment that may place people at risk, the Entrant must exit the confined space and the entry team must evacuate the area immediately.

If the Entrant is injured or rendered unconscious and needs assistance to exit the space:

- Attendant will operate entrant retrieval system to evacuate personnel within the confined space. If this system fails, they will call the Emergency Dispatcher for assistance.
- Once Rescuers arrive at the space, the Rescuer(s) will enter the space to untangle, stabilize, package, and extricate the downed entrant. If the space configuration allows.

The Rescuers will assume the duties of the Attendant during extrication (including maintaining communication lines with all Rescue personnel inside the confined space). The Attendant will remain at the confined space and provide assistance to the Rescuers, if requested, such as performing first aid services as required.

7.11 Outside Rescue Service (including client services)

Prior to authorizing entry into any confined space, the Project Manager must:

- Evaluate a prospective rescuer's ability to respond to an emergency in a timely manner (within 5 minutes for life threatening situations or 15 minutes for non-life-threatening injuries), considering the hazard(s) identified
- Select a rescue team or service from those evaluated that:
 - Has the capability to reach the victim(s) within a timeframe that is appropriate for the permit space hazard(s) identified
 - Is equipped for and proficient in performing the needed rescue services
 - Inform each rescue team or service of the hazards they may confront when called on to perform rescue at the site; and
 - Provide the rescue team or service selected with access to all permit spaces from which rescue may be necessary so that the

rescue service can develop appropriate rescue plans and practice rescue operations.

7.12 Facilitating Non-Entry Rescue

Retrieval systems or methods shall be used whenever an authorized entrant enters a permit space (unless the retrieval equipment would increase the overall risk of entry).

Retrieval systems shall meet the following requirements:

- Each authorized entrant shall use a full body harness with a retrieval line attached at the center of the entrant's back near shoulder level or other suitable locations as appropriate
- The other end of the retrieval line shall be attached to a mechanical device (mandatory for more than 5 feet deep rescue) or fixed point outside the permit space

8.0 REFERENCES

- 29 CFR 1910.146, Permit Required Confined Spaces

9.0 REQUIRED RECORDS

- Confined Space Identification Log - Confined spaces under the control of Cabrera or that may be entered by Cabrera employees will be identified, evaluated, and classified using this document or an equivalent; this log must be reviewed annually. The log will be maintained in the project files.
- Hazard Assessment - Should document the existing and probable conditions/hazards within the confined space to facilitate proper categorization of the space (Attachment B). Once completed, the hazard assessment should be maintained in the project files.
- Entry Permit - Will be signed by the entry supervisor and maintained onsite during the confined space entry activity. Once the entry activity is officially closed the entry permit should be maintained in the project files.

10.0 ATTACHMENTS

Attachment A – Confined Space Identification Log

Attachment B – Confined Space Hazard Assessment

Attachment C – Confined Space Entry Permit

Attachment A
Confined Space Identification Log

OP 582, Confined Spaces




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Confined Space Identification Log

Name of Confined Space and Location	Permit Required Confined Space		Alternate Procedure Confined Space		Non-Permit Required Confined Space	
	Y	Initial Date Inventoried	Y	Date Reclassified	Y	Date Reclassified
	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
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	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	

Attachment B
Confined Space Hazard Assessment

OP 582, Confined Spaces	 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>
Confined Space Hazard Assessment	
Confined Space Name:	
Dimensions:	
Description of Space:	
Is this space entered on a routine basis? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Described Tasks and Frequency:	
PART II. NATURE OF THE HAZARDS—ASSUMPTIONS: Tanks are empty and clean, all energy sources have been identified and isolated, and no other hazards are introduced into the spaces. A more formal hazard assessment must be done at the time of entry.	
<u>Potential Atmospheric Hazards</u> <input type="checkbox"/> O ₂ Deficient /Enriched <input type="checkbox"/> Combustibles/Flammables <input type="checkbox"/> CO <input type="checkbox"/> H ₂ S <input type="checkbox"/> Other Toxics	<u>Potential Non-Atmospheric Hazards</u> <input type="checkbox"/> Contains material that could engulf entrant? _____ <input type="checkbox"/> Internal configuration could trap entrant? _____ <input type="checkbox"/> Electrical (live circuits)? _____ <input type="checkbox"/> Mechanical (pipes, linkages)? _____ <input type="checkbox"/> Slick/residue-covered surfaces? _____ <input type="checkbox"/> Equipment preventing safe exit? _____ <input type="checkbox"/> Low/inadequate lighting? _____ <input type="checkbox"/> Hazardous chemicals present? _____ <input type="checkbox"/> Fall potential? _____ <input type="checkbox"/> Potential for dropped objects? _____ <input type="checkbox"/> Multiple work groups/nature of work _____ <input type="checkbox"/> Other _____
Insert photo of space here.	

Attachment C
Confined Space Entry Permit

OP 582 - Confined Spaces		 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>	
Confined Space Entry Permit (Page 1 of 2)			
Project Name/Number:		Location:	
Permit Date/Time: Valid only for one 8-hour shift			
Purpose of Entry:			
Hazards within permit space:			
Hazard Controls & Confirmations:			
1. Work area isolated with signs/barriers? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>		8. Communications: <input type="checkbox"/> Direct Verbal <input type="checkbox"/> Radio	
2. All energy sources locked/tagged out? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>		9. Safety Equipment required for Entry	
3. All input lines capped/blinded? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>		Atmospheric Monitoring	Specify:
4. Space contents drained/flushed/neutralized? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>		Ventilation Equipment	Specify:
5. Permit space cleaned/purged? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>		Retrieval Equipment	Specify:
6. Ventilation provided before entry? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>		Specialized PPE	Specify:
7. Rescue services: <input type="checkbox"/> On Site <input type="checkbox"/> Off Site		Additional Permits (ie Hot Work)	Specify:
Identity and phone # for rescue services or means of summoning:			
Designated Personnel:			
Authorized Entrants		Authorized Attendants	Entry Supervisor(s)
Initial Atmospheric Testing			
Time of Test:	Parameter	Acceptable Level	Reading
Note: Initial testing must be completed prior to entry. Continuous testing to be completed in minimum of 10 minute intervals. Remember to test for stratified atmosphere.	Percent Oxygen (%)	19.5% to 23.5%	
	Explosivity/LEL %*	< 10%	
	Carbon Monoxide	< 25 ppm	
	Hydrogen Sulfide*	< 10 ppm	
	VOC	Chemical Specific	
Verification & Authorization			
Physical conditions at confined space checked and verified to be in accordance with the permit. I certify that I have inspected the work area for safety and have reviewed all safety precautions recorded on this permit.			
Entry Supervisor Signature:		Date:	

OP 582 - Confined Spaces	 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>
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Confined Space Entry Permit (Page 1 of 2)

Reminder: Test for stratified atmosphere.

Continuous Atmospheric Testing

Parameter	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Time						
Percent Oxygen (%)						
Explosivity/LEL %*						
Carbon Monoxide						
Hydrogen Sulfide*						
VOC						
Parameter	Test 7	Test 8	Test 9	Test 10	Test 11	Test 12
Time						
Percent Oxygen (%)						
Explosivity/LEL %*						
Carbon Monoxide						
Hydrogen Sulfide*						
VOC						

Note any issues that occurred during entry:

Signature of Attendant/Tester:	Date:
--------------------------------	-------

Permit Review & Closeout

Any problems encountered during entry?	
Corrective actions taken?	
Additional precautions/recommendations for future entries?	

Entry Supervisor Signature:	Date:
-----------------------------	-------



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

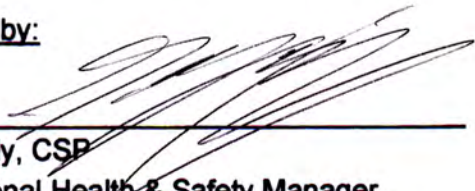
FOR

EXCAVATION & TRENCHING

OP-583

**Revision 1
October 2013**

Prepared by:

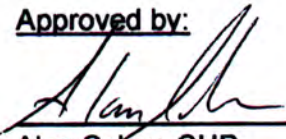


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Selow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the minimum requirements for evaluating of excavation and trenching operations to provide for proper protective systems for employee protection.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Benching (Benching system) - A series of horizontal levels or steps, usually with vertical or near vertical surfaces between levels to protect employee from cave-ins and slumping soil material.
- 3.2 Cave-in (collapse) - The separation of a mass of soil or rock material from the side of an excavation or the loss of soil from beneath a trench shield or support system due to sudden movement of material into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure, immobilize or incapacitate a person.
- 3.3 Competent person – A person, who by way of training, knowledge, and/or experience, is capable of classifying or “typing” the soils and who is also capable of identifying existing and predictable hazards in excavation/trenching work areas. This person has the authority to establish best management practices and controls and to take prompt corrective measures to eliminate potential hazards. The person must also be familiar with the requirements in the regulation.
- 3.4 Excavation - A manmade cut, cavity, trench, pit or depression in an earth surface formed by earth removal. Examples include trenches, tunnels, shafts, caissons and open cut holes.
- 3.5 Faces (or sides) - The vertical or inclined earth surfaces formed as a result of excavation work.
- 3.6 Failure - A structural member’s integrity and supportive capabilities is compromised, causing a breakage, displacement, or permanent deformation.
- 3.7 Hazardous Atmosphere - An atmosphere that by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen-deficient, toxic, or otherwise harmful may cause death, illness, or injury.
- 3.8 Protective Systems - Devices or methods used to protect employees from cave-ins or a collapse or falling material while working in an excavation.

Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection such as a trench box.

- 3.9 Ramp - An inclined walking or working surface that is used to gain access to one point from another in the excavation and is constructed from earth or from structurally suitable materials such as steel or wood. A ramp is typically placed at a gentle slope, less than a 10 percent grade.
- 3.10 Registered Professional Engineer - An engineer who can authorize any state of work by his professional designation. However, a professional engineer is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.
- 3.11 Shield (Shield system) - A structure that is able to withstand the forces imposed on it by a cave-in or slumping soil material and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre manufactured or job-built. Shields used in trenches are usually referred to as "trench boxes" or "trench shields."
- 3.12 Shoring (Shoring system) - A structure such as a metal hydraulic, mechanical, or timber shoring system that supports the sides of an excavation and that is designed to prevent cave-ins.
- 3.13 Sloping (Sloping system) - An alternative to shoring is trench sloping. This means that the trench walls are cut back to decrease the possibility of cave-ins. The angle of incline required to prevent a cave-in varies with such factors as soil type, environmental conditions of exposure, and application of surcharge loads.
- 3.14 Stable rock - A natural solid mineral material that is indurated but not lithified and can be excavated with vertical side wall; unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against cave-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.
- 3.15 Support system - A structure such as underpinning, bracing, or shoring that provides support to an adjacent structure, underground installation, or the sides of an excavation.
- 3.16 Trench - An open narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width (measured at the bottom) is often not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet

(4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered a trench.

- 3.17 Trench Box - A trench box is a unit of shoring that is an engineered shoring system capable of protecting workers in case of cave-in of trench walls. The space between the trench wall and the trench box must be backfilled.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

Because of their inherent dangers, entry into trenches and excavations shall not be performed if there are means other than entry to perform the work. Where entry into trenches and excavations is necessary, strict adherence to the procedures specified below is extremely important and mandatory. Whenever there are questions regarding the safety of trench or excavation entry, contact shall be made with the Competent Person or the Occupational Health and Safety (OH&S) Manager.

No one shall enter any trench or excavation until the walls have been adequately cut back or otherwise stabilized with temporary protective structures. A trench or excavation may be entered if it is shallower than the legal minimums and the surrounding soil has been deemed stable by the competent person.

Excavation work must be undertaken with care. Excavations should be inspected daily and when conditions change in accordance with local, state and/or federal regulations.

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

- 6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Implementation of this procedure for supervised employees.

- 6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

- 6.3 Employees' responsibilities:

Apply appropriate precautions and work practices in their use of ladders, ramps and other structures while working in and around excavations. Bring any concerns to the competent person and OH&S Manager for discussion immediately.

6.4 Competent Person responsibilities:

A competent person must be present during all work that involves entry by Cabrera personnel into trenches or excavations greater than 5 feet/1.5m in depth (as above).

For the purpose of this OP, a competent person is defined as an individual, who by education or experience, is capable of evaluating the hazards associated with trench or excavation collapse and is capable of classifying soils. The competent person for the project will be indicated in the Activity Hazard Analysis (AHA) for the project.

The competent person:

- Determines the maximum allowable slope for the walls of the trench or excavation

Classifies or types the soil in and surrounding the trench or excavation in accordance with the requirements specified in the legislation (e.g., CFR 1926 subpart P, Appendix A Soil Classification) prior to determining that a maximum allowable slope, other than 34° with the horizontal, is selected.

- Inspects the excavation or trench on a daily basis and when conditions change to assess the potential for employees to be exposed to the hazards of the trench or excavation..sts.

7.0 PROCEDURE

7.1 Underground and Overhead Utilities

Prior to beginning any excavation work at a site, the location of all underground and overhead utilities shall be identified. Work locations will be carefully planned to avoid any potential for inadvertent contact with them. Call Before You Dig, Dig Safe or other underground utility locator will be notified as is necessary and required by State and local regulations.

Locate underground utilities and expose (when possible) prior to excavating. Flag, paint or otherwise demarcate the locations and orientations of underground utilities not exposed so as to avoid during earthwork.

Identify any overhead power lines and de-energize (when possible) or protect / avoid by other appropriate means.

7.2 Excavation Requirements

Soil conditions, wall slope, or shoring must be identified and designed by a professional engineer or Competent Person to meet the federal, state,

provincial, territorial regulations.

Excavated (spoil) material shall be kept at least 1.0 meter (3.2 feet) from the edge of the excavation, or further if local regulations are more stringent.

If the walls of an excavation or trench are not sloped or cutback, barriers must be placed around the perimeter. The barrier must be at least 1.1 meters (3.6 feet) in height.

Workers must be protected whenever shoring is being installed or removed.

If water is controlled or prevented from accumulating by the use of water removal (dewatering) equipment, the water removal equipment and operations shall be monitored regularly to ensure proper operation.

If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require regular inspections. Groundwater that is removed (dewatered) from the excavation shall be controlled / managed in accordance with the contract documents and all applicable local, state and federal regulations / guidelines.

All excavations must be secured at the end of the day with a protective covering (metal plate, etc) or other appropriate barriers to prevent the public from falling into the open excavation.

Backfill trenches as soon as is reasonably possible after work is complete.

7.3 Sloping or Shoring Protection Requirements

A Professional Engineer or qualified soils professional can properly assess the need for and the type of shoring required for specific applications. Shoring may not be needed in all cases, but failure to recognize the need for shoring can be catastrophic.

Exceptions. Each individual in an excavation shall be protected from cave-ins and trench collapse by an adequate protective system except when:

- Excavations are made entirely in stable rock
- Excavations are less than 5 feet (and as above) in depth and an examination of the excavation by a competent person reveals no indication of a potential cave-in

The depth of the excavation is to be measured at its greatest vertical

dimension. Be aware that crouching or kneeling in a trench that is greater than 3 feet in depth may still pose significant hazard for the employee involved. The three means for supporting trench walls are sloping, shoring, and trench boxes.

The protective system may include sloping the excavation walls, shoring the excavation walls, or installing a shielding system. The protective system chosen must have the capacity to resist, without failure, all expected loads that would be applied to the system.

In the case when an excavation is deeper than 20 feet (6.0 m), a professional engineer experienced in civil work must approve and sign on all protective systems.

Trenches must be protected from cave-ins or loss of ground prior to workers entering the trench when the following conditions apply:

- The trench is greater than 3'11" (1.2 m) in depth (however, even if the trench is less than 1.2 meters deep the potential for a cave-in exists, and appropriate controls must be implemented prior to entry to ensure the trench is safe)
- A worker is required to enter the trench
- A worker is required to be closer to a trench wall than the height of the trench wall; and
- If an excavation may affect the stability of an adjacent building or structure, precautions must be taken to prevent damage to the structure. The precautions shall be specified in writing by a professional engineer.

7.4 Use of Sloping as a Means of Protection

Sloping of the excavation or trench walls is the preferred, and typically simplest means of protecting employees who must enter trenches or excavations which are greater than 5 feet (1.5 m) in depth or where there is danger of collapse.

The trench or excavation walls may be sloped back so that the ratio of the horizontal distance to the vertical rise (H:V ratio) of the sloped wall is at least 1½:1 (i.e., equivalent to an angle with the horizontal of 34° or less).

In many cases, determining the maximum allowable slope may allow the use of a steeper slope, which will result in a narrower excavation. However, determination of soil classification is complicated and requires that the competent person be familiar with the manual and visual tests. Since incorrect

soil classification may result in the use of a steeper, and potentially unsafe, slope, it is recommended that an angle of 34° (or less) with the horizontal typically be selected.

7.5 Use of Shoring or Shielding as a Means of Protection

Where sloping the walls of the trench or excavation is unfeasible (e.g., when there are dimensional constraints or adjacent structures), the use of shoring or a shield systems (e.g., trench boxes) may be necessary.

Factors that affect the selected method of shoring include:

- **Soil Structure and Strength:** Trench walls, at first glance, may appear to have strength, particularly if rock is encountered. Fractures in the rock can develop because of construction and soil strength may fail when subjected to undercutting or high-energy impacts. Irregular slopes on stratified soils that appear stable can fail if lower materials do not have adequate strength.
- **Soil Moisture Content:** Soil may be moist even though the weather has been dry. Care must be taken and shoring provided if the soil appears to be moist.
- **Weather and Humidity:** These can have a significant impact on shoring requirements. Frozen stable soil may collapse if warm mild weather persists. Percolation of water into the soil can increase the load on the shoring due to the increased weight and mobility of saturated soils. Frozen ground does not preclude the need to install shoring unless the freezing process is designed and approved by a Professional Engineer.
- **Soil Stress:** Stress can originate from many sources. Heavy machinery passing close to the shoring creates vibrations that decrease the soil strength and can result in shoring failure. Stationary equipment at the edges of the excavation can transmit loads and additional stresses to the shoring.
- **Trench Depth and Width:** These directly influence the choice of materials and the spacing of support bracing. The shoring requirements of a wide and deep trench differ substantially from those of a narrower trench.
- **Erosion Time:** If excavations are to be left open for extended periods, shoring materials may have to be increased.

7.6 Working Around the Trench/Excavation

While workers are in a trench, an aboveground observer must be present to warn of earth movements and to advise equipment operators of the presence and location of those in the trench so as to avoid vibrating equipment near trenches or excavations.

If there is a danger of a worker or equipment falling into an excavation, or whenever the edge is not clearly visible, the observer must identify the trench or excavation perimeter with visual markers (e.g., barricade tape, wooden railings, stop logs, etc). If the trench or excavation is 4 ft (1.2 m) or greater in depth, the visual barrier must be a minimum of 6 ft (1.8 m) from the edge.

Personnel must notify workers of the excavation through flagging, marking, safeguards, or other appropriate and effective means. Safety meetings should address any excavation concerns and issues.

Where employees or equipment are required or permitted to cross over excavations, walkways or bridges over excavations must have a minimum clear width of 20 inches (0.6 meters), be fitted with standard guard rails and extend a minimum of 24 inches (0.6 meters) past the surface edge of the trench. If vehicle crossings over excavations are required, they must be designed by and installed under the direction of a registered professional engineer.

Precautions must be taken to isolate loose rocks or other slumping materials that may slide, roll, or fall into the trench and onto workers..

While operating heavy equipment in the work area, the equipment operator shall maintain communication with a designated signal person through either direct voice contact or approved standard hand signals.

When mobile equipment is operated adjacent to an excavation or when such equipment is required to approach the edge of an excavation and the operator does not have a clear and direct view of the edge of the excavation, a warning system such as barricades, hand or mechanical signals, or stop logs shall be used. If possible, the grade should be away from the excavation.

All site personnel should maintain a safe distance and remain clear of the swing of operating excavation equipment.

Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.

Personnel that operate or work in the vicinity of heavy equipment shall wear all required safety equipment, including a high visibility vest (Class 2 or 3).

All materials such as pipe, rebar, etc., shall be kept out of traffic lanes and access ways. Materials and equipment shall be stored in a designated storage or laydown area so as not to disrupt work operations or endanger personnel at any time.

A flagman with roadwork, signs, cones, and high-level warning signs shall be provided when it is necessary to control normal vehicular traffic due to vehicles, such as end-dumps, entering, or leaving the site.

7.7 Working Within the Trench/Excavation

Employees shall not work in excavations in which there is accumulated water or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

A stairway, ladder, ramp, or other safe means of egress shall be located in excavations or trenches that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees. Ladders should extend at least 3 feet (0.75m) above the trench top.

Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design and shall be constructed in accordance with the contract documents and/or system design.

Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement. Structural members used for ramps and runways shall be of uniform thickness. Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping. Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

7.8 Hazardous Atmospheres

Confined spaces may exist in excavations where there is limited access or egress and in which a hazardous gas, vapor, dust, or fume or an oxygen deficient atmosphere may occur.

To prevent exposure to harmful levels of atmospheric contaminants, entry into trenches and excavations greater than 5 feet/1.5m in depth in which a

hazardous atmosphere exists, or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, must be performed in accordance with the requirements specified in OP 582, Confined Spaces.

Adequate precautions, such as mechanical ventilation or appropriate respiratory protection shall be taken prior to entry into trenches and excavations in which the oxygen concentration is less than 19.5 percent or the concentration of flammable gases or vapors is in excess of 10 percent of the lower explosive limit (LEL).

When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to confirm that the atmosphere remains safe. Atmospheric testing will be conducted in the anticipated breathing zone of the work area to determine oxygen content, combustible gas, and toxic gases and vapors, if applicable. Downwind sample points and atmospheric sampling may be required to assess any potential off-site migration of airborne contaminants.

Appropriate respiratory protection shall be donned prior to entry into any trench or excavation in which airborne levels of toxic substances are present at concentrations in excess of their Threshold Limit Value (TLV) or Permissible Exposure Limit (PEL).

If a confined space is identified, emergency rescue procedures will be in place in accordance with OP 582, Confined Spaces.

7.9 Stability of Adjacent Structures

Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

- A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
- The excavation is in stable rock; or
- A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

- A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

In addition, sidewalks, pavements, and appurtenant structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

7.10 Inspections

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions.

An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift and when site conditions. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

7.11 Personal Protective Equipment (PPE)

Minimum PPE requirements include:

- Hard hats
- Safety glasses with side shields
- Steel-toed boots
- Reflective vest
- Respiratory equipment, as required

7.12 Special Excavation Entry Permit Required for California

In California, for the construction of trenches or excavations that are 5 feet/1.5 m or deeper and into which a person is required to descend, an additional permit must be obtained from Cal/OSHA.

8.0 REFERENCES

- 29 CFR 1926, Subpart P, Excavations

9.0 REQUIRED RECORDS

- Completed Daily Excavation Checklist will be kept with project files (must be retained for +1 year).

10.0 ATTACHMENTS

Attachment A – Excavation Inspection Form

Attachment A
Excavation Inspection Form

OP 583 - Excavation & Trenching



Excavation Inspection Form

Designated Competent Person must inspect/document excavation prior to beginning work, after a rain event, and as needed throughout the shift.

Project Name: _____ **Project Number:** _____ **Project Location:** _____

Date: _____ **Inspection Completed By:** _____

Excavation Information:

Soil Type: _____ **Excavation Depth:** _____ **Excavation Width:** _____

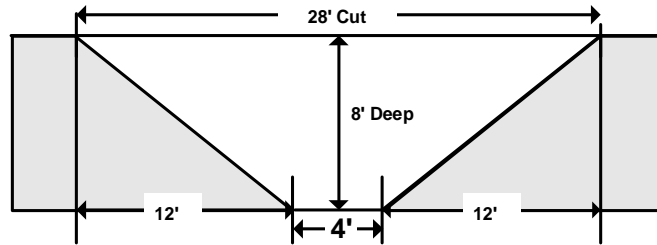
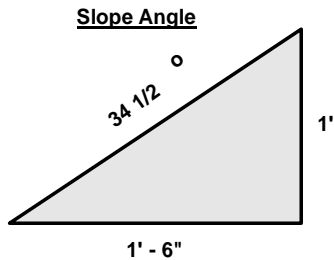
Type of Protective System Used: _____

1. General Information:	Yes	No	N/A
A. Is excavation less than five feet in depth?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Is there a potential for a cave-in? *IF YES, excavation must be sloped, shored, or shielded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Is excavation deeper than 5 feet? * IF YES, excavation must be sloped, shored, or shielded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Is sloping used as your protective system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. 1- Manual & 1- Visual Method utilized to determine Soil Classification as A-B-C (select one: Y=A, N=B, N/A=C)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Manual Test Method Used: Plasticity Dry Strength Thumb Penetration Dry Testing Pocket Penetrometer

Visual Characteristics: Cemented Cohesive Dry Fissured Granular Layered Moist Plastic Saturated
 Submerged Surface cracking Undercut

Slope information to keep in mind:



Example of a Simple 34-degree Slope commonly used around the site for cave-in protection.

2. Surface Conditions	Yes	No	N/A
A. Surface encumbrances removed or supported.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Individuals protected from loose rock/soil that may pose a hazard by falling/rolling into excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Hard hats, safety-toed boots, and safety glasses worn by all individuals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. High visible vest (Class 2 or 3) worn by all individuals. Vest required around heavy equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Spoils, materials, and equipment set back at least 3 feet from the edge of the excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Adequate barriers provided at all excavations, wells, pits, shafts, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Individuals are required to stand away from vehicles being loaded or unloaded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Warning system established and utilized when mobile equipment is operating near the edge of the excavation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(e.g., barricade tape, signalpersons, stop logs, etc).			
I. Individuals prohibited from going under suspended loads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Utilities	Yes	No	N/A
A. Location of utilities marked.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Prior to the use of equipment, underground utilities have been located by hand digging and exposed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Underground utilities are protected, supported, or removed when excavation is open.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Means of Access and Egress:	Yes	No	N/A
A. Travel distance to means of egress no greater than 25 feet in excavations 4 feet or more in depth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Straight ladders used in excavations extend at least 3 feet above the edge of the trench.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Ramps being used for employee access have been designed by the competent person.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. All individuals are protected from cave-ins when entering or exiting the excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Wet Conditions:	Yes	No	N/A
A. Precautions have been taken to protect individuals from the accumulation of water.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Water removal equipment monitored by a competent person.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Surface water or runoff is diverted or controlled to prevent accumulation in the excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Inspections have been made after every rainstorm or other hazard-increasing occurrence (freeze/thaw, local demolition, rerouting of traffic, etc).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Hazardous Atmosphere:	Yes	No	N/A
A. Are there exposed sewer or natural gas lines in excavation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Is excavation near a landfill, or are hazardous substances being stored close to the excavation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If you answered YES to A or B, then treat the excavation as a confined space. OP 582 Confined Spaces			
C. All individuals will contact the Fire/Rescue Group at _____ prior to entry and in case of emergencies.			
7. Support Systems:	Yes	No	N/A
System Manufacturer:	System Type:		
A. Tabulated Data for system on-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Materials/equipment for support systems selected based on soil analysis, trench depth, and expected loads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Materials/equipment used for protective systems have been inspected and are in good condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Protective systems installed without exposing all individuals to the hazards of cave-ins, collapses, or the threat of being struck by materials or equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Members of support system are securely fastened to prevent failure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Support systems are provided to ensure stability of adjacent structures (buildings, roadways, sidewalks, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Excavations below the level of the base of a footing have been approved by a registered PE.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Removal of support systems progresses from the bottom (members released slowly to note indication of possible failure).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I. Backfilling progresses with the removal of support system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J. Material excavated to a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

K. A shield system has been placed to prevent lateral movement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
M. All individuals are prohibited from remaining in the shield system during vertical movement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Training:	Yes	No	N/A
A. All individuals have had Excavation Safety Awareness Training.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



CABRERA SERVICES
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OPERATING PROCEDURE

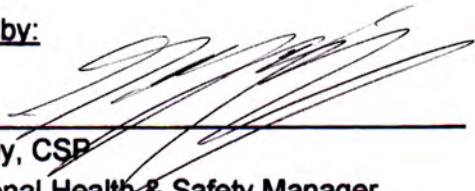
FOR

EXCAVATION & TRENCHING

OP-583

**Revision 1
October 2013**

Prepared by:

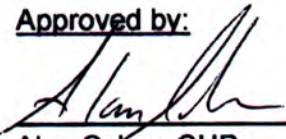


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Selow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the minimum requirements for evaluating of excavation and trenching operations to provide for proper protective systems for employee protection.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Benching (Benching system) - A series of horizontal levels or steps, usually with vertical or near vertical surfaces between levels to protect employee from cave-ins and slumping soil material.
- 3.2 Cave-in (collapse) - The separation of a mass of soil or rock material from the side of an excavation or the loss of soil from beneath a trench shield or support system due to sudden movement of material into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure, immobilize or incapacitate a person.
- 3.3 Competent person – A person, who by way of training, knowledge, and/or experience, is capable of classifying or “typing” the soils and who is also capable of identifying existing and predictable hazards in excavation/trenching work areas. This person has the authority to establish best management practices and controls and to take prompt corrective measures to eliminate potential hazards. The person must also be familiar with the requirements in the regulation.
- 3.4 Excavation - A manmade cut, cavity, trench, pit or depression in an earth surface formed by earth removal. Examples include trenches, tunnels, shafts, caissons and open cut holes.
- 3.5 Faces (or sides) - The vertical or inclined earth surfaces formed as a result of excavation work.
- 3.6 Failure - A structural member’s integrity and supportive capabilities is compromised, causing a breakage, displacement, or permanent deformation.
- 3.7 Hazardous Atmosphere - An atmosphere that by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen-deficient, toxic, or otherwise harmful may cause death, illness, or injury.
- 3.8 Protective Systems - Devices or methods used to protect employees from cave-ins or a collapse or falling material while working in an excavation.

Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection such as a trench box.

- 3.9 Ramp - An inclined walking or working surface that is used to gain access to one point from another in the excavation and is constructed from earth or from structurally suitable materials such as steel or wood. A ramp is typically placed at a gentle slope, less than a 10 percent grade.
- 3.10 Registered Professional Engineer - An engineer who can authorize any state of work by his professional designation. However, a professional engineer is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.
- 3.11 Shield (Shield system) - A structure that is able to withstand the forces imposed on it by a cave-in or slumping soil material and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre manufactured or job-built. Shields used in trenches are usually referred to as "trench boxes" or "trench shields."
- 3.12 Shoring (Shoring system) - A structure such as a metal hydraulic, mechanical, or timber shoring system that supports the sides of an excavation and that is designed to prevent cave-ins.
- 3.13 Sloping (Sloping system) - An alternative to shoring is trench sloping. This means that the trench walls are cut back to decrease the possibility of cave-ins. The angle of incline required to prevent a cave-in varies with such factors as soil type, environmental conditions of exposure, and application of surcharge loads.
- 3.14 Stable rock - A natural solid mineral material that is indurated but not lithified and can be excavated with vertical side wall; unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against cave-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.
- 3.15 Support system - A structure such as underpinning, bracing, or shoring that provides support to an adjacent structure, underground installation, or the sides of an excavation.
- 3.16 Trench - An open narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width (measured at the bottom) is often not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet

(4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered a trench.

- 3.17 Trench Box - A trench box is a unit of shoring that is an engineered shoring system capable of protecting workers in case of cave-in of trench walls. The space between the trench wall and the trench box must be backfilled.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

Because of their inherent dangers, entry into trenches and excavations shall not be performed if there are means other than entry to perform the work. Where entry into trenches and excavations is necessary, strict adherence to the procedures specified below is extremely important and mandatory. Whenever there are questions regarding the safety of trench or excavation entry, contact shall be made with the Competent Person or the Occupational Health and Safety (OH&S) Manager.

No one shall enter any trench or excavation until the walls have been adequately cut back or otherwise stabilized with temporary protective structures. A trench or excavation may be entered if it is shallower than the legal minimums and the surrounding soil has been deemed stable by the competent person.

Excavation work must be undertaken with care. Excavations should be inspected daily and when conditions change in accordance with local, state and/or federal regulations.

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

- 6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Implementation of this procedure for supervised employees.

- 6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

- 6.3 Employees' responsibilities:

Apply appropriate precautions and work practices in their use of ladders, ramps and other structures while working in and around excavations. Bring any concerns to the competent person and OH&S Manager for discussion immediately.

6.4 Competent Person responsibilities:

A competent person must be present during all work that involves entry by Cabrera personnel into trenches or excavations greater than 5 feet/1.5m in depth (as above).

For the purpose of this OP, a competent person is defined as an individual, who by education or experience, is capable of evaluating the hazards associated with trench or excavation collapse and is capable of classifying soils. The competent person for the project will be indicated in the Activity Hazard Analysis (AHA) for the project.

The competent person:

- Determines the maximum allowable slope for the walls of the trench or excavation

Classifies or types the soil in and surrounding the trench or excavation in accordance with the requirements specified in the legislation (e.g., CFR 1926 subpart P, Appendix A Soil Classification) prior to determining that a maximum allowable slope, other than 34° with the horizontal, is selected.

- Inspects the excavation or trench on a daily basis and when conditions change to assess the potential for employees to be exposed to the hazards of the trench or excavation..sts.

7.0 PROCEDURE

7.1 Underground and Overhead Utilities

Prior to beginning any excavation work at a site, the location of all underground and overhead utilities shall be identified. Work locations will be carefully planned to avoid any potential for inadvertent contact with them. Call Before You Dig, Dig Safe or other underground utility locator will be notified as is necessary and required by State and local regulations.

Locate underground utilities and expose (when possible) prior to excavating. Flag, paint or otherwise demarcate the locations and orientations of underground utilities not exposed so as to avoid during earthwork.

Identify any overhead power lines and de-energize (when possible) or protect / avoid by other appropriate means.

7.2 Excavation Requirements

Soil conditions, wall slope, or shoring must be identified and designed by a professional engineer or Competent Person to meet the federal, state,

provincial, territorial regulations.

Excavated (spoil) material shall be kept at least 1.0 meter (3.2 feet) from the edge of the excavation, or further if local regulations are more stringent.

If the walls of an excavation or trench are not sloped or cutback, barriers must be placed around the perimeter. The barrier must be at least 1.1 meters (3.6 feet) in height.

Workers must be protected whenever shoring is being installed or removed.

If water is controlled or prevented from accumulating by the use of water removal (dewatering) equipment, the water removal equipment and operations shall be monitored regularly to ensure proper operation.

If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require regular inspections. Groundwater that is removed (dewatered) from the excavation shall be controlled / managed in accordance with the contract documents and all applicable local, state and federal regulations / guidelines.

All excavations must be secured at the end of the day with a protective covering (metal plate, etc) or other appropriate barriers to prevent the public from falling into the open excavation.

Backfill trenches as soon as is reasonably possible after work is complete.

7.3 Sloping or Shoring Protection Requirements

A Professional Engineer or qualified soils professional can properly assess the need for and the type of shoring required for specific applications. Shoring may not be needed in all cases, but failure to recognize the need for shoring can be catastrophic.

Exceptions. Each individual in an excavation shall be protected from cave-ins and trench collapse by an adequate protective system except when:

- Excavations are made entirely in stable rock
- Excavations are less than 5 feet (and as above) in depth and an examination of the excavation by a competent person reveals no indication of a potential cave-in

The depth of the excavation is to be measured at its greatest vertical

dimension. Be aware that crouching or kneeling in a trench that is greater than 3 feet in depth may still pose significant hazard for the employee involved. The three means for supporting trench walls are sloping, shoring, and trench boxes.

The protective system may include sloping the excavation walls, shoring the excavation walls, or installing a shielding system. The protective system chosen must have the capacity to resist, without failure, all expected loads that would be applied to the system.

In the case when an excavation is deeper than 20 feet (6.0 m), a professional engineer experienced in civil work must approve and sign on all protective systems.

Trenches must be protected from cave-ins or loss of ground prior to workers entering the trench when the following conditions apply:

- The trench is greater than 3'11" (1.2 m) in depth (however, even if the trench is less than 1.2 meters deep the potential for a cave-in exists, and appropriate controls must be implemented prior to entry to ensure the trench is safe)
- A worker is required to enter the trench
- A worker is required to be closer to a trench wall than the height of the trench wall; and
- If an excavation may affect the stability of an adjacent building or structure, precautions must be taken to prevent damage to the structure. The precautions shall be specified in writing by a professional engineer.

7.4 Use of Sloping as a Means of Protection

Sloping of the excavation or trench walls is the preferred, and typically simplest means of protecting employees who must enter trenches or excavations which are greater than 5 feet (1.5 m) in depth or where there is danger of collapse.

The trench or excavation walls may be sloped back so that the ratio of the horizontal distance to the vertical rise (H:V ratio) of the sloped wall is at least 1½:1 (i.e., equivalent to an angle with the horizontal of 34° or less).

In many cases, determining the maximum allowable slope may allow the use of a steeper slope, which will result in a narrower excavation. However, determination of soil classification is complicated and requires that the competent person be familiar with the manual and visual tests. Since incorrect

soil classification may result in the use of a steeper, and potentially unsafe, slope, it is recommended that an angle of 34° (or less) with the horizontal typically be selected.

7.5 Use of Shoring or Shielding as a Means of Protection

Where sloping the walls of the trench or excavation is unfeasible (e.g., when there are dimensional constraints or adjacent structures), the use of shoring or a shield systems (e.g., trench boxes) may be necessary.

Factors that affect the selected method of shoring include:

- **Soil Structure and Strength:** Trench walls, at first glance, may appear to have strength, particularly if rock is encountered. Fractures in the rock can develop because of construction and soil strength may fail when subjected to undercutting or high-energy impacts. Irregular slopes on stratified soils that appear stable can fail if lower materials do not have adequate strength.
- **Soil Moisture Content:** Soil may be moist even though the weather has been dry. Care must be taken and shoring provided if the soil appears to be moist.
- **Weather and Humidity:** These can have a significant impact on shoring requirements. Frozen stable soil may collapse if warm mild weather persists. Percolation of water into the soil can increase the load on the shoring due to the increased weight and mobility of saturated soils. Frozen ground does not preclude the need to install shoring unless the freezing process is designed and approved by a Professional Engineer.
- **Soil Stress:** Stress can originate from many sources. Heavy machinery passing close to the shoring creates vibrations that decrease the soil strength and can result in shoring failure. Stationary equipment at the edges of the excavation can transmit loads and additional stresses to the shoring.
- **Trench Depth and Width:** These directly influence the choice of materials and the spacing of support bracing. The shoring requirements of a wide and deep trench differ substantially from those of a narrower trench.
- **Erosion Time:** If excavations are to be left open for extended periods, shoring materials may have to be increased.

7.6 Working Around the Trench/Excavation

While workers are in a trench, an aboveground observer must be present to warn of earth movements and to advise equipment operators of the presence and location of those in the trench so as to avoid vibrating equipment near trenches or excavations.

If there is a danger of a worker or equipment falling into an excavation, or whenever the edge is not clearly visible, the observer must identify the trench or excavation perimeter with visual markers (e.g., barricade tape, wooden railings, stop logs, etc). If the trench or excavation is 4 ft (1.2 m) or greater in depth, the visual barrier must be a minimum of 6 ft (1.8 m) from the edge.

Personnel must notify workers of the excavation through flagging, marking, safeguards, or other appropriate and effective means. Safety meetings should address any excavation concerns and issues.

Where employees or equipment are required or permitted to cross over excavations, walkways or bridges over excavations must have a minimum clear width of 20 inches (0.6 meters), be fitted with standard guard rails and extend a minimum of 24 inches (0.6 meters) past the surface edge of the trench. If vehicle crossings over excavations are required, they must be designed by and installed under the direction of a registered professional engineer.

Precautions must be taken to isolate loose rocks or other slumping materials that may slide, roll, or fall into the trench and onto workers..

While operating heavy equipment in the work area, the equipment operator shall maintain communication with a designated signal person through either direct voice contact or approved standard hand signals.

When mobile equipment is operated adjacent to an excavation or when such equipment is required to approach the edge of an excavation and the operator does not have a clear and direct view of the edge of the excavation, a warning system such as barricades, hand or mechanical signals, or stop logs shall be used. If possible, the grade should be away from the excavation.

All site personnel should maintain a safe distance and remain clear of the swing of operating excavation equipment.

Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.

Personnel that operate or work in the vicinity of heavy equipment shall wear all required safety equipment, including a high visibility vest (Class 2 or 3).

All materials such as pipe, rebar, etc., shall be kept out of traffic lanes and access ways. Materials and equipment shall be stored in a designated storage or laydown area so as not to disrupt work operations or endanger personnel at any time.

A flagman with roadwork, signs, cones, and high-level warning signs shall be provided when it is necessary to control normal vehicular traffic due to vehicles, such as end-dumps, entering, or leaving the site.

7.7 Working Within the Trench/Excavation

Employees shall not work in excavations in which there is accumulated water or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

A stairway, ladder, ramp, or other safe means of egress shall be located in excavations or trenches that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees. Ladders should extend at least 3 feet (0.75m) above the trench top.

Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design and shall be constructed in accordance with the contract documents and/or system design.

Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement. Structural members used for ramps and runways shall be of uniform thickness. Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping. Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

7.8 Hazardous Atmospheres

Confined spaces may exist in excavations where there is limited access or egress and in which a hazardous gas, vapor, dust, or fume or an oxygen deficient atmosphere may occur.

To prevent exposure to harmful levels of atmospheric contaminants, entry into trenches and excavations greater than 5 feet/1.5m in depth in which a

hazardous atmosphere exists, or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, must be performed in accordance with the requirements specified in OP 582, Confined Spaces.

Adequate precautions, such as mechanical ventilation or appropriate respiratory protection shall be taken prior to entry into trenches and excavations in which the oxygen concentration is less than 19.5 percent or the concentration of flammable gases or vapors is in excess of 10 percent of the lower explosive limit (LEL).

When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to confirm that the atmosphere remains safe. Atmospheric testing will be conducted in the anticipated breathing zone of the work area to determine oxygen content, combustible gas, and toxic gases and vapors, if applicable. Downwind sample points and atmospheric sampling may be required to assess any potential off-site migration of airborne contaminants.

Appropriate respiratory protection shall be donned prior to entry into any trench or excavation in which airborne levels of toxic substances are present at concentrations in excess of their Threshold Limit Value (TLV) or Permissible Exposure Limit (PEL).

If a confined space is identified, emergency rescue procedures will be in place in accordance with OP 582, Confined Spaces.

7.9 Stability of Adjacent Structures

Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

- A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
- The excavation is in stable rock; or
- A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

- A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

In addition, sidewalks, pavements, and appurtenant structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

7.10 Inspections

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions.

An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift and when site conditions. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

7.11 Personal Protective Equipment (PPE)

Minimum PPE requirements include:

- Hard hats
- Safety glasses with side shields
- Steel-toed boots
- Reflective vest
- Respiratory equipment, as required

7.12 Special Excavation Entry Permit Required for California

In California, for the construction of trenches or excavations that are 5 feet/1.5 m or deeper and into which a person is required to descend, an additional permit must be obtained from Cal/OSHA.

8.0 REFERENCES

- 29 CFR 1926, Subpart P, Excavations

9.0 REQUIRED RECORDS

- Completed Daily Excavation Checklist will be kept with project files (must be retained for +1 year).

10.0 ATTACHMENTS

Attachment A – Excavation Inspection Form

Attachment A
Excavation Inspection Form

OP 583 - Excavation & Trenching



Excavation Inspection Form

Designated Competent Person must inspect/document excavation prior to beginning work, after a rain event, and as needed throughout the shift.

Project Name: _____ **Project Number:** _____ **Project Location:** _____

Date: _____ **Inspection Completed By:** _____

Excavation Information:

Soil Type: _____ **Excavation Depth:** _____ **Excavation Width:** _____

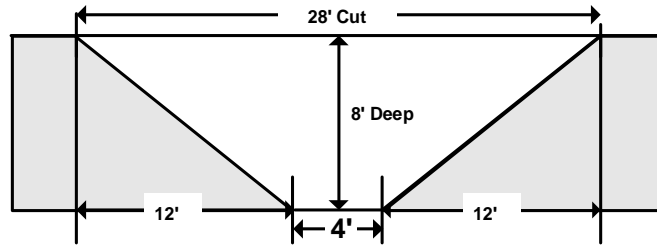
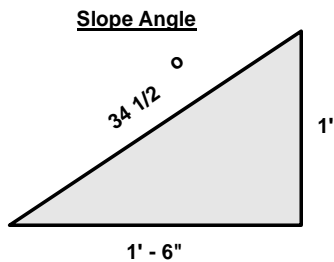
Type of Protective System Used: _____

1. General Information:	Yes	No	N/A
A. Is excavation less than five feet in depth?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Is there a potential for a cave-in? *IF YES, excavation must be sloped, shored, or shielded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Is excavation deeper than 5 feet? * IF YES, excavation must be sloped, shored, or shielded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Is sloping used as your protective system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. 1- Manual & 1- Visual Method utilized to determine Soil Classification as A-B-C (select one: Y=A, N=B, N/A=C)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Manual Test Method Used: Plasticity Dry Strength Thumb Penetration Dry Testing Pocket Penetrometer

Visual Characteristics: Cemented Cohesive Dry Fissured Granular Layered Moist Plastic Saturated
 Submerged Surface cracking Undercut

Slope information to keep in mind:



Example of a Simple 34-degree Slope commonly used around the site for cave-in protection.

2. Surface Conditions	Yes	No	N/A
A. Surface encumbrances removed or supported.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Individuals protected from loose rock/soil that may pose a hazard by falling/rolling into excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Hard hats, safety-toed boots, and safety glasses worn by all individuals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. High visible vest (Class 2 or 3) worn by all individuals. Vest required around heavy equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Spoils, materials, and equipment set back at least 3 feet from the edge of the excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Adequate barriers provided at all excavations, wells, pits, shafts, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Individuals are required to stand away from vehicles being loaded or unloaded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Warning system established and utilized when mobile equipment is operating near the edge of the excavation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(e.g., barricade tape, signalpersons, stop logs, etc).			
I. Individuals prohibited from going under suspended loads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Utilities	Yes	No	N/A
A. Location of utilities marked.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Prior to the use of equipment, underground utilities have been located by hand digging and exposed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Underground utilities are protected, supported, or removed when excavation is open.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Means of Access and Egress:	Yes	No	N/A
A. Travel distance to means of egress no greater than 25 feet in excavations 4 feet or more in depth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Straight ladders used in excavations extend at least 3 feet above the edge of the trench.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Ramps being used for employee access have been designed by the competent person.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. All individuals are protected from cave-ins when entering or exiting the excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Wet Conditions:	Yes	No	N/A
A. Precautions have been taken to protect individuals from the accumulation of water.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Water removal equipment monitored by a competent person.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Surface water or runoff is diverted or controlled to prevent accumulation in the excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Inspections have been made after every rainstorm or other hazard-increasing occurrence (freeze/thaw, local demolition, rerouting of traffic, etc).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Hazardous Atmosphere:	Yes	No	N/A
A. Are there exposed sewer or natural gas lines in excavation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Is excavation near a landfill, or are hazardous substances being stored close to the excavation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If you answered YES to A or B, then treat the excavation as a confined space. OP 582 Confined Spaces			
C. All individuals will contact the Fire/Rescue Group at _____ prior to entry and in case of emergencies.			
7. Support Systems:	Yes	No	N/A
System Manufacturer:	System Type:		
A. Tabulated Data for system on-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Materials/equipment for support systems selected based on soil analysis, trench depth, and expected loads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Materials/equipment used for protective systems have been inspected and are in good condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Protective systems installed without exposing all individuals to the hazards of cave-ins, collapses, or the threat of being struck by materials or equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Members of support system are securely fastened to prevent failure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Support systems are provided to ensure stability of adjacent structures (buildings, roadways, sidewalks, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Excavations below the level of the base of a footing have been approved by a registered PE.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Removal of support systems progresses from the bottom (members released slowly to note indication of possible failure).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I. Backfilling progresses with the removal of support system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J. Material excavated to a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

K. A shield system has been placed to prevent lateral movement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
M. All individuals are prohibited from remaining in the shield system during vertical movement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Training:	Yes	No	N/A
A. All individuals have had Excavation Safety Awareness Training.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

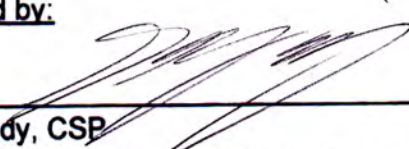
FOR

HEAVY EQUIPMENT OPERATIONS

OP-584

**Revision 1
October 2013**

Prepared by:

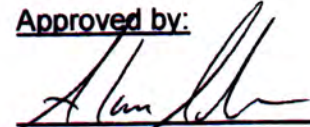


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the safe working requirements for working with and in the vicinity of heavy equipment.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Heavy equipment - All excavating equipment including scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and other similar equipment.
- 3.2 Operator - Any qualified and/or licensed person who operates the controls while the heavy equipment is in motion or the engine is running
- 3.3 Ground personnel/workers - Personnel performing work on the ground around heavy equipment (note: operators are considered ground personnel when outside of the equipment cab).

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc.

The following outlines the requirements while performing heavy equipment operations that may lead to contact with aboveground or underground utilities:

- Always be aware of surrounding utilities. Confirm all equipment (i.e., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath aboveground utilities.
- Confirm utilities are cleared and identified prior to beginning any earthmoving operation. Contact the local utility service providers (Dig Safe, Call Before You Dig, etc.) for clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc.
- Observe and understand all color-coded ground markings for the presence of buried utilities. If working near marked out utilities or in areas where utilities are assumed to exist but have not been marked out, contact the project manager or site health and safety officer for direction if uncomfortable; it is better to be safe than sorry.

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

6.1 Project Managers (PM) and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Implementation of this procedure for supervised employees.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Employees' responsibilities:

Apply appropriate precautions and work practices when working with, or in close proximity to, heavy equipment. Contact the PM, SSHO or field site manager for direction / clarification if unsure or unclear regarding work tasks in the vicinity of buried and overhead utilities.

6.4 Competent Person responsibilities:

A competent person must be present during all work that involves heavy equipment operations by Cabrera personnel or selected subcontractor.

For the purpose of this OP, a competent person is defined as an individual, who by education or experience, is capable of evaluating the hazards associated with heavy equipment operations and is capable of taking corrective actions to control the hazards. The competent person for the project will be indicated in the Activity Hazard Analysis (AHA) for the project.

The competent person:

- Is knowledgeable in the safe operation of the selected/designate piece of heavy equipment
- Possesses the skill level to safely operate the heavy equipment in the manner prescribed for the equipment, and the environment in which it is operating.
- Will inspect the equipment on a daily basis to ensure safe operation.
- Informs all ground personnel of appropriate precautions when working with/around the heavy equipment and when operating in close proximity to buried and/or overhead utilities and other hazards.

7.0 PROCEDURE

For work under Cabrera control, PMs are responsible for ensuring all equipment is in good working order and all equipment operators are qualified on the piece of machinery they are assigned. If the equipment and operator have been subcontracted and there are concerns regarding the equipment and/or the operator, the PM will first discuss with the operator to resolve any concerns. If the PM does not resolve those concerns satisfactorily with the operator, he/she will contact the operator's supervisor to resolve.

The operator will confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.

The operator of mobile equipment is the only worker permitted to ride the equipment unless the equipment is a worker transportation vehicle.

A person will not operate heavy equipment unless the person has received adequate instruction and training in the safe use of the equipment, has demonstrated to a qualified supervisor or instructor competency in operating the equipment. The operator will provide documentation indicating he/she maintains the proper license to operate the equipment and will not operate the equipment until such license is obtained and provided to Cabrera.

The operator of heavy equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment.

7.1 Prior to work commencing

All heavy equipment will be regularly inspected pre-shift and then regularly as required with the details of the inspection recorded using the attached Heavy Equipment Inspection form or in a log book.

The operator will report defects and conditions affecting the safe operation of the equipment to the supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.

Exposed moving parts on equipment which are a hazard to the operator or to other workers will be guarded and if a part will be exposed for proper function it will be guarded as much as is practicable consistent with the intended function of the component.

An approved Underwriter's Laboratories (UL) 4A40BC fire extinguisher shall be present on all mobile equipment.

Inform the operators of the equipment that employees are in the area and inquire if there are any restricted areas or specific rules or requirements. In some industrial facilities, equipment has the 'right of way'. Stay in visual contact with the operator as is necessary to work safely.

Where the operator will not have a full view of the path of travel, a signal person will be used on the ground that has a full view of the load, the operator, and the path.

Where the operator of heavy equipment cannot directly or by mirror or other effective device, see immediately behind the machine, an automatic audible warning device (alarm) will be utilized to provide safe movement. The alarm will activate whenever the equipment controls are positioned to move the equipment in reverse, and if practicable and should be audible above the ambient noise level.

7.2 Inspection and Maintenance

Maintenance records will be maintained on the site or project for equipment.

Servicing, maintenance and repair of heavy equipment will not be done when the equipment is operating, unless continued operation is essential to the process and a safe means is provided.

Prior to use, all heavy equipment shall be inspected. Inspections and any repairs will be documented. Inspections and/or repair reports will be available for review upon request. Operators shall not operate heavy equipment that has not been inspected and cleared for use. All machinery and mechanized equipment will be certified to be in safe operating condition by a competent individual prior to on-site operation (typically by rental company). Certifications shall be renewed annually or when maintenance and/or repairs are made to make the equipment safe to operate.

All heavy equipment shall be inspected in accordance with the manufacturer's recommendations. All defects shall be reported to the site supervisor/manager immediately. Inspection records shall be maintained at the site. If a manufacturer's or company-specific inspection checklist is not provided, use the Heavy Equipment Inspection Form (attached).

Defective heavy equipment shall be immediately taken out of service until repaired and recertified for safe usage.

7.3 Fueling and batteries

A well-ventilated area shall be used for refueling.

Only the type and quality of fuel recommended by the engine manufacturer

shall be used.

Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.

No one shall spill fuel on hot surfaces. Any spillage shall be cleaned before starting an engine.

Spilled fuel shall be contained and cleaned with cotton rags or cloths; do not use wool or metallic cloth. Consult the site-specific spill response plan to contain and remediation of spills. At a minimum, absorbent material should be applied to contain/mitigate spills.

Open flames, lighted smoking materials, or sparking equipment shall remain well away from the fueling area.

Heaters in carrier cabs shall be turned off when refueling.

Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.

The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.

Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.

Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent buildup of a static charge.

Cell phones and other electronic devices are not allowed in the refueling area during refueling operations.

Batteries shall be serviced in a ventilated area while wearing appropriate PPE.

When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first.

When installing a battery, the battery shall be connected ground post last.

When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.

When charging a battery, the power source shall be turned off to the battery before either connecting or disconnecting charger loads to the battery posts.

Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water. Absorbent material shall, at a minimum, be applied to contain

any spill (Refer site-specific spill response plan).

Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention sought immediately.

To avoid battery explosions, the cells shall be filled with electrolytes. A flashlight (not an open flame) shall be used to check water electrolyte levels. Avoid creating sparks around battery by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least 25 feet away from battery-charging stations.

7.4 Safe Operation (Operator)

The operator of heavy equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment.

The operator of heavy equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement such as by setting the parking brake, placing the transmission in the manufacturer's specified park position, and by chocking wheels where necessary.

The operator will maintain the cab, floor and deck of mobile equipment free of material, tools or other objects which could create a tripping hazard, interfere with the operation of controls, or be a hazard to the operator or other occupants in the event of an accident.

If mobile equipment has seat belts required by law or manufacturer's specifications, the operator and any passengers will use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.

Do not wear loose clothing where there is a danger of entanglement in rotating equipment.

Maintain a distance of 10 feet between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, the area will be barricaded or guarded to prevent access.

Vibration from moving traffic or mobile equipment can cause excavations or spoil piles to become unstable. Be aware of the risk and keep clear.

All heavy equipment shall be operated in a safe manner that will not endanger persons or property.

All heavy equipment shall be operated at safe speeds.

Always move heavy equipment up and down the face of a slope. Never move

equipment across the face of a slope.

When feasible, operators shall travel with the “load trailing”, if the load obstructs the forward view of the operator.

Slow down and sound horn when approaching a blind curve or intersection. Flagmen equipped with 2-way radio communications may be required to adequately control traffic.

Operators shall remain in cab while heavy equipment is being loaded.

Equipment shall be shut down prior to and during fueling. Do not smoke or use electrical devices while fueling. Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.

Turn off heavy equipment, place gear in park (or leave in gear) and set parking brake prior to leaving vehicle unattended. Buckets and blades are to be placed on the ground and with hydraulic gears in neutral. Heavy equipment parked on slopes shall have the wheels chocked.

Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.

Never exit heavy equipment while it is in motion.

Passengers shall only ride in heavy equipment designed for occupancy of passengers.

Never ride on the outside of a piece of heavy equipment (e.g., tailgates, buckets, steps, etc.).

Operators shall never push/pull “stuck” or “broken-down” equipment unless a spotter determines that the area is cleared of all personnel around and underneath the equipment.

If designated for work in contaminated areas/zones, equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

Equipment left unattended at night adjacent to traveled roadways shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of that equipment, and shall not be closer than 6 feet (or the regulatory requirement for the work location) to the active roadway.

Pneumatic-tired earthmoving haulage equipment, with a maximum speed exceeding 15 miles per hour, shall be equipped with fenders on all wheels. Support vehicles with flashing lights, signage made be required when moving

heavy equipment for one job site to another.

Lift trucks shall have the rated capacity clearly posted on the vehicle. These ratings will not be exceeded.

Steering or spinner knobs shall not be attached to steering wheels.

High lift rider industrial trucks shall be equipped with overhead guards.

When ascending or descending grades in excess of 5%, loaded trucks shall be driven with the load upgrade.

All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.

All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

All equipment having a charging skip shall be provided with guards on both sides and open end of the skip area to prevent persons from walking under the skip while it is elevated.

Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.

Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.

7.5 Safe Operation (Ground Personnel)

A supervisor will not knowingly operate or permit a non-authorized or licensed worker to operate mobile equipment which could create an undue hazard to the health or safety of any person.

When approaching or crossing the intended path of travel of heavy equipment, establish eye contact with the operator of the mobile equipment first to and confirm that it is safe to proceed.

Have vehicle headlights on at all times when driving in the area.

Park motor vehicles off the haul roads, or away from the work areas. Site vehicles will be parked in a designated parking location away from heavy equipment.

Do not enter the swing area of machines such as cranes, or excavators, without first making eye contact with the operator, and receiving permission to

do so.

Stay out of the blind areas around heavy equipment and never assume that the equipment operators have seen or are aware of your presence.

Do not wear loose clothing where there is a danger of entanglement in rotating equipment.

Vibration from moving traffic or mobile equipment can cause excavations or spoil piles to become unstable. Be aware of the risk and keep clear.

Stay on the uphill side of equipment while operating near steep slopes, shoulders, ditches, cuts, or excavations.

7.6 Communication

Communication between site supervisors/managers, heavy equipment operators, and other site personnel is a key method of preventing serious injury or death during heavy equipment operations.

The following outlines the communication requirements during heavy equipment operations:

- Site supervisors/managers shall confirm that all operators are notified/informed of when, where, and how many ground personnel will be working on site and within close proximity to heavy equipment operations.
- Site supervisors/managers shall inform all ground personnel before changes are made in the locations of designated work areas
- Prior to work initiating onsite the site supervisor/manager will confirm that all operators and ground personnel are trained on the hand signals that will be used to communicate between operators and ground personnel
- Personnel working around heavy equipment operations will maintain eye contact with operators to the greatest extent possible (always face equipment). Never approach equipment from a blind spot or angle.
- All heavy equipment whose backup view can be obstructed shall be equipped with reverse warning devices (i.e., backup alarms) that can be heard distinctly, over equipment and other background noise. Reverse signaling lights and alarms shall always be in working order
- When feasible, two-way radios shall be used to verify the locations of nearby ground personnel

- When an operator cannot adequately survey the working or traveling zone, a guide shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may also be used to highlight these signals.

7.7 Ground Personnel

Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

The following outlines the clearance requirements during heavy equipment operations:

- Ground personnel shall always yield to heavy equipment
- Ground personnel shall maintain a suitable “buffer” area of clearance from all active heavy equipment. Recommended minimum safe distance is 50 feet plus the maximum swing radius of the piece of equipment being used.
- A job-specific hazard analysis (AHA) that identifies any special precautions shall be completed and communicated to all site personnel
- Site supervisors/managers shall designate areas of heavy equipment operation and confirm that all ground personnel are aware of these designated areas. Designated areas shall include boundaries and travel routes for heavy equipment. Travel routes shall be set up to reduce crossing of heavy equipment paths and to keep heavy equipment away from ground personnel.
- When feasible, site supervisors/managers shall set up physical barriers (e.g., caution tape, orange cones, concrete jersey barriers, etc.) around designated areas and confirm that unauthorized ground personnel do not enter such areas
- Operators shall stop work whenever unauthorized personnel or equipment enter the designated area and only resume when the area has been cleared
- Operators shall only move equipment when aware of the location of all workers and when the travel path is clear
- Ground personnel shall never stand between two pieces of heavy equipment or other objects (i.e., steel support beams, trees, buildings, etc.)
- Ground personnel shall never stand directly below heavy equipment

located on higher ground

- If working near heavy equipment, ground personnel shall stay out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment
- Personnel shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment
- Personnel shall not talk on a cell phone while standing or walking on a roadway or other mobile equipment path.

At a minimum, all ground personnel and operators outside of heavy equipment shall wear the following:

- High visibility, reflective (Class 2 or 3) safety vest that is visible from all angles and made of fluorescent material and orange, white, or yellow reflective material (confirm that vest is not faded or covered with outer garments, dirt, etc.)
- Retro-reflective striping for arms and legs (night work)
- American National Standards Institute (ANSI) approved hard hat
- ANSI approved safety glasses with side shields
- ANSI approved work boots (unless project requirements are more stringent)
- ANSI approved hearing protection as needed
- Appropriate work clothes (i.e., full length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

7.8 Training

The operator or other qualified supervisor will provide all on-site personnel with an orientation to the heavy equipment and its associated hazards and controls.

Only designated, qualified (licensed if required) personnel shall operate heavy equipment.

Operators shall have all appropriate local, state, or federal licenses or training to operate a designated piece of heavy equipment.

Operators shall be evaluated through documented experience and routine

monitoring of activities unless the equipment is operated by a Cabrera operator in which case a practical evaluation is needed. Operators shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.

8.0 REFERENCES

- 29 CFR 1926 Subpart O, Motor Vehicles, Mechanized Equipment & Marine Operations
- 29 CFR 1926 Subpart W, Rollover Protective Structures

9.0 REQUIRED RECORDS

- Completed Heavy Equipment Inspection Forms will be kept with project files.

10.0 ATTACHMENTS

Attachment A – Heavy Equipment Inspection Form

Attachment A
Heavy Equipment Inspection Form

OP 584 - Heavy Equipment Operations



Heavy Equipment Inspection Form

Competent Person must inspect/document equipment when it is put into service, using this form. Equipment must be inspected prior to each use by the operator.

Project Name:	Project Number:	Project Location:
Operator:		Make/Model:

Week of:	Monday			Tuesday			Wednesday			Thursday			Friday		
Hour meter reading:															
Check the following as appropriate	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A
1. Operator qualified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Overhead guard (ROPS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Horn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Parking brake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Service brakes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Steering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Engine Oil level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Hydraulic oil level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Radiator fluid level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Major fluid leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Windows/Wipers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Backup alarm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Tires (visual)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Seat belts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Fuel leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Fire extinguisher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Fuel lines secure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Electrical lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Exhaust components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SAT – Satisfactory, UNSAT – Unsatisfactory, N/A – Not Applicable

Comments/Remarks:



CABRERA SERVICES
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OPERATING PROCEDURE

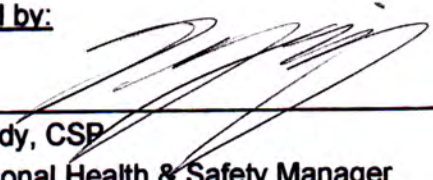
FOR

FALL PROTECTION

OP-585

**Revision 1
October 2013**

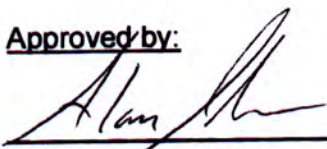
Prepared by:



Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013
Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013
Date

1.0 PURPOSE

This operating procedure (OP) establishes fall prevention and protection requirements for employees who perform work at heights of 6 feet (1.8 m) or more above ground or other work surfaces.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Anchor Point - A secure point of attachment for lifelines or lanyards, usually a building structural component, crane, or other support capable of holding a 5,400 pound static load.
- 3.2 Base Surface - The area immediately beneath an elevated structure or surface (ground, walking surface, floor, etc.). Used synonymously here with "grade."
- 3.3 Body Harness (Class III) - A tight fitting harness designed to fit the torso and spread the shock associated with arresting a fall over the entire torso area. Harnesses typically have connecting D rings at chest level in the front and the back for attaching a lanyard.
- 3.4 Climbing Protection System - A type of fall protection used while working from long ladders, poles, and towers. The climbing protection system incorporates a permanently installed rail or cable that runs the length of the ladder. The climber's harness is attached to the rail or cable by a sliding device or sleeve that allows climbing freedom but locks the instant a fall is sensed.
- 3.5 Deceleration Device - A mechanism, such as a rope grab, rip-stitch lanyard, specially woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards, etc., that serves to dissipate a substantial amount of energy during a fall arrest or to otherwise limit the energy imposed on an employee during fall arrest.
- 3.6 Fall Prevention - Any structure (e.g., a ladder cage or guardrail), fence, or barrier that will prevent falls while working from heights. A safety belt and short lanyard is also considered a type of fall prevention.
- 3.7 Fall Protection - A personal lifeline system (e.g., harness and lanyard), deceleration device, and fixed anchor points or climbing protection system (e.g., permanent ladder rails) that limit falls to less than 6 feet (1.8m).
- 3.8 Free Climbing - Climbing on a structure such as a ladder, tower, or chimney that is not equipped with guardrails, walls, a cage, or other type of structural

fall prevention. Free climbing generally requires the use of a fall protection system.

3.9 Grade - (see Base Surface).

3.10 Lanyard - A line connecting a safety harness or safety belt to a safety line or structure. When used with a safety belt, the lanyard must be short enough to prevent the employee from approaching the fall hazard.

3.11 Personal Lifeline System - A type of fall protection that is comprised of a body support (i.e., a safety belt or body harness) and a lanyard that is attached to an anchorage point or a safety line.

3.12 Personal fall arrest system - A system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, and full-body harness and may include a lanyard, deceleration device, or static line.

3.13 Safety Belt (Class I) - A belt worn around the waist that when attached to an anchor point with a lanyard prevents a worker from approaching a fall hazard. Safety belts should not be used other than as a restraint device without the prior approval of the Project Manager and the Occupational Health and Safety (OH&S) Manager.

3.14 Safety Line - A rope or cable secured to one or more anchor points to which lanyards may be attached to limit fall distance.

3.15 Standard Railing - Railing provided to enclose open-sided work platforms and consisting of a top rail, intermediate rail, and posts. The top rail has a vertical height of 42 inches above the platform surface and the intermediate rail is approximately halfway between the top rail and the platform surface.

3.16 Work at Heights - Any work/job/task to be performed above the normal walking/working surface that necessitates the use of some form of fall protection as determined by the applicable governing rules and regulations. In the absence of applicable rules and/or regulations governing this type of work in a particular jurisdiction, the default requirement shall be 6 feet (1.8 meters).

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

All fall arrest equipment must bear a manufacturer's label and confirmation of annual inspection.

All workers must visually inspect fall arrest equipment prior to each use.

Use all Personal Protective Equipment (PPE) in accordance with manufacturers' specifications.

Do not attempt to repair or modify equipment yourself.

If there are any concerns regarding unacceptable risks while working at an elevated work station, the work shall not be initiated until such concerns have been address by the site health and safety officer and/or the OH&S Manager. Alternatives to climbing (elevators, aerial lifts, etc.) shall be used when practical.

Any fall arrest components which have been involved in a fall must be tagged out and removed from service.

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Responsible for implementing the requirements of this procedure, ensuring that work done at elevations is done safely and that the proper precautions are taken. The Field Site Manager's responsibilities include;

- Assuring that all personnel who perform work at heights are familiar with and understand this procedure
- Designating a competent person to monitor the safety of other employees and ensure that the safety monitor complies with the following requirements:
 - Assure that all personnel are apprised of any site specific hazards prior to performing work more than 6 feet (1.8 m) above grade
 - Assure that required PPE and/or personal lifeline systems are available on site as necessary

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Employees' responsibilities:

Apply appropriate controls and safe work practices in their use of fall protection.

6.4 Competent Person responsibilities:

A competent person must be present during all work that involves Cabrera personnel working at heights more than 6 feet (1.8 m) above grade.

For the purpose of this OP, a competent person is defined as an individual, who by education or experience, is capable of evaluating the hazards associated with working at heights. The competent person for the project will be indicated in the Activity Hazard Analysis (AHA) for the project.

The competent person will:

- Recognize fall hazards
- Warn employees if they are unaware of a fall hazard or are acting in an unsafe manner
- Ensure fall protection equipment is properly inspected and maintained
- Provide site specific fall protection training to employees

7.0 PROCEDURE

7.1 General Requirements

Each worksite and all activities shall be evaluated prior to the start of the job to identify the hazards of falling from any elevation. The results of this evaluation shall be described in either a Site Specific Safety and Health Plan (SSHP) or site-specific fall protection program. The evaluation shall identify the areas/activities requiring fall protection, the manner in which fall protection will be accomplished, a listing of qualified individuals for fall protection and a roster of personnel authorized to utilize specific fall protection equipment. As part of this evaluation, all applicable requirements of 29 CFR 1926 Subpart M shall be addressed.

- Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems (refer to 29 CFR 1926.501(b)(1)).
- Every open sided floor or platform (walk ways, scaffolding, stairs, etc) 4 feet or more above adjacent floor or ground level shall be guarded by a standard railing on all open sides except where there is entrance to a ramp, stairway, or fixed ladder. The railing shall be provided with a toeboard wherever, beneath the open sides (refer to 29 CFR 1910.23(c)(1)).
- All elevated work, regardless of the height, shall incorporate job planning to anticipate and mitigate the consequences of a fall. Job planning should include rescue after a fall.

- First consideration shall be given to the elimination of fall hazards. If a fall hazard cannot be practically eliminated, second consideration shall be implementing effective permanent or temporary means of fall prevention.
- Before using any equipment, pipelines, or trusses for elevated work, it must be determined by the project manager if they are suitable for climbing or walking. Not all pipelines, trusses, and hanger systems are designed to support individuals doing elevated work. For example, walking on pipelines may cause flanges to leak, damage insulation, damage tracing or deform piping.
- Weather must be a safety consideration whenever outdoor elevated work is to be done. The weather hazard must be addressed prior to and during the work.
- When fall protection is required, a personal fall arrest system must be utilized that complies with 29 CFR 1926.502(d) (full body harness with a fall arrest system)

The following are specific situations/work areas that require fall protection:

- Aerial lift devices: Personnel operating or working from an aerial lift platforms shall wear fall protection equipment with the lanyard attached to a designated anchor point. When exiting or entering an aerial lift device at elevated heights, the use of continuous fall protection is required.
- Elevated work stations: Working from elevated work stations of 4 feet or greater and not protected by fall prevention shall utilize fall protection (refer to 29 CFR 1910.23(c)(1)).
- Scaffold erection/disassembly: Personnel engaged in scaffold erection or disassembly shall use fall protection. These options include, but are not limited to, vertical and self-retracting lanyard lifeline attachments to associated structures and horizontal lifeline attachments when guardrails are not installed. Scaffolds shall be adequately secured if they are used as an anchorage point. Braces and/or couplers of scaffolds shall not be used as anchorage points.
- Ladders:
 - Portable: When working from a portable ladder and the work requires the use of both hands, fall protection shall be used whenever working at 6 feet or above, as measured from the ladder base to the bottom of the employee's feet unless a Safe Operating Procedure for the job is approved by the Project

Manager.

- Fixed: Any fixed ladder 20 feet in height or greater must be equipped with a cage or fall arrest device. For fixed ladders less than 20 feet in height, ladder climbing devices shall be utilized whenever available, and are the preferred method of ladder travel. Personnel are allowed to climb or descend a fixed ladder less than 20 feet in height without fall protection or a cage only where if both hands are free for climbing.
- Crane suspended platforms: Personnel working from or riding in any crane-suspended platform shall wear fall protection with a lanyard attached to the boom or basket. Work platforms shall not be used in winds in excess of 15 miles per hour or during electrical, snow, ice, and/or sleet storms, or other adverse weather conditions which could affect the safety of personnel.
- Designed access ways: Personnel using designed access ways (cab accesses, crane accesses, trucks, railcars, etc.) may climb or descend the access way using a minimum of three points of contact (hands and feet).
- Working on a flat roof or low-pitched roof (<9.5 degree slope): Personnel working within 6 feet of any unprotected roof edge or opening (i.e. not protected by a guardrail, or a parapet of at least 39 inches in height) are required to use fall protection. When working more than 15 feet from an unprotected roof edge/opening a warning line system shall be erected that is not less than 15 feet from the edge, unless some other means of fall prevention is in use. A safety observer is not an acceptable fall prevention system.
- Working on a sloped roof: Personnel working on any sloped roof, other than low pitched roofs (<9.5 degree slope) shall use fall protection at all times.
- Trucks, railcars, and large equipment: Personnel working on top of trucks, railcars, and large equipment shall use fall prevention or protection systems.

7.2 Fall Protection Plan

Where the risk of a fall exists, a fall protection plan must be developed for the project or site by a qualified and competent person. The plan must:

- Identify specific fall protection needs and systems prior to the start of the project

- Confirm that the worker is trained appropriately for the fall protection plan
- Identify fall hazards on an ongoing basis and review fall protection equipment needs
- Hold a pre-job meeting to address and discuss the fall protection system requirements. This includes any training or review of equipment usage. Provide updated meetings as necessary to address any changes in site conditions that would affect fall protection system requirements.
- Consider the procedures and tracking for assembly, maintenance, inspection, and disassembly of equipment
- Confirm that there will be adequate anchor points available at each location where fall protection systems are used
- Control or restrict access below or around the personnel working at elevation.
- Confirm the use of barricades, caution tape, and signs identify restricted areas

Fall protection systems can be either:

1. A fall RESTRAINT system (physically stops a worker from getting too close to a fall hazard), or
2. A fall ARREST system (stops a fall already occurring and limits arresting forces to 800 kilo newtons or less)

Guardrails are the preferred fall RESTRAINT system; however, if guardrails are not feasible, staff shall be adequately protected by at least one of the following methods:

- Positioning Device Systems
- Personal Fall Protection Equipment

7.3 Guardrails

Where possible, guardrails must be installed:

- along the open edges of roofs, platforms, and floors
- on formwork, scaffolds, and other work surfaces

- openings in floors and roofs; and
- where ever workers are exposed to the risk of falling

All guardrails—especially wooden guardrails—must be inspected regularly.

When guardrail systems are used, they shall meet the requirements given in 29 CFR 1926.502(b).

The top edge of the guard rail shall be from 39 inches to 45 inches above the walking/working surface. Midrails, screen, or mesh shall be installed unless there is a wall or parapet wall at least 21 inches high outside of the guardrail.

Guardrails shall be constructed to withstand a lateral or downward vertical force of 200 pounds without failure. Midrails, screen, mesh, or equivalent shall be constructed to withstand a lateral or downward vertical force of 150 pounds without failure. Guardrails constructed in accord with Appendix B to Subpart M of 29 CFR 1926, shall be considered adequate.

7.4 Protection From Falling Objects

Toeboards used as falling object protection shall be erected along the edge of the overhead working level for a distance sufficient to protect employees below. Toeboards shall be capable of withstanding a 50-pound force outward or downward at any point. Toeboards shall be at least 3½ inches in height, and the gap between the working surface and bottom of the toeboard shall not be greater than ¼ inch. Toeboards shall be solid, or have openings less than 1 inch in greatest dimension. Where tools, material, or equipment exceed the height of the toeboard, paneling or screening shall be added to protect employees below.

Guardrail systems used as falling object protection shall have openings small enough to prevent passage of potential falling objects. Falling object protection during overhand bricklaying work shall comply with 29 CFR 1926.502(j)(6).

Canopies when used as falling object protection shall be strong enough to prevent collapse, and to prevent penetration by any objects which may fall onto the canopy.

7.5 Floor, Roof, and Other Walking/Working Surfaces

Covers in roadways, and vehicular aisles shall be capable of supporting at least twice the maximum axle load of the largest vehicle expected to cross over the cover.

All other covers shall be capable of supporting at least twice the weight of employees, equipment, and materials that may be imposed on the cover at

any one time.

All covers shall be secured when installed so as to prevent accidental displacement by the wind, equipment, or employees.

All covers shall be color-coded, or marked with the word "Hole" or "Cover" to provide warning of the hazard. (This does not apply to cast manhole covers or steel grates used on streets or roadways.)

7.6 Positioning Device Systems

If fall protection normally provided by walls, floors, guardrails, scaffolds, and cages is absent during work at height, personal lifeline, or positioning device systems, must be used. Personal lifeline systems typically consist of a body support (i.e., a safety belt or harness), an attached lanyard, and an anchorage point.

These systems shall be constructed in such a manner that allows employees to access (reach) the leading edge, but prohibits them from falling. Lifeline and lanyard are adjusted to let you travel only so far. When you get close to the open edge of a floor or roof, the system holds you back. Positioning devices shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kN), whichever is greater.

Locking type snaphooks designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member shall be used on these systems. Any equipment used for fall protection systems must meet the applicable American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM) requirements for that equipment.

7.7 Personal Fall Protection Equipment

A fall-arrest system consists of a full body harness, lanyard with shock absorber or retractable lifeline, and the anchorage point to which the lanyard is attached. Any fall arrest components which have been involved in a fall must be removed from service and destroyed (unable to reuse).

All Fall Arrest Equipment must be formally inspected and certified annually according to the manufacturer's specifications.

Full Body Harness

A Class III safety harness, often referred to as a body harness or parachute harness, is a belt system designed to spread shock load over the torso (shoulders, thighs, and seat area). It must be used during free climbing or

working above 6 feet (1.8 m).

Connectors shall be drop-forged, pressed or formed steel, or made of equivalent materials. Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

D-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds. D-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or taking permanent damage.

Snaphooks shall be the locking type, and designed and used to prevent disengagement of the keeper by the connected components.

Safety belts (Class 1) are no longer approved for personal fall arrest systems (PFAS). Only a full body harness may be used for this purpose.

Lanyard

A lanyard is a short, flexible rope or strap webbing that connects a worker's safety harness to an anchorage point. Lanyards cannot exceed 6 feet (1.8 m) in length. Length should be selected to allow appropriate freedom of movement while limiting the fall to as short a distance as possible.

A shock-absorbing lanyard is designed to absorb a portion of the shock as the lanyard becomes taut during a fall and should be used in all applications when possible.

Do not wrap the lanyards and/or rope around beams, girders, pipes, etc. The safety lines and lanyards must be protected from cuts, wear, and abrasions.

Lanyards should be replaced at the first sign of wear and after they have been subjected to a fall.

Retractable Lifelines

Retractable lifelines contain a cable wound around a drum with a spring that removes slack from the line and an inertial latching device that stops a sudden decent. The device is attached to an anchor point. This system allows a freedom of motion for the worker but stops a fall very rapidly.

Anchorage Point

The anchorage point is the position on an independent structure to which the lanyard is attached. It should be capable of supporting a minimum 5,000-pound static load per employee. Fall-arrest loads can be high, depending on the height of the fall and the weight of the person.

To limit the fall distance, lanyards should be attached to an anchorage point at or over the head.

7.8 Use of Personal Fall Protection Equipment

Personal fall protection systems shall limit the maximum arresting force on an employee to 1,800 pounds when using a body harness; limit free fall distance to 6 feet (4 feet in California) (where this maximum distance will not cause the employee to contact any lower level); limit deceleration distance to 3.5 feet; and be able to withstand twice the potential impact energy of an employee falling 6 feet or the maximum free fall distance permitted by the system.

Fall protection must be maintained 100% of the time when working from heights. In order to achieve this, two (or a double) lanyard must be used, and a minimum of one lanyard must be attached to an acceptable anchorage point at all times during use.

As an example, for climbing purposes, the worker attaches the first lanyard to an anchorage point (e.g., ladder rung or tower brace) above his/her head and climbs until the anchorage point is at slightly below waist height. At that point, the worker attaches the second lanyard to an anchorage point over his/her head, detaches the first lanyard, and repeats the process. By using this method, the worker is always attached during the climb, resulting in 100% fall protection.

Personal fall-arrest systems shall not be attached to guardrail systems.

Body harnesses and components shall not be used to hoist material or equipment.

7.9 Equipment Inspection and Maintenance

All equipment must be inspected prior to use, daily as required. Visually inspect all restraint components before each use for wear, damage, or deterioration. Defective components are removed from use and tagged out to prevent others from using them.

Thorough, annual inspections of fall protection equipment must be performed, documented using the attached harness and lanyard inspection forms (Attachments A & B), and initialed on the equipment tags.

Inspection

Inspect all equipment visually before each use and periodically thereafter. The frequency of subsequent checks should be contingent upon the conditions where used. If defective conditions are found as described below, remove the item from service immediately, and get it properly repaired or replaced.

Damaged items should be destroyed and removed from service. If conditions are found that are not included below, remove the item from service and contact safety engineer, distributor, OH&S Manager, or manufacturer for advice.

Webbing - Beginning at one end, bend a portion of the harness (6 to 8 inches) into a U-shape between your hands to reveal worn, cut, frayed, burnt, or damaged fibers. Check both sides of the harness and all straps along the entire length.

Buckle and D-ring attachment - Carefully check the buckles and D-rings attached to the webbing for excessive wear, cut, or torn fibers.

D-rings - Check for rough or sharp edges, corrosion, burrs, cracks, dents, or distortions.

Tongue buckle - Check for rough or sharp edges, corrosion, burrs, cracks, dents, or distortions. Buckle tongues should be free of distortion, move easily back and forth, and overlap the buckle frame. The frame roller should rotate freely.

Friction buckle - Check for rough or sharp edges, corrosion, burrs, cracks, dents, or distortions. All portions of the buckle should be straight.

Sliding bar buckle - Check for rough or sharp edges, corrosion, burrs, cracks, dents, or distortion. Sliding bar should move freely within the frame; ridges should be complete and not smooth. Carefully check the ends of the bar for distortion.

Grommets - Check for rough or sharp edges, corrosion, burrs, cracks, dents, or distortion. Grommets must be tight.

Labels - The manufacturer's labels should be on each piece of equipment and easily read. If missing, remove from service and contact purchasing, or distribution.

Rope - Rope lanyards should be inspected by bending the rope into a U-shape between the hands and untwisting the rope slightly to check the inside fibers as well. This helps to reveal frayed, worn, cut, broken, burnt, or damaged fibers. Check all sides of each strand along the entire length of the lanyard.

Locking-type snap hooks - All snap hooks must operate smoothly, and open and close completely. Check snap hook body for sharp edges, burrs, distortion, cracks, corroded, or pitted surfaces. Rivets should be checked for cracks, broken, or bent or otherwise damaged conditions. Gate and double-locking gate keepers should be free from distortion, bending, and seat properly

against the snap hook nose and body. The gate keeper spring should be sufficient to completely and firmly close the snap hooks should freely rotate into the locked position when released.

Lanyard - If any part of the danger label is showing or if there is any broken stitching, remove from service.

Anchorage points inspection - Check all identified anchorage points for corrosion and adherence to minimum sizes and conditions.

Maintenance and Cleaning

Cleaning - Nylon or polyester; if lanyards or harnesses need to be cleaned, they may be wiped down with a wet sponge, then washed with a soapy sponge using a brisk back-and-forth motion. Rinse completely with clear water and hang up to air dry avoiding exposure to high heat, steam, or long durations of sunlight.

Storage - Lanyards or harnesses should be hung up or placed loosely (in a container) in a clean, dry area free from exposure to harmful fumes or corrosive agents.

7.10 Training

Prior to using personal fall protection equipment, staff must be trained in Fall Protection and must be provided detailed instructions on the inspection and use of the equipment and all on-site work procedures.

Training required for employees working at height is identified below. At a minimum, the training will include instructions on the following functions:

- Work on scaffolds erected by others
- Wear and use personal fall arrest systems (refer to PPE procedure)
- Work on and/or operate Aerial Lift devices
- Work on and/or utilize fixed and portable ladders
- Work on roofs (where applicable)
- Work around unprotected walking/working surfaces such as unfinished mezzanines, etc.

People Requirements: Only properly trained personnel shall be permitted to perform Work at Height tasks.

Workers weighing above 300 pounds (lbs) must consult a qualified fall

protection engineer who can review the circumstances and establish procedures to control the free fall and/or provide additional equipment that will confirm that the energy absorber will not bottom out.

8.0 REFERENCES

- 29 CFR 1926 Subpart M
- 29 CFR 1910 Subpart F

9.0 REQUIRED RECORDS

- Completed Harness and Lanyard Inspection Forms will be kept with project files.

10.0 ATTACHMENTS

Attachment A – Harness Inspection Form

Attachment B – Lanyard Inspection Form

Attachment A
Harness Inspection Form

OP 585 - Fall Protection



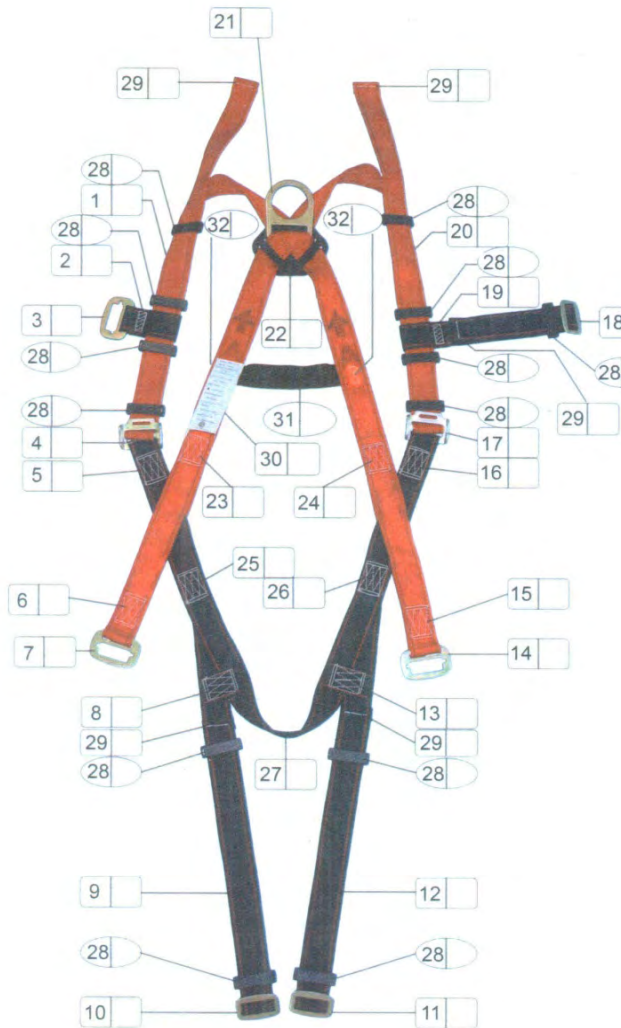
Harness Inspection Form

Designated Competent Person must inspect/document before initial use, and annually thereafter. The inspection must also be dated on the equipment tag. Defective equipment shall be removed from service and destroyed.

Project Name:	Project Number:	Project Location:
Date:	Inspection Completed By:	

Harness Information:	
Harness Manufacturer:	Manufacture Date:
Serial Number:	Harness Class:


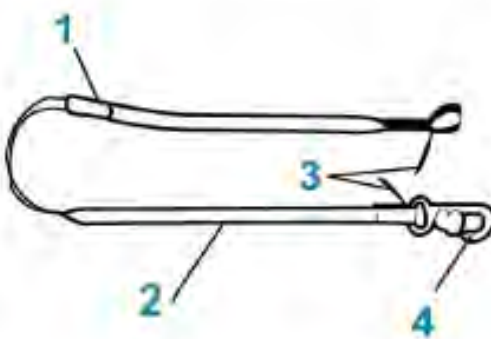
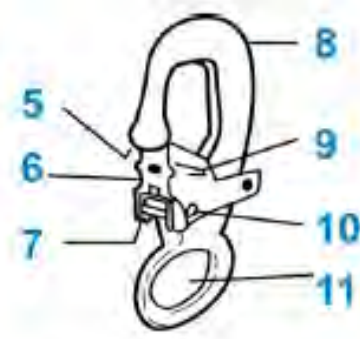

Inspection



	Description	Pass	Fail
1	Left Shoulder Webbing		
2	Stitching		
3	Mating Buckle		
4	Adjusting Buckle		
5	Stitching		
6	Stitching		
7	Mating Buckle		
8	Stitching		
9	Left Leg Webbing		
10	Mating Buckle		
11	Mating Buckle		
12	Right leg webbing		
13	Stitching		
14	Mating Buckle		
15	Stitching		
16	Stitching		
17	Adjusting Buckle		
18	Mating Buckle		
19	Stitching		
20	Right shoulder webbing		
21	Dorsal D Ring		
22	D-ring back pad		
23	Stitching		
24	Stitching		
25	Stitching		
26	Stitching		
27	Sub-pelvic strap		
28	Belt keepers		
29	Stitching – end pattern		
30	Product label		
31	Back Strap		
32	Stitching – back strap		
	Load Indicators		

Comments:

Attachment B
Lanyard Inspection Form

OP 585 - Fall Protection			 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>																																																																					
Lanyard Inspection Form																																																																								
Designated Competent Person must inspect/document before initial use, and annually thereafter. The inspection must also be dated on the equipment tag. Defective equipment shall be removed from service and destroyed.																																																																								
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CABRERA SERVICES
RADIOLOGICAL • ENGINEERING • REMEDIATION

OPERATING PROCEDURE

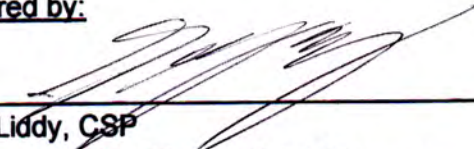
FOR

UTILITY CLEARANCE & ISOLATION

OP-589

**Revision 1
October 2013**

Prepared by:

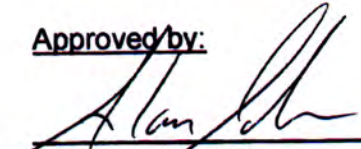


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

The purpose of this Operating Procedure (OP) is to establish requirements necessary to ensure that underground installations are properly identified before ground disturbing work commences and to outline requirements to be observed where overhead power lines are present on a job site.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Underground Utilities - All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling and communications, etc.
- 3.2 Ground Disturbance (GD) - Any indentation, interruption, intrusion, excavation, construction, or any other activity on the earth's surface and results in the penetration of the ground.
- 3.3 Overhead utility lines include:
- Overhead power lines
 - Structural cable supports
 - Guide wires
 - Cable television / communication lines

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

When contacted by equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc.

The following outline the requirements while performing operations that may lead to contact with aboveground or underground utilities:

- Always be aware of surrounding utilities.
- Confirm all equipment (i.e., boom, towers) is lowered prior to moving underneath of aboveground utilities.
- Confirm utilities are cleared and identified prior to beginning any intrusive operation. Contact the local utility service providers for

clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc. Contractor performing the actual work has the ultimate responsibility for this.

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

6.1 Project Managers (PM) and Field Site Manager (FSM) or designee (Site Safety & Health Officer – SSHO) responsibilities:

Ensure that all work, including the identification, location, and access to all underground and overhead utilities, is planned and performed in accordance with contract specifications and safety requirements.

Plan for associated work and avoidance of contacting utilities shall be part of the project safety planning in the Site Safety & Health Plan (SSHP).

Verify that all steps have been taken to identify existing underground and overhead utilities in the area to be disturbed.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Employees' responsibilities:

Apply appropriate precautions and work practices when working with, or within close proximity to utilities.

7.0 PROCEDURE

7.1 Underground Utility Lines

To avoid injury from electrical and other utilities on site, utility lines shall be located and marked prior to conducting any drilling or digging on site. If available, refer to site drawings or client interviews for information pertaining to utilities on site. Proper utility clearances must be obtained, and copies of all dig tickets (from all applicable agencies), maintained on-site prior to the commencement of any intrusive operations.

Types of underground lines:

- Gas line

- Potable water line
- Raw water line
- Sewer line
- Power line
- Cable television/communication/fiber optic line
- Cathodic protection lines
- Grounding cable
- Process piping/flow line

7.2 Surface Markings

Color-coded surface marks (paints or similar coatings) shall be used to indicate the type, location, and route of buried installations. Additionally, to increase visibility, color-coded vertical markers (temporary stakes or flags) shall supplement surface marks.

All marks and markers shall indicate the name, initials, or logo of the company that owns or operates the installation and the width of the installation if it is greater than two inches.

If the surface over the buried installation is to be removed, supplemental offset marking shall be used. Offset markings shall be on a uniform alignment and shall clearly indicate that the actual installation is a specific distance away.

Uniform Color-Coding

To control hazards associated with coming in contact with such installations, the American Public Works Association's (APWA) guidelines for the uniform identification of underground installations has been adopted. The colors and corresponding installation type are as follows unless otherwise contract-specified:

- Red: Electric Power Lines, Cables, Conduit, and Lighting Cables
- Yellow: Gas, Oil, Stream, Petroleum, or Gaseous Materials
- Orange: Communication, Alarm or Signal Lines, Cables, or Conduit
- Green: Sewers and Drain Lines

- Purple: Non-potable Water
- Pink: Temporary Survey Markings
- White: Proposed Ground Disturbance area

7.3 Identification of Installations

Extreme caution shall always be exercised when attempting to locate underground utilities. The location of utilities can be in some cases not be consistent with site drawings or plans, as indicated by the placement of surface signage, or as described by personnel. Coordination and planning of the job shall be required with the client or site owner.

One Call System

The One Call System Directory or equivalent shall be used as the first step to prepare for ground disturbing work. The One-Call system (811) provides a listing of public utilities that may be present in the proposed work area and will be marked accordingly. In order to give line operators sufficient time to respond to a request to locate, a minimum waiting period of 72 business hours is required prior to beginning work.

Private Utility Clearances

Privately owned utilities on a project site are not part of the One Call System. Examples include power to light poles/fixtures and storm water and potable water lines. As such, a third party, independent verification contractor, should be obtained to assist in marking out the privately owned underground utilities.

As-built drawings (if available) should be obtained from the property owner or client to help facilitate marking out privately owned utilities. Most private utility clearance companies will utilize a combination of Ground Penetrating Radar (GPR) or electromagnetic locating equipment to identify the locations of the utilities.

Department of Defense (DOD) facilities and sites (or similar), may require base/location specific dig permits to be obtained prior to starting ground disturbing work. The PM is responsible for verifying the need to obtain these permits prior to commencing intrusive work.

Visual Verification

Even after dig tickets and private clearances/permits have been obtained, the potential still exists to encounter undocumented utilities during intrusive activities. Prior to commencing operations, the designated competent person(s) for the task, along with the SSHO, should attempt to visually identify

the presence of such previously undocumented infrastructure. Several potential indicators are as follows:

- Look for warning signs where pipelines cross roads or water courses.
- Look for manholes and other surface obstructions. If possible, open manhole and attempt to identify orientation of lines entering/exiting.
- Look for cut lines, wells, tanks, or valves that may indicate the presence of pipelines.
- Look for ground settling from previous work.
- Talk to nearby landowners and residents.
- Look for vegetation appearing “different” from the surrounding vegetation (e.g., greener, taller, shorter, or more brown than surrounding vegetation).

Soft Dig Techniques

Where a line placement and depth is known or suspected and where there is potential for contact, soft dig techniques (hand digging or air knifing/vacuum extraction) shall be used. Additionally, all underground utilities within 5 feet (1.6 m) of a planned disturbance, or within the distance required by the owner of the utility, will be exposed via soft dig techniques before operating any mechanized equipment.

When utilizing soft dig techniques, proceed with caution, as hand tools may still damage utilities (shovels, picks, digging bars).

Once the underground installation has been identified, proper surface markings shall be made in accordance with the American Public Works Association (APWA) guidelines or as contract-specified. Document the exact location in a field log book, and include measurements from adjacent structures, adequate enough to allow you to relocate if necessary.

In summary, typical utility identification/isolation process for underground utilities is as follows:

- Obtain One Call Ticket
- Obtain private utility mark-out or base/location permit
- Perform visual identification/location in field
- Hand clear or air knife within 5 feet of utility mark-outs

- Proceed with ground disturbing activities using spotter.

7.4 During ground disturbance:

Various forms of underground utility lines or pipes may be encountered during deployments to field sites. Damaged utilities, in particular, can present other hazards including asbestos, explosion, electric shock, scalding, etc. The presence of damaged utilities at any work location shall be immediately brought to the attention of the Field Site Manager or SSHO.

Guidance will be provided on the appropriate action to be taken, which could include suspension of work until the responsible utility agency and/or owner is contacted and the hazard is either isolated or eliminated.

All underground installations shall be considered “live” and “operational” until the owner, client, or utility authority isolates any hazardous energy or deactivates the system and can demonstrate that condition.

If an underground utility is struck, stop the work immediately and notify the Project Manager and OH&S Manager. Notification will also be required to the owner or client responsible for the facility or site at which the work is occurring. The owner or client shall be informed of the location of the contact and the type of damage that resulted.

If the utility is a pipeline, the company (client) shall immediately notify the required agencies and regulatory bodies of the location of the contact and the type of damage that resulted.

7.5 Overhead Utility Lines

An appropriate distance must be kept between equipment and overhead utility lines, especially overhead power lines (Refer to table for Minimum Safe Work Distances from Overhead Power Lines). Operation of heavy equipment and cranes in areas with overhead power lines represents a significant hazard to all personnel on the job site. Accidental contact with an energized line or arcing between a high power line and grounded equipment can cause electrocution of equipment operators or nearby ground personnel, and damage to power transmission and operating equipment.

Although maintaining a safe distance from all energized lines is the preferred means for control of this hazard, site conditions may not always accommodate this. If work will (or may) occur within 50 feet of any energized line, the procedures outlined below will be observed.

Overhead power lines will be identified on each job site before the work commences. For each identified line, the PM/FSM must determine whether it is energized (and the operating voltage for energized lines), and whether work

activities will require use of heavy equipment (excavators, loaders, cranes, etc.) within 50 feet (15.25 meters) of the line. Unless verified, it will be assumed that all lines are energized.

Contact with the utility (power line) owner shall be completed before commencement of operations, and/or before equipment is operated within 50 feet (15.25 meters) of an energized overhead power line. The purpose of this contact is to:

- Determine the voltage of the power line, and
- Establish the appropriate safe limit of approach distance as identified by regulations.

Safe working distance is the minimum distance that must be maintained between any energized electrical line and any part of the operating equipment to maintain adequate safety margins and is based on the line voltage of the power line. The table below lists the line voltages in kilovolts and the Minimum Safe Work Distance as required in the United States. The following safe working distance criteria will be applied for all Cabrera operations:

**Minimum Safe Work Distances
from Overhead Power Lines**

Line Voltage (Kilovolts)	Minimum Safe Working Distance
0 – 50	10 feet
>50 – 200	15 feet
>200 – 350	20 feet
>350 – 500	25 feet
>500 – 750	35 feet
>750 – 1,000	45 feet

- Source: American National Standards Institute, Publication B30.5.

Field Site Managers or designee (SSHO) will notify equipment operators and employees of the presence of overhead lines before work commences.

Employees must not place material under or beside an overhead power line if doing so reduces the safe clearance to less than the safe limit of approach distances.

To maintain minimum safe clearances:

- Install warning devices and signs (hang a sign from and mark all guide wires to warn traffic of low clearance; provide warning signage for all overhead services).
- Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearances for the line voltage.
- Position signs or other devices to determine the “Danger Zone.”
- Inform all on-site staff with the on-site clearances required.
- Beware of atmospheric conditions, such as temperature, humidity, and wind, which may require more stringent safety procedures.

Under no circumstances will any object pass closer than 10 feet (3 meters) to any energized, electrical line.

7.6 Acceptable Safety Procedures for Overhead Utilities

When any work task does not allow the minimum safe working distance to be maintained at all times, an alternate means of protection must be identified and approved by the OH&S Manager. In order of preference, acceptable procedures are:

- De-energize the power line(s)/lockout by local utility authorities
- Install insulated sleeves on power lines
- Assign line spotters to assist the equipment operator

De-energize Power Lines

Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site power lines are under the control of the site manager (and can be de-energized locally), electrical distribution and transmission lines can be de-energized only by the owner of the line (generally the local electrical utility). Therefore, de-energizing a line requires advance coordination with the line owner; generally, at least one week advance notice should be provided.

Install Insulating Sleeves

Insulating sleeves can be placed over power lines to provide a contact and arcing barrier if work must occur closer to the power lines than the accepted safe work distance. Although not as desirable as line de-energizing, the use of these sleeves can provide an acceptable alternative where electrical lines are required to remain in service.

As with de-energizing of distribution and transmission lines, placement of insulating sleeves can be performed only by the line owner. This requires advance coordination with the line owner; generally, at least one week advance notice should be provided. To install the sleeves, representatives of the line owner will require access to the job site.

Assign Line Spotters

A line spotter is a person located at ground level who is assigned to observe equipment operations, with the specific duty of assisting the equipment operator to ensure that no part of the equipment gets too close to an energized, unprotected electrical line.

Personnel assigned to act as line spotters must meet the following requirements:

- While acting as a line spotter, no other duties may be performed (e.g., the line spotter cannot also act as the load spotter during lifting operations).
- The spotter will have a radio or other direct means of communicating with the equipment operator at all times.
- The spotter will be positioned at a right angle to the equipment operator's line of sight to maximize the sight angles between personnel.
- Under no circumstances will any portion of a piece of equipment pass closer than 10 feet to any energized electrical line.

Additional Safety Measures

The following additional safety measures can be implemented as needed when working around energized power lines:

- Provide equipment with proximity warning devices. These provide an audible alarm if any part of the equipment gets too close to a line.
- Install ground safety stops. These prevent vehicles from accidentally entering hazardous areas.
- Equip cranes with a boom-cage guard. This prevents the boom from becoming energized if an electrical line is contacted.
- Utilize insulated links and polypropylene tag lines. These prevent the transmission of electricity to loads or tag line handlers if an electrical line is contacted.

NOTE: These additional safeguards are intended as supplemental protection. Use of these measures is not permissible as a substitute for maintaining the safe working distance or implementation of the procedures herein.

7.7 Overhead Utility Incidents

If an electrical power line is hit or an electrical arc occurs:

- All ground personnel must evacuate IMMEDIATELY to a distance of at least 50 feet (15.25 meters). DO NOT attempt to rescue any injured person until the line has been de-energized.
- The operator should remain in the cab until the line can be de-energized and should carefully try to extricate the equipment from the power line. This may not be possible where melting of insulator material or metal has occurred.
- If the operator must evacuate while the line is still energized (because of fire or other life-threatening condition) he/she should jump clear of the equipment (making sure to avoid touching the equipment and the ground simultaneously), and land upright and with both feet together. Once on the ground, proceed in a direct line away from the equipment using a short, shuffling gait (feet touching, sliding each foot no more than 1 foot forward at a time) to minimize shock hazard from electrical energy being transmitted through the ground.
- Contact the line owner to report the line contact and request that the line be de-energized immediately.
- Once the line has been confirmed to be de-energized, the operator can safely evacuate the cab and rescue can commence for any injured personnel.
- Contact the PM and OH&S Manager immediately to report the incident and implement any instructions provided.

8.0 REFERENCES

- American Public Works Association, Excavator's Damage Prevention Guide and One-Call System Directory International 1990-1991, Utility Location and Coordination Committee
- 29 CFR 1926 Subpart: CC, Cranes & Derricks in Construction, Parts 1407 through 1411, Power line safety
- American National Standards Institute, Publication B30.5

9.0 REQUIRED RECORDS

- All utility clearance tickets, and site specific dig permits, will be kept with project files.

10.0 ATTACHMENTS

None.



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE


FOR

FORKLIFTS

OP-592

**Revision 1
October 2013**

Prepared/Reviewed by:

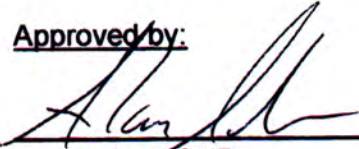


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the safe working requirements for operations and maintenance of forklift trucks.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc (Cabrera) employees and operations.

3.0 DEFINITIONS

3.1 Forklift - Powered industrial truck or truck.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

Only properly trained and authorized personnel shall operate forklifts. Operators must provide proof of competency.

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Implementation of this procedure for supervised employees.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Operator's responsibilities include:

Complete the Forklift Inspection Form, prior to daily use to ensure that truck systems are fully functional (e.g., brakes, lights, horn, operations).

Shall not allow unauthorized personnel to ride on the trucks.

Shall not operate the truck carrying loose items, tools or other equipment in the cab.

Do not drive or attempt to lift or lower loads with vision obstructed without the assistance of an attendant.

Slow down and sound the horn at intersections and where vision is obstructed.

Use a safe speed of not more than 5 miles (8 km) per hour.

Ride in reverse if the load obstructs forward view; paying close attention to the swing radius of the forks when turning.

When leaving a truck unattended, lower forks to ground level, neutralize controls, shut power off, and set brakes. Wheels should be chocked if parked on an incline; never leave a truck unattended with a suspended load.

Never allow ground personnel to stand under a suspended load.

Maintain a safe distance from the edge of ramps or platforms.

Use a load backrest extension to prevent load from falling backward. Only stable or safely arranged loads should be handled. Lift only loads that are within the rated capacity of the truck.

Use seat belt if forklift truck is so equipped.

Never use the truck for anything other than what it was designed for.

7.0 PROCEDURE

7.1 Operations

The forklift will be inspected at the start of the day using the Forklift Inspection Form (Attachment A).

If at any time a powered industrial truck is found to be in need of repair, defective, or in any way unsafe, the truck shall be taken out of service until it has been restored to a safe operating condition.

Trucks shall not be driven up to anyone standing in front of a bench or other fixed object to avoid a serious crushing injury.

No person shall be allowed to stand or pass under the elevated portion of any truck, whether loaded or empty.

Unauthorized personnel shall not be permitted to ride on powered industrial trucks.

Arms or legs shall not be placed between the uprights of the mast or outside the running lines of the truck.

When a powered industrial truck is left unattended, load engaging means shall be fully lowered, controls shall be neutralized, power shall be shut off, and brakes set. Wheels shall be chocked if the truck is parked on an incline.

A safe distance shall be maintained from the edge of ramps or platforms while on any elevated dock, or platform or freight car. Trucks shall not be used for opening or closing freight doors.

There shall be sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.

An overhead guard shall be used as protection against falling objects. It should be noted that an overhead guard is intended to offer protection from the impact of small packages, boxes, bagged material, etc., representative of the job application, but not to withstand the impact of a falling capacity load.

A load backrest extension shall be used whenever necessary to minimize the possibility of the load or part of it falling rearward.

Trucks shall not be parked so as to block fire aisles, access to stairways, or fire equipment.

If forklift equipment is used to lift a personnel platform, other requirements are necessary, including:

- As with all aerial lift equipment, employees shall be secured to the anchorage point with a full body harness and fall arrest system.
- The platform shall have a full railing system on all four (4) sides.
- The lift equipment shall be capable of supporting the weight of the platform, personnel and equipment to be used.
- The platform shall be designed for positioning personnel.
- The platform shall be secured to the lift equipment in addition to the support provided by the forks.
- Employees shall be trained to use the platform and regarding fall protection.
- If the equipment is operated by a separate operator and not by employees within the platform, coordination between the operator and employees shall be established.

See OP 590, Elevated Work Platforms.

7.2 Loading

Only stable or safely arranged loads shall be handled. Caution shall be exercised when handling off-center loads which cannot be centered.

Only loads within the rated capacity of the truck shall be handled.

The long or high (including multiple-tiered) loads which may affect capacity shall be adjusted.

Trucks equipped with attachments shall be operated as partially loaded trucks when not handling a load.

A load engaging means shall be placed under the load as far as possible; the mast shall be carefully tilted backward to stabilize the load.

Extreme care shall be used when tilting the load forward or backward, particularly when high tiering. Tilting forward with load engaging means elevated shall be prohibited except to pick up a load. An elevated load shall not be tilted forward except when the load is in a deposit position over a rack or stack. When stacking or tiering, only enough backward tilt to stabilize the load shall be used.

7.3 Training

Training will be provided by a qualified trainer with the knowledge, training, and experience to train operators and evaluate their competence.

All operators must successfully complete training according to the regulatory requirements before being allowed to operate a powered industrial truck.

Training is to consist of a combination of formal instruction and demonstration performed by the trainer; practical exercises performed by the trainee, and documented evaluation of the trainee's performance.

Training will include the following topics:

- Operating instructions, warnings, and precautions for the types of truck the operator will be authorized to operate.
- Differences between the truck and the automobile.
- Truck controls and instrumentation, where they are located, what they do, and how they work.
- Engine or motor operation.
- Steering and maneuvering.
- Visibility (including restrictions due to loading).
- Fork and attachment adaptation, operation, and use limitations.

- Vehicle capacity.
- Vehicle stability.
- Vehicle inspection and maintenance.
- Refueling and/or charging and recharging of batteries.
- Operating limitations.
- Any other operating instructions, warnings, or precautions listed in the operator's manual for the types of vehicle that the employee is being trained to operate.
- Surface conditions where the vehicle will be operated.
- Composition of loads to be carried and load stability.
- Load manipulation, stacking, and unstacking.
- Pedestrian traffic in areas in which the vehicle will be operated including narrow aisles and other restricted places where the vehicle will be operated.
- Hazardous (classified) locations where the vehicle will be operated.
- Ramps and other sloped surfaces that could affect the vehicle's stability.
- Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a buildup of carbon monoxide or diesel exhaust.
- Other unique or potentially hazardous environmental conditions in the workplace that could affect safe operation.

Refresher Training and Evaluation

Each forklift operator's performance will be evaluated once every three years or more frequently if required by regulation. Refresher training will be provided in the following circumstances:

- Operator has been observed to operate the vehicle in an unsafe manner.
- Operator has been involved in an accident or near-miss incident. (Note: complete a Near Miss or Incident Report).

- Operator has received an evaluation that reveals that the truck is not being operated safely.
- Operator is assigned to drive a different type of truck.
- A condition in the workplace changes in a manner that could affect safe operation of the truck.

Company Certification

For in-house training on the safe use of Forklifts, the OH&S Manager will verify that the operator has been certified through training and evaluation. The certification will include the name of the operator, the date of the training, the date of the evaluation, and the identity of the person performing the training or evaluation.

8.0 REFERENCES

- 29 CFR 1910.178, Powered Industrial Trucks
- 29 CFR 1926 Subpart W, Rollover Protective Structures

9.0 REQUIRED RECORDS

- Completed Forklift Inspection Forms will be kept with project files.

10.0 ATTACHMENTS

Attachment A – Forklift Inspection Form

Attachment A
Forklift Inspection Form

OP 592 - Forklifts



Forklift Inspection Form

Operator must inspect/document equipment when it is put into service, using this form. Equipment must be inspected prior to each use by the operator.

Project Name:	Project Number:	Project Location:
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Operator:	Make/Model:	
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Week of:	Monday			Tuesday			Wednesday			Thursday			Friday		
Hour meter reading:															
Check the following as appropriate	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A
1. Operator qualified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Overhead guard (ROPS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Horn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Brakes (service and park)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Steering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Engine Oil level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Hydraulic oil level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Radiator fluid level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Major fluid leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Windows/Wipers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Backup alarm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Tires (visual)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Seat belts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Fuel leaks (lines secure)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Fire extinguisher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Electrical lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Exhaust components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Load Rating Plates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Forks and Mast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Load back extension	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Chain lubricated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SAT – Satisfactory, UNSAT – Unsatisfactory, N/A – Not Applicable

Comments/Remarks:



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

OPERATING PROCEDURE

FOR

HAZARDOUS ENERGY CONTROL

OP-593

Revision 1
October 2013

Prepared/Reviewed by:

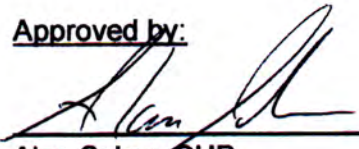


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the requirements for employees to perform hazardous energy control (equipment lockout and tagout (LOTO)) operations. Work is regulated by this procedure when:

- An unexpected energization or start-up of machines and/or equipment would result in the release of stored energy which could cause injury to an employee.
- Any employee (or contractor) is required to remove or bypass a guard or other safety device.
- Any employee (or contractor) is required to place any part of his body into the mechanism of a piece of equipment or path of hazardous energy.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc. (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Affected Employee - A trained person whose job requires him/her to operate or use a machine or piece of equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.
- 3.2 Authorized Employee - A person who locks out or tags out a machine or piece of equipment in order to perform servicing or maintenance on that machine or equipment.
- 3.3 Cord and Plug-connected Equipment - Equipment where the only energy source is electrical power provided by a plug-in connection.
- 3.4 Energy Source - Any electrical, mechanical, hydraulic, pneumatic, chemical, radiation, thermal, or compressed gas energy source; energy stored in springs; and potential energy from suspended objects (gravity) that may injure personnel, cause property damage, and/or cause a release of hazardous substance to the environment.
- 3.5 Energized - Connected to an energy source or containing residual or stored energy.
- 3.6 Energy-isolating Device - A mechanical device that physically prevents the transmission or release of energy. This includes locks, hairpins, tongs,

lockable valves, clamshell devices for valves, blank flanges for piping systems, and restraining devices to prevent movement of parts.

- 3.7 Energy Source - Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.
- 3.8 Isolation - A physical activity using a device which prevents the transmission or release of energy. Examples of devices used to isolate equipment/systems include, but are not limited to restraint blocks, electrical circuit breakers, disconnect switches, fuses, slip gates, slip blinds, or double valves. Control circuit devices, motor controllers, etc., are not acceptable isolation devices.
- 3.9 Locking Device - A device that utilizes a lock, key, and identification number to hold an energy isolation device in the safe position for the purpose of protecting personnel.
- 3.10 Lockout - The use of a locking device to ensure that an energy-isolating device and the equipment it controls cannot be operated until the lockout device is removed.
- 3.11 Lockout/Tagout (LOTO) Specific Procedure - A written procedure developed specifically for each piece of machinery or equipment capable of unexpectedly releasing energy. This procedure outlines in detail how lockout/tagout will be performed.
- 3.12 Normal Production Operations - The utilization of a machine or piece of equipment to perform its intended production function.
- 3.13 Servicing and/or Maintenance - Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment, and making adjustments or tool changes where employees could be exposed to the unexpected energization or start-up of the equipment or a release of hazardous energy.
- 3.14 Tagout - The use of a warning device to establish that an energy-isolating device and the equipment it controls may not be operated until the tagout device is removed.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

UNAUTHORIZED REMOVAL OF A LOCKOUT/TAGOUT DEVICE WILL
RESULT IN IMMEDIATE DISMISSAL FROM THE PROJECT SITE AND
POTENTIAL TERMINATION!

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Determining whether employees will be responsible for implementing any required lockout/tagout of energy sources at client facilities

Consulting with the OH&S Manager regarding project specific requirements for lockout/tagout.

Informing the field team about the client or facility's requirements for lockout.

Ensuring that only authorized employees work on or near equipment requiring hazardous energy control.

Assuring that the written LOTO procedure in effect on a project is audited at least annually including the observation of workers performing the procedure.

Assure that all employees under their direction are fully aware of, understand, and adhere to the Lockout/Tagout procedures.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Authorized Employees:

Verifying with the Project Manager who is responsible for LOTO.

Obtaining a lock, key and tags.

Meeting with the facility representative and affected employees to review the LOTO activities.

Implementing project specific LOTO procedures.

6.4 Affected Employees:

Assist Authorized Employees with the safe shutdown and restart of equipment.

Assure that no attempt is made to restart equipment without the knowledge of all employees performing work on the equipment.

6.5 All Employees:

Refrain from making any attempt to restart equipment that is locked or tagged out.

Avoid areas where other employees are working on equipment.

7.0 PROCEDURE

7.1 General Procedures

Energy control means to neutralize and make inoperable all potential sources of energy or power in the equipment or machinery to be worked on. No part of the equipment should be capable of inadvertent activation or movement, which may lead to personal injury. Removing a fuse, closing a valve or turning a switch is not an acceptable isolation from the energy source.

Only staff orientated to the lockout/energy control procedure will be involved with the locking out, de-energizing and control of all potential sources of energy on energized systems.

Written procedures for lockout and energy control shall be developed and approved by the Field Site Manager (FSM) (or SSHO) or Client and must be implemented prior to performing work. Where the procedures are affected by the facilities or workers of the Client, procedures will follow the requirements of and be approved by the Client.

The site, project or Client specific procedures must be understood and followed for the health and safety of all workers affected by or involved with the locking out, de-energizing and control of all potential sources of energy prior to the performance of work on energized systems.

Be aware of all potential energy sources, such as:

- Chemical
- Hydraulic
- Electrical
- Mechanical
- Residual
- Gravitational
- Pneumatic

- Thermal
- Radiological

The supervisor must also identify and communicate to all on-site personnel how the sources of energy will be isolated, brought to a zero energy state, locked out of service and tested to verify the effectiveness of the controls.

7.2 Padlocks and Danger Tags

Where there is a danger of equipment being energized, the motor switch on all individual motor drives shall be locked in the open position.

It shall be the responsibility of each employer to maintain an adequate supply of safety locks.

Each worker affected shall affix their own individual lock.

In addition, a danger tag shall also be applied to the lockout bearing the following information:

- Brief description of the work being done
- Company name
- Worker's name
- Supervisor's name
- Date
- Phone number.

The tag and locks shall remain in place until the work has been completed.

Where a lock has been abandoned or must be removed due to an emergency, the FSM/SSHO or Client contact must be notified and the removal must follow the approved lock abandonment procedure.

LOTO of energy sources must be performed only by an Authorized Employee. If more than one employee is involved, either each individual Authorized Employee must use his/her own lock (multiple lockout), or a group lockout may be performed by the employees' supervisor/foreman.

The locks, tags, and equipment shall not be tampered with by any employee.

Only the person placing the lock and tag the equipment may remove the lock and tag.

If the employee who placed the lockout/tagout device/sign subsequently no longer works for the company, or cannot be located, only the authorized supervisor/foreman can remove the locks and tags in accordance with the procedure outlined below for Removal of Unattended Lockout/Tagout Devices.

7.3 Specific LOTO Procedures

Written procedures will be developed for the lockout and tagout of each piece of equipment that has potentially hazardous energy sources (Attachment A – LOTO Procedure Form).

Each procedure must be reviewed and approved by the SSHO and/or OH&S Manager prior to implementation.

Equipment-specific written lockout/tagout procedures are not required, if ALL of the following conditions are met:

- The equipment's only energy source is electrical; and
- The unexpected start up of the equipment is controlled by unplugging the equipment from the electrical source; and,
- The plug or switch is under the exclusive control of the person performing the work.

Additionally, equipment-specific Lockout/Tagout procedures are not required if ALL of the following apply:

- The machine has no potential for stored or residual energy, or re-accumulation of stored energy after shutdown (i.e. contains a capacitor to store electrical energy or pressurized tank to store air/gas); and,
- The machine has a single energy source that can be readily identified and isolated (if more than one energy source is present (e.g., gas and electric), then written procedures shall be developed); and,
- The isolation and locking out of the single energy source completely de-energizes and deactivates the equipment; and,
- Servicing of the machine requires that its energy source must previously have been locked out and tagged out in accordance with this section; and,
- A single lock-out device achieves a locked-out condition.

Procedure Outline

All equipment-specific Lockout/Tagout procedures will be prepared to meet the following steps:

- Identify type and magnitude of energy.
- Notify affected employees that the machine/equipment will be shut down and locked out for servicing.
- Shut down machine/equipment by normal stopping procedure.
- Identify all energy-isolating device(s) for the machine or equipment being serviced.
- Lock out each device with individual locks. Tag out only if a device is not capable of being locked out.
- Relieve or restrain stored and/or residual energy.
- Verify the isolation of equipment and its zero energy state (attempt to restart the equipment.)
- Establish that energy to the equipment being worked on was isolated.
- Perform work.
- Check work area to remove non-essential items and ensure equipment components are intact.
- Check work area to ensure all personnel are removed from the area.
- Verify that the controls are in neutral (off).
- Remove lockout device(s).
- Notify affected employees that the machine/equipment is ready for use.
- Reenergize the machine or equipment.

7.4 Non-Specific LOTO Procedures

In the absence of an equipment-specific LOTO procedure, the following procedures, in combination with a completed Activity Hazard Analysis, can be used as an acceptable substitute. For all operations, the basic steps/approach outlined above (Procedure Outline) for Equipment Specific Procedures, should

be followed.

Process Equipment

Determine what energy sources are present, such as electrical, gas, pressurized systems (e.g., steam, water, and hydraulics), heated fluids or gas (e.g., steam, hot water), and gravity (e.g., presses, elevated vehicles).

Determine which of these sources requires isolation to perform the work.

Determine the locations where each energy source for that piece of equipment can be turned off/isolated AND be locked out. For example, if a machine has an on/off button, pushing the button to the off position is not sufficient isolation, since the button cannot be locked out. You must then either unplug the equipment or find, close, and lock out the circuit breaker or electrical switch supplying the machine.

Make sure anyone in the area knows you are about to turn off and lock out the equipment, and then close the isolation devices. Once closed, lock out the isolation devices so they cannot be inadvertently opened.

Place an appropriate tag on each lock out device, with the appropriate warning (e.g., Do Not Open, Do Not Start) with date and time of isolation and a means of identifying who has performed the lockout.

Once everything is locked out, verify that the isolation was successful by following manufacturers' directions or standard trade practice. Means of determining whether isolation was successful include:

- Try to turn the equipment on.
- Use pressure relief valves.
- Try to ignite the pilot light.

If additional work is required (e.g., repair of leak, fine tuning of work), the lockout/tagout procedure must be re-established. Under no circumstances shall work be performed on the equipment without prior isolation of the energy sources.

High Voltage Electrical Systems

In general, Cabrera personnel will provide lockout/tagout services in low voltage situations only (voltage is below 600 volts). For high voltage situations (above 600 volts), Cabrera will either subcontract operations to an electrical subcontractor or obtain approval of the equipment-specific Lockout/Tagout procedure from the OH&S Manager. If an electrical subcontractor is utilized,

they will be required to provide documentation of their high voltage certification.

Low Voltage Procedure

Make sure the equipment to be worked on is turned off.

Locate the source of the electrical supply and isolate the equipment. This can be accomplished by:

- Turning the appropriate circuit breaker off.
- Unplugging the equipment.
- Disconnecting the source from the battery (e.g., pulling cables from automotive batteries).
- Lock the isolation circuit in the closed position using an appropriate locking device and a unique lock and key system.
- Tag the locked-out circuit. The tag used shall warn against the hazard (e.g., Do Not Start), and include a means of identifying the employee who installed the tag and lock.

Go back to the equipment and try to turn it on to ensure that the proper source has been isolated. If the machine turns on, reverse the above steps, and start again until the proper circuit is isolated. Report the incident to the FSM or SSHO as a serious near miss and do not perform the task until proper isolation is performed and verified. The FSM or SSHO is responsible for developing the written procedure for LOTO of this equipment prior to authorizing re-work on it.

Upon completion of the work, inspect the area to ensure all tools and parts are removed. If tools or parts are noticed after the energy source is no longer locked out, all steps **MUST** be performed again prior to retrieval of the tools/parts. Under no circumstances shall the items be retrieved without the equipment being locked out.

Pressurized Water or Air/Gas

Turn the appropriate valve upstream from the area of work to the off position (closed). Note: if steam or water can enter the pipe from the normal downstream side, either verify that the check valve is operating properly, or ensure that all necessary valves have been closed to stop all fluid or steam flow into the section to be worked. If this procedure is being used in preparation of Confined Space Entry, positive isolation (i.e. line break, blind plate, or double-block and bleed) must be established on both sides prior to

authorizing confined space entry.

Using the appropriate device, lock the valve(s) in the closed position using a unique lock and key.

Tag the locked-out valve(s). The tag shall warn against the hazard (Do Not Open) and include date and time of isolation and a means of identifying the employee who installed the lock and tag.

Allow the system to be worked to cool down (in the case of steam or hot water).

Relieve the pressure in the system and then drain any fluid from the system. If the system is not equipped with a pressure relief or drain system, make sure the pipes are cool to the touch and slowly open and drain in accordance with standard trade practice.

Once the system has been bled to atmospheric pressure, the pipes or lines shall be disconnected, blinded, or closed by a valve and locked out and/or tagged accordingly. Observe line entry procedures when first opening the line.

Once work is complete and locks/tags removed, slowly open the valve, stopping when water or steam flow has started. Observe the work performed to make sure no leaks are evident. If there are no leaks, then the valve can be completely opened. If leaks are observed, then re-close the valve, and follow steps above to reapply the LOTO to the system.

Natural Gas Lines

Turn off the valve upstream from the area to be worked.

Using the appropriate device, lock the valve in the closed position using a unique lock and key.

Ensure all spark sources in the area have been isolated or removed.

Using non-sparking tools, remove the remaining gas in the line using standard trade practice. If in an enclosed area, make sure appropriate ventilation is present. If the flow of gas does not stop, then shut down the next upstream valve, or the gas main valve. Each additional valve closed must be locked out and tagged out.

Perform the required work. If hot work is necessary (i.e. soldering, grinding, welding), make sure the line has been purged of gas and that the hot work requirements of this manual are followed, including explosivity check prior to authorizing work.

Make sure that all connections are secure. Also, have a solution of soap and

water for leak testing. Once work is complete and locks/tags removed slowly crack open the valve(s) and test the work area for leaks using the soap solution. If leaks are detected, the system must be locked out and tagged out following steps above before additional repairs can be made. If no leaks are detected, gradually open the isolation valves to their normal position.

7.5 Authorized Employees

Only employees that have completed training for Lockout/Tagout Authorized Employees will be permitted to perform work under Lockout/Tagout procedures.

Each Authorized Employee will also be responsible for reviewing any applicable equipment-specific Lockout/Tagout procedure prior to initiating work.

Any problems identified with the equipment-specific procedure are to be immediately reported as an incident or near miss and should be brought to the attention of the OH&S Manager and all work on affected equipment halted.

7.6 Shift Change Procedures

If ongoing work requires carryover from shift to shift, or transfer of responsibility between employees, the following procedure will be implemented:

- The employee(s) who originally performed the lockout shall walk through the lockout/isolation steps with the new worker.
- At each isolation point the original worker shall remove his/her lockout/tagout device(s), to be immediately replaced by the new worker's device(s).
- Upon transfer of the lockout/tagout equipment, the new employee shall verify that the equipment is still isolated prior to continuation of work.
- Under no circumstances shall the original devices remain in place and just the keys transferred.

For supervisor/foreman and/or group lockouts, the same procedure shall be used with the oncoming supervisor/foreman.

7.7 Removal of Unattended Lockout/Tagout devices

Only the person(s) who placed the lockout/tagout devices on the system can remove the devices, unless:

- The FSM has verified that the employee is not on site and is not available to return to the site to remove the lock.
- All reasonable efforts have been made to contact the employee to verify that the work is complete and the devices are about to be removed.
- The FSM inspects the locked-out/tagged-out device and ensures that the equipment is capable of being safely re-energized.

If all of the above apply, the locks and tags can be removed at the direction of the FSM.

7.8 Emergency Lock Removing Procedures

This procedure will ONLY be used in an emergency situation defined as an event that may cause injury, fire, explosion, over exposure or other hazards to the general public, the environment or personnel.

In an emergency event that requires a lock or tag to be removed by a person other than the person who placed the lock or tag, the following lock-removing procedure will be implemented by another Authorized Employee:

Investigate and verify that all equipment and material in relation to the work has been completed and/or put into a safe configuration.

Ensure all personnel have been removed from the hazardous location and Affected Employees on site are notified.

Attempt to contact the person that originally provided LOTO to advise him that the LOTO has being removed.

Whenever a LOTO is removed for emergency purposes by anyone other than the employee who placed the LOTO, that person and all affected personnel must be contacted prior to the start of their next shift to inform them that the equipment/system is no longer locked out/tagged out.

7.9 Annual Program Review

At least annually (or whenever any incident or serious near miss occurs due to inadequate lockout/tagout) , an independent Authorized Employee who is not involved in the procedure being inspected must conduct and document a review and inspection of the Hazardous Energy Control Procedure specific to the identified facility. The inspection should include a meeting with authorized employees and any other affected employees.

The inspection procedure must include the following elements:

- Where lockout is used, discuss the authorized employee's responsibilities under the lockout/tagout program with the inspector.
- Hold group meetings with the authorized employees who are performing the inspection and all authorized employees who implement the procedure.
- Where tagout is used, discuss the authorized employee's responsibilities under the lockout/tagout program and the limitations of the tagout system.
- Review of lockout/tagout verification checklists and other documentation to ensure procedure is being correctly followed and documented.

If deficiencies are noted during the inspection, corrective actions and retraining of employees, as necessary, must be performed immediately.

The inspector shall provide a copy of all inspection documentation to the OH&S Manager for review and filing.

These inspections shall at least provide for a demonstration of the procedures and may be implemented through random audits and planned visual observations. These inspections are intended to ensure that the energy control procedures are being properly and consistently implemented.

7.10 Training

Authorized Employees

Authorized Employees involved in or affected by lock out will be trained in the following areas before being allowed to work on equipment requiring LOTO:

- Recognition of hazardous energy sources;
- Types and magnitudes of energy sources located in the workplace;
- Procedures for energy isolation and control, including specific procedures developed for specific equipment and systems;
- Purpose and use of the energy-control (lock out/tag out) procedure, equipment, and devices;
- Prohibitions and penalties for attempting to restart or re-energize equipment which has been locked out/tagged out, or to work on equipment without following the lock out/tag out procedures.

Affected Employees

Affected Employees will be trained in the purpose and use of the lock out/tag out procedure. All employees whose work operations may be in an area where lock out/tag out procedures may be utilized will be trained about the procedure and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out/tagged out. These personnel are not required to be familiar with specific procedures for equipment and systems.

Retraining

Retraining or refresher training for Authorized and/or Affected employees will be conducted annually or whenever one of the following exists:

- The employee has a change in job assignment;
- There has been a change in the equipment or process;
- There has been a change in the energy-control procedure;
- An inspection reveals deviations from the standard procedures or inadequacies in the employee's knowledge or use of the lock out/tag out procedure;
- An incident occurs as a result of unexpected energy release.

Training Documentation

All employee training, including refresher training, will be documented. Employee training records will include type of training, date, and employee name. These records will be maintained for each employee for the duration of their employment.

8.0 REFERENCES

- 29 CFR 1910.147 - The control of hazardous energy (lockout/tagout)
- 29 CFR 1910, Subpart: S, Electrical, 333, Selection and use of work practices
- 29 CFR 1926.417 - Lockout and tagging of circuits
- National Fire Protection Association (NFPA) 70, National Electric Code, 70E, Standard for Electrical Safety in the Workplace.

9.0 REQUIRED RECORDS

- All LOTO logs and documentation will be kept with project files.

10.0 ATTACHMENTS

Attachment A – LOTO Procedure Form

Attachment A
LOTO Procedure Form

OP 593, Hazardous Energy Control



LOTO Procedure Form

PURPOSE: This 7-step procedure establishes the minimum requirements for the lockout of energy isolating devices whenever servicing or maintenance is done on facility equipment. This procedure will be used to ensure that the equipment is stopped, isolated from all potentially hazardous energy sources and locked out before employees perform any maintenance where the unexpected energization or startup of the equipment or release of energy could cause injury.

EQUIPMENT:

EQUIPMENT NO:

LOCATION:

COMPLIANCE WITH THIS PROCEDURE: All employees are required to comply with the restrictions and limitations imposed on them during the use of this procedure. The authorized employees are required to perform the lockout in accordance with this procedure. Other employees, upon observing a piece of equipment which is locked and/or tagged out, will not attempt to start, energize, or use said equipment.

Sequence of Lockout/Tagout

1. All affected employees will be notified that the equipment must be shut down and locked out to perform servicing or maintenance.

Specific Instructions:

2. The authorized employee will identify the type and magnitude of the energy that the equipment utilizes, will understand the hazards of the energy, and will know the methods to control the energy.

ENERGY

- Electrical (440V) Natural Gas Spring Hydraulic Gravity Steam Chemical Pneumatic
- Thermal Other:

3. Shut down operating equipment by the normal stopping procedures (depress stop button, open switch, close valve, etc.).

Specific Instructions:

4. Deactivate the energy isolating device(s) so that the equipment is isolated from the energy sources(s).

Specific Instructions:

5. Lockout and tagout the energy isolating devices(s) with assigned individual locks and tags.

Lockout Equipment Needed:

6. Dissipate any stored or residual energy (such as that in capacitors, springs, hydraulic systems, and air, steam, or water pressure, etc.) by methods such as grounding, repositioning, blocking, bleeding down, etc.

Specific Instructions:

7. Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the normal operating control(s) or by testing to make certain the equipment will not operate. **CAUTION: Return controls to "OFF" after verification. THE EQUIPMENT SHOULD NOW BE LOCKED OUT AT ZERO ENERGY STATE.**

Specific Instructions:

METHODS OF VERIFICATION

Verification should be determined via start-up attempts, visual observations and testing. For electrical verification, place local on/off switch to ON position and verify equipment will not operate. Return the switch to OFF position and commence work.



CABRERA SERVICES
RADIOLOGICAL • ENGINEERING • REMEDIATION

OPERATING PROCEDURE


FOR

HOT WORK OPERATIONS

OP-594

Revision 1
October 2013

Prepared by:

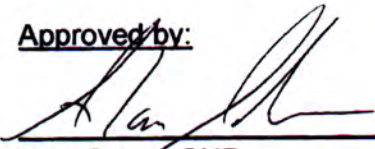


Sean Liddy, CSP
Occupational Health & Safety Manager

12-19-2013

Date

Approved by:



Alan Solow, CHP
Chief Executive Officer

12/19/2013

Date

1.0 PURPOSE

This operating procedure (OP) establishes the minimum requirements for welding, cutting, and hot work activities.

2.0 APPLICABILITY

This procedure applies to all Cabrera Services Inc. (Cabrera) employees and operations.

3.0 DEFINITIONS

- 3.1 Combustible Material - Any material that may ignite when introduced to an ignition source (e.g., wood, paper, cardboard and plastic).
- 3.2 Hot Work - A work activity that by the nature of the operation (e.g., grinding, burning thermo cutting/welding, brazing, etc.) creates an open source of ignition or that could produce temperatures high enough to cause the ignition of flammable gases and combustible materials
- 3.3 Hot Work Permit - Document issued prior to the start of hot work, which is used to verify the presence of appropriate fire prevention and protection measures.
- 3.4 Sources of ignition - In locations where flammable vapors may be present, precautions shall be taken to prevent ignition by eliminating or controlling sources of ignition. Sources of ignition may include open flames, lightning, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, and mechanical), spontaneous ignition, chemical and physical-chemical reactions, and radiant heat.

4.0 PRECAUTIONS, LIMITATIONS AND REQUIREMENTS

A hot work permit must be issued prior to conducting all hot work operations. In some circumstances, a client specific hot work permit must be obtained and may take the place of the Cabrera permit. Other Cabrera activities may also trigger the need for a Hot Work Permit and procedure (for example, engine ignition in flammable atmospheres). Refer to the approved Activity Hazard Analysis for the operation to obtain specific hazard controls.

5.0 EQUIPMENT

Refer to Section 3.

6.0 RESPONSIBILITIES

6.1 Project Managers and Field Site Manager or designee (Site Safety & Health Officer – SSHO) responsibilities:

Assures that employees receive the specified level of protection as to project welding, cutting and burning activities.

Assures that a Hot Work Permit is issued and all control measures are maintained.

6.2 Occupational Health & Safety (OH&S) Manager responsibilities:

Provide technical guidance and support as to this procedure.

6.3 Hot Work Operator:

In the scope of this procedure, a Hot Work Operator is defined as an individual who operates hot work equipment to perform hot work operations. The Hot Work Operator shall perform the following duties:

- Know and apply applicable company and regulatory policies, standards and procedures related to hot work operations.
- Participate in the inspection of welding and burning equipment and work areas.
- Participate in the completion of and sign the Hot Work Permit to acknowledge his or her understanding of the conditions documented on the permit.
- Comply with the conditions of the issued Hot Work Permit.
- Safely handle hot work equipment and processes.
- Cease hot work operations if unsafe conditions develop and notify the Field Site Manager and/or SSHO immediately for evaluation and appropriate action.

6.4 Fire Watch:

In the scope of this procedure, the Fire Watch is responsible for monitoring hot work and the surrounding area for incipient fires and changing conditions. The Fire Watch shall not have any other duties besides those specified in this procedure during the hot work activities and for 30 minutes afterwards. The Fire Watch shall perform the following duties:

- Understand the location, nature and hazards of the hot work to be

performed.

- Survey the area to verify that the necessary fire protection equipment is in place and ready for use.
- Confirm that safe conditions are maintained during hot work operations.
- Make fire-extinguishing equipment readily available and be trained in its use.
- Remain within communication range of the person(s) performing the hot work and maintain a line of sight with the hot work.
- Not leave the area for any reason without a replacement or stopping the hot work.
- Watch for fires in all areas exposed to hot work and communicate to hot work operators to cease all hot work if a fire occurs.
- Try to extinguish a fire only when the fire is obviously within the capacity of the equipment available.
- Sound the alarm (e.g., air horn) and implement evacuation procedures immediately if he or she determines that a fire is not within the capacity of the available extinguishing equipment.
- Remain in the hot work area at least 30 minutes after the hot work has ceased to detect and extinguish possible smoldering fires.

7.0 PROCEDURE

7.1 General Procedures

Equipment will be used only for operations for which it is approved and as recommended by the manufacturer.

Employees assigned to operate or maintain oxygen/fuel-gas supply equipment and resistance welding equipment will be thoroughly instructed in the safe use of such equipment by a qualified person.

Engineering controls will be implemented to control hot work hazards to the extent feasible.

Before any cutting or welding is performed, the area will be evaluated for flammables or combustibles by the Supervisor responsible for authorizing hot work.

A written Hot Work Permit (Attachment A or the equivalent) is required for all work. A client specific permit may need to be obtained in certain locations, and may substitute for the Cabrera permit. In both cases, the Field Site Manager and/or SSHO should review any Hot Work permits issued.

Where hot work permits are used, all welding activities shall be controlled and isolated from flammables and combustibles.

Training shall be provided as to the use of Hot Work Permits to all associated workers.

7.2 Gas Welding and Cutting Safety

Fuel-gas hoses and oxygen hoses will be easily distinguishable from each other. The contrast will be made by different colors or by surface characteristics readily distinguishable by touch.

Oxygen and fuel-gas hoses will not be interchangeable. A single hose having more than one gas passage will not be used. When parallel sections of oxygen and fuel-gas hose are taped together, not more than 4 inches out of 12 inches will be covered by tape.

All hoses in use will be inspected at the beginning of each work shift. Defective hose will be removed from service.

Hoses, cables, and other equipment will be kept clear of walkways, ladders, and stairs.

Clogged torch tip openings will be cleaned with approved cleaning wires, drills, or other devices designed for this purpose.

Torches to be used will be inspected at the beginning of each work shift for leaking shutoff valves, damaged hose couplings, and clogged tip connection. Defective torches will not be used.

Torches will be ignited by friction lighters or other approved devices only. Matches, flame lighters, or hot work will not be used to ignite a torch.

Oxygen and fuel-gas pressure regulators, including related gauges, will be in proper working order and equipped with "Flashback" arrestors attached to the gauges.

Note: Flashback arresters are in addition to "Backflow" devices.

All oxygen cylinders and fittings will be kept away from oil or grease. Cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus will be kept free from oil or greasy substances and will not be handled with oily hands or gloves. Oxygen will not be directed at oily surfaces

or greasy clothes, or used within close proximity to a fuel oil or other storage tank/vessel.

Torches and hoses will be completely depressurized (bled) of pressurized gas, prior to storage, or at the end of each shift.

Torches and hoses will not be stored in enclosed areas (e.g., gang boxes, lockers) while connected to cylinders and gauges will be removed at the end of shift.

Oxygen connections will include a means to prevent backflow.

Fuel gas cylinders will be provided flashback protection.

7.3 Arc Welding and Cutting Safety

Electrode holders which are designed for arc welding/cutting will be capable of safely handling the maximum current used.

Any current-carrying parts (arc welder, cutter grips, rod holder) will be fully insulated against the maximum voltage encountered and properly grounded.

All arc welding/cutting cables will be completely insulated and flexible, capable of handling the maximum current requirements of the work.

Only cables free from repair or splices for a minimum distance of 10 feet from the electrode holder will be used. Cables with standard insulated connectors or splices with insulating quality that is equal to that of the cable are permitted.

If it is necessary to splice lengths of cable, insulated connectors equivalent to that of the cable will be used. If connections are made by cable lugs, they will be securely fastened together and provide a good electrical contact. Exposed metal parts of the lugs will be completely insulated.

If electrode holders are left unattended, the electrodes will be removed and the holder placed so that they cannot make electrical contact with employees or conducting objects.

To avoid the possibility of electric shock, electrode holders will not be dipped in water.

When work stops for any length of time, or when the arc welding/cutting machine is to be moved, the power supply to the equipment will be turned off.

Any faulty or defective equipment will be reported to the supervisor and tagged out of service until repaired.

All arc welding/cutting operations will be shielded by noncombustible or

flameproof screens to protect employees and other persons working in the vicinity from the direct ray of the arc.

7.4 Welding/Cutting on Containers

No welding, cutting, or other hot work will be performed on empty drums, barrels, tanks, or other containers until they have been thoroughly cleaned. (This is to ensure that there are no flammable materials present or any substances such as greases, tars, acids, or other materials which, when subjected to heat, might produce a hazard. Any connection to a drum or vessel will be disconnected or blanked off.

All hollow spaces, vacancies, or containers will be ventilated to remove gases before preheating, cutting, or welding. Purging with inert gas is recommended.

In addition to the requirements presented in OP 582 – Confined Spaces, welding/cutting in confined spaces such as a tank, boiler, pressure vessel, or small compartment will require the following precautionary measures:

- Local exhaust ventilation will be provided, unless workers wear supplied-air respirators.
- Gas cylinders and/or welding machines will be placed outside the confined space.

7.5 Mechanical Ventilation

Mechanical ventilation will consist of either general dilution systems or local exhaust systems. Local exhaust systems are preferred.

Mechanical ventilation will be of sufficient capacity and so arranged as to produce the number of air changes necessary to maintain welding fume and smoke within safe limits.

General dilution systems may not be used as the only means of control when toxic metals are involved in the operation.

Mechanical ventilation will consist of freely movable hoods intended to be placed by the welder or burner as close as practicable to the work. This system will be of sufficient capacity and so arranged as to remove fumes and smoke at the source and keep the concentration of them in the breathing zone within safe limits

Contaminated air exhausted from a working space will be discharged into the open air or otherwise clear of the source of intake air. Environmental regulations may require filtering or other cleaning of exhausted air.

All makeup air will be clean and suitable for breathing.

Oxygen will not be used for ventilation purposes, comfort cooling, blowing dust from clothing, or for cleaning the work area.

The SSHO, in consultation with the OH&S Manager, will provide appropriate methods and controls in the case of specific requirements (including welding rods and fluxes, paints and coatings) for materials containing zinc, lead, mercury, beryllium, cadmium, and stainless steel to be cut, heated, and/or welded.

7.6 Storage and Handling of Compressed Gas Cylinders

Compressed gas cylinders will be legibly marked with either the chemical or trade name of the gas. Such markings will be stenciled, stamped, or labeled and will not be easily removable.

The marking will be located on the shoulder of the cylinder.

Compressed gas cylinders will be equipped with approved connections.

Acetylene cylinders will be stored and used valve end up.

Cylinders will not be stored near highly combustible/flammable materials, especially oil or grease.

Cylinders will be stored in an upright and secure position with caps installed and separated from fuel-gas cylinders or combustible materials (especially oil or grease), by a minimum distance of 20 feet, or by a noncombustible barrier at least 5 feet high and having a fire resistance rating of at least one half hour.

Cylinders will be not dropped, struck by objects, or permitted to strike each other violently.

Cylinder valves will be closed and gauges removed before moving cylinders

Cylinder valves will be closed and gauges removed at the end of the shift or when work is finished.

Valves of empty cylinders will be closed.

Cylinders will be kept far enough away from the actual welding/cutting operation so that sparks, hot slag, or flames will not reach them.

Cylinder valves will always be opened slowly.

An acetylene cylinder valve will not be opened more than one and one-half turns of the valve stem and preferably no more than three-fourths of a turn.

Where a special wrench is required to operate a cylinder valve, it will be left in position on the stem of the valve while the cylinder is in use. In the case of manifolded or coupled cylinders, at least one such wrench will be available for immediate use.

Regulators will be removed, valve caps in place, and valves closed when cylinders are transported by vehicles. All vehicles used to transport cylinders will have a proper support rack installed.

A suitable cylinder truck, chain, or other steadying device will be used to prevent cylinders from being knocked over while in use or storage.

Cylinders will not be placed where they may become part of an electric circuit. Tapping of an electrode against a cylinder to strike an arc will be prohibited.

7.7 Manifolding of Cylinders

Cylinder manifolds will be installed under the supervision of an experienced person(s) and must comply with proper practices in construction and use.

All manifolds and parts will be appropriate for the gases for which they are approved.

When acetylene cylinders are manifolded, approved flashback arresters will be installed between each cylinder and the coupler block. One flash arrestor installed between the coupler block and regulator is acceptable only for outdoor use or if the number of cylinders coupled does not exceed three.

Each cylinder lead will be provided with a backflow check valve.

7.8 Personal Protective Equipment

Selection and use of personal protective equipment will comply with OP 561 – Personal Protective Equipment.

Eye and Face Protection

Eye and face protection will comply with the following:

- Welding helmets and hand shields will be used during all arc welding/cutting operations, excluding submerged arc welding.
- Cutting/welding goggles will also be worn during arc welding/cutting operations. The goggles or glasses may be either clear or colored glass, depending on the type of exposure in welding operations. Helpers or attendants will wear proper eye protection.
- Safety goggles or other approved eye/face protection are for use

during gas welding operations on light work, torch brazing, or inspection.

- All operators and attendants on resistance welding or brazing equipment will use face shields or goggles, depending on the particular job.

Protective Clothing

Hot work will require the following protective clothing:

- Except when engaged in light work, all welders will wear flameproof gauntlet gloves.
- Flameproof aprons made of leather, or other suitable material, may also be desirable for protection against radiated heat and sparks.
- Woolen clothing will be worn in preference to cotton because it is not so readily ignited. Nylon clothing is not permitted for welding/cutting operations.
- All outer clothing, such as jumpers or overalls, will be reasonably free from oil or grease.

Respiratory Protective Equipment

Respiratory protective devices will be required when one or more of the following conditions exist:

- Feasible engineering controls are insufficient to mitigate the hazards.
- Room size is limited, or welding/cutting work is extensive and ventilation is limited.
- Several welders are working in the area at the same time.
- Potentially unsafe atmospheric conditions exist.
- Too much heat is generated.
- Hazardous fumes, gases, or dusts of toxic metals, particularly lead, cadmium, chrome, beryllium, and zinc are present in the base metal or in coatings.
- Respiratory protective equipment will be selected, used, and maintained in accordance with OP 562, Respiratory Protection.

7.9 Fire Protection

When possible, objects to be welded, cut, or heated will be moved to a designated safe location. If this is not possible, all movable fire hazards in the workspace will be taken away to a safe place.

If the object to be welded, cut, or heated cannot be moved and all fire hazards cannot be removed (e.g., equipment, walls, floors, etc.), positive means will be taken to confine the heat, sparks, and slag to protect the immovable fire hazards as well as opposite sides.

No welding, cutting, or heating will be done where the application of flammable paint, the presence of other flammable compounds, or heavy dust concentrations create a possible hazard

Wherever there are openings or cracks in the flooring that cannot be closed, precautions will be taken so that no sparks will drop through the floor. The same precautions will be taken in the presence of cracks or holes in walls, open doorways, and open or broken windows.

Approved fire extinguishing equipment will be present in the immediate work area. A minimum of a 10-pound ABC fire extinguisher is required.

7.10 Fire Watch

When required, a fire watch will be maintained for at least 30 minutes after completion of welding/cutting operations so that possible smoldering fire can be detected and extinguished.

Firewatchers will have fire-extinguishing equipment readily available and be trained in its use.

They will be familiar with facilities and procedures in the event of a fire. They will watch for fires in all exposed areas and attempt to extinguish them only when obviously within the capacity of the equipment available. The Fire Department will be immediately notified of all fires.

A second fire watch shall be required if one fire watch cannot directly observe combustible materials that could be ignited by the hot work operation.

7.11 Hot Work Permits

Performing hot work is considered a hazardous activity, and a Hot Work Permit is required. The Hot Work Permit has five purposes:

- To serve as written permission to do the work.
- To provide a safety checklist.

- To show the steps necessary for making the work site safe for conducting hot work.
- To alert operating personnel to the work in progress.

A Hot Work Permit is valid for no more than one work shift. If hot work is suspended during a shift, the permit shall be revalidated before further hot work can continue. Revalidation involves inspecting the hot work area for any change in previous conditions and conducting air monitoring (if necessary).

8.0 REFERENCES

- 29 CFR 1910.106, Hazardous Materials – Flammable and combustible liquids
- 29 CFR 1910.251-255, Welding, Cutting, and Brazing
- 29 CFR 1926.350-354, Welding and Cutting


9.0 REQUIRED RECORDS

- Hot Work Permits will be kept with project files.

10.0 ATTACHMENTS

Attachment A – Hot Work Permit

Attachment A
Hot Work Permit

OP 594 - Hot Work Operations		 CABRERA SERVICES <small>RADIOLOGICAL · ENGINEERING · REMEDIATION</small>	
Hot Work Permit			
The SSHO will issue the Hot Work Permit for all Hot Work Activities. Permit is valid for one shift only. Dedicated fire watch required for minimum 30 minutes post operation.			
Project Name:		Project Number:	Date:
Hot Work Location:		Purpose of Hot Work:	
Hot Work Operator:		Fire Watch:	
Hot Work Start Time:		Hot Work Stop Time:	
Permit Conditions			
Work Area Preparation	Satisfactory	Unsatisfactory	N/A
Hot Work equipment in proper working order (torches, welding leads, etc)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Welding equipment properly grounded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Welding screen used to prevent flash to others in work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flash suppressors in place (torch lines)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Backflow preventers in place (torch lines)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cylinders secured in upright position?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Valves opened ¼ to 1 ½ turns only?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wrench (if necessary) present and on valve?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Combustible materials removed from area (>35 ft) or properly guarded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Combustible floor coverings adequately guarded/protected?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flammable liquids removed from area (>35 ft)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire fighting equipment in working order (min 10 lbs ABC fire extinguisher)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ducts, drains, and other openings guarded to prevent sparks/slag?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Containers cleaned, purged, ventilated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation controls in place?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air Monitoring			
Specific air monitoring required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If yes, please specify?			
Personal Protective Equipment			
Required PPE (including respiratory protection, refer to AHA) present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Welding/cutting goggles present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Signatures			
Hot Work Operator:		Fire Watch:	
Hot Work Supervisor			
The location where this work is to be done has been examined, necessary precautions have been taken, and permission to proceed with the work is hereby granted.			
Name/Title:		Signature:	

**APPENDIX D
SAFETY FORMS**

OP 502 - OHSMS Assessment & Auditing



Corrective Action Plan

Recommendations and Actions Required

Concern raised by/from:	Concern	Corrective Action Required	Action By	Rectified	
				Date	By

General Remarks & Comments:

OP 511 - Safe Work Standards



STOP WORK ORDER

This form must be completed if any of the following Criteria are met:

1. Imminent danger exists involving the public or employees' safety and health, the environment, facilities, or property.
2. Continuing work or equipment usage will result in significant repair, rework, or removal.
3. There is a discrepancy, deficiency, or potentially dangerous condition or act that is likely to cause an unsafe or unhealthy situation or an imminent danger situation.

***** All Stop Work Orders will be sent to the OH&S Manager for Review*****

Project Name:

Project Manager:

Project #:

Reported by:

Date/Time:

Stop Work Order is the result of the following:

Inspection/Audit

Environmental Impairment

Injury/Incident

Unsafe Condition

Unsafe Behavior/Act

Improper Scope of Work

Other

Stop Work Order (Describe):

Return to Work

The above Stop Work Order issues/concerns have been corrected and documented. By signing below, I certify that the above Stop Work Order scenario has been corrected and work is safe to resume.

Title

Print Name

Signature

Individual/party issuing Stop Work Order:

Project Manager:

Sub-Contractor Supervisor (if applicable):

OH&S Manager:

OP 512 - INCIDENT REPORT



1. EMPLOYEE MUST REPORT ALL INCIDENTS TO THEIR SUPERVISOR IMMEDIATELY.
2. REPORT THE INCIDENT TO THE APPROPRIATE SENIOR MANAGER AND OH&S MANAGER WITHIN 2 HOURS.
3. COMPLETE FORM AND SUBMIT WITHIN ONE 24 HOURS FOLLOWING THE OCCURRENCE OF THE INCIDENT.

I. LOCATION INFORMATION

INCIDENT ADDRESS/LOCATION:

DATE:

TIME:

CLIENT NAME:

PROJECT NAME:

SUPERVISOR (FIELD):

REPORT COMPLETED BY:

II. DESCRIPTION OF INCIDENT

TYPE OF OCCURRENCE: INJURY/ILLNESS (SEC III) MOTOR VEHICLE INCIDENT (COMPLETE SUPPLEMENT) PROPERTY DAMAGE (SEC IV)
 ENV DAMAGE/SPILL (SEC IV) REGULATORY INSPECTION/NOV/CITATION (SEC V)
 OTHER BE SPECIFIC

DESCRIPTION OF EVENT:

WHAT, WHEN, WHERE, WHY, HOW? ATTACHED NOTES/DIAGRAMS AS REQUIRED AND LIST ANY MACHINERY OR EQUIPMENT INVOLVED

WERE THERE ANY WITNESSES OR OTHER PERSONS INVOLVED: Yes No

IF YES, PLEASE PROVIDE NAMES AND CONTACT INFORMATION

III. PERSONAL INJURY (COMPLETE FOR INJURY/ILLNESS ONLY)

EMPLOYEE NAME:

EMPLOYEE NUMBER:

WORK PHONE:

CELL PHONE:

EMPLOYEE STATUS FULL TIME PART TIME TEMP AGENCY
 SUBCONTACTOR THIRD PARTY

HOME OFFICE ADDRESS:

JOB TITLE/HIRE DATE:

Date Reported to Supervisor:

TYPE OF INJURY: FIRST AID (TREATED ON-SITE) MEDICAL AID (TREATED BY PROFESSIONAL) FATALITY

DESCRIBE THE INJURY AND BODY PART AFFECTED: *BE SPECIFIC (I.E. RIGHT HAND, INDEX FINGER, BELOW FIRST JOINT)*

WAS A DOCTOR OR HOSPITAL VISITED? Yes No

IF YES, WHEN:

FIRST AID/MEDICAL TREATMENT RECEIVED:

FIRST AIDER/DOCTOR/HOSPITAL NAME:

PROVIDER ADDRESS:

PHONE NUMBER:

OP 512 - INCIDENT REPORT



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IV. PROPERTY DAMAGE OR ENVIRONMENTAL RELEASE

TYPE OF DAMAGE: Cabrera PROPERTY SUBCONTRACTOR PROPERTY MAJOR STRUCTURAL FAILURE
 MOTOR VEHICLE (REFER TO MVI SUPPLEMENT FOR GREATER DETAIL) ENVIRONMENTAL RELEASE OTHER:

DESCRIBE THE SPECIFIC DAMAGE:

RANK THE SEVERITY OF THE DAMAGE: MINOR SERIOUS MAJOR

WHERE CAN THE PROPERTY BE SEEN?

PROPERTY OWNER NAME:

CONTACT INFORMATION:

IS THERE ANY POTENTIAL FOR CIVIL, CRIMINAL OR REGULATORY LIABILITY AGAINST Cabrera? Yes No

If YES, DISCUSS WITH SENIOR MANAGEMENT AND OH&S MANAGER.

INDICATE WHO HAS BEEN NOTIFIED OF THE EVENT (E.G., OWNER/OPERATOR, STATE (US) OR GOVERNING BODY OF LABOUR, ETC?)

V. REGULATORY INSPECTION/NOV/CITATION

TYPE OF EVENT: INSPECTION NOV CITATION

DESCRIBE EVENT: BE SPECIFIC

FINDINGS NOTED AT SITE YES NO **IF YES, WHAT:**

NAME OF REGULATORY AGENCY

FOLLOW UP SCHEDULED:

CONTACT PERSON:

PHONE NUMBER:

VI. REVIEW AND ACCEPTANCE

EMPLOYEE COMMENTS:

EMPLOYEE NAME AND PHONE

SIGNATURE AND DATE

SUPERVISOR COMMENTS:

SUPERVISOR NAME AND PHONE

SIGNATURE AND DATE

MANAGER COMMENTS:

MANAGER NAME AND PHONE

SIGNATURE AND DATE

FOR OH&S MANAGER USE ONLY:

NAME AND SIGNATURE:

DATE:

RECORDABILITY DETERMINATION FIRST AID RECORDABLE RECORDABILITY UNDETERMINED NON WORK

PROPERTY DAMAGE GENERAL LIABILITY VANDALISM

COMMENTS:

OP 512 - INCIDENT REPORT



MOTOR VEHICLE INCIDENT (MVI) SUPPLEMENT

REMEMBER: STAY CALM. TAKE PICTURES OF INCIDENT SCENE (LICENSE PLATE, DAMAGES, ETC)
Do not admit liability, agree to pay for any damage or sign any document except as required by law.

ADMINISTRATIVE

VEHICLE TYPE: <input type="checkbox"/> FLEET <input type="checkbox"/> RENTAL <input type="checkbox"/> PERSONAL	JOB ACTIVITY AT TIME OF MVI:
DATE OF MVI: TIME OF MVI:	LOCATION OF MVI:
MANAGER:	NUMBER OF VEHICLES INVOLVED:

DRIVER INFORMATION

DRIVER:	PASSENGERS:	PASSENGERS:
DRIVER'S LICENSE:	STATE ISSUED:	EXPIRATION DATE:
INJURIES TO DRIVER:		
INJURIES TO PASSENGERS:		

VEHICLE INFORMATION

YEAR:	MAKE:	MODEL:
SERIAL/VIN #:	LICENSE PLATE #:	REGISTRATION #:
OWNER:	INSURANCE COMPANY:	POLICY #:

COMMERCIAL MOTOR VEHICLE : IF RENTED OR PERSONAL, CONTACT INFORMATION OF OWNER:

RANK THE SEVERITY OF THE DAMAGE TO THE VEHICLE: 0 - \$500 \$500 - \$1000 \$1000 - \$4000 >\$4000

DESCRIPTION OF DAMAGE TO THE BODY OF THE VEHICLE:

OTHER DRIVER/VEHICLE INFORMATION

YEAR:	MAKE:	MODEL:
SERIAL/VIN #	LICENSE PLATE #:	REGISTRATION #:
DRIVER'S NAME:	CONTACT INFO:	LICENSE #:
OWNER:	INSURANCE COMPANY:	POLICY #:

IF RENTED OR PERSONAL, CONTACT INFORMATION OF OWNER:

DESCRIPTION OF DAMAGE TO THE BODY OF THE OTHER VEHICLE:

INCIDENT DESCRIPTION

EXACT LOCATION OF MVI (HIGHWAY, INTERSECTION, EXACT ADDRESS, ETC.)?

OTHER PROPERTY DAMAGED:

DESCRIBE THE EVENTS LEADING UP TO AND THE INCIDENT (REPORT FACTS ONLY: SPEED OF VEHICLES, DIRECTION TRAVELLING, WEATHER CONDITIONS, ETC. DO NOT GIVE OPINIONS REGARDING CAUSE OF INCIDENT OR LOSS.):

DID THE POLICE ATTEND THE SCENE: YES NO CITATION ISSUED: YES NO To WHO:

POLICE :	CONTACT INFO:
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SUBMIT THIS MVI SUPPLEMENT WITH A COMPLETED INCIDENT REPORT TO THE APPROPRIATE MANAGER

OP 513 - Incident Investigations



CABRERA SERVICES
RADIOLOGICAL · ENGINEERING · REMEDIATION

Incident Investigation Report

Refer to Incident Investigation Guidelines and Categories to complete this form.
Attach the original Incident Report and a “Why? Tree” Analysis as an attachment to this completed form.
Ensure Part A contains adequate information to relay the exact timeline of events.

PART A: Incident Investigation (Severity Level 1,2 and 3 incidents to complete)

Incident Severity Rating (Level 1-3)	Actual	Potential	
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Incident Date	Time of Incident	Dept.	
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Project (if applicable)	Office (if applicable)
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Who was involved (employee, contractor, and 3rd party?)

Client notified? Yes <input type="checkbox"/> No <input type="checkbox"/> (attach documentation of contract requirement)	Name	
	Contact No.	

Description of Incident (*Who, what, where, how*)

Timeline attached?	(Attachment 1) <input type="checkbox"/>
--------------------	---

Original Incident form attached?	(Attachment 2) <input type="checkbox"/>
----------------------------------	---

Details of Injuries/Damage/Impact (Nature and extent of injuries/damage)

Immediate Action Taken

Corrective Actions Recommended (If actions are accepted transfer into Part C)

Was there a risk assessment tool in use at the time of the event?

AHA <input type="checkbox"/>	SSHP <input type="checkbox"/>	APP <input type="checkbox"/>	Operating Procedure <input type="checkbox"/>	None <input type="checkbox"/>
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Has the risk assessment tool been updated to reflect this incident?

Yes <input type="checkbox"/>	No <input type="checkbox"/>	List:
------------------------------	-----------------------------	-------

Is there an existing procedure to control this event?

Yes <input type="checkbox"/>	No <input type="checkbox"/>	List:
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Was this procedure in use at the time of the incident?

Yes <input type="checkbox"/>	No <input type="checkbox"/>	Explain:
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Photographs (Insert photographs or diagrams below or at end of report)

Part B: Incident Investigation (Must be completed for all Severity Level 3 Incidents) – use Incident Investigation Guidelines and Categories for guidance in classifying the categories below.			
Absent/Failed Defenses	Individual or Team Factors	Task/Environmental Conditions	Organizational Factors
Part C: Corrective Actions Implemented (Must be completed for all Corrective Actions (CA))			
All Recommendations must include a timeframe for implementation and a person responsible. Add rows as required.			
CA #	Recommendations	Person Responsible	Completion Date
Part D: Key Learning's (What should the organization learn and pass on from this event?)			

Person Completing this Form (Contact for further information)			
Name		Position	
Date		Contact No.	
Email	@cabreraservices.com	Status of investigation	Initial / Final
List Investigation Team Members			

Reviewed by (Compulsory only for Level 3 Incidents)			
Name	Senior Manager	Signature	Date
Title			
Name	OH&S Manager	Signature	Date
Title			
Name	Project Manager/ Supervisor	Signature	Date
Title			

ATTACHMENT 1 – Copy of Incident Report

ATTACHMENT 2 – Why? Tree Analysis

OP 520 - Driver & Vehicle Safety



CABRERA SERVICES
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Driver's Acknowledgement Form

IF YOU DRIVE ON COMPANY BUSINESS, YOU MUST READ THIS PROCEDURE, ACKNOWLEDGE THE STATEMENT BELOW AND RETURN A COMPLETED COPY OF THIS PAGE TO THE OH&S MANAGER.

NOTE: It is not a requirement to provide copies of your driver license or proof of insurance as an attachment to this form. Supervisors are responsible for reviewing and confirming these documents are valid and accurately represented herein.

Drivers Information

Employee Name (Print):		State of Issuance:	
Driver's License #		Expiration Date	

I acknowledge that I have read the attached Procedure and understand that it contains important information about employee use of motor vehicles for business purposes. I agree to adhere to the requirements set forth in the Procedure.

As a condition of driving a vehicle on company business, I will present my Driver's License and proof of insurance for validation purposes to my Supervisor as witnessed below.

In addition to completing this form, I understand that the company may run a Motor Vehicle Driving Record report and provide this report to my Supervisor.

I understand that I must notify Cabrera immediately if there is any change in the status of my Driver's License and Cabrera reserves the right to terminate my driving privileges and any associated benefits at any time, for any reason, in its sole discretion.

I understand that Cabrera may require me to participate in a defensive driving course at Cabrera's expense in order to continue my driving privileges.

This Procedure and my signed Acknowledgement are intended to and shall supplement the terms of my employment relationship with Cabrera.

Date:		Employee Signature:	
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I confirm that the Driver's License number and expiry date set forth above are consistent with the employee's Driver's License.

Date:		Supervisor Name:	
		Supervisor Signature:	

OP 531 - First Aid & Medical Services



FIRST AID KIT INSPECTION FORM

A complete inventory, including quantities of supplies used, must be kept, and regularly updated on minimum of a monthly basis. Employees that take items from the first aid kit are required to complete this log, and notify the SSHO of the reason (personal or work related) and initiate the Incident Reporting process if necessary.

LOCATION INFORMATION

OFFICE/PROJECT NAME:	OFFICE/PROJECT MANAGER:
ADDRESS/LOCATION:	DATE:
	TIME:
FIRST AID KIT ID:	FIRST AID KIT LOCATION:

FIRST AID KIT USAGE LOG

EMPLOYEE NAME	DATE	ITEMS USED	QUANTITY USED	PERSONAL USE	*WORK** RELATED
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
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				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>

IF WORK RELATED, EMPLOYEE MUST REPORT INCIDENT TO SSHO AND COMPLETE INCIDENT REPORT

OP 555 - Safety Meetings



CABRERA SERVICES
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TAILGATE/TOOLBOX SAFETY MEETING FORM

SIX QUESTIONS FOR SUCCESS – Take two minutes to think through and answer these questions:

1. What are we about to do?
2. What equipment are we going to use?
3. Have I/we been trained to use this equipment?
4. Have I/we been trained to do this job?
5. How can I/we be hurt?
6. How can I/we prevent this incident?

If you and your team aren't prepared to do the assigned work, *STOP WORK*, and take time to properly prepare.

Project Information

This sign-in log documents the topics of the safety meeting and individual attendance. Personnel who perform work operations onsite are required to attend and acknowledge their ability to ask questions and receipt of such briefings daily. Please provide a brief narrative of the selected topics as applicable to the Project in the comment box (ex. Name of AHA reviewed).

PROJECT NAME & LOCATION

PROJECT NO.

DATE/TIME

WEATHER CONDITIONS

Topic

Discussion – check one

Today's Scope of Work (All tasks)	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Access / Egress / Slips, Trips, & Falls	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Schedule / New Work / Scope Changes	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Smoking, Eating, & Drinking	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Reviewed Procedures, AHA, etc.	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Washroom / Facilities Location	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Emergency Action Plan & Procedures	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Heat/Cold Stress	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Communications Protocol	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Exclusion Areas Barricades / Cones	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Required PPE	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Required Permits, Passes, Keys, etc.	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Required Monitoring / Instruments	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Decon Procedures / IDW Mgmt.	<input type="checkbox"/> yes <input type="checkbox"/> n/a
Site Control / Work Zones / Security	<input type="checkbox"/> yes <input type="checkbox"/> n/a	Eqpmt. Inspections/Safety Checklists	<input type="checkbox"/> yes <input type="checkbox"/> n/a

OTHER/COMMENTS:

Safety Meeting Attendees

Print Name

Signature

Safety Meeting Leader

Name of Meeting Leader

Signature

OP 556 - Project Safety Inspections



Project Safety Inspection Report

Project Name:		Inspection Date:	
Project Number:		Inspector/SSHO:	
Project Manager:		Client:	

Site Safety Plan	YES	NO	NA
1. Is a site safety plan posted on site or accessible to all employees?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Have potential hazards been described to employees on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Are manufacturer safety data sheets available for review by employees on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Is there a designated SSHO on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Are employees aware and knowledgeable of the results of potential exposures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Site Posters	YES	NO	NA
Are the following documents posted in a prominent and accessible area?			
6. Cabrera Safety Policy and Guiding Principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. OSHA Job Safety and Health Protection (or state-OSHA equivalent)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Equal Employment Opportunity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medical and First Aid	YES	NO	NA
9. Are first aid kits accessible and identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Are emergency eye wash and safety showers available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Are daily logs for first aid present and up to date?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Are first aid kits inspected weekly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Site Set Up	YES	NO	NA
13. Are work zones clearly defined?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Are support trailers located to minimize exposure from a potential release?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Is general housekeeping up to Cabrera standards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personal Protective Equipment	YES	NO	NA
16. Have levels of personal protection been established?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Do all employees know their level of protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Are respirators used, decontaminated, inspected, and stored according to standard procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Have employees been fit-tested?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

20. Is defective personal protective equipment tagged?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Does compressed breathing air meet CGA grade "D" minimum?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Are there sufficient quantities of safety equipment and repair parts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire Prevention	YES	NO	NA
23. Is smoking prohibited in flammable storage areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Are fire lanes established and maintained (where applicable?)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Are flammable dispensing systems grounded and bonded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Are proper receptacles available for storage of flammables?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Has the local fire department been contacted to inform of work ops?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Welding and Cutting	YES	NO	NA
28. Are fire extinguishers present at welding and cutting operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Are confined spaces, such as, tanks, pipelines, and trenches, tested prior to cutting and welding operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Are hot work permits available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Are proper helmets, aprons & gloves available for welding/cutting ops?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Are welding and machines properly grounded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Are oxygen and fuel gas cylinders stored a minimum of 20 feet apart?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Are only trained personnel permitted to operate welding/cutting equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hand And Power Tools	YES	NO	NA
35. Are defective hand and power tools tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Is eye protection available and used when operating power tools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Are guards and safety devices in place on power tools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Are power tools inspected before each use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Are non-sparking tools available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OP 556 - Project Safety Inspections



Project Safety Inspection Report

Motor Vehicles	YES	NO	NA
40. Are vehicles inspected before each use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Are personnel licensed for the equipment they operate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Are unsafe vehicles tagged and reported to supervision?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. Are vehicles shut down before fueling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. When backing vehicles, are spotters provided (when necessary)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Plans	YES	NO	NA
45. Are emergency telephone numbers posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. Have emergency escape routes been designated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. Are employees familiar with site-specific emergency signals?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Materials Handling	YES	NO	NA
48. Are materials stacked and stored as to prevent sliding or collapsing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49. Are flammables and combustibles stored in non-smoking areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50. Is machinery braced when personnel are performing maintenance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
51. Are tripping hazards labeled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52. Are semi-trailers chocked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
53. Are fixed jacks used under semi-trailers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
54. Are riders prohibited on materials handling equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55. Are cranes inspected as prescribed and logged?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
56. Are OSHA-approved manlifts provided for the lifting of personnel?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57. Are all containers labeled as to contents?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58. Are flammable liquids stored in approved safety cans?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hazardous Waste/Environmental Compliance	YES	NO	NA
59. Are hazardous wastes stored in DOT approved containers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
60. Is hazardous waste stored in a secure area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
61. Are hazardous waste containers labeled and dated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
62. Are waste container dates outdated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
63. Is a contingency plan on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
64. Is there a preparedness and prevention plan in effect?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
65. Are warning signs posted where required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
66. Have the project's environmental hazards been assessed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
67. Has a reg. permit needs assessment been completed for the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire Protection	YES	NO	NA
68. Has a fire warning system been established?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
69. Do employees know the location and use of all fire extinguishers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
70. Are fire extinguishers marked and inspected weekly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
71. Are combustible materials segregated from open flames?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electrical	YES	NO	NA
72. Are warning signs exhibited on high voltage equipment (>250 V)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
73. Is electrical equipment and wiring properly guarded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
74. Are electrical lines, extension cords, and cables guarded and maintained in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
75. Are extension cords kept out of wet areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
76. Is damaged electrical equipment tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
77. Have underground electrical lines been identified by proper authorities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
78. Has a positive lock-out system been established by the project electrician?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Slings And Chains	YES	NO	NA
79. Are damaged slings, chains, and rigging tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
80. Are slings inspected before each use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
81. Are slings padded or protected from sharp corners?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
82. Do employees keep clear of suspended loads?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compressed Gas Cylinders	YES	NO	NA
83. Are breathing air cylinders charged only to prescribed pressures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
84. Are like cylinders segregated in well ventilated areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OP 556 - Project Safety Inspections



Project Safety Inspection Report

85. Is smoking prohibited in cylinder storage areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
86. Are cylinders stored secure and upright?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
87. Are cylinders protected from snow, rain, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
88. Are cylinder caps in place before cylinders are moved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
89. Are fuel, gas, and O2 cylinders stored a min. of 20 feet apart?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ladders and Scaffolding	YES	NO	NA
90. Are ladders/scaffolds placed on a flat, firm surface?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
91. Are ladders/scaffolds planks free of mud, ice, grease, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
92. Are ladders/scaffolding inspected before each use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
93. Are defective ladders or scaffold parts taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
94. Does scaffold height exceed 4 times the width or base dimension?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
95. Does scaffold planking overlap a minimum of 12 inches?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
96. Does scaffold planking extend over end supports 6" to 18"?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Walking and Working Surfaces	YES	NO	NA
97. Are access ways, stairways, ramps, and ladders clean of ice, md, snow or debris?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
98. Do ladders exceed maximum lengths?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
99. Are ladders used in passageways, doors, or driveways?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
100. Are broken or damaged ladders tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101. Are metal ladders prohibited in electrical service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102. Are stairways and floor openings guarded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
103. Are safety feet installed on straight and extension ladders?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
104. Is general housekeeping up to Cabrera standards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105. Are support trailers accessible for emergency vehicles?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106. Is the site properly secured during and after work hours?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy Equipment	YES	NO	NA
107. Is heavy equipment inspected as recommended by the manufacturer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
108. Is defective heavy equipment tagged and taken out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
109. Are project roads and structures inspected for load capacities and proper clearances?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
110. Is heavy equipment shut down for fueling and maintenance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Excavation	YES	NO	NA
111. Are the sides of excavations sloped or shored to properly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
112. Are guardrails or fences placed around excavations, near pedestrian or vehicle thoroughfares?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
113. Prior to opening excavations, are utilities located and marked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
114. Are ladders used in trenches over 4 feet deep (when entered)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
115. Is material excavated placed a minimum of 3 ft from the trench?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Confined Spaces	YES	NO	NA
116. Have employees scheduled to be part of the confined space entry team been trained to the level of their responsibilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
117. Are confined space permits available on project site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
118. Is a confined space entry procedure on the project site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personnel Decontamination	YES	NO	NA
119. Are decontamination stations set up in the site contamination reduction zone(s)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
120. Are waste receptacles available for contaminated clothing / PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
121. Are steps taken to contain liquids used for decontamination?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
122. Have decontamination steps and procedures been covered by the site supervisor or acting site safety officer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
123. Are personnel using utility knives or FOBKs to doff PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
124. Is all personal protective equipment and respiratory equipment being cleaned on a daily basis (when applicable)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspection Summary			
Comments:			
I have reviewed this inspection checklist with the safety inspector/SSHO, fully understand the recommendations and will make every attempt to immediately implement the appropriate corrective actions:			
Project/Field Site Manager _____			Date _____

OP 562 - Respiratory Protection



CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

Record of Fit Test

Employee Name:		Date of Testing:	
Location:		Respirator Manufacturer:	
Method & Testing Agent:		Respirator Type(s):	
Qualitative Test Agent(s): IAA <input type="checkbox"/> Smoke <input type="checkbox"/>		Quantitative Test Device:	
Test Exercise	Pass / Fail	Test Exercise	Pass / Fail
Sensitivity Check		Normal Breathing	
Deep Breathing		Turning Head (side to side)	
Moving Head (up/down)		Rainbow Passage*	
Bending Over		Normal Breathing	

***Rainbow Passage.** "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."

Successful Respirator Fit Determined: Yes No

I certify that I have been tested with the respirator(s) listed above. I have also had the opportunity to ask questions and those questions have been answered to my satisfaction. I also understand that the above fit test is voided if respirator limitations are not followed or the respirator is not worn or if conditions (e.g., facial hair) prevent a good face seal.

Employee Signature:	Date:
Signature of Tester:	Date:

OP 562 - Respiratory Protection



CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

Respiratory Equipment Inspection Form

Date:		Inspected by:
Air Purifier Unit #:		

	N/A	Pass	Fail
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Examine Face Piece for:

Excessive dirt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracks, tears, holes, or distortion from improper storage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inflexibility (stretch and massage to restore flexibility)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracked or badly scratched lenses in full face pieces	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incorrectly mounted full-face piece lens or broken or missing mounting clips	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lens sealed properly in receptacle, retaining clamp secured	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracked or broken air-purifying element holder(s), badly worn threads or missing gasket(s) (if appropriate)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Examine the Head Straps or Head Harness for:

Breaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss of elasticity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Broken or malfunctioning buckles and attachments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excessively worn serrations on the head harness that might permit slippage (full face pieces only)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tears in headband at cradle attachment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Examine the Inhalation and Exhalation Valves for:

Foreign material, such as detergent residue, dust particles, or human hair under the valve seat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracks, tears, or distortion in the valve material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improper insertion of the valve body in the face piece	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cracks, breaks, or chips in the valve body, particularly in the sealing surface	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Missing or defective valve cover	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Examine the Air Purifying Elements for:

Incorrect cartridge, canister, or filter for the hazard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incorrect installation, loose connection, missing or worn gaskets, or cross-threading in the holder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expired shelf life date on cartridge or canister	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Defects Noted:

Unit Deemed Suitable for Use	<input type="checkbox"/> Yes	<input type="checkbox"/> No
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OP 563 - Heat Stress



Heat Stress Monitoring Log

The purpose of this form is to track entry into hot zones wearing chemically protective clothing and monitor employees for heat stress-related illness. It is the responsibility of the foreman or supervisor-in-charge to ensure that each person entering the hot zone completes the required information. Vital signs must be taken by a competent person.

Project Name:			Foreman/Supervisor:						Work/Rest Schedule¹:			IN (min)		OUT (min)			
Date:		Water Provided²		Acclimated³		Initial Vitals⁴		Vital Signs and Time In/Out⁵									
Employee Name		Yes	No	Yes	No	Vitals	In	Out	Vitals	In	Out	Vitals	In	Out	Vitals	In	Out
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	P			P			P			P		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BP			BP			BP			BP		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temp			Temp			Temp			Temp		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	P			P			P			P		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BP			BP			BP			BP		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temp			Temp			Temp			Temp		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	P			P			P			P		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BP			BP			BP			BP		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temp			Temp			Temp			Temp		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	P			P			P			P		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BP			BP			BP			BP		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temp			Temp			Temp			Temp		

- Section 7.5 provides specific details on how to develop a work-rest schedule.
- Each employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
- A worker is "acclimated" if he/she has worked in a hot environment for at least 7 to 10 consecutive days. If a worker is acclimated, check "Yes." If a worker is not acclimated, check "No" and reduce the "Min In" by 50 percent for that employee until the 7- to 10-day period is reached.
- "Vitals" refers to employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work operations in the hot zone. Each time the employee exits the hot zone, vitals must be taken and evaluated for heat stress criteria. Section 7.7 provides specific instructions for taking and evaluating employee vital signs.
- Body temperature vital signs will be recorded in °F.

OP 582 - Confined Spaces



Confined Space Entry Permit (Page 1 of 2)

Project Name/Number: _____ **Location:** _____

Permit Date/Time: _____ **Valid only for one 8-hour shift**

Purpose of Entry: _____

Hazards within permit space: _____

Hazard Controls & Confirmations:

1. Work area isolated with signs/barriers?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA	8. Communications:	<input type="checkbox"/> Direct Verbal <input type="checkbox"/> Radio
2. All energy sources locked/tagged out?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA	9. Safety Equipment required for Entry	
3. All input lines capped/blinded?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA	Atmospheric Monitoring	Specify: _____
4. Space contents drained/flushed/neutralized?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA	Ventilation Equipment	Specify: _____
5. Permit space cleaned/purged?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA	Retrieval Equipment	Specify: _____
6. Ventilation provided before entry?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA	Specialized PPE	Specify: _____
7. Rescue services: <input type="checkbox"/> On Site <input type="checkbox"/> Off Site		Additional Permits (ie Hot Work)	Specify: _____

Identity and phone # for rescue services or means of summoning: _____

Designated Personnel:

Authorized Entrants	Authorized Attendants	Entry Supervisor(s)

Initial Atmospheric Testing

Time of Test:	Parameter	Acceptable Level	Reading
Note: Initial testing must be completed prior to entry. Continuous testing to be completed in minimum of 10 minute intervals. Remember to test for stratified atmosphere.	Percent Oxygen (%)	19.5% to 23.5%	
	Explosivity/LEL %*	< 10%	
	Carbon Monoxide	< 25 ppm	
	Hydrogen Sulfide*	< 10 ppm	
	VOC	Chemical Specific	

Verification & Authorization

Physical conditions at confined space checked and verified to be in accordance with the permit. I certify that I have inspected the work area for safety and have reviewed all safety precautions recorded on this permit.

Entry Supervisor Signature: _____ Date: _____

OP 582 - Confined Spaces



Confined Space Entry Permit (Page 1 of 2)

Reminder: Test for stratified atmosphere.

Continuous Atmospheric Testing

Parameter	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Time						
Percent Oxygen (%)						
Explosivity/LEL %*						
Carbon Monoxide						
Hydrogen Sulfide*						
VOC						
Parameter	Test 7	Test 8	Test 9	Test 10	Test 11	Test 12
Time						
Percent Oxygen (%)						
Explosivity/LEL %*						
Carbon Monoxide						
Hydrogen Sulfide*						
VOC						

Note any issues that occurred during entry:

Signature of Attendant/Tester:

Date:

Permit Review & Closeout

Any problems encountered during entry?

Corrective actions taken?

Additional precautions/recommendations for future entries?

Entry Supervisor Signature:

Date:

OP 583 - Excavation & Trenching



Excavation Inspection Form

Designated Competent Person must inspect/document excavation prior to beginning work, after a rain event, and as needed throughout the shift.

Project Name:	Project Number:	Project Location:
Date:	Inspection Completed By:	

Excavation Information:

Soil Type:	Excavation Depth:	Excavation Width:
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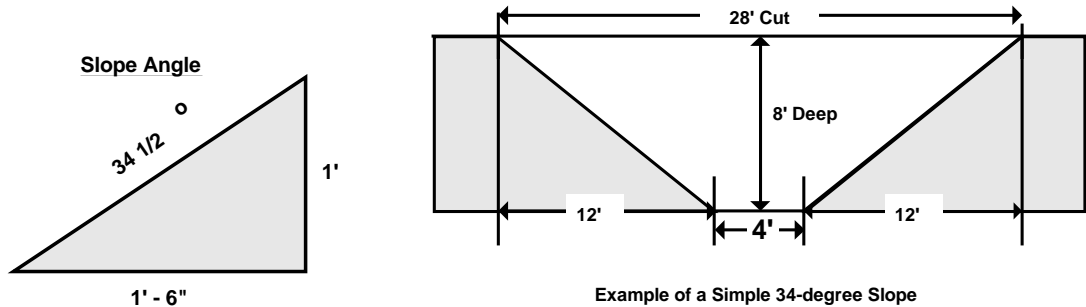
Type of Protective System Used:

1. General Information:	Yes	No	N/A
A. Is excavation less than five feet in depth?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Is there a potential for a cave-in? *IF YES, excavation must be sloped, shored, or shielded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Is excavation deeper than 5 feet? * IF YES, excavation must be sloped, shored, or shielded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Is sloping used as your protective system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. 1- Manual & 1- Visual Method utilized to determine Soil Classification as A-B-C (select one: Y=A, N=B, N/A=C)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Manual Test Method Used: Plasticity Dry Strength Thumb Penetration Dry Testing Pocket Penetrometer

Visual Characteristics: Cemented Cohesive Dry Fissured Granular Layered Moist Plastic Saturated Submerged Surface cracking Undercut

Slope information to keep in mind:



Example of a Simple 34-degree Slope commonly used around the site for cave-in protection.

2. Surface Conditions	Yes	No	N/A
A. Surface encumbrances removed or supported.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Individuals protected from loose rock/soil that may pose a hazard by falling/rolling into excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Hard hats, safety-toed boots, and safety glasses worn by all individuals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. High visible vest (Class 2 or 3) worn by all individuals. Vest required around heavy equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Spoils, materials, and equipment set back at least 3 feet from the edge of the excavation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Adequate barriers provided at all excavations, wells, pits, shafts, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Individuals are required to stand away from vehicles being loaded or unloaded.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Warning system established and utilized when mobile equipment is operating near the edge of the excavation (e.g., barricade tape, signalpersons, stop logs, etc).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I. Individuals prohibited from going under suspended loads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Utilities		Yes	No	N/A
A. Location of utilities marked.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Prior to the use of equipment, underground utilities have been located by hand digging and exposed.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Underground utilities are protected, supported, or removed when excavation is open.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Means of Access and Egress:		Yes	No	N/A
A. Travel distance to means of egress no greater than 25 feet in excavations 4 feet or more in depth.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Straight ladders used in excavations extend at least 3 feet above the edge of the trench.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Ramps being used for employee access have been designed by the competent person.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. All individuals are protected from cave-ins when entering or exiting the excavation.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Wet Conditions:		Yes	No	N/A
A. Precautions have been taken to protect individuals from the accumulation of water.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Water removal equipment monitored by a competent person.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Surface water or runoff is diverted or controlled to prevent accumulation in the excavation.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Inspections have been made after every rainstorm or other hazard-increasing occurrence (freeze/thaw, local demolition, rerouting of traffic, etc).		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Hazardous Atmosphere:		Yes	No	N/A
A. Are there exposed sewer or natural gas lines in excavation?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Is excavation near a landfill, or are hazardous substances being stored close to the excavation?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If you answered YES to A or B, then treat the excavation as a confined space. OP 582 Confined Spaces				
C. All individuals will contact the Fire/Rescue Group at _____ prior to entry and in case of emergencies.				
7. Support Systems:		Yes	No	N/A
System Manufacturer:		System Type:		
A. Tabulated Data for system on-site?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Materials/equipment for support systems selected based on soil analysis, trench depth, and expected loads.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Materials/equipment used for protective systems have been inspected and are in good condition.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Protective systems installed without exposing all individuals to the hazards of cave-ins, collapses, or the threat of being struck by materials or equipment.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Members of support system are securely fastened to prevent failure.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Support systems are provided to ensure stability of adjacent structures (buildings, roadways, sidewalks, etc.)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Excavations below the level of the base of a footing have been approved by a registered PE.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Removal of support systems progresses from the bottom (members released slowly to note indication of possible failure).		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I. Backfilling progresses with the removal of support system.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J. Material excavated to a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K. A shield system has been placed to prevent lateral movement.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
M. All individuals are prohibited from remaining in the shield system during vertical movement.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Training:		Yes	No	N/A
A. All individuals have had Excavation Safety Awareness Training.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OP 584 - Heavy Equipment Operations



Heavy Equipment Inspection Form

Competent Person must inspect/document equipment when it is put into service, using this form. Equipment must be inspected prior to each use by the operator.

Project Name:	Project Number:	Project Location:
Operator:		Make/Model:

Week of:	Monday			Tuesday			Wednesday			Thursday			Friday		
Hour meter reading:															
Check the following as appropriate	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A
1. Operator qualified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Overhead guard (ROPS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Horn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Parking brake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Service brakes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Steering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Oil level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Hydraulic oil level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Radiator fluid level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Major fluid leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Windows	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Backup alarm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Tires (visual)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Seat belts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Fuel leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Fire extinguisher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Fuel lines secure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Electrical lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Exhaust components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments/Remarks:

OP 585 - Fall Protection



Harness Inspection Form

Designated Competent Person must inspect/document before initial use, and annually thereafter. The inspection must also be dated on the equipment tag. Defective equipment shall be removed from service and destroyed.

Project Name: _____ **Project Number:** _____ **Project Location:** _____

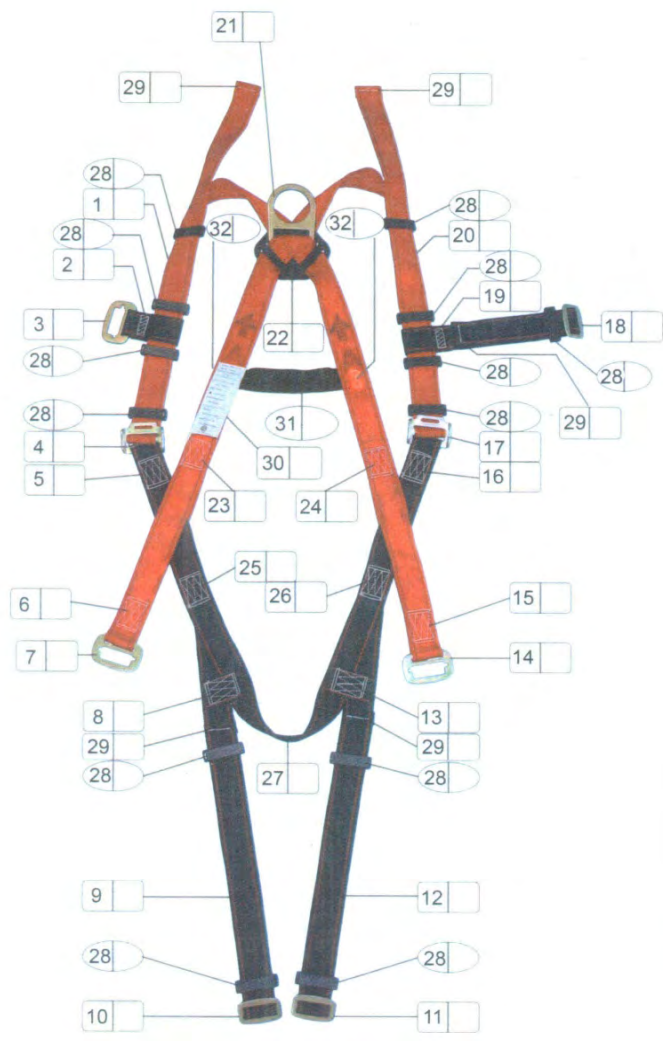
Date: _____ **Inspection Completed By:** _____

Harness Information:

Harness Manufacturer: _____ **Manufacture Date:** _____

Serial Number: _____ **Harness Class:** _____

Inspection



	Description	Pass	Fail
1	Left Shoulder Webbing		
2	Stitching		
3	Mating Buckle		
4	Adjusting Buckle		
5	Stitching		
6	Stitching		
7	Mating Buckle		
8	Stitching		
9	Left Leg Webbing		
10	Mating Buckle		
11	Mating Buckle		
12	Right leg webbing		
13	Stitching		
14	Mating Buckle		
15	Stitching		
16	Stitching		
17	Adjusting Buckle		
18	Mating Buckle		
19	Stitching		
20	Right shoulder webbing		
21	Dorsal D Ring		
22	D-ring back pad		
23	Stitching		
24	Stitching		
25	Stitching		
26	Stitching		
27	Sub-pelvic strap		
28	Belt keepers		
29	Stitching – end pattern		
30	Product label		
31	Back Strap		
32	Stitching – back strap		
	Load Indicators		

Comments: _____

OP 585 - Fall Protection



Lanyard Inspection Form

Designated Competent Person must inspect/document before initial use, and annually thereafter. The inspection must also be dated on the equipment tag. Defective equipment shall be removed from service and destroyed.

Project Name: _____ Project Number: _____ Project Location: _____

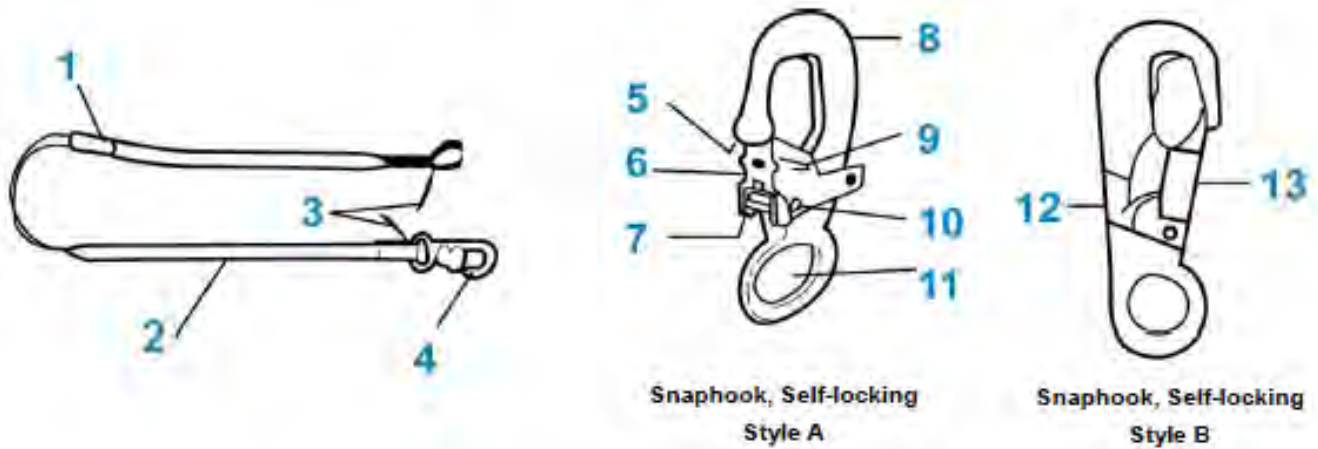
Date: _____ Inspection Completed By: _____

Lanyard Information:

Lanyard Manufacturer: _____ Manufacture Date: _____

Serial Number: _____ Lanyard Type: _____

Inspection



	Description	Pass	Fail
1	Flag Indicator	<input type="checkbox"/>	<input type="checkbox"/>
2	Outside Core Webbing	<input type="checkbox"/>	<input type="checkbox"/>
	Core	<input type="checkbox"/>	<input type="checkbox"/>
3	Wear Pads	<input type="checkbox"/>	<input type="checkbox"/>
	Labelling Tags	<input type="checkbox"/>	<input type="checkbox"/>
	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
4	Snaphooks (self-locking)	<input type="checkbox"/>	<input type="checkbox"/>
5	Hook nose	<input type="checkbox"/>	<input type="checkbox"/>
6	Gate (keeper)	<input type="checkbox"/>	<input type="checkbox"/>
7	Lock	<input type="checkbox"/>	<input type="checkbox"/>
8	Hook Body	<input type="checkbox"/>	<input type="checkbox"/>
9	Spring (inside gate)	<input type="checkbox"/>	<input type="checkbox"/>
10	Hinge	<input type="checkbox"/>	<input type="checkbox"/>
11	Eye	<input type="checkbox"/>	<input type="checkbox"/>
12	Lock	<input type="checkbox"/>	<input type="checkbox"/>
13	Gate	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

OP 592 - Forklifts



Forklift Inspection Form

Operator must inspect/document equipment when it is put into service, using this form. Equipment must be inspected prior to each use by the operator.

Project Name:	Project Number:	Project Location:
Operator:	Make/Model:	

Week of:	Monday			Tuesday			Wednesday			Thursday			Friday		
Hour meter reading:															
Check the following as appropriate	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A
1. Operator qualified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Overhead guard (ROPS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Horn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Brakes (service and park)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Steering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Engine Oil level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Hydraulic oil level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Radiator fluid level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Major fluid leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Windows/Wipers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Backup alarm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Tires (visual)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Seat belts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Fuel leaks (lines secure)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Fire extinguisher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Electrical lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Exhaust components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Load Rating Plates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Forks and Mast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Load back extension	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Chain lubricated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SAT – Satisfactory, UNSAT – Unsatisfactory, N/A – Not Applicable

Comments/Remarks:

OP 593 - Hazardous Energy Control



LOTO Procedure Form

PURPOSE: This 7-step procedure establishes the minimum requirements for the lockout of energy isolating devices whenever servicing or maintenance is done on facility equipment. This procedure will be used to ensure that the equipment is stopped, isolated from all potentially hazardous energy sources and locked out before employees perform any maintenance where the unexpected energization or startup of the equipment or release of energy could cause injury.

EQUIPMENT:

EQUIPMENT NO:

LOCATION:

COMPLIANCE WITH THIS PROCEDURE: All employees are required to comply with the restrictions and limitations imposed on them during the use of this procedure. The authorized employees are required to perform the lockout in accordance with this procedure. Other employees, upon observing a piece of equipment which is locked and/or tagged out, will not attempt to start, energize, or use said equipment.

Sequence of Lockout/Tagout

1. All affected employees will be notified that the equipment must be shut down and locked out to perform servicing or maintenance.

Specific Instructions:

2. The authorized employee will identify the type and magnitude of the energy that the equipment utilizes, will understand the hazards of the energy, and will know the methods to control the energy.

ENERGY

- Electrical (440V) Natural Gas Spring Hydraulic Gravity Steam Chemical Pneumatic
 Thermal Other:

3. Shut down operating equipment by the normal stopping procedures (depress stop button, open switch, close valve, etc.).

Specific Instructions:

4. Deactivate the energy isolating device(s) so that the equipment is isolated from the energy source(s).

Specific Instructions:

5. Lockout and tagout the energy isolating devices(s) with assigned individual locks and tags.

Lockout Equipment Needed:

6. Dissipate any stored or residual energy (such as that in capacitors, springs, hydraulic systems, and air, steam, or water pressure, etc.) by methods such as grounding, repositioning, blocking, bleeding down, etc.

Specific Instructions:

7. Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the normal operating control(s) or by testing to make certain the equipment will not operate. **CAUTION:** Return controls to "OFF" after verification. **THE EQUIPMENT SHOULD NOW BE LOCKED OUT AT ZERO ENERGY STATE.**

Specific Instructions:

METHODS OF VERIFICATION

Verification should be determined via start-up attempts, visual observations and testing. For electrical verification, place local on/off switch to ON position and verify equipment will not operate. Return the switch to OFF position and commence work.

OP 594 - Hot Work Operations



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Hot Work Permit

The SSHO will issue the Hot Work Permit for all Hot Work Activities. Permit is valid for one shift only. Dedicated fire watch required for minimum 30 minutes post operation.

Project Name:	Project Number:	Date:
Hot Work Location:	Purpose of Hot Work:	
Hot Work Operator:	Fire Watch:	
Hot Work Start Time:	Hot Work Stop Time:	

Permit Conditions

Work Area Preparation	Satisfactory	Unsatisfactory	N/A
Hot Work equipment in proper working order (torches, welding leads, etc)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Welding equipment properly grounded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Welding screen used to prevent flash to others in work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flash suppressors in place (torch lines)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Backflow preventers in place (torch lines)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cylinders secured in upright position?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Valves opened ¼ to 1 ½ turns only?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wrench (if necessary) present and on valve?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Combustible materials removed from area (>35 ft) or properly guarded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Combustible floor coverings adequately guarded/protected?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flammable liquids removed from area (>35 ft)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire fighting equipment in working order (min 10 lbs ABC fire extinguisher)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ducts, drains, and other openings guarded to prevent sparks/slag?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Containers cleaned, purged, ventilated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation controls in place?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Air Monitoring

Specific air monitoring required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If yes, please specify?			

Personal Protective Equipment

Required PPE (including respiratory protection, refer to AHA) present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Welding/cutting goggles present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Signatures

Hot Work Operator:	Fire Watch:
---------------------------	--------------------

Hot Work Supervisor

The location where this work is to be done has been examined, necessary precautions have been taken, and permission to proceed with the work is hereby granted.

Name/Title:	Signature:
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**APPENDIX E
HAZARDOUS SUBSTANCES INVENTORY**

OP 517 - Hazardous Materials Communication



SITE SPECIFIC HAZARDOUS SUBSTANCES INVENTORY (HSI)

A complete inventory, including location and quantities of specified materials, must be kept, and regularly updated. Cabrera relies on the information contained in SDSs as permitted by the OSHA Hazard Communication Standard (29CFR1910.1200) and does not perform independent hazard determinations.

LOCATION INFORMATION

OFFICE/PROJECT NAME: FUSRAP Maywood Superfund Site	OFFICE/PROJECT MANAGER: Bill Lorenz
ADDRESS/LOCATION: 100 West Hunter Ave, Maywood NJ	DATE: November 2013
	TIME:
RESPONSIBLE PERSON: AL CRAIG	HSI ATTACHED: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

SAFETY DATA SHEETS (SDS)

Attach copies of all SDSs to the back of this HSI. SDSs not on-hand, that are requested by employees, will be requested of suppliers within seven days by letter. The SSHO will be responsible for keeping this HSI updated. All subcontractors will be required to provide information on any chemicals used at this site.

SITE SPECIFIC PROCEDURES FOR COMPLIANCE (IF NECESSARY):

EMPLOYEE TRAINING VERIFICATION

INITIAL ON BOARDING AT OFFICE
 SITE SPECIFIC ORIENTATION (SSHP ACKNOWLEDGMENT)
 PERIODIC THRU AHA REVIEW
 PERIODIC THRU 8-HR REFRESHER
 OTHER BE SPECIFIC

HAZARDOUS SUBSTANCE INVENTORY

PRODUCT NAME	QUANTITY	LOCATION
3M Spray Adhesive		
Ace Hardware - Roof Coating		
Acetone		
AERUOE Rust Proofing Paint		
AgriLab - Disinfectant Concentrate - Pesticide/Tuberculocidal		
Alcanox		
Alcohol-Free Towelettes		
America's Finest Interior/Exterior Spray Paint		
America's Finest Latex Semi-Gloss Enamel Paint		
Amoco Industrial Oils - AW Oil No. 32		
Antifreeze (In vehicles)		
Aqua-Cure VOX		
Bacitracin Ointment		
Barricade 4FL Herbicide		

OP 517 - Hazardous Materials Communication



BEHR - Acrylic Latex Exterior Satin Flat Paint/Red Oxide		
Behr Hi-gloss enamel acrylic latex		
Benjamin Moore - Interior Latex Flat Finish Wall Satin Base		
Benjamin Moore - Latex Epoxy Reinforce Enamel Paint		
Benjamin Moore - Latex Semi-Gloss Enamel Base Paint		
Bentonite Sealing Agent		
Berkley Hi-solids orange enamel		
Burke Hypalon - Industrial Grade Seaming Adhesive		
CETCO - Non-Flammable Water Based Adhesive		
Clearshield Windshield Washer Antifreeze Solvent		
Clear Emulsified Concrete Curing Compound Cure & Seal 309		
Clifton Adhesive - Wash Primer Coating Solution LA-2826		
Concentrate Sulfuric Acid		
Congoleum - Premium Clear Thin Spread Tile Adhesive		
CRC Brakleen Brake Parts cleaner		
Deep Woods Off		
Dem-Kote - Amoniated Floor Stripper 2W349		
DEP Degreaser		
Diesel Fuel (In equipment)		
Dowex 21K XLT Anion Exchange Resin		
Drydene - Dieselall Oil SAE 30		
Drydene - Heavy Duty Lubes SAE 15W-40 Motor Oil		
Drylok Fast Plug #80		
Dutch Boy - Exterior Acrylic Latex Semi-Gloss Enamel Paint		
Eagle/Safety Can - Metal Fuel Containers		
ELCO - SBR Latex Bonding Admixture		
Elite Performance Windshield Washer Fluid		
Elmer's - Siliconized Acrylic Latex Caulk		
Elmer's Glue		
Epoxy Systems Product #901 Component "A" & "B"		
Ethyl Acetate		
Eyesaline Solution		
Fisherbrand 19 - Mechanical Pump Fluid No. 1-184-150B		
Fresh Gear – FG350 – germicidal detergent		
Gardner - Elastic Roof Cement		
Gardner - Premium Roof Cement		

OP 517 - Hazardous Materials Communication



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Gardner roofing cement		
Gasoline (In vehicles)		
GE5020 – Silicone Rubber Compound		
Glidden Interior Enamel Semi-Gloss		
Glidden latex semi-gloss exterior		
Glidden Maximum High - Latex Semi-Gloss Paint		
Goop adhesive/sealant		
Grease		
Great Stuff Big Gap Filler Foam Sealant		
Hazorb Universal Sorbent		
Henry - Cove Base Adhesive 440		
Henry - Floor Tile Adhesive/Clear Thin-Spread		
Henry - Non-Flammable Acrylic Latex Cove Base Adhesive 440		
Hexane		
Higro Cure & Seal		
Homelite 2 cycle oil		
Instant Gum Cutter Carb Cleaner		
Isobutylene		
Isopropyl Alcohol		
JPS Elastomerics hypalon adhesive		
Karnak - Combustible Mixture Flashing Cement		
Klean Strip - Paint Thinner 100% Mineral Spirit		
Lab Safety Supply - Synthetic Aliphatic Hydrocarbons		
Liquid Nitrogen		
Master Mechanic - Pressurized Propane		
Methanol		
Miscellaneous Lab Plasticware		
Mixed Calibration Gas (Carbon Monoxide, Methane, Hydrogen Sulfide, Oxygen, Nitrogen)		
Mobil - DTE 24 Hydraulic Oil		
Motor Oil (In vehicles)		
Nashua - Spray Adhesive - Contains no CFCs		
Nitric Acid 1%		
Nitric Acid 10%		
Nitric Acid 65%		
Nitric Acid 69% - 70%		
Naval Jelly – NJ3		

OP 517 - Hazardous Materials Communication



CABRERA SERVICES
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Oatley - Purple Prime Cleaner for CPVC/PVC		
Oatley – Heavy Duty Gray PVC Solvent Cement		
Orange marking paint		
Ortho Weed-b-Gone		
P-10 counting gas (90% Argon & 10% Methane)		
Pennzoil - Motor Oil HD SAE 30		
Pennzoil SAE 15W - 40 motor oil		
Pittsburgh - Enamel Gloss Oil Based Paint/Safety Yellow		
Powerlane Bar & Chain 2 cycle oil		
Prime Roof Coating		
Propanol		
Proseal Plastic Roof Cement		
Pruning Sealer		
Quaker Supreme - Anti Foam Hydraulic Oil No. 65-105		
Quikrete Acrylic Concrete Cure & Seal 8800		
Quikrete Concrete Bonding Adhesive #9902		
Quikrete 5,000 Fast Setting Concrete		
RBS Concentrate - Replacement for Dichromate Sulfuric Acid		
Real-Kill Wasp and Hornet Killer		
Readi-Crete Concrete Mixes		
Ricca Chemical - Deionized Water Reagent Grade		
Riverdale Razor Pro - Herbicide		
Round-Up weed killer		
Rust-Oleum - Industrial Enamel - Damp Proof Red Primer		
Rust-Oleum - Industrial Enamel -Federal Safety Yellow Paint		
Rust-Oleum - Latex Wall Paint- White		
Rust-Oleum - Multipurpose Latex Paint/Apple red		
Rust-Oleum - Oil Based Enamel - Safety Yellow Paint K7744		
Rust-Oleum - Professional Inverted Marking Paint		
Rust-Oleum Appliance epoxy		
Rust-Oleum -Oil Based Primer/Rusty Metal Primer		
Rust-Oleum oil enamel safety “red”		
Rust-Oleum Sandable Primer		
Safe-T-Way - Metal Fuel container		
Sheetrock - Joint Compound Plus 3		
Shell Denax TD transmission fluid		

OP 517 - Hazardous Materials Communication



CABRERA SERVICES
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Sight Savers brand Premoistened Lens Cleaning Tissue		
Sikaflex – 1CSL – polyurethane sealant		
Simple Green		
Soil-Sement – dust control agent		
Spill-X-S Solvent Adsorbent		
Super Stripe Athletic Power Paint Cartridge		
Tamms - Formshield/Chemical Release Agent		
TechNu Outdoor Skin Cleanser		
Tradco Engine Starting fluid		
Tru-Test - Latex Semi-Gloss Enamel Paint/Navajo White		
Valvoline - Gear Oil SAE 80W-85W-90		
Valvoline multi-purpose grease		
Valvoline SAE 15W-40 motor oil		
VWK Scientific - Vacuum Pump Oil 19		
WD-40		
Weldwood - Contact Cement		
Weldwood - Neoprene Rubber Formula Combustible Liquid		
WilsonArt contact adhesive		
ZEP - Weed Defeat		
ZEP-45 Lubricant		
Zeston 2,000 PVC		