

M-766

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the Maywood Site, New Jersey



**US Army Corps
of Engineers®**

FUSRAP POST-REMEDIAL ACTION SURVEY PLAN

PURPOSE

The purpose of this plan is to describe the methodologies that Bechtel, functioning as the project management contractor (PMC) for the Department of Energy's (DOE's) Formerly Utilized Sites Remedial Action Program (FUSRAP), will use for radiological surveys, sampling, and analysis to document the final condition of the remediated properties as free of radioactive contamination above the release standards in DOE Order 5400.5 (reference 1). Where radioactive contaminants are commingled with chemical contaminants, and where chemical contaminants are the result of former DOE activities, the remediation will include remediation of the chemical contaminants. Criteria for chemical contaminant remediation, when appropriate, will be negotiated with the DOE, EPA, and appropriate state agencies on a site specific basis following the DOE guidelines for chemically contaminated sites (reference 2).

Nothing herein is intended to compromise the Independent Verification Contractor's (IVC) independence; the purpose is to document the methodology the PMC will employ to direct its radiological support subcontractor (RSS) to conduct post-remedial action (post-RA) surveying and sampling activities, how these survey and sampling activities will be documented (and the information provided to the IVC), and how post-RA and verification surveys will be coordinated with the IVC (Oak Ridge National Lab or the Oak Ridge Institute of Science and Education). This plan follows the DOE protocol for verification and certification of sites under FUSRAP (reference 2).

RESIDUAL CONTAMINATION GUIDELINES

Soil Guideline

Generic guidelines for residual radioactive material in soils from DOE Order 5400.5, chapter IV for Ra^{226} , Ra^{228} , Th^{230} , and Th^{232} are:

Soil Concentration Above Background^a

5 pCi/g when averaged over the first 15-cm-thick layer of soil.^b

15 pCi/g averaged over 15-cm thick layers of soil more than 15 cm below the surface.

a These guidelines take into account in growth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If either thorium-230 and radium-226 or thorium-232 and radium-228 are both present, not in secular equilibrium, the guidelines apply to the higher concentration. If other mixtures of radionuclides occur, the sum of the ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide shall not exceed one.

b This is the limit for any 15-cm-thick layer of soil located on residential properties in Maywood, New Jersey (reference 4).

Guidelines for other radionuclides present are derived from the basic dose limit by means of environmental pathway analysis (e.g., RESRAD modelling) using site specific property data and exposure scenarios. Final soil criteria are negotiated with the appropriate regulatory agencies. For mixtures of individual radionuclides in soil, the sum of the ratios of the individual soil concentrations to the allowable limit shall not exceed one.

The residual contamination guidelines for fixed and removable radioactive contamination (dpm/100 cm²) from 10 CFR 835, Appendix D are as follows:

Surface Contamination Guidelines

Radionuclide	Average	Maximum	Removable
U-nat, ²³⁵ U, ²³⁸ U, and associated decay product alpha emitters	5,000	15,000	1,000
Th-nat, ²³² Th, ¹²⁶ I, ¹³¹ I, ¹³³ I, ²³² U, ²²³ Ra, ²²⁴ Ra, and ⁹⁰ Sr	1,000	3,000	200
²²⁶ Ra, ²²⁸ Ra, ²³⁰ Th, ²²⁸ Th, ¹²⁵ I, ¹²⁹ I, ²³¹ Pa, ²²⁷ Ac, and transuranics	500	1,500	20
Beta-gamma emitters (except as noted above)	5,000	15,000	1,000

Radon

When the residual radioactivity contributing to a radon concentration above criteria at a site is of DOE origin, remedial action and verification of compliance with the radon and radon decay product (working level) criteria is required as part of the post-RA process. The applicable criteria are as follows:

Radon ²²²	3.0 pCi/L
Radon ²²⁰	3.0 pCi/L
Radon Decay Products	0.03 Working Levels (WL)

When both isotopes of radon are present, the sum of the ratios of the individual concentrations to the allowable limit must be less than one.

When there is reasonable assurance that the residual radioactivity requiring remediation at a site is either;

- not a potential source of radon (i.e., no radium present above background concentrations) or;
- is not of DOE origin, then

remedial action and compliance with the radon concentration and radon decay product criteria is not required.

External Gamma Exposure Rates

The average external gamma exposure rate inside a building or habitable structure on a site to be released without radiological restrictions shall not exceed background by more than 20 $\mu\text{R/hr}$ and shall comply with the basic dose limit (100 mrem/yr) when an "appropriate use" scenario is considered. This requirement is not applicable to structures scheduled for demotion or to be buried foundations.

External gamma exposure rates on open lands shall also comply with the basic dose limit (100 mrem/yr, excluding radon) and the ALARA process, considering appropriate-use scenarios for the area.

POST REMEDIATION SURVEYS AND SAMPLING

Post-RA survey and sampling activities focus on confirming that soil and structures that remain after remedial action do not contain residual radioactive contamination at concentrations exceeding applicable guidelines. Following remediation, the RSS performs post-remedial action surveys and sampling to determine the completeness of the remedial action and to document that the site complies with the applicable criteria.

Survey Equipment

The equipment used by FUSRAP for delineation of the containment boundaries (determination of "hot spots") during remediation and post-RA surveys of soils includes, but is not limited to:

- Field Instrument for Detection of Low Energy Radiation (FIDLER) (calibration source: Am-241).
- Gamma Scintillation Detector (Eberline SPA-3 or equivalent), or low range/high range HP-270 or equivalent (calibration source: Cs-137)

- Reuter-Stokes Pressurized Ion Chamber (PIC) (calibrated by manufacturer) or Ludlum "µR Meter".
- Canberra® In-situ Gamma Spectrometer (calibration source: mixture of uranium and thorium utilizing EML standards)
- Canberra ® 96-6697 Procount Gamma Spectroscopy system (calibration source: mixture of uranium and thorium utilizing EML standards)

The equipment used by FUSRAP for Post-RA surveys of structures includes, but is not limited to:

- Alpha Scintillation detector (Eberline AC-3 or equivalent) (calibration source: Th-230)
- Beta/Gamma Pancake GM detector (7 mg/cm² mylar shielded, Eberline HP-210 or equivalent) (calibration sources: Sr-90, Y-90)
- Alpha Scintillation Counter (Eberline SAC-4 or equivalent) (calibration source: Th-230)

The same type calibration sources (i.e., same radionuclide) and methods for instrument calibration will be used whenever possible by the PMC and the IVC to ensure compatibility and reproducibility of survey results.

Background Measurements

Prior to performing post-remedial action surveys, the RSS will obtain site-specific background measurements and samples from three remote background locations in the general vicinity (0.5 to 3 miles) of the site being remediated according to Thermo NUtech (TN) procedure 3C.2 (reference 5G). The location for background measurements will be selected by the PMC and the RSS to be representative of site conditions yet unaffected by operations at the site. Background measurements and samples will be taken at each location by the RSS and the IVC.

If similar materials (concrete, mortar, brick, asphalt, etc.) cannot be found within 0.5 to 3 miles of the site, then samples of materials taken from uncontaminated portions of the facility may be used for determining background.

Structural Surveys

After completion of surface decontamination of structures, the RSS shall conduct post-RA surveys to verify satisfactory decontamination of the area. A survey grid shall be established at the site, conforming to the specifications in TN procedure 3A.1 (reference 5B) and the "Instruction Guide for Post-Remediation Radiological Survey of Structures" (191-IG-031, reference 6). Surveys shall be conducted in each 1 m by 1 m (1 m²) grid. The IVC will use the same coordinate grid to locate direct and transferable measurement locations.

Interior external gamma radiation exposure rates should be taken at a frequency of one per 100 m² of floor area, or one per room, whichever yields a greater frequency.

Excavation Surveys

After completion of excavation of contaminated soils, the RSS shall conduct post-RA surveys to verify satisfactory decontamination of the area. A survey grid shall be established at the site, conforming to the specifications in TN procedure 3B.1 (reference 5F) and the "Instruction Guide for Post-Remediation Survey of Soil" (191-IG-032, reference 7), and surveys shall be conducted in each square of a suggested 10 m by 10 m grid (100 m²). When deviating from the 10 m by 10 m grid (due to small irregularities in the area of contamination), the total area of each grid shall not exceed 100 m². The IVC will use the same coordinate grid to locate post-RA survey measurements and sample locations.

After all visible loose dirt has been removed, structures (foundations, culverts, etc.) in the formerly contaminated areas will be surveyed for release in accordance with TN procedure 2C.1 (reference 5A).

The RSS will obtain a sufficient number of external gamma radiation exposure rate measurements at a height of 1 m in the center of the 10 m by 10 m grid using methods in accordance with TN procedure 3B.3 (reference 5F) to adequately determine the average external gamma exposure rate within the remediated area.

Soil Sampling

The RSS shall also collect post-RA soil samples to verify satisfactory remediation of the area. Samples shall be collected from an approximately 100 m² grid (suggested 10 m by 10 m as directed in 191-IG-032, and TN procedure 4A.1 (references 7 and 5H).

Point Sources ("Hot Spots") will be evaluated by using the averaging criteria contained in "A Manual for Implementing Residual Radioactive Material Guidelines" (reference 8) and DOE Order 5400.5, Chapter IV, Section 4. Where appropriate, a "hybrid grid" (made up of portions of one or more site grids) will be implemented to bound, by sampling or instrument readings, and assign the area (in square meters) to each "hot spot" in question to determine compliance.

Composite samples will be collected from each remediated grid by taking individual samples (at a frequency of 25 per 100 m²) from each sample grid and compositing these individual samples into one sample for that grid. The IVC may collect splits of the composite concurrently.

Samples from each grid square shall be collected using properly decontaminated sampling equipment (reference 9).

Onsite analytical techniques (gamma and alpha spectroscopy) will be used (where/when available) to analyze all composite soil samples on site. Ten percent (10%) of the samples shall also be shipped to the TN laboratory in Oak Ridge, TN to be analyzed using gamma spectroscopy (Gamma List 1). Preliminary lab results should be available within 3 days of receipt of the sample by the lab.

Hazard Assessment

In accordance with DOE Order 5400.5, supplemental limits may be recommended in areas where the dose to members of the public, as well as environmental harm, is low and the cost of remediation is relatively high. If supplemental limits are recommended, a hazard assessment would be developed to estimate doses from current and future use scenarios. Sufficient sampling, as determined by the PMC and the IVC, would be performed in order to define contaminant concentration boundaries and average concentrations in order to aid in the development of the supplemental standards.

Safety and Health

Safety and health risks associated with tasks described herein are identified and addressed by the generic and site specific Health and Safety Plans and the FUSRAP Project Health and Safety Manual (reference 10) and the FUSRAP Radiation Safety Manual (reference 11). Where applicable, all work will be performed under a Hazardous Work Permit and an Activity Safety Envelope specific to the survey activities.

Quality Assurance/Quality Control

QA/QC field duplicate samples and measurements shall be collected at a frequency of one additional sample/measurement for each 20 collected.

Rinse blanks from decontaminated sampling equipment will not be required for decontaminated post-RA survey and sampling equipment unless post-decon smears indicate surface contamination in excess of twice background. When chemical post-RA sampling is required, rinse blanks shall be collected at the rate of one rinse blank per day of sampling. Rinse blanks shall be collected according to the recommendations in 191-IG-028 (reference 12).

Data Quality Objectives

Quality indicator goals shall be as follows: Precision, ± 2 sigma; completeness, 100%; Accuracy range, 75 to 125%. QA/QC samples are discussed in the previous section.

PMC/IVC COORDINATION

Bechtel, functioning as the PMC, is the contractor responsible for completing the remedial action. To define the areas for remediation, Bechtel uses data collected during designation, as well as supplemental information obtained by Bechtel as part of pre-RA planning and scoping activities (characterization, waste classification, and foundry delineation sampling activities).

Upon completion of remediation, the RSS will perform post-RA surveys, and the IVC will commence verification of the remediated property. The results of this survey shall be used to determine whether there are areas requiring additional remediation. This survey is expected to include all areas previously identified as being contaminated on the designed properties. The Bechtel Site Superintendent will notify the IVC when remediation of an area is complete, and the IVC will perform independent verification surveys of the area. Bechtel will assist the IVC in this survey by interfacing with the property owner in advance to secure approval for property access.

Bechtel will initiate remediation of areas identified by the IVC that require additional remediation. The remediation of these additional areas will occur concurrently with the IVC's verification activities, to the extent that remediation does not interfere with verification.

Data Transmittal

Bechtel will provide the IVC copies of all final (reviewed and verified) post-remediation survey and sample results as they become available. Post-RA survey data shall be documented per the appropriate TN procedure for the type survey or sampling being performed and shall include sufficient information to document the final remediated condition of the site, including the location, average concentration, and approximate area of "hot spots" as defined in DOE Order 5400.5.

Comparability

Measurements taken by Bechtel and the IVC at identical locations should agree within the 95 percent confidence interval for the analytical methods used (reference). For consistency and ease of data comparison, Bechtel's RSS and the IVC shall utilize the same type of calibration techniques, calibration sources, and survey techniques in conducting the surveys. Bechtel and the IVC shall utilize the same survey grid and shall conduct their surveys referring to that grid.

Site Release Documentation

Prior to demobilization from a site, the IVC will provide the Site Superintendent with verbal agreement that indicates all the samples and instrument readings needed to verify the area as clean have been obtained. After all soil samples have been analyzed by the IVC, final documentation releasing the area of interest should be faxed to the Site Superintendent.

Once it has been established that the site meets the applicable DOE criteria as determined by direct measurements and analytical results, Bechtel will proceed to restore the site to the condition agreed upon by the property owner(s).

Bechtel will prepare a draft post-remedial action report (PRAR) for DOE review (copies to the acting IVC) within three months of demobilization from the site.

REFERENCES

- (1) DOE Order 5400.5, Radiation Protection of the Public and Environment, Washington, DC
- (2) CCN 063475, Fiore to Gross, "Chemical Contamination at FUSRAP Sites", August 24, 1989
- (3) DOE, 1990, Verification and Certification Protocol for the Office of Environmental Restoration FUSRAP and D&D Program, Revision 3, November.
- (4) CCN 114978, Muszynski to LaGrone , "EPA Region 2's Position on the Dispute Regarding Cleanup Levels for Radionuclide Contamination", March 23, 1994.
- (5) Thermo NUtech (TN), Health Physics Operational Procedures Manual.
 - A) 2C.1 "Release of Equipment and Materials"
 - B) 3A.1 "Radiological Survey of Structures"
 - C) 3A.2 "Direct Surface Contamination Survey"
 - D) 3A.3 "Transferable Surface Contamination Survey"
 - E) 3B.1 "Delineation of Survey Areas in Open Land"
 - F) 3B.3 "Gamma Ray Exposure Rate Surveys at 1-Meter in Open and Enclosed Areas"
 - G) 3C.2 "Determination of Background"
 - H) 4A.1 "Systematic and Bias Surface Soil Sampling (Radiological)"
- (6) BNI, 1993, Instruction Guide for Post-Remediation Radiological Survey of Structures, 191-IG-031, Revision 0.
- (7) BNI, 1993, Instruction Guide for Post-Remediation Radiological Survey of Soil, 191-IG-032, Revision 0.
- (8) DOE/CH/8901, A Manual For Implementing Residual Radioactive Material Guidelines, June 1989.
- (9) BNI, 1992, Instruction Guide for Decontamination of Field Sampling Equipment at FUSRAP Sites, 191-IG-011, Revision 5.
- (10) FUSRAP Project Safety and Health Manual
- (11) FUSRAP Radiation Safety Manual
- (12) BNI, 1993, Instruction Guide for Surface Water and Sediment Sampling Activities, 191-IG-028, Revision 0.