ANNUAL ENVIRONMENTAL MONITORING REPORT, 2015

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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Prepared by

CABRERA SERVICES
RADIOLOGICAL• ENVIRONMENTAL• REMEDIATION

100 West Hunter Avenue
Maywood, New Jersey 07607

August 2016
Revision 0

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ABBREVIATIONS AND ACRONYMS

%	percent
µg/L	micrograms per liter
ASTM	American Society of Testing Materials International
BNL	Brookhaven National Laboratory
Cabrera	Cabrera Services Inc.
CFR	Code of Federal Regulations
CIIAW	Commission on Isotopic Abundances and Atomic Weights
DOE	U.S. Department of Energy
Eh	oxidation/reduction potential
EMP	Environmental Monitoring Program
EPA	U.S. Environmental Protection Agency
FMSS	FUSRAP Maywood Superfund Site
ft	feet
ft/ft	foot per foot
FUSRAP	Formerly Utilized Sites Remedial Action Program
GEPP	General Environmental Protection Plan
GW	groundwater
GWCL	groundwater cleanup level
J	estimated value
K-40	potassium 40
kg	kilogram
L	liter
Li	lithium
m	meter
MCL	Maximum Contaminant Level
MCW	Maywood Chemical Works
MDA	minimum detectable activity
mg/kg	milligram per kilogram
MISS	Maywood Interim Storage Site
mrem	millirem
mrem/yr	millirem per year
NJ	New Jersey
NJDEP	New Jersey Department of Environmental Protection
NESHAP	National Emission Standards for Hazardous Air Pollutants
NGVD	National Geodetic Vertical Datum
NRC	U.S. Nuclear Regulatory Commission
OSLD	optically stimulated luminescence detector
pCi	picocurie
pCi/g	picocuries per gram
pCi/L	picocuries per liter
$pCi/m^2/s$	picocuries per square meter per second
QA	Quality Assurance
Ra-226	radium 226
Ra-228	radium 228
RCRA	Resource Conservation and Recovery Act
Rn-222	radon 222
ROD	Record of Decision
SI	Système Internationale
SOP	Standard Operating Procedure
TEDE	total effective dose equivalent
Th-228	thorium 228
Th-230	thorium 230
Th-232	thorium 232
Th-234	thorium 234
TOC	top of inner casing
U-232	uranium 232
U-234	uranium 234
U-235	uranium 235
U-238	uranium 238
$U_{(tot)}$	total uranium
UFML	USACE FUSRAP Maywood Laboratory
UFP QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
VP	vicinity property

EXECUTIVE SUMMARY

The Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS) includes the Maywood Interim Storage Site (MISS) and vicinity properties (VPs). The FMSS is located in Bergen County, New Jersey (NJ) and managed by the U.S. Army Corps of Engineers (USACE) under FUSRAP. In the early history of the FMSS, from 1916 to 1959, the former Maywood Chemical Works extracted radioactive thorium and rare earth metals from monazite sand resulting in contamination at the FMSS with low levels of Th and lower levels of uranium and radium . These residues or constituents of concern are the focus of this report. The radioactive constituents of concern include thorium 232 (Th-232), radium 226 (Ra-226), uranium 238 (U-238), and total U ($U_{(tot)}$) as described in the *Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site, Maywood, New Jersey*, August 2003 (Soil Record of Decision [Soil ROD]) (USACE 2003). Additional non-radioactive constituents of concern were identified through the *FUSRAP Maywood Superfund Site Groundwater Record of Decision* (Groundwater ROD) (USACE 2012). These constituents include arsenic), lithium , and benzene.

Per the requirements of the *General Environmental Protection Plan, FUSRAP Maywood Superfund Site, Maywood, New Jersey*, November 24, 1999 (USACE 1999), an Environmental Monitoring Program (EMP) was established for the FMSS. The *General Environmental Protection Plan* (GEPP), Revision 1 was issued in January 2014 (USACE 2014). One of the main objectives of the EMP is to ensure that the public and the environment are adequately protected from FUSRAP contaminants present at the FMSS. This is accomplished through annual monitoring of the air, surface water, sediment, and groundwater. This report prepared by Cabrera Services Inc. (Cabrera) presents the results of the EMP that was conducted for calendar year 2015.

AIR

The 2015 maximum airborne particulate dose to an off-site resident with 100 percent occupancy, considering all site contributions throughout the year, was 8.4×10^{-3} millirem (mrem). The maximum dose to an off-site worker was calculated to be 2.08×10^{-3} mrem. This is well below the 10 millirem per year (mrem/yr) standard specified in the 40 Code of Federal Regulations (CFR) 61, Subpart H (EPA [U.S. Environmental Protection Agency] 2015a).

Radon 222 flux monitoring was performed over a 24-hour period between December 9, 2015 and December 10, 2015. The maximum measured Radon 222 flux concentration during the 24-hour period of time was 0.0343 picocuries per square meter per second ($pCi/m^2/s$), and thus was in compliance with the 40 CFR 61, Subpart Q standard of 20 $pCi/m^2/s$ (EPA 2015b).

Radon 220 and Radon 222 monitoring was performed continuously at numerous locations along the site perimeter throughout 2015. For the first 6 months of the monitoring year, the maximum Radon 220 concentration was 3.42 picocuries per liter (pCi/L), and 3.81 pCi/L for the last 6 months of the monitoring year. Radon 222 concentrations for 2015 were below the Lower Limit of Detection at all measurement locations: 0.2 pCi/L for the first 6 months of the monitoring year and 0.1 pCi/L for the last 6 months of the monitoring year.

GAMMA RADIATION

Calculated doses, above background, to the hypothetical maximally exposed resident and off-site worker from direct gamma radiation at the MISS in 2015 are 50.0 mrem/yr and 13.5 mrem/yr, respectively. This is well below the U.S. Nuclear Regulatory Commission (NRC) standard, specified in 10 CFR 20, of 100 mrem/yr (NRC 2015).

SURFACE WATER

During 2015, surface water was collected from nine locations within Westerly and Lodi brooks. Surface water samples were analyzed for gross alpha, gross beta, Ra-226, radium 228 (Ra-228), thorium 228 (Th-228), thorium 230 (Th-230), Th-232, uranium 234 (U-234), uranium 235 (U-235), and U-238. The gross alpha results are not corrected for uranium or radon . The gross beta results are not corrected for potassium 40 (K-40).

The gross alpha results ranged from non-detect to a maximum of 3.04 picocuries per liter (pCi/L) at Location SWSD001. The gross beta results ranged from non-detect to a maximum of 10.73 pCi/L at Location SWSD002. The combined Ra-226 and Ra-228 results ranged from 0.17 pCi/L at Location SWSD006 to a maximum of 0.93 pCi/L at Location SWSD009. The total uranium ($U_{(tot)}$) results ranged from non-detect to a maximum of 1.42 micrograms per liter (µg/L) at Location SWSD008.

SEDIMENT

Sediment was collected from eight of nine locations within Westerly and Lodi brooks. Sediment was not present at Location SWSD004. The stream flow at Location SWSD004 is such that no sediment was deposited at this location. Sediment samples were analyzed for Ra-226, Th-232, and U-238. In the absence of regulatory criteria for radionuclides in sediment, the limits established in the *Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site*, August 2003 (Soil ROD) (USACE 2003) were used to evaluate the shallow streambed sediment. The measured concentrations of radionuclides of concern in sediment samples collected in Westerly and Lodi brooks did not exceed the soils cleanup criteria established in the Soil ROD.

The highest combined concentration of Ra-226 and Th-232 was found at Location SWSD009 in Lodi Brook (2.75 picocuries per gram (pCi/g)), which does not exceed the Soil ROD unrestricted use soil cleanup criteria of 5 pCi/g above background (6.64 pCi/g, with background included).

The highest U-238 result was identified at Location SWSD008 (0.87 pCi/g), which translates for this site to a $U_{(tot)}$ concentration of approximately 2.14 pCi/g; less than three percent of the Soil ROD soil cleanup criteria of 100 pCi/g above background (102.73 pCi/g with background included).

GROUNDWATER

During 2015, groundwater was collected from 23 monitoring wells located on-site and off-site. Groundwater samples were analyzed for the following radioactive constituents: gross alpha, gross beta, Ra-226, Ra-228, Th-228, Th-230, Th-232, $U_{(tot)}$, K-40, and Rn-222. $U_{(tot)}$ is the sum of U-238, U-235, and U-234. The gross alpha results are not corrected for uranium or radon. The gross beta results are not corrected for K-40.

The gross alpha results for the overburden wells ranged from non-detect to a maximum of 4.78 pCi/L at Well MW28S. The gross alpha results for the bedrock wells ranged from non-detect to a maximum of 18.88 pCi/L at Well MW24D. When corrected for total uranium content, the maximum was 8.46 pCi/L at Well B38W24D. Overall, gross alpha concentrations are consistent with past years' data.

The gross beta results for the overburden wells ranged from 2.54 pCi/L to a maximum of 95.32 pCi/L at Well B38W15S. When corrected for K-40, the maximum was 18.92 pCi/L at Well B38W15S. The gross beta results for the bedrock wells ranged from 1.22 pCi/L to a maximum of 923 pCi/L at Well MISS05BR. When corrected for K-40, the maximum was 15.78 pCi/L at Well MW28D. The K-40 result for Well MISS05BR was 914.00 pCi/L.

The combined Ra-226 and Ra-228 results for the overburden wells ranged from non-detect to a maximum of 1.30 pCi/L at Well MW24S. The combined Ra-226 and Ra-228 results for the bedrock wells ranged from non-detect to a maximum of 1.44 pCi/L in Well B38W17B. In general, the combined Ra-226 and Ra-228 results for 2015 were within the historical range.

The $U_{(tot)}$ results for the overburden wells ranged from non-detect to a maximum of 1.64 µg/L at Monitoring Well MW28S. The $U_{(tot)}$ results for the bedrock wells ranged from non-detect to a maximum $U_{(tot)}$ level of 17.14 µg/L in Monitoring Well MW-24D. Monitoring Well MW-24D may be impacted by radon. The radon result for this well was 1,350 pCi/L. Approximately 52 percent [%] of the $U_{(tot)}$ sample results were non-detectable.

The K-40 results for the overburden wells ranged from 0.83 to 76.40 pCi/L at Well B38W15S. The K-40 results for the bedrock wells ranged from 1.00 to 914.00 pCi/L at Well MISS05BR.

The Rn-222 results for the overburden wells ranged from 62 pCi/L to a maximum of 450 pCi/L at Well MISS05AR. The Rn-222 results for the bedrock wells ranged from 88 pCi/L to a maximum of 1,350 pCi/L at Well MW24D. All of the Rn-222 data were qualified and detectable.

The non-radioactive constituents that were identified in the Groundwater ROD were added to the EMP in 2014. The constituents are lithium, arsenic, and benzene. Groundwater cleanup levels are 730 µg/L for lithium, 3 µg/L for arsenic, and 1 µg/L for benzene (USACE 2012).

Lithium was detected in all of the 23 wells at concentrations ranging from 5.20 to 5,500 µg/L. The average lithium concentration was 1,314 µg/L. The highest concentration occurred in Deep Bedrock Monitoring Well MISS05BR at a concentration of 5,500 µg/L. The duplicate sample for this well location had a reported lithium concentration of 5,300 µg/L. Ten of the 23 wells sampled had lithium concentrations that exceeded the cleanup level.

Arsenic concentrations ranged from 0.83 µg/L to a maximum concentration of 72 µg/L in Bedrock Monitoring Well MISS07B. The average arsenic concentration was 4.538 µg/L. Six of the 23 wells had arsenic concentrations that exceeded the cleanup standard.

Benzene concentrations ranged from 0.96 to 1,000 µg/L in Bedrock Monitoring Well MISS05BR. The benzene cleanup standard was exceeded in three wells.

STATUS OF REMEDIAL ACTIVITIES

As of the end of 2015, all VPs identified in the Soils ROD (USACE 2003) located in the Borough of Lodi have been remediated of accessible contaminated soil, while studies of additional properties are ongoing. Additional properties located within the Borough of Maywood and Township of Rochelle Park have also been remediated of accessible contaminated soil.

Groundwater at the FMSS is being addressed under the groundwater operable unit. Monitoring for the groundwater ROD (USACE 2012) constituents (arsenic, lithium and benzene) has been ongoing since 2014 as part of the groundwater sampling program. Monitoring for these constituents will be included under the Long-Term Groundwater Monitoring Plan.

SUMMARY

Overall, the results of the 2015 annual EMP sampling are within the historical ranges and comparable to results reported in previous years. Based on the results discussed above, the following objectives of the EMP have been met:

- To ensure that the public and the environment are adequately protected from radiological contaminants present at the MISS

- To assess compliance with the federal, state, and local environmental laws and regulations
- To characterize and define trends in the condition of the environmental media
- To identify and quantify new or existing environmental quality problems

At this time there is no need to revise the EMP because all objectives have been met. As the remedial action progresses, the media sampled and the locations for these samples will continue to be evaluated on a case-by-case basis to ensure that the objectives of the EMP continue to be met.

1.0 INTRODUCTION

The FUSRAP Maywood Superfund Site (FMSS) is located in Bergen County, New Jersey (NJ), approximately 12 miles (20 kilometers) northwest of New York City and 13 mi (21 km) northeast of Newark, NJ (Appendix A, Figure A-1). The FMSS consists of 92 designated residential, commercial, municipal, and state or federal properties in the Boroughs of Maywood and Lodi, and the Township of Rochelle Park.

From 1916 to 1956, waste and residues associated with the processing of Th and Th compounds from monazite ores were generated by the former Maywood Chemical Works (MCW) in Maywood. These activities ceased in 1956; approximately three years later, the 30-acre MCW property was purchased by the Stepan Company.

Wastes from these manufacturing processes were generally stored in open piles and retention ponds. The wastes migrated off the property through two primary mechanisms: natural drainage and flooding events associated with the former Lodi Brook, which originated on the MCW property and; the use of the contaminated soils from the MCW as fill. Radionuclide constituents of the waste include Th-232, radium-226 (Ra-226), uranium, and associated daughter products.

In 1961, the Atomic Energy Commission issued a radioactive material license to the Stepan Company for radioactive material storage and remediation of the facility. Between 1966 and 1968, contaminated material was removed from the property west of NJ Route 17 and buried in three pits on the Stepan Company site.

In 1983, the EPA added the FMSS to the National Priorities List, and the following year cleanup of radioactive contamination at the FMSS was assigned to the U.S. Department of Energy (DOE) by Congress. To expedite remediation of the FMSS, the DOE purchased an 11.7-acre (4.7 hectare) portion of the Stepan Company property for use as an interim storage facility for radiologically-contaminated materials (DOE 1992) removed from the VPs. This property referred to as the Maywood Interim Storage Site (MISS) was the initial focus of the Environmental Monitoring Plan (EMP). The soil stockpile was removed for off-site disposal in 1996. On October 13, 1997, the Fiscal Year 1998 Energy and Water Appropriations Bill transferred management of FUSRAP from the DOE to the USACE. The USACE became a successor to the DOE as of March 17, 1999. FUSRAP activities presently continue with the USACE on the MISS and several of the remaining commercial/residential VPs.

As of the end of 2015, all VPs and properties previously identified in the identified in the Soils ROD (USACE 2003) have been remediated of accessible contaminated soil while selected studies of additional properties are ongoing. Additional properties located within the Borough of Maywood and Township of Rochelle Park have also been remediated of accessible contaminated soil. In 2015, the USACE directed investigation of additional properties in Lodi, Maywood, and Rochelle Park. Table 1-1 provides a summary of the status of the properties as listed.

Table 1-1. Summary of Soil Remedial Activities

Property Address	Municipality	Status
72 Sidney Street	Borough of Lodi	Remediation completed in 2002
100 Hancock Street	Borough of Lodi	Planned remediation completed in 2006; inaccessible soils remain
80 Hancock Street	Borough of Lodi	Planned remediation completed in 2006; inaccessible soils remain
8 Mill Street	Borough of Lodi	Remediation completed in 2007
80 Industrial Road	Borough of Lodi	Planned remediation completed in 2007; inaccessible soil remediated in 2013; additional inaccessible soils remain
170 Gregg Street	Borough of Lodi	Remediation completed in 2004
160 & 174 Essex Street	Borough of Lodi	Remediation completed in 2003
61 Trudy Drive	Borough of Lodi	Remediation completed in 2015
205 Main Street	Borough of Lodi	Remediation ongoing in 2015
Interstate 80 Right-of-Way		Planned remediation completed in 2003; inaccessible soils remain
99 Essex Street	Borough of Maywood	Remediation completed in 2008
113 Essex Street	Borough of Maywood	Remediation completed in 2008
200 NJ Route 17 South	Borough of Maywood	Remediation completed in 2006
85, 87, 99-101 NJ Route 17 North	Borough of Maywood	Remediation completed in 2006
137 NJ Route 17 North	Borough of Maywood	Remediation completed in 2006
167 NJ Route 17 North	Borough of Maywood	Planned remediation completed in 2007; inaccessible soils remain
239 NJ Route 17 North	Borough of Maywood	Planned remediation completed in 2007; inaccessible soils remain
111 Essex Street	Borough of Maywood	Remediation completed in 2011
Hackensack & Lodi Railway	Borough of Maywood	Remediation completed in 2011
126 West Central Avenue	Borough of Maywood	Remediation completed in 2015
130 West Central Avenue	Borough of Maywood	Remediation completed in 2015
146 West Central Avenue	Borough of Maywood	Remediation completed in 2015
23 West Howcroft Road	Borough of Maywood	Planned remediation completed in 2006; inaccessible soils remain
149-151 Maywood Avenue	Borough of Maywood	Portions of property previously remediated; however, there was no remediation in 2015
100 West Hunter Avenue (Stepan Company)	Borough of Maywood	Ongoing remediation performed in 2015
100 West Hunter Avenue (MISS)	Borough of Maywood	Ongoing remediation performed in 2015
61 West Hunter Avenue	Borough of Maywood	Remediation completed in 2009

Table 1-1. Summary of Soil Remedial Activities

Property Address	Municipality	Status
50 West Hunter Avenue	Borough of Maywood	Remediation completed in 2009
205 Maywood Avenue	Borough of Maywood	Remediation completed in 2010
NYS&W Railway	Borough of Maywood & Township of Rochelle Park	Ongoing remediation performed in 2015
NJ Route 17		Portions of property previously remediated; however, there was no remediation in 2015

In keeping with the remedial activities and objectives of FUSRAP, an ongoing EMP has been conducted at the FMSS on an annual basis per the requirements of the *General Environmental Protection Plan* (GEPP). First prepared and implemented in 1999, the GEPP was updated in January 2014 (USACE 2014). This program has been designed to ensure the following objectives:

- That the public and the environment are adequately protected from radiological contaminants present at the MISS
- To verify compliance with applicable Federal, State and, local laws and regulations
- To characterize and define trends in the condition of the environmental media
- To provide an assessment of the effectiveness of remediation activities
- To identify and quantify new or existing environmental quality problems

These monitoring activities include the monitoring of credible transport pathways; the selection of suitable monitoring locations; and the use of appropriate sampling methods, techniques, and analyses.

This report has been prepared to satisfy applicable monitoring requirements and to address the above objectives. A detailed description of the measured parameters, evaluation criteria, sampling locations, monitoring methodology, interpretation of results, and conclusions is presented in this report.

1.1 MEASURED PARAMETERS

The key elements of the EMP were as follows:

- Continuous Monitoring
  Measurement of external gamma radiation
  Measurement of radon gas concentrations in air (from radon 220 [Rn-220] and radon 222 [Rn-222])
- Groundwater level measurements of monitoring wells
- Annual Monitoring/Sampling
  Sampling and analysis of streambed sediment for radioactive constituents
  Sampling and analysis of surface water for radioactive constituents
  Sampling and analysis of groundwater for radioactive constituents
  Sampling and analysis of groundwater for non-radioactive constituents
  Measurement of Rn-222flux for soil stockpiled at MISS

1.2 CALCULATED ELEMENTS

As part of the EMP, measurements and calculations were performed to determine the dose and cumulative dose to the hypothetical maximally exposed individual (off-site and on-site) from external gamma radiation at the MISS, as well as airborne particulate dose to the hypothetical maximally exposed individual (off-site) from airborne particulate emissions generated from activities associated with the MISS in 2015. The methodology for performing dosimetric measurements and calculations for both follow. More detailed discussions of these calculations and the results with regard to regulatory compliance issues are provided in Sections 5.0, 0, and Appendix B, which contains the Annual National Emission Standards for Hazardous Air Pollutants (NESHAP) Compliance Report for 2015.

1.2.1 External Gamma Radiation

External gamma radiation dose rates are measured continuously at various locations at the MISS using optically stimulated luminescence detectors (OSLDs). When the readings are corrected for shelter/absorption and background concentration, and normalized to exactly one year's exposure, these detectors provide a measurement of the annual external gamma radiation at that location. The exposure time starts with the date of installation at the site and ends with the date of removal from the site. Background is estimated as the average of the off-site OSLD results.

The dose rate at a given distance from the site fence line can be approximated by a dose rate at a distance from a line source. The line source dose rate is represented by the average of the OSLD results from locations on the fence line facing the individual. The length of the line source is represented by the length of the fence line facing the individual (Cember 2009). The dose rate calculation for gamma radiation is based on the assumption that a resident with 100 percent (%) occupancy and a worker with 27% occupancy are located 50 feet (ft) from the maximum measured source (Location 21). This is a conservative approach since the nearest receptor is located over 200 ft from Location 21. Additional details of these measurements and calculations are provided in Section 0.

1.2.2 Airborne Particulate Dose

The computer program used to model potential off-site exposure from airborne emissions is the Clean Air Act Assessment Package – 1988 Personal Computer program (CAP88-PC), Version 4.0 (EPA 2014a). Airborne emissions contributing to off-site exposure can occur in areas where radioactively contaminated surface soils and waste stockpiles are subjected to wind-blown erosion and; from on-site contaminated soil excavation/handling operations with heavy earth-moving equipment.

The CAP88-PC, Version 4.0 (EPA 2014a) model determines the hypothetical maximally exposed individual based on the radionuclide emissions, local meteorological data, occupancy assumptions, and other factors. The model can calculate the effective dose equivalent for any receptor of interest (e.g., residences, schools, off-site workers).

Although the emission of radon gas is not considered in this analysis, the daughters of radon gas generated by the decay of Ra-226 in fugitive dust are accounted for by the model in the computation of the effective dose equivalents for the various internal and external exposure pathways.

1.3 UNIT CONVERSIONS

Table 1-2 and Table 1-3 list the units of measurement and appropriate abbreviations used in this document. Conventional units for radioactivity are used because the regulatory guidelines are generally provided in these terms; Système Internationale (SI) units of measurement are used in the discussion of all other parameters. Unit conversions are provided in the text for water level information only.

Table 1-2. Units of Measurement and Conversion Factors – Radioactivity

Parameter	Conventional Units	SI Units	Conversion Factor
Dose	millirem (mrem)	millisievert)	1 mrem = 0.01 millisievert
Activity	picocurie (pCi)	becquerel	1 pCi = 0.037 becquerel

Table 1-3. Units of Measurement and Conversion Factors – Mass, Length, Area, and Volume

Parameter	SI Units	English Units	Conversion Factor
Mass	gram	ounce	1 g= 0.035 ounces
	kilogram (kg)	pound	1 kg = 2.2046 pounds
Length			
	meter (m)	feet (ft)	1 m = 3.281 ft
	kilometer	mile	1 kilometer = 0.621 miles
Area	hectare	acre	1 hectare = 2.47 acres
Volume	milliliter (mL)	fluid ounce	1 mL = 0.0338 fluid ounce
	liter (L)	gallon	1 L = 0.264 gallon

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2.0 EVALUATION CRITERIA

Regulatory and other criteria used to evaluate the results of the EMP are summarized as follows, categorized by media and parameters.

2.1 EXTERNAL GAMMA RADIATION AND AIR (AIRBORNE PARTICULATES)

The criteria for evaluating the calculated maximum doses from external gamma radiation and inhalation of radioactive particulates are shown in Table 2-1 and discussed below.

2.1.1 10 CFR 20

Dose limits for members of the public from U.S. Nuclear Regulatory Commission (NRC) licensed activities are presented in 10 Code of Federal Regulations (CFR) 20.1301. While the FMSS project is not licensed by the NRC, the USACE applies the public dose standard of 100 mrem per year total effective dose equivalent (TEDE) and includes all pathways (NRC 2015). External deep dose equivalent (DDE) from environmental dosimetry and Committed Effective Dose Equivalent (CEDE) from modeled site particulate radionuclide air emissions are included in the calculation of the TEDE.

2.1.2 40 CFR 61, Subparts H & Q (NESHAP)

Section 112 of the Clean Air Act authorized EPA to promulgate the NESHAP, which is applicable at the MISS under Subpart H (i.e., for particulate airborne radionuclide emissions) (EPA 2015a) and Subpart Q (for radon emissions from waste soil stockpile(s) awaiting shipment) (EPA 2015b). Compliance with Subpart H is verified by applying the EPA-approved CAP88-PC, Version 4.0 (EPA 2014a). Compliance with Subpart Q is verified by annual stockpile monitoring for Rn-222 flux (see Appendix B for the Annual NESHAP Compliance Report).

Table 2-1. Criteria for Radiological Parameters

Parameter	NRC Standard	EPA Standard or Guideline
Radon Flux [a]	No standard	20 $pCi/m^2/s$ [c]
Radionuclide Emissions [a] (airborne particulates)	10 mrem/yr [d]	10 mrem/yr [e]
TEDE [a] (total contribution from all sources [b])	100 mrem/yr [f]	No standard

Notes:
a. The strictest standards or guidelines for each parameter are used to assess/evaluate regulatory compliance issues.
b. Contributing sources at the MISS consist of external gamma radiation exposure, the radionuclide emissions listed above, and ingested radionuclides in water and soil/sediment.
c. EPA standard 40 CFR 61, Subpart Q (EPA 2015b).
d. NRC standard from 10 CFR 20.1101(d) for particulate and Rn-220 emissions only; excludes Rn-222 and its decay products (NRC 2015).
e. EPA standard from 40 CFR 61, Subpart H, for particulate emissions only; excludes Rn-222 and Rn-220 (EPA 2015a).
f. NRC standard from 10 CFR 20.1301(a); background is excluded in the calculation of dose (NRC 2015).

2.2 SEDIMENT – RADIOACTIVE CONSTITUENTS

The criteria for evaluating the measured concentrations of radionuclides in sediment at the MISS are shown in Table 2-2 and discussed below:

Soil Cleanup Criteria for the FMSS

No specific radionuclide criteria are established for "sediments" at the FMSS. The "Unrestricted Use" soils cleanup criteria, established in the *Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site*, August 2003 (Soil ROD) (USACE 2003), is used for sediment results comparison purposes in this report, as follows:

Table 2-2. Radiological Criteria for Sediment

Parameter	Soil ROD Cleanup Criteria [a]
Ra-226 + Th-232	6.64 pCi/g
$U_{(tot)}$ [C]	102.73 pCi/g 51.33 pCi/g (as U-238) [b]

Notes:
a. "Unrestricted Use" soils cleanup criteria established in the Soil ROD (USACE, 2003). Criteria includes background soil concentrations reported in the *FMSS Background Study Investigation Report* (USACE, 2004).
b. Assuming natural uranium isotope enrichment ratios for U-238, U-234, and U-235 (i.e., 1:1.007:0.046).
c. $U_{(tot)}$ = total uranium

2.3 GROUNDWATER CONSTITUENTS OF CONCERN

The criteria for evaluating the measured concentrations of the FUSRAP constituents of concern in groundwater at the MISS were established in the *Final Groundwater Record of Decision, FUSRAP Maywood Superfund Site*, May 2012 (Groundwater ROD) (USACE 2012). The criteria for the non-radioactive constituents in groundwater are shown in Table 2-3:

Table 2-3. Groundwater Cleanup Levels

Constituent of Concern	ROD Cleanup Criteria [a]
Arsenic	3 micrograms per liter [a]
Benzene	1 microgram per liter [a]
Lithium	730 micrograms per liter [b]

Notes:
a. Groundwater ROD criteria (USACE 2012) derived from the lowest of Federal Maximum Contaminants Level (MCLs) (EPA 2015c) or New Jersey Groundwater Quality Criteria or higher practical quantitation limit (New Jersey Administrative Code 7:9C).
b. Since Applicable or Relevant and Appropriate Requirements are not available for lithium in groundwater, a cleanup level was derived for lithium based on ingestion of groundwater (USACE 2012).

Groundwater is analyzed for contaminants of concern, radionuclides, and water quality parameters. This list of parameters is reviewed annually prior to the next round of monitoring; no changes were made to the parameters for this year's EM round. Groundwater conditions (water level, flow velocities, estimated contaminant transport, and flow directions) are determined to aid in the evaluation of potential environmental impacts. Sampling and analysis methods for groundwater are provided in *the Uniform Federal Policy-Quality Assurance Project Plan* (*UFP-QAPP)* (USACE, 2015). Groundwater monitoring wells are inspected annually to ensure their integrity and to note any damage or deterioration; observed damage to wells is described in Section 3.0.

3.0 SAMPLING LOCATIONS AND RATIONALE

Contamination at the MISS is present as MCW process wastes comingled in surface & subsurface soils, as well as on some historic structural surfaces. Exposure to members of the public by this radioactively contaminated material is unlikely because of site access restrictions (e.g., manned guard-shack, fences) and engineering controls (e.g., dust suppression, pile stabilization, truck decontamination, etc.). Potential pathways include direct exposure to external gamma radiation, inhalation of radon or radioactively contaminated particulates in air, and contact with or ingestion of contaminated streambed sediments, surface water, or groundwater. There are no drinking water wells within the area sampled for groundwater contaminants. In addition, surface water is not used as a potable water source. The EMP has been developed to evaluate and monitor these potential exposure routes through annual sampling and analysis for radioactive constituents. In Appendix A, Figure A-2, Figure A-3, and Figure A-4 show the EMP sampling locations at the MISS and VPs, and indicate the type of media sampled at each location. In Appendix C, Table C-1 summarizes the monitoring-sampling program at the MISS for External Gamma Radiation, Radon Gas, Groundwater, Surface Water, and Sediment.

Measurements of external gamma radiation are along fence line locations surrounding the MISS in order to assess potential exposure levels to the public and off-site workers (Appendix A, Figure A-2; Appendix C, Table C-2).

Atmospheric monitoring of radon gas is conducted on-site, both in known areas of contamination and at fence line locations (Appendix A, Figure A-2; Appendix C, Table C-3).

Radon flux measurements were collected at six locations on the on-site soil stockpile (refer to Appendix B, Figure A-6).

Surface water and sediment sampling includes the analysis for radioactive constituents along Westerly Brook and Lodi Brook (Table 3-1; Appendix A, Figure A-3 and Figure A-4; Appendix C, Tables C-4, and C-5). Sampling locations along Westerly and Lodi brooks are used to assess both upstream and downstream conditions. Because Lodi Brook receives drainage from areas of known contamination, sampling is also conducted along the eastern and western tributaries of this stream.

Water level measurements and groundwater samples from monitoring wells enable the assessment of groundwater flow patterns and are used to evaluate groundwater quality upgradient and downgradient of the site, in the source area, and at the MISS/Stepan Company boundary (Appendix A, Figure A-2). Groundwater in both the surficial unconsolidated sediments and bedrock is monitored at the MISS. Additional Monitoring Wells B38W04B, B38W07B, MISS04A, MISS04B, MISS07A, MW33D, and MW-33S are monitored solely to provide supplementary groundwater elevation data.

Monitoring Well MISS 07a was dry and could not be sampled. Monitoring Well B38W18D was not sampled because (1) the well was located in the center of an active (flooded) excavation, and was not accessible during the sampling event, and (2) the well was damaged during remediation, and the well integrity was a concern. Nearby Monitoring Well MW-42D was designated a temporary replacement well for B38W18D and sampled in 2015. Monitoring Well MW-25S (which was damaged in 2014 and not sampled for that event) was repaired in April 2015 and sampled in May 2015. An above ground section of the PVC riser pipe was replaced due to damage from freezing. Contained within Appendix D is a chronology of changes to the program since 2001.

Table 3-1. Rationale for Selection of Surface Water and Sediment Sampling Locations

Location	Watercourse	Description of Location	Rationale for Selection
SWSD001	Westerly Brook	Located downstream of the MISS at the point where the Westerly Brook storm water culvert discharges into Saddle River	Downstream of the MISS; potential area where sediments may accumulate prior to discharge to Saddle River
SWSD002	Westerly Brook	Located downstream of the MISS. The location is in an area where Westerly Brook is in open channel flow	Downstream of the MISS in the first area downstream of the MISS where Westerly Brook is in open channel flow; potential area where sediments may accumulate
SWSD003	Westerly Brook	Located approximately 100 ft (30.5 m) upstream of the MISS; the location is in an area where Westerly Brook is in open channel flow	Upstream of and in close proximity to the MISS; serves as a background location
SWSD004	Westerly Brook	Located downstream of the MISS; the location is in a catch basin where a portion of Westerly Brook is located in a storm water culvert	Initial sampling location downstream of the MISS where sediments may accumulate and where surface water can be sampled
SWSD006	Lodi Brook	Located south of the MISS on an FMSS Vicinity Property (VP); eastern tributary of Lodi Brook that is in open channel flow. Does not receive storm water runoff from the MISS	Located on a VP and near the head waters to Lodi Brook where there is usually sufficient flow in Lodi Brook for surface water and sediment sampling
SWSD007	Lodi Brook	Located south of the MISS on an FMSS VP (167 NJ [New Jersey] Route 17 North) that is in open channel flow; does not receive storm water runoff from the MISS	Located on a VP
SWSD008	Lodi Brook	Located south of the MISS on an FMSS VP; does not receive storm water runoff from the MISS	Located on a VP; forms a portion of the headwaters of Lodi Brook in an area designated as wetlands
SWSD009	Lodi Brook	Located south of the MISS on an FMSS VP; does not receive storm water runoff from the MISS	Located on a VP; forms a portion of the headwaters of Lodi Brook in an area designated as wetlands
SWSD010	Lodi Brook	Located south of the MISS on an FMSS VP; Lodi Brook is in open channel flow	Located on a VP; downstream of the MISS and VPs

4.0 MONITORING METHODOLOGY

The controls designed to prevent contamination from soil, water, and air emission resulting from remediation at the FMSS are discussed in the GEPP (USACE 2014). The GEPP also describes the methodology for implementing the EMP at the FMSS to monitor the successful implementation of those controls. The EMP monitors the various media where there is potential for off-site impact to the public and the environment from FMSS contaminants. Surface water, sediment, and groundwater in the vicinity of the MISS are also monitored.

The laboratories conducting the radiological analyses adhere to EPA-approved methods and procedures developed by the Environmental Measurements Laboratory, American Society of Testing and Materials International (ASTM), and the State of NJ. All laboratories analyzing FUSRAP radiological samples are certified by the New Jersey Department of Environmental Protection (NJDEP). A detailed listing of the specific procedures and the data quality objectives for the monitoring conducted in the 2015 program is provided in the UFP QAPP (USACE 2015).

The USACE FUSRAP Maywood Laboratory (UFML), located in Maywood, NJ, performed radiological analysis of surface water, sediment, and groundwater samples. ALS Laboratory Group, located in Fort Collins, Colorado, performed radiological analysis for potassium-40 (K-40) and Rn-222 groundwater samples. Test America, located in Earth City, Missouri, performed radiological analysis of USACE Quality Assurance (QA) split samples.

Environmental monitoring activities were conducted in accordance with the UFP QAPP and Standard Operating Procedures (SOPs) listed in Table 4-1. The monitoring activities are based on guidelines provided in the *RCRA* (i.e., Resource Conservation and Recovery Act *Ground Water Monitoring: Draft Technical Guidance* (EPA 1992); *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846 (EPA 2014b); and *A Compendium of Superfund Field Operations Methods* (EPA 1987). Groundwater samples were collected using the EPA *Low Flow (Minimal Drawdown) Ground-water Sampling Procedures* (EPA 1996).

Table 4-1. Standard Operating Procedures Used for Environmental Monitoring Activities

SOP Number	SOP Title
OP 349	Surface Water and Sediment Sampling (USACE 2015)
OP 350 and 355	Purging and Sampling Monitoring Wells (USACE 2015)
OP 390	On-site Water Quality Testing (USACE 2015)
OP 340	Groundwater Level Measurement (USACE 2015)
SOP 506-1	Decontamination (USACE 2015)

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5.0 ANALYTICAL DATA AND INTERPRETATION OF RESULTS

This section presents the data and interpretation of results for the 2015 EMP that is subject to the evaluation criteria discussed within Section 2.0. Data for 2015 are presented in Appendix C. Year-to-year trending data for the surface water and sediment locations and groundwater monitoring wells are presented in Appendix E.

Total uranium ($U_{(tot)}$) surface water and groundwater sample results in micrograms per liter (µg/L) are calculated by dividing isotopic uranium-238 (U-238) results in picocuries per liter (pCi/L) using a Specific Activity conversion factor (0.33) derived from the latest reference atomic weights and natural isotopic abundance values for uranium (CIIAW [Commission on Isotopic Abundances and Atomic Weights] 2015), uranium isotope-specific decay information (BNL [Brookhaven National Laboratory] 2015), and Avogadro's number (6.02×10^{23} atoms/mol). Mass-based uranium values can then be directly compared to and trended against benchmark values.

Gross alpha surface water and groundwater sample results may be corrected to account for uranium present in the sample after initial assessment of the total alpha content. To account for the uranium component in gross alpha results, the reported analytical results for uranium-234 (U-234), uranium 235 (U-235), and U-238 are each subtracted from the lab reported gross alpha result. Gross beta surface water and groundwater sample results may also be corrected by subtracting out the screening result reported by the lab for K-40. Corrected gross alpha & gross beta results can then be more appropriately compared to and trended against benchmark radionuclide levels based on National Primary Drinking Water Regulations for Radionuclides (EPA 2015c). Gross results are presented as uncorrected for (uranium or K-40) in tables and trend charts.

5.1 EXTERNAL GAMMA RADIATION

External gamma radiation dose rates are measured using OSLDs that are placed at the MISS and at off-site locations. The OSLDs continuously measure external gamma radiation dose rates throughout the year. Locations of OSLDs are shown on Figure A-2 in Appendix A. Each OSLD measures a cumulative dose over the period of exposure (approximately 1 year). Control OSLDs are deployed simultaneously to record cumulative dose due to background. When corrected for shelter/absorption and background, and normalized to exactly one year's exposure, these detectors provide a measurement of the annual external gamma radiation deep dose equivalent at that location. OSLD results for the 2015 external gamma radiation dose (both raw and corrected data) are summarized in Appendix C, Table C-2.

The corrected readings from the OSLDs are used to calculate the external gamma radiation dose rate (d) in mrem to a hypothetical maximally exposed resident and off-site worker using the following equation:

$$d = (\text{mrem}) = \left(\text{OSLD result} \times \frac{\text{number of days per year}}{\text{number of days exposed}} \times \text{fade} \times \text{attenuation} \right) - \text{background}$$

Where:

- fade = a correction factor applied to the measured dose in dosimeters to adjust for thermoluminescent glow that occurs from exposure to lower-energy photons (such as those encountered at Maywood)
- attenuation = a correction factor applied to the measured dose to adjust for transmission loss

$$d = 1/2 \times [796 + 849.6] = 822.8 \text{ mrem}$$

The dose rate at any distance from a line source (Cember 2009) is:

$$d_h = d\,[\tan^{-1}(l/h)]\,/h$$

Where:

- d_h = dose rate at point "h"
- d = average measured dose for year
- h = distance from OLSD to receptor (50 ft or 15.24 meters)
- l = one half the length of the line source (66.5 ft or 20.27 meters)

The receptor is assumed to be centered on the line source.

Substituting known values into the equation and solving for the dose rate at the resident's location d_h assuming 100% occupancy is:

$$d_h = 822.8 \text{ mrem } [\tan^{-1}(20.27 \text{ meters}/15.24 \text{ meters})]\ 1 \text{ meter} / 15.24 \text{ meters} = \\ = 50.0 \text{ mrem/yr}$$

Multiplying the dose rate by the time the worker occupied the location during 2015, the dose (D) is:

$$d_{worker} = 50.0 \text{ mrem (27\% occupancy)(1 yr)} = 13.5 \text{ mrem/yr}$$

The hypothetical maximally exposed resident and off-site worker are conservatively assumed to be located 50 ft (15.2 meters [m]) from the side of the property with the highest radiation readings.

OSLD results are corrected for time, fade, housing attenuation, and background. The fade factor is approximately one indicating that fade is not a major factor for the radiation levels measured at the MISS. The dosimeter housing attenuation factor is estimated to be 1.075.

The corrected data are used to calculate the external gamma radiation dose (i.e., deep-dose equivalent) to a hypothetical maximally exposed individual conservatively assumed to be located 50 ft from the fence line. Identification of this hypothetical individual is a function of the fence line dose, the distance of the individual from the fence line, and the amount of time that the individual spends at the specific location. The data from the side of the site displaying the highest radiation readings (around Location 21) are averaged, and the external gamma dose rate at the distance to individuals at the nearest commercial/industrial facility and residence is then determined. The calculated doses above background to the hypothetical maximally exposed resident (assuming 100% occupancy) and off-site worker (assuming 27% occupancy, 9 hours per day, 5 days per week, 52 weeks per year) from direct gamma radiation at the MISS in 2015 were 50.0 mrem/yr and 13.5 mrem/yr, respectively (see Appendix B). These levels are well below the NRC standard of 100 mrem/yr (NRC 2013). Location 19 (see Appendix A, Figure A-2) was used to determine the average background rate. As a comparison, the calculated doses to the hypothetical maximally exposed resident and off-site worker from direct gamma radiation at the MISS in the previous calendar year (2014) were 50.0 mrem/yr and 13.5 mrem/yr, respectively.

5.2 RADON 220 AND RADON 222

5.2.1 Radon 222 Flux Monitoring

Rn-222 flux monitoring is typically performed to determine compliance with 40 CFR 61, Subpart Q for stockpiles that are present for a significant period of time, such as 6 months or greater (EPA 2015b). Soil was stockpiled at the MISS for the duration of calendar year 2015. Thus, it was deemed prudent to perform Rn-222 flux monitoring for a soil stockpile to assess regulatory compliance.

Rn-222 flux monitoring was performed over a 24-hour period between December 9, 2015 and December 10, 2015 to determine compliance with 40 CFR 61, Subpart Q (EPA 2015b). To determine the Rn-222 flux from the storage pile, charcoal canisters were placed at six locations on the main soil stockpile located within the staging area at the MISS. The volume of the soil stockpile at the time radon flux monitoring was conducted was approximately 4,500 cubic yards..

The Rn-222 flux measurement locations on the soil stockpile at the MISS are shown in Appendix A, Figure A-2. The analysis of the Rn-222 flux canisters was performed by Eberline Services of Oak Ridge, Tennessee.

The results of the Rn-222 flux monitoring are presented in Table 5-1. The measured concentrations from the storage pile were well in compliance with the 20 picocuries per square meter per second ($pCi/m^2/s$) Rn-222 flux standard specified in 40 CFR 61, Subpart Q (EPA 2015b).

Table 5-1. Year 2015 – Rn-222 Flux Monitoring Results for the Soil Stockpile at the MISS

Sample Identifier [a]	Date Collected	Date Analyzed	Analyte	Result ($pCi/m^2/s$)	Error [b] ($pCi/m^2/s$)	MDA [c] ($pCi/m^2/s$)
1	12/10/2015	12/11/2015	Rn-222	0.0238	0.0255	0.0415
2	12/10/2015	12/11/2015	Rn-222	0.0055	0.0243	0.0478
3	12/10/2015	12/11/2015	Rn-222	0.0043	0.0241	0.0451
4	12/10/2015	12/11/2015	Rn-222	0.0240	0.0186	0.0380
5	12/10/2015	12/11/2015	Rn-222	-0.0059	0.0319	0.0474
6	12/10/2015	12/11/2015	Rn-222	0.0343	0.0573	0.0706

Notes:
a. All monitoring locations for the storage piles are shown in Appendix A, Figure A-2
b. The error is reported at the 95% uncertainty level (k = 1.96)
c. The minimum detectable activity (MDA) is reported at the 95 percent confidence level

5.2.2 Radon 220 and Radon 222 Perimeter Monitoring

Results of the 2015 monitoring for radon gas (Rn-220 and Rn-222) are presented in Appendix C, Table C-3 and detector locations are shown in Appendix A, Figure A-2. Two types of detectors were exposed at each exterior location. One detector type, the RadTrak®, allowed both isotopes of radon to enter. The other detector type, the RadTrak®-modified, contains a membrane that specifically excluded Rn-220. Rn-222 results are reported as received from the laboratory (i.e., the data are obtained directly from the RadTrak®-modified detectors).

Rn-220 concentrations are calculated using the RadTrak® and RadTrak®-modified data. For the first 6 months of the monitoring year, the maximum Rn-220 concentration was measured at Location 22 (3.42 picocuries per liter [pCi/L]). For the last 6 months of the monitoring year, the maximum Rn-220 concentration was also measured at Location 22 (3.81 pCi/L).

Rn-222 concentrations for 2015 were all below the Lower Limit of Detection. The Rn-222 concentration for the first 6 months was 0.2 pCi/L at all measurement locations. The Rn-222 concentrations for the last 6 months was 0.1 pCi/L at all measurement locations.

As with most low concentrations of gases in an open, unconfined area, the radon gas dissipates quickly and does not significantly affect workers or the general population. The closest residential inhabitants live to the northeast, approximately 200 ft (61 m) from the MISS perimeter fence. Off-site monitoring locations 32 and 33 (Appendix A, Figure A-2) were installed in 1996 in order to examine radon gas concentrations in this area. Rn-220 results at these two locations were non-detect for the 12 month monitoring period. The results are presented on Appendix C, Table C-3.

5.3 AIRBORNE PARTICULATE DOSE

To determine the annual effective dose from airborne emissions of radioactive particulates generated during the year 2015 at the MISS and VPs, multiple potential sources were considered (see Appendix B):

1. *In-situ* wind erosion at the MISS, Maywood
2. Soil load-outs at the MISS, Maywood
3. Remedial action locations

The particulate release rates from the preceding multiple potential sources were calculated using the methodology contained in the "Industrial Wind Erosion" section of EPA's AP-42 (EPA 2006). The emissions of particulate matter from the exhaust system for the soil sample preparation laboratory was determined based on the number of soil samples prepared, the average quantity of particulate emissions resulting from the grinding of the samples, and the removal efficiency of the High Efficiency Particulate Air filter.

The radionuclide emission rates were based on the particulate release rates and the average radionuclide source concentrations of U-238, Ra-226, and Th-232 obtained from soil measurements for in situ soil that has vegetative cover or gravel (i.e., covered). Weighted average values measured for the excavated soil from the vicinity properties were used for the soil load-outs, which also comprises the bare soil stored in piles at the MISS for in situ wind erosion. Radionuclide source concentrations for the evaluation of the vicinity property impacts are based on average values at the 95% confidence level, with the exception of one property which is evaluated based on average radionuclide source concentration values at the 99.7% confidence level due to their higher radionuclide concentrations. Unmeasured radionuclide source concentrations were based on the known source concentrations assuming secular equilibrium in the decay chains (Shleien 1998).

Although the emission of radon gas is not considered in this analysis, the daughters of radon generated by the decay of Ra-226 in dust off-site is accounted for by the model in the computation of the effective dose equivalents for the various internal and external exposure pathways. The radionuclide emissions for the year from each of the above sources were entered into the EPA CAP88-PC, Version 4.0 software to perform the dose modeling calculations (EPA 2014a).

The effective dose equivalents for the collective population and the hypothetical maximally exposed individual were calculated in a three-step process. The first step was to model the release of particulates from the site using the methodology given in the EPA's *Estimation of Air Impacts from Area Sources of Particulate Matter Emissions at Superfund Sites* (EPA 1993). Particulate emissions were determined based on the number of times the soil was disturbed (e.g., excavated, stockpiled, loaded into trucks/containers/rail cars, unloaded, and moved) at the VPs and at the MISS. The second step was to input these particulate release rates in the form of radionuclide emissions based on source concentrations, along with local population and meteorological data, into the CAP88-PC program (EPA 2014a). The third step involved summing the doses calculated by the CAP88-PC program from the various activities at the individual receptors and determining the dose for the hypothetical maximally exposed individual.

The hypothetical collective dose from airborne radioactive particulates for the population within 50 mi (80 km) of the site was estimated using a population file (generated from county population densities) to determine the number of people in graduated, concentric grid sections radiating outward to 50 mi (80 km) from the center of the site.

The CAP88-PC, Version 4.0 model determines the maximally exposed individual based on the radionuclide emissions, local meteorological data, and other factors. The model can calculate the effective dose equivalent for any receptor of interest (e.g., residences, schools, workers). Doses can be tabulated as a function of radionuclide, pathway, location, and organ as shown in the calculation presented in Appendix B.

In assessing the airborne particulate dose, a site worker was the hypothetical maximally exposed individual in the year 2015. The airborne particulate dose to that individual, considering all site conditions throughout the year, was 2.08×10^{-3} mrem/yr. This is well below the 10 mrem/yr standard specified in the 40 CFR 61, Subpart H (EPA 2015a).

The 2015 airborne particulate dose to an off-site resident with 100 percent occupancy, considering all site contributions throughout the year, was 8.4×10^{-3} mrem. The hypothetical airborne particulate collective dose equivalent to the population in 2014, within 50 mi (80 km) of the site, was 6.14×10^{-3} person-rem.

5.4 SURFACE WATER AND SEDIMENT

Surface water courses and drainage near the MISS and VPs include Westerly and Lodi brooks (Appendix A, Figure A-3 and Figure A-4). Westerly Brook flows through a culvert after it enters the northwestern corner of the MISS. The subsurface culvert redirects Westerly Brook to the west, south, and then to the west again, along the northern and western property boundaries. After leaving the MISS, the culvert remains below grade for approximately 1,100 ft (335 m) before it terminates. At this point, Westerly Brook reemerges and resumes its westward course. Ultimately, Westerly Brook discharges into the Saddle River. Lodi Brook begins on the property located at 149-151 Maywood Avenue in a low marshy area that collects runoff from the 149-151 Maywood Avenue and Stepan Company properties; from there it flows southward under NJ Route 17 remaining underground in a storm water culvert for most of its course. From this area, the Lodi Brook flows approximately 1.8 mi (2.9 km) downstream of the confluence of Westerly Brook and the Saddle River before joining the Saddle River.

5.4.1 Surface Water

A total of nine sample locations (four locations along Westerly Brook and five locations along Lodi Brook) were sampled in 2015 (Appendix A, Figure A-3 and Figure A-4). In 2007, sampling at Locations SWSD011 through SWSD015 was suspended. These locations lie along the lower Lodi Brook in the Borough of Lodi. In 2008, sampling at Location SWSD005 was terminated due to the NJ Department of Transportation's widening of NJ Route 17. Relative to the MISS on Westerly Brook, upstream location SWSD003, and downstream Locations SWSD001, SWSD002, and SWSD004 were sampled. On Lodi Brook, locations that were sampled included: SWSD006, SWSD007, SWSD008, and SWSD009 (on the eastern tributary of Lodi Brook); and SWSD010 (downstream of the MISS and VPs along Lodi Brook). The western tributary of Lodi Brook drains portions of the MISS, Stepan Company, and 149-151 Maywood Avenue properties. Background sampling was conducted in Westerly Brook, upstream (north) of the site, at SWSD003.

Field Parameters

In Appendix C, Table C-4 presents a summary of field parameters measured during annual surface water sampling activities at the FMSS. Field parameters include temperature, pH, oxidation/reduction potential (Eh), turbidity, specific conductance, and dissolved oxygen. These parameters were monitored prior to surface water sample collection.

Radioactive Constituents

Surface water samples were analyzed for gross alpha, gross beta, Ra-226, radium 228 (Ra-228), Th-228, Th-230, Th-232, and $U_{(tot)}$. The gross alpha results are not corrected for uranium or radon. The gross beta results are not corrected for K-40. The results are presented in Appendix C, Table C-5. The gross alpha results ranged from non-detect to a maximum of 3.04 pCi/L at Location SWSD001. The gross beta results ranged from non-detect to a maximum of 10.73 pCi/L at Location SWSD002. The combined Ra-226 and Ra-228 results ranged from 0.17 pCi/L at Location SWSD006 to a maximum of 0.93 pCi/L at Location SWSD009. The $U_{(tot)}$ results ranged from non-detect to a maximum of 1.42 µg/L at Location SWSD008. The gross alpha, gross beta, and combined Ra-226 plus Ra-228 results for the upstream location (SWSD003) and downstream location (SWSD004) within Westerly Brook from the MISS are shown on Figure 5-1, Figure 5-2, and Figure 5-3. Gaps in the chart are the result of problems during the analysis of the sample or the resulting data was not usable. The results of the usable data show that the gross alpha and gross beta levels measured for both the upstream and downstream monitoring locations are within the range of previously measured results.

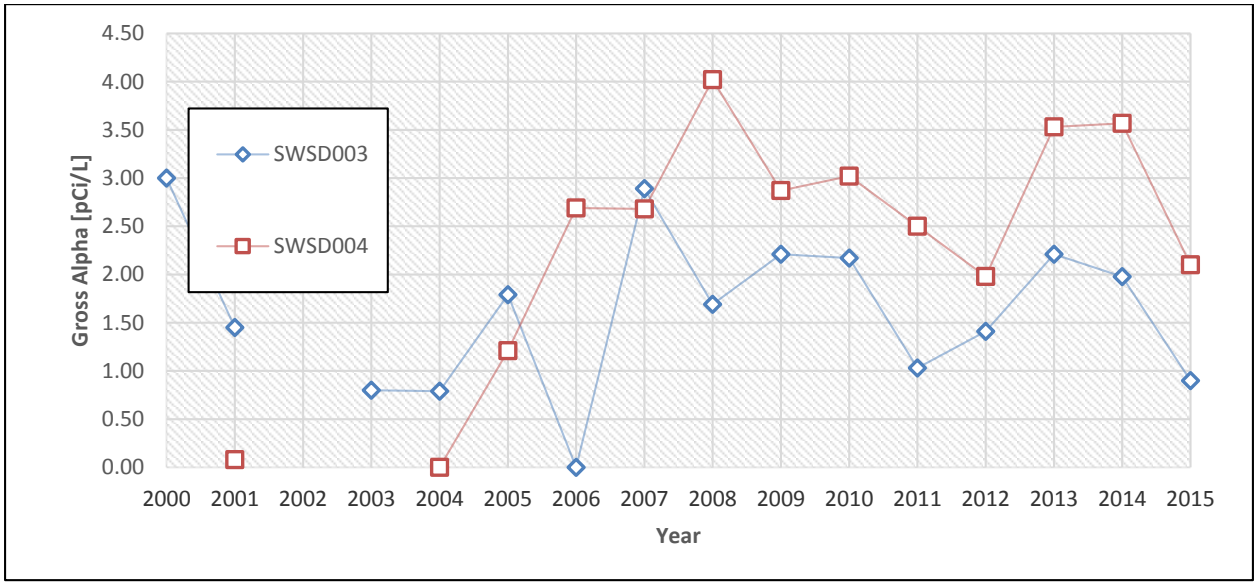

Figure 5-1. Gross Alpha Results for Surface Water in Westerly Brook

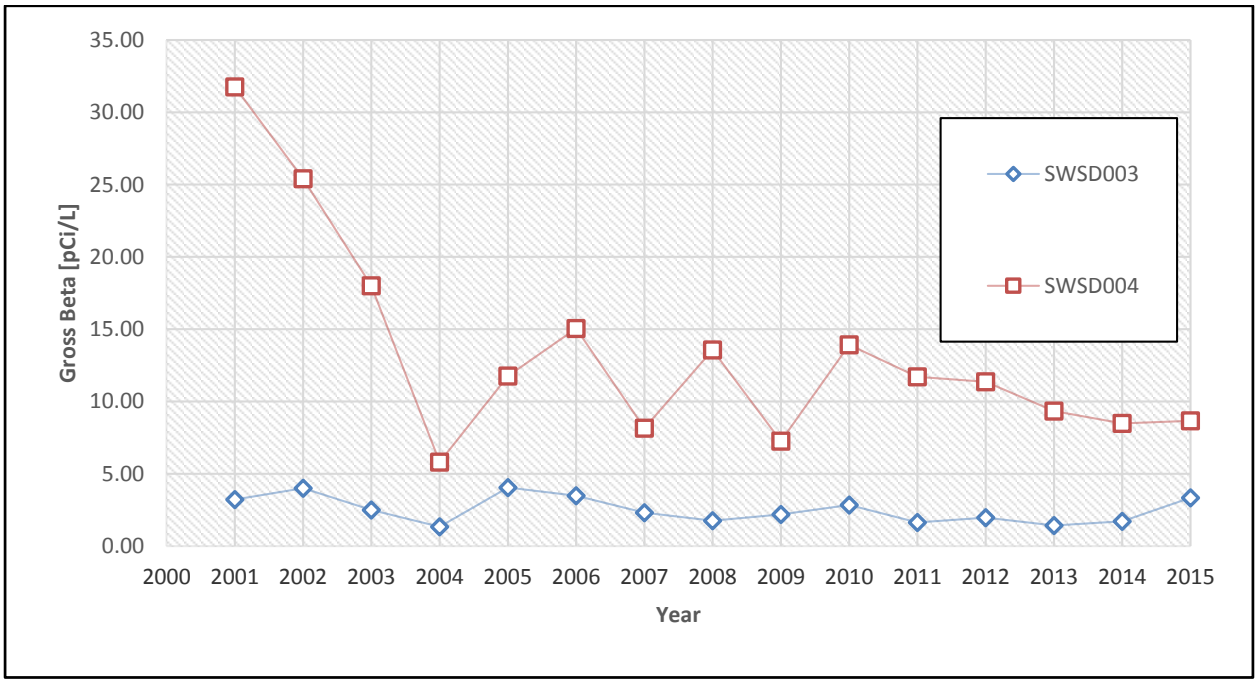

Figure 5-2. Gross Beta Results for Surface Water in Westerly Brook

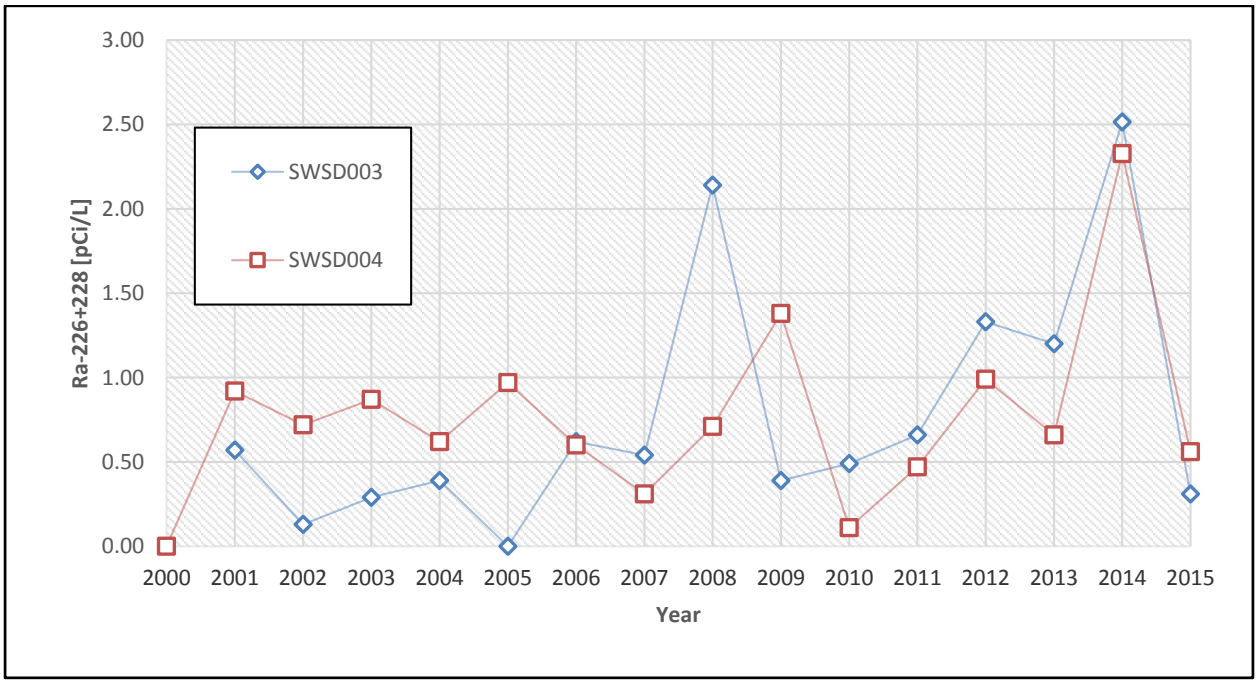

Figure 5-3. Ra-226 + Ra-228 Results for Surface Water in Westerly Brook

The gross alpha, gross beta, and combined Ra-226 plus Ra-228 results for the upstream location (SWSD009) and downstream location (SWSD010) within Lodi Brook are shown on Figure 5-4, Figure 5-5, and Figure 5-6. Gaps in the chart are the result of problems during the analysis of the sample or the resulting data was not usable. The results for downstream location (SWSD010) and upstream location (SWSD009) are within the range of results that have been measured during previous years.

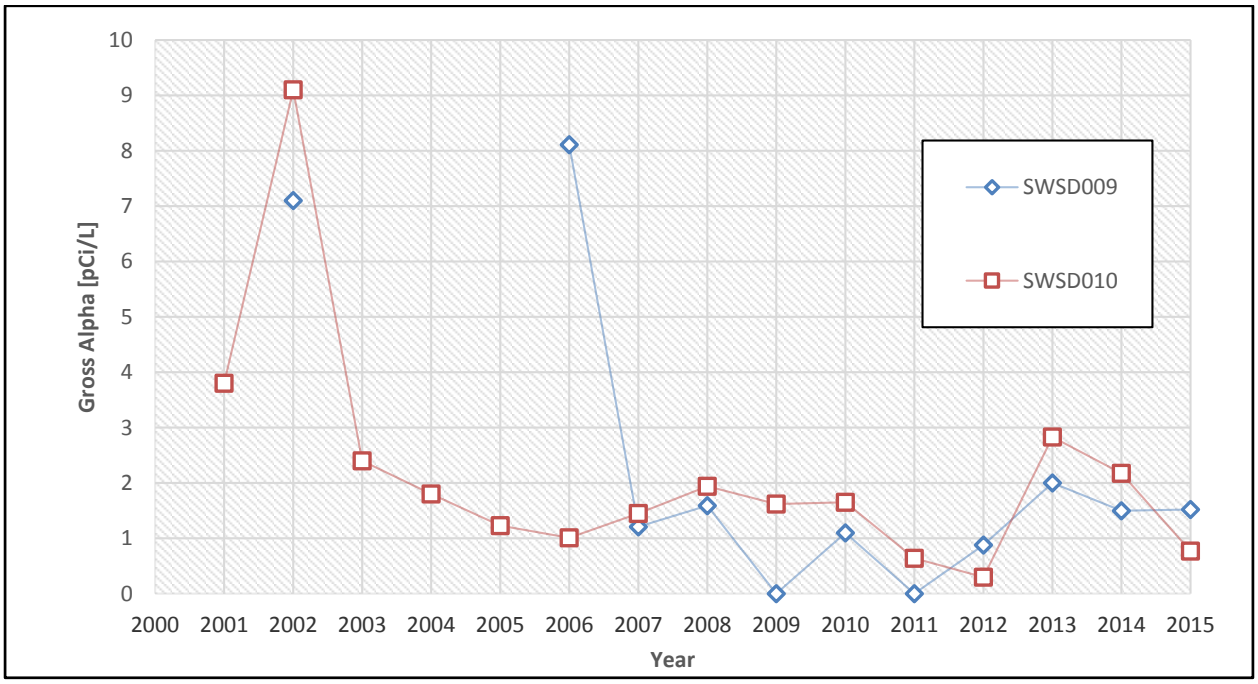

Figure 5-4. Gross Alpha Results for Surface Water in Lodi Brook

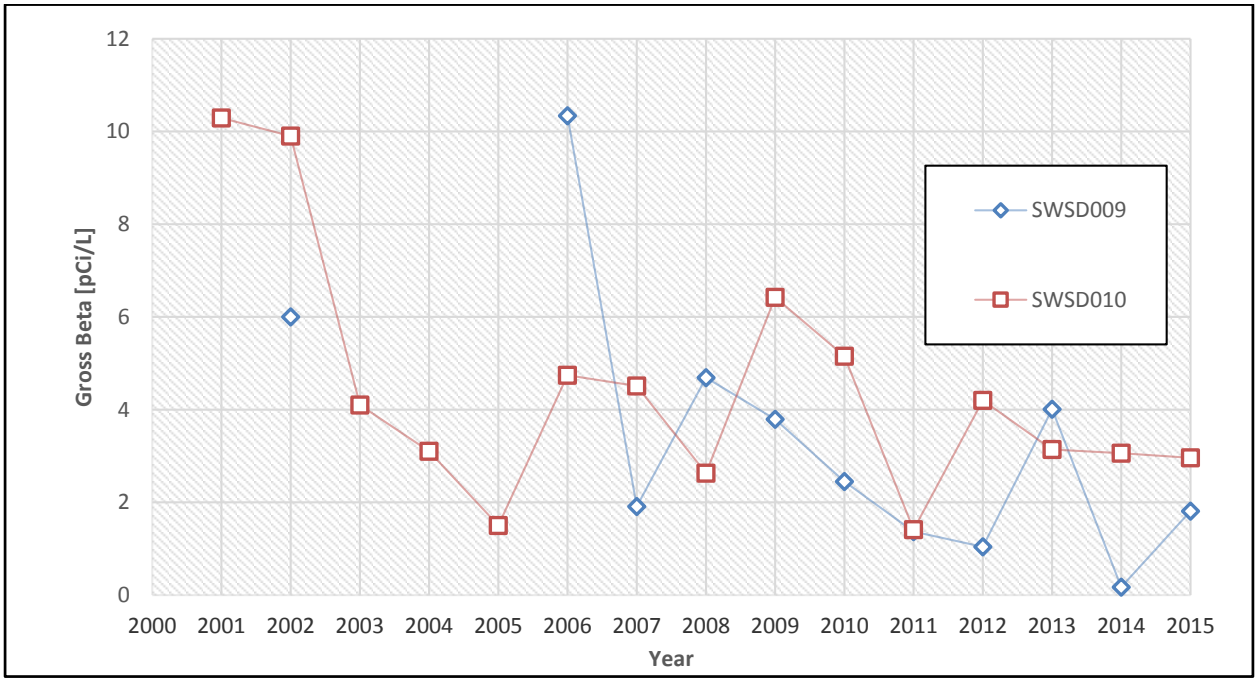

Figure 5-5. Gross Beta Results for Surface Water in Lodi Brook

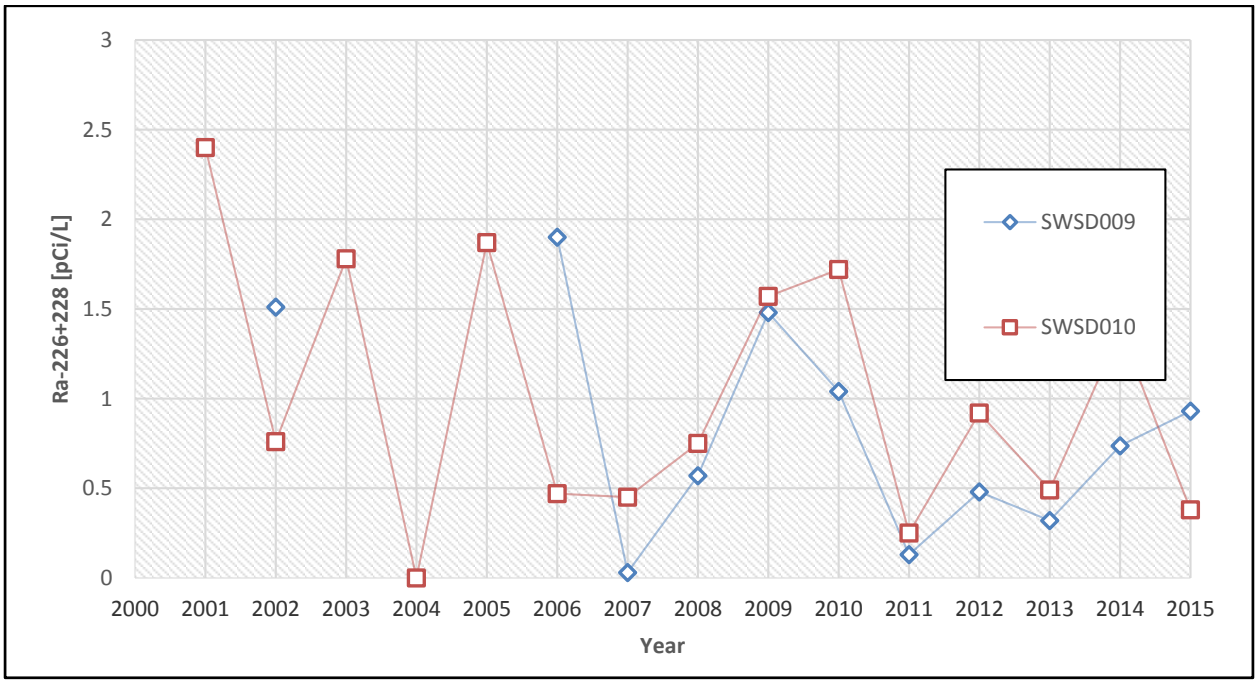

Figure 5-6. Ra-226 + Ra-228 Results for Surface Water in Lodi Brook

Historical results for surface water Locations SWSD001 through SWSD010 are presented in Figures E-1 through E-9, located within Appendix E.

5.4.2 Sediment

As shown in Appendix A, Figure A-3 and Figure A-4, there are four active sediment sampling locations (SWSD001 through SWSD004) on Westerly Brook, and five active sediment sampling locations (SWSD006 through SWSD010) on Lodi Brook. In 2015, there was no sediment present at Location SWSD004 and no sample could was collected.

Radioactive Constituents

The UFML, located at the MISS, analyzed the sediment samples by gamma spectrometry for Ra-226, Th-232, and U-238.

Consistent with historical results, the sediment samples collected in Westerly Brook (SWSD001, SWSD002, and SWSD003) were below the Soil ROD unrestricted use soil cleanup criteria. The highest gross result for Ra226 + Th-232 was 1.57 pCi/g at SWSD001. In Lodi Brook (SWSD006, SWSD007, SWSD008, SWSD009 and SWSD010), the sediment sample results also did not exceed the Soil ROD cleanup criteria (see Appendix C, Table C-6). The highest combined gross concentration of Ra-226 and Th-232 was found at Location SWSD009 in Lodi Brook (2.75 pCi/g). As a comparison to the 2014 results, the highest combined gross concentration of Ra-226 and Th-232 was also reported in Lodi Brook at SWSD007 (5.25 pCi/g).

The reported gross U-238 concentrations at all monitoring locations were well below the Soil ROD unrestricted use soil cleanup criteria of 50 pCi/g above background with a maximum U-238 concentration of 0.87 pCi/g reported at SWSD008. The maximum reported U-238 concentration during 2014 was also at this location (0.54 pCi/g).

For comparison purposes, the background soil concentrations for the sum of Ra-226 & Th-232, and U-238 in the vicinity of the FMSS are approximately 1.64 pCi/g, and 1.33 pCi/g, respectively (USACE 2004).

The sampling results for 2015 show that the levels of Ra-226 and Th-232 within Westerly Brook remain below background levels at all stations (SWSD001, SWSD002 and SWSD003). The results for SWD003 are consistent with past years' data (see Figure 5-7).

The results for 2015 show that radiological concentrations in the streambed sediment of Lodi Brook for Locations SWSD006, 007 and 008 remain at background levels. Sample results for SWSD009 remain slightly above background, but well below the Soil ROD unrestricted use soil cleanup criteria (see Figure 5-8). Gaps in the chart are the result of problems during the analysis of the sample or the resulting data was not usable, or sediment was not present during the sampling period.

Historical results for sediment Locations SWSD001 through SWSD010 are also presented in Figures E-1 through E-9, located within Appendix E.

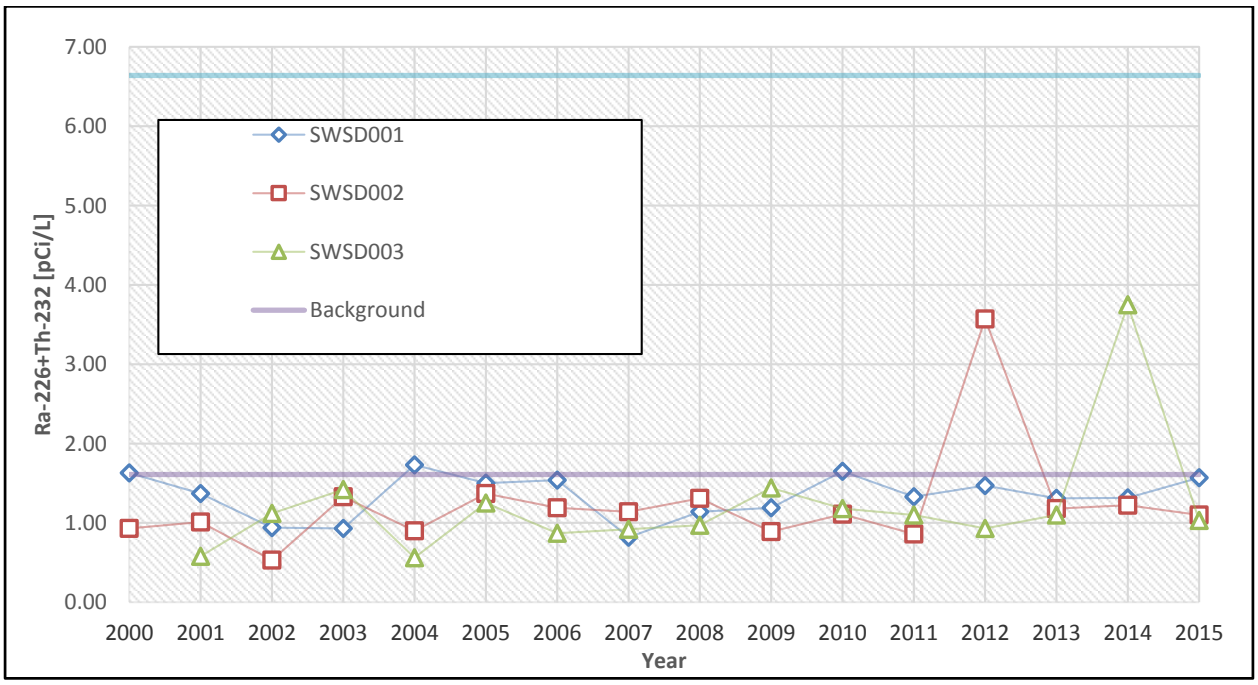

Figure 5-7. Ra-226 + Th-232 Results for Sediment in Westerly Brook

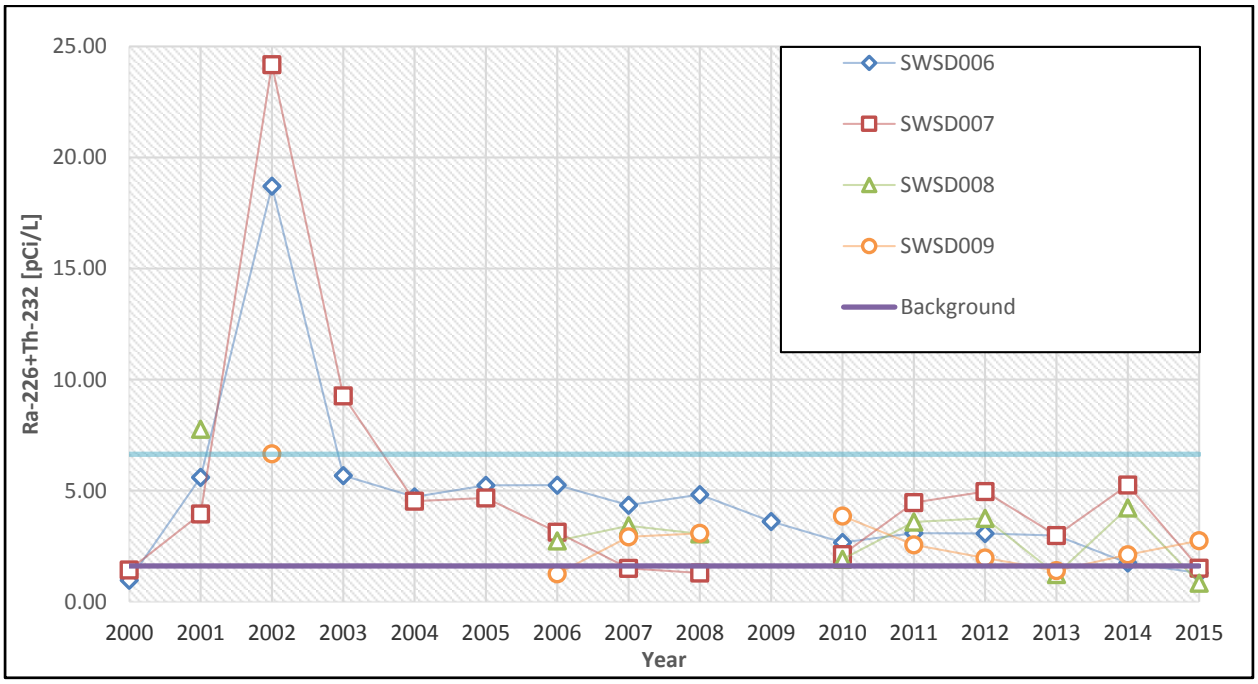

Figure 5-8. Ra-226 + Th-232 Results for Sediment in Lodi Brook

5.5 GROUNDWATER

Groundwater at the FMSS is being addressed under the groundwater operable unit. The groundwater (GW) operable unit ROD (GW ROD) establishes the groundwater cleanup levels for arsenic at 3 µg/L, benzene at 1 µg/L, and lithium at 730 µg/L (USACE 2012). The GW ROD also establishes the soil cleanup level on the MISS to attain groundwater cleanup for arsenic at 19 milligrams per kilogram (mg/kg), lithium at 194 mg/kg, and benzene at 0.005 mg/kg (USACE 2012). Groundwater monitoring for these constituents were added to the 2014 groundwater sampling program and will be included under the Long-Term Groundwater Monitoring Plan, upon approval.

The locations of groundwater monitoring wells at the MISS are shown on Appendix A, Figure A-2. During 2015, 23 wells in the groundwater monitoring network were sampled in May and June 2015. The locations of these wells, with respect to the MISS, are given in Table 5-2.

Table 5-2. Locations of Wells Sampled/Monitored in 2015 with Respect to the MISS

Well Type	Location
Upgradient Wells	B38W01S, B38W02D
On-site Wells	B38W03B, B38W04B*, B38W07B*, B38W-24S, B38W-24D MISS01AA, MISS01B, MISS04A*, MISS04B*, MISS05AR, MISS05BR, MISS07A*, MISS07B MW-24S, MW-24D, MW-25S, MW-25D, MW-28S, MW-28D; MW-33S*, MW-33D*, MW-42D
Downgradient Wells	B38W14S, B38W14D, B38W15S, B38W15D, B38W17A, B38W17B

Notes:
* well location monitored solely to provide supplementary groundwater elevation data

Background information, descriptions of activities performed under the groundwater monitoring program, and monitoring results are discussed below.

5.5.1 Groundwater Quality

Natural System

Groundwater within the FMSS flows in both the bedrock and the overlying unconsolidated sediments (i.e., overburden). Bedrock is composed of fractured sandstone and shale belonging to the Passaic Formation. Unconsolidated sediments are composed of interbedded sand and clay of glacial origin. Although there is no continuous confining layer present across the FMSS, the *Remedial Investigation Report for the Maywood Site, New Jersey* (DOE 1992), indicated that the unconsolidated overburden deposits may be divided into three units that interbed with the underlying and overlying unit. The lower lithostratigraphic unit is characterized as consisting of stratified, moderately well sorted to well sorted fine grained sands and silts, with varying amounts of organic material. The middle lithostratigraphic unit consists of layers of clayey silt and silty clay with clayey to clean sand. The upper lithostratigraphic unit consists of undifferentiated deposits of sand, silt, and gravel. These deposits are poorly to moderately sorted.

Bulk groundwater flow is predominantly horizontal; however, hydraulic head elevations obtained within the FMSS indicate that there is a downward component of groundwater flow within the MISS/Stepan Company property, and an apparent upward component of groundwater flow near groundwater discharge points such as the Saddle River and Lodi Brook. Additional information on groundwater flow at the FMSS is presented in the following sections.

Water Level Measurements

Water level measurements were obtained from 30 monitoring wells (Appendix A, Figure A-2). Of these 30 monitoring wells, 13 are completed in unconsolidated overburden deposits, while 17 are completed in bedrock. During the synoptic gauging year 2015, water levels were obtained as part of the EMP on May 18, 2015. The Water Level Record Sheet for the synoptic water level gauging is provided in Appendix C, Table C-7 and Table C-8. Water levels fluctuate in response to short- and long-term seasonal changes in precipitation and evapo-transpiration. In the unconsolidated deposits, minimum and maximum groundwater levels measured during the gauging round varied as shown in Table 5-3.

Table 5-3. Minimum and Maximum Water Level Elevations in Overburden Monitoring Wells Synoptic Gauging

Parameter	Measurement Date	Monitoring Well
	5/18/2015	
Minimum GW Elevation (ft NGVD)	39.59	B38W14S
Maximum GW Elevation (ft NGVD)	49.19	MW-28S

Notes:
GW denotes groundwater
NGVD denotes National Geodetic Vertical Datum – 1929

Note that water level measurements were collected from 30 wells but samples were only collected from 23 wells; Monitoring Wells B38W04B, B38W07B, MISS04A, MISS04B, MISS07A, MW-33D, and MW-33S are monitored solely to provide supplementary groundwater elevation data. Justification for why some wells have been removed from the sampling program and why some other wells have been abandoned is provided in Appendix D.

Table C-7 in Appendix C, presents the surveyed elevation of the top of inner casing (TOC), depth to water below TOC, and groundwater elevations for the 13 monitoring wells gauged and completed in the unconsolidated deposits. The minimum groundwater elevation (39.59 ft National Geodetic Vertical datum [NGVD]) was measured in Well B38W14S. The maximum groundwater elevation (49.19 ft NGVD) was measured in Well MW-28S.

In the bedrock aquifer, minimum and maximum groundwater levels measured during the gauging round are provided in Table 5-4.

Table C-8 in Appendix C presents the surveyed elevation of the TOC, depth to water below TOC, and a groundwater elevation for the 17 bedrock monitoring wells. As depicted in Table A-7, Monitoring Well B38W14D showed the minimum (41.45 ft NGVD) and B38W02D showed the maximum (60.17 ft NGVD) water level elevations.

Table 5-4. Minimum and Maximum Water Level Elevations in Bedrock Monitoring Wells Synoptic Gauging

Parameter	Measurement Date	Monitoring Well
	5/18/2015	
Minimum GW Elevation (ft NGVD)	41.45	B38W14D
Maximum GW Elevation (ft NGVD)	60.17	B38W02D

Notes:
GW denotes groundwater
NGVD denotes National Geodetic Vertical Datum – 1929

Groundwater Flow System

Water table contour maps and potentiometric surface contour maps were prepared for the May 18, 2015 synoptic gauging round. Water table contour maps for the unconsolidated deposits and bedrock potentiometric surface maps are presented in Appendix A, Figure A-5 and Figure A-6. Figure A-5 presents the groundwater flow for wells completed in the overburden soils; Figure A-6 presents the potentiometric surface maps for the wells completed in bedrock. A figure depicting the contours of the bedrock surface excerpted from the *Remedial Investigation Report for the Maywood Site, New Jersey* (DOE 1992) is presented in Appendix A, Figure A-7. Bedrock highs exist in the northeast portion of the FMSS within the Stepan Company property and locally within the MISS. These bedrock highs form a local groundwater divide and naturally control the direction of groundwater flow in the overburden and bedrock aquifers.

During the 2015 synoptic gauging round, the horizontal hydraulic gradient within the overburden varied spatially and ranged from 0.013 to 0.0057 foot/foot (ft/ft) on the MISS and 0.01 to 0.0048 ft/ft off-site, west of Route 17N. The direction of groundwater flow in the overburden aquifer is predominantly to the west towards the Saddle River (Figure A-5). The direction of groundwater flow in bedrock is shown in Figure A-6 and is similarly towards the west. In the bedrock aquifer, the horizontal hydraulic gradient ranges from approximately -0.005 ft/ft on the MISS to 0.0047 ft/ft west of NJ Route 17.

Based on the synoptic gauging round, information regarding the vertical component of groundwater flow may be inferred. As depicted in Appendix C, Table C-9, eleven well clusters were used to determine if a vertical gradient (either upward or downward) exists between overburden and bedrock wells or whether the groundwater is in a transitional "horizontal" flow system; a hydraulic gradient of less than 0.2 ft/ft is considered to be a weak vertical gradient and transitional in nature.

On-site Well Clusters

Of the eight well clusters measured within the MISS/Stepan Company property, five overburden wells showed a greater hydraulic head than corresponding bedrock wells, indicating a downward gradient. For the remaining three evaluated MISS well clusters, MW-24S/D showed an upward component of groundwater flow and; MISS01AA/MISS01B and B38W24S/B38W24D displayed a transitional/horizontal component of groundwater flow in 2015. The data presented in Appendix C, Table C-9 indicates that most of the MISS/Stepan Company property represents a recharge zone to the aquifer, i.e., a net or overall downward gradient.

Off-site Well Clusters

For Well cluster B38W14S/14D, the hydraulic head in the bedrock aquifer was lower than the head in the overburden aquifer, indicating a downward gradient. For Well cluster B38W15S/15D, the hydraulic head in the bedrock aquifer was higher than the head in the overburden aquifer, indicating an upward gradient. These wells are located in proximity to Westerly Brook and the Saddle River. Well cluster B38W17A/17B displayed a transitional/horizontal component of groundwater flow in 2015, as noted in previous gauging years. This well cluster appears to be located transitionally between a recharge and a discharge area.

Field Parameters

In Appendix C, Table C-4 presents a summary of final field parameters measured during annual groundwater sampling activities at the FMSS. Field parameters included temperature, pH, Eh, turbidity, specific conductance, and dissolved oxygen. These parameters were periodically monitored during the purging of the wells to determine when to commence sample collection. Field procedures require these parameters to reach a stable condition prior to sampling. Measurements are periodically recorded in field notebooks during well purging. In Appendix C, Table C-4 presents the final stabilized values.

5.5.2 Groundwater – Radioactive Constituents

Groundwater samples collected in 2015 from both on-site and off-site monitoring wells (Appendix A, Figure A-2) were analyzed for radioactive constituents. Ten (10) shallow wells and 13 deep wells were sampled for radionuclides. Duplicate groundwater samples were obtained from three monitoring wells (MISS05BR, MW28D and MW42D). In addition, a filtered groundwater sample was collected from B38W24S.

Groundwater samples were analyzed for the following radioactive constituents: gross alpha, gross beta, Ra-226, Ra-228, Th-228, Th-230, Th-232, $U_{(tot)}$, K-40, and Rn-222. The gross alpha results are not corrected for uranium or radon. The gross beta results are not corrected for K-40. Results are provided in Appendix C, Table C-10.

The gross alpha results for the overburden wells ranged from non-detect to a maximum of 4.78 pCi/L at Well MW28S. The gross alpha results for the bedrock wells ranged from non-detect to a maximum of 18.88 pCi/L at Well MW24D. When corrected for total uranium content, the maximum was 8.46 pCi/L at Well B38W24D. The results for Wells B38W01S, MW25D and MW28D were qualified with U flags, signifying that no gross alpha was detected. The results for Wells B38W14S, B38W15S, B38W17A, MW24S, B38W02D, B38W03B, B38W14D, B38W15D and MISS01B were qualified with a J flag, signifying that the value as reported is an estimated value.

Overall, gross alpha concentrations are consistent with past years' data. Figure 5-9 depicts the 2015 concentrations in relation to the wells with elevated concentrations; a significant decrease can be observed from 2014 which saw a dramatic increase from previous years' data, but the longer-term trend indicates the concentrations are generally consistent. Even the maximum recorded concentrations from 2015 (MW28S and MW24D) are less than previously detected. While Monitoring Well B38W18D was not sampled in 2015, a gross alpha concentration of 782.44 was reported in 2014; an explanation regarding why Well B38W18D was not sampled is provided in Section 3.0. The temporary replacement well for 2015 (MW-42D) contained 2.46 pCi/L gross alpha.

The gross beta results for the overburden wells ranged from 2.54 pCi/L to a maximum of 95.32 pCi/L at Well B38W15S. When corrected for K-40, the maximum was 18.92 pCi/L at Well B38W15S. The gross beta results for the bedrock wells ranged from 1.22 pCi/L to a maximum of 923 pCi/L at Well MISS05BR. When corrected for K-40, the maximum was 15.78 pCi/L at Well MW28D. The K-40 result for Well MISS05BR was 914.00 pCi/L.

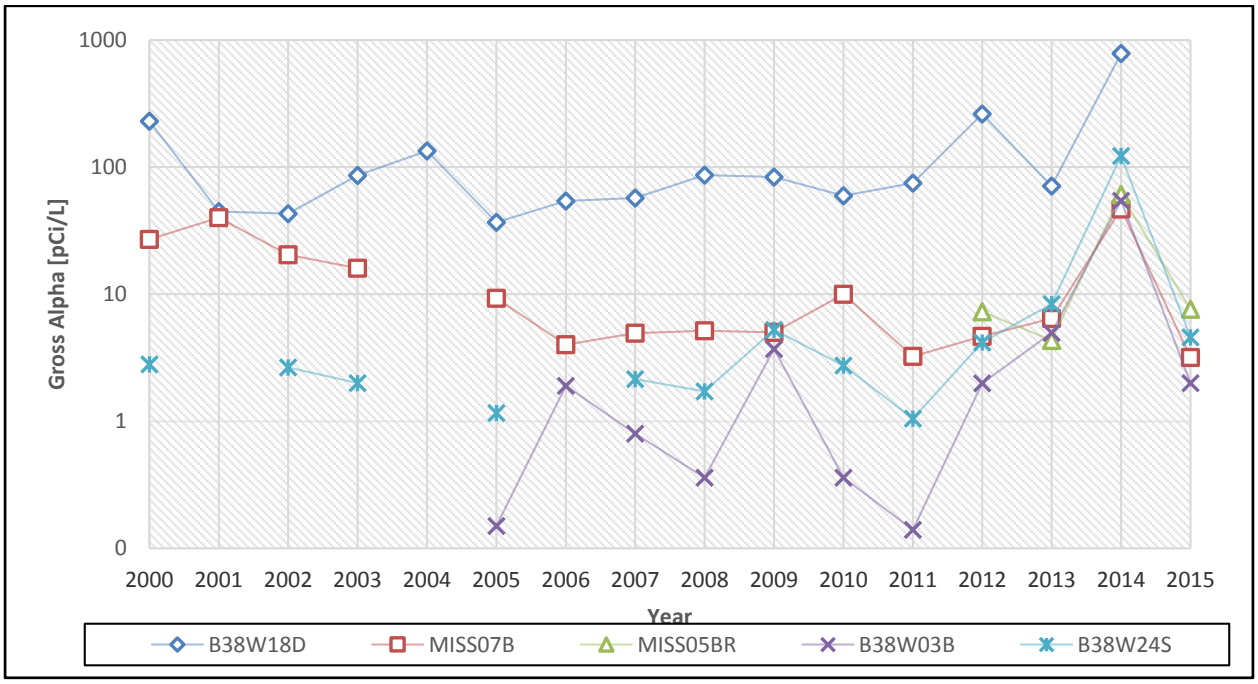

Figure 5-9. Monitoring Wells with Elevated Gross Alpha Results

The gross beta results for Monitoring Wells B38W15S, B38W17B, and MISS05BR, MW-25D, and MW-28D are shown on Figure 5-10. These wells exhibit the highest gross beta results and may be impacted by elevated K-40 results. In general, concentration in the remaining wells are consistent with past years' data.

The combined Ra-226 and Ra-228 results for the overburden wells ranged from non-detect to a maximum of 1.30 pCi/L at Well MW24S. The combined Ra-226 and Ra-228 results for the bedrock wells ranged from non-detect to a maximum of 1.44 pCi/L in Well B38W17B. The results for Wells B38W01S, B38W14S, B38W15S, B38W17A, MISS05AR, MW24S, MW28S were qualified with U flags, signifying that no analytes were detected. The results for Wells B38W24S, MISS01AA, MW25S, B38W01S, B38W14S, B38W15S, B38W17A, MISS01AA, and MISS05AR were qualified with J flags, signifying that the value as reported is an estimated value.

In general, the combined Ra-226 and Ra-228 results for 2015 were within the historical range. While Monitoring Well B38W18D was not sampled in 2015, a combined Ra-226 and Ra-228 concentration of 32.7 was reported in 2014. The temporary replacement Well for 2015 (MW-42D) contained 0.86 pCi/L combined Ra-226 and Ra-228 Figure 5-11 shows the historical results for Monitoring Wells B38W17B and MW25S that had elevated results for Ra-226 plus Ra-228 as compared to the other monitoring wells.

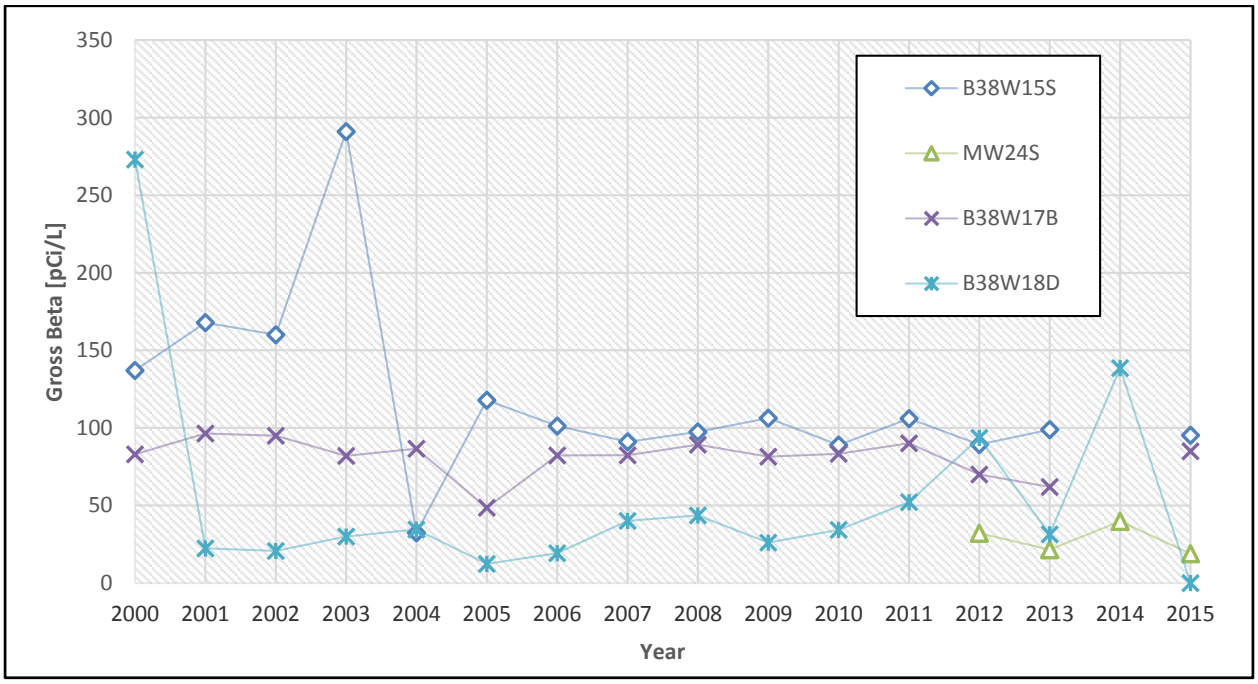

Figure 5-10. Monitoring Wells with Elevated Gross Beta Results

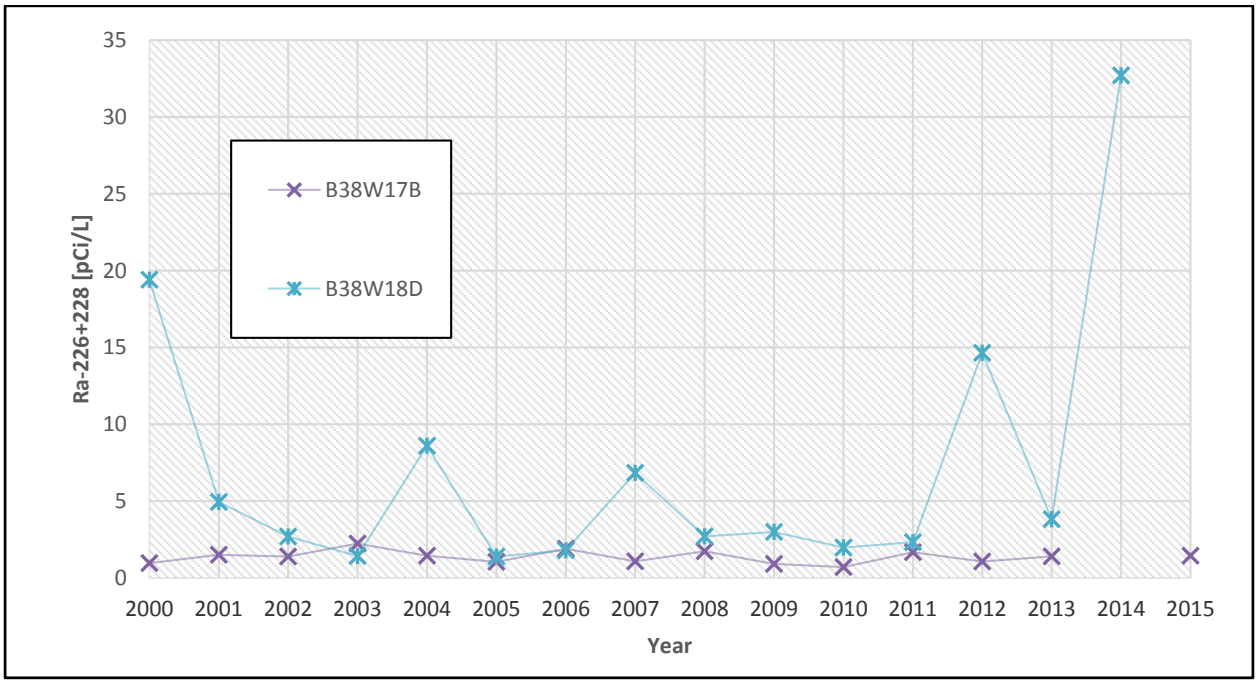

Figure 5-11. Monitoring Wells with Elevated Ra-226 + Ra-228 Results

The $U_{(tot)}$ results for the overburden wells ranged from non-detect to a maximum of 1.64 µg/L at Well MW28S. The $U_{(tot)}$ results for the bedrock wells ranged from non-detect to a maximum $U_{(tot)}$ level of 17.14 µg/L in Well MW-24D. Monitoring Well MW-24D may be impacted by radon. The radon result for this well was 1,350 pCi/L.

Figure 5-12 shows the historical results for Monitoring Wells MW28S and MW24D which have elevated $U_{(tot)}$ results as compared to the other monitoring wells sampled.

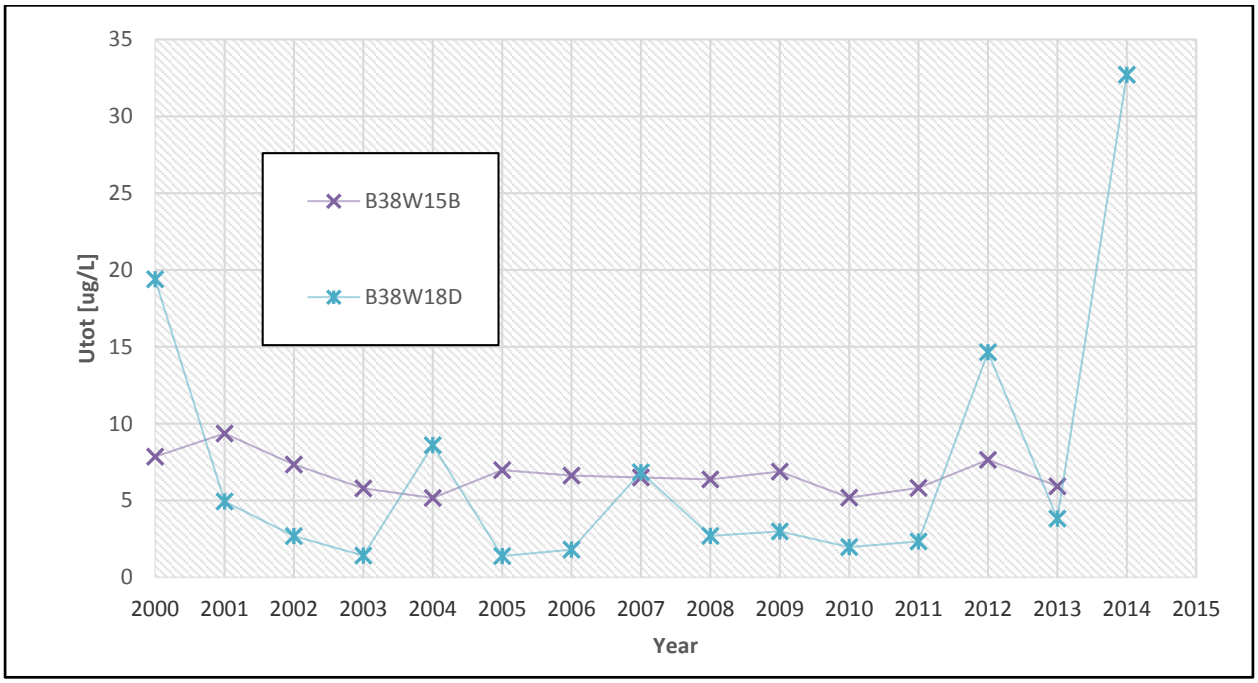

Figure 5-12. Monitoring Wells with Elevated $U_{(tot)}$ Results

The K-40 results for the overburden wells ranged from 0.83 to 76.40 pCi/L at Well B38W15S. The K-40 results for the bedrock wells ranged from 1.00 to 914.00 pCi/L at Well MISS05BR.

The Rn-222 results for the overburden wells ranged from 62 pCi/L to a maximum of 450 pCi/L at Well MISS05AR. The Rn-222 results for the bedrock wells ranged from 88 pCi/L to a maximum of 1,350 pCi/L at Well MW24D. All of the Rn-222 data were qualified and detectable as validated by Kestrel Environmental Technologies, Inc. (refer to Appendix F, Section 7.03.0).

Historical results for the 23 groundwater monitoring wells are presented in Figures E-10 through E-33, located within Appendix E.

5.5.3 Groundwater – Non-Radioactive Constituents

Site-specific groundwater cleanup levels (GWCL) were established for non-radioactive constituents in the GW ROD, Table 1 (USACE, 2012). The non-radioactive constituents are arsenic, benzene and lithium. Analysis for these parameters as part of EMP sampling began with the 2014 sampling event. The rate of detections of these constituents is summarized in Table 5-5. As noted in Section 5.5.2, duplicate groundwater samples were obtained from three Monitoring Wells (MISS05BR, MW28D and MW42D) and a filtered groundwater sample was collected from B38W24S. Results are provided in Appendix C, Table C-11.

Arsenic

The site-specific GWCL for arsenic is 3 µg/L. Arsenic concentrations ranged from 0.78 µg/L to a maximum concentration of 72 µg/L in deep Monitoring Well MISS07B. The average arsenic concentration was 5.18 µg/L. Six of the 23 wells had arsenic concentrations that exceeded the GWCL: B38W15D, MISS05AR, MISS05BR, MISS07B, MW24S, and MW28S.

Benzene

The site-specific GWCL for benzene is 1 µg/L. Three of a total of 23 groundwater samples contained detectable concentrations of benzene. These concentrations ranged from 0.96 to 1,000 µg/L in deep Monitoring Well MISS05BR (this result was J qualified, signifying that the value as reported is an estimated value). The next highest concentration reported was 1.20 µg/L in Well MW24D. The average benzene concentration was 44.01 µg/L. The GWCL for benzene was exceeded in two wells: MISS05BR and MW24D.

Lithium

The site-specific GWCL for lithium in groundwater is 730 µg/L. Lithium was detected in all of the 23 wells at concentrations ranging from 5.20 to 5,500 µg/L in deep Monitoring Well MISS05BR. The average lithium concentration was 1,262 µg/L. The highest concentration occurred in deep Monitoring Well MISS05BR at a concentration of 5,500 µg/L. The duplicate sample for this well location had a reported lithium concentration of 5,300 µg/L. Ten of the 23 wells sampled had lithium concentrations that exceeded the cleanup level; Wells B38W01S, B38W15S, B38W15D, MISS05AR, MISS05BR, MISS07BR, MW24D, MW25D, MW28D, and MW28S.

Table 5-5. Summary of Detections of Non-Radioactive Constituents

Parameter	Cleanup Level (µg/L) [a]	Quantity of Detections	Maximum Detection (µg/L)	Minimum Detection (µg/L)	Average Concentration (µg/L) [b]
Arsenic [c]	3	16	72	0.78	5.18
Benzene	1	3	1,000	0.96	44.01
Lithium	730	22	5,500	5.2	1,262.36

Notes:
a. The site-specific cleanup level is stated in the GW ROD, Table 1 (USACE, 2012)
b. Non-detectable results were incorporated by using values set at 50% of the detection limits
c. Total Arsenic

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6.0 CONCLUSIONS

6.1 EXTERNAL GAMMA RADIATION

The monitors for gamma radiation were deployed at nine on-site locations and six off-site locations in 2014 (Appendix A, Figure A-2).

The calculated doses for 2015, above background, from direct gamma exposure at the MISS to a hypothetical maximally exposed resident and off-site worker assumed to be located 50 ft (15.2 m) from the fence line at Location 21 were 50.0 mrem/yr and 13.5 mrem/yr, respectively (refer to Sections 1.2.1 and 0). This is a conservative approach because the nearest receptor is located approximately 200 ft (61.0 m) from location 21. The results obtained from the gamma radiation monitors are consistent with historical data and all 15 locations will continue to be monitored during the 2015 program.

6.2 RADON 222 FLUX MONITORING

Rn-222 flux monitoring was performed for the soil storage pile located at the MISS to determine compliance with 40 CFR 61, Subpart Q (EPA 2015b) (see Appendix B, Section 4.0). Specifically, the Subpart Q standard requires that no source (i.e., storage pile) at a DOE facility shall emit more than 20 $pCi/m^2/s$ of Rn-222, as an average for the entire source, into the ambient air. To determine the Rn-222 flux from the storage pile, charcoal canisters were placed on the stockpile at six locations for a period of 24 hours. The charcoal canisters were then sent to a laboratory for analysis. The maximum Rn-222 concentration obtained from the flux monitoring was 0.034 $pCi/m^2/s$ and thus, was in compliance with the 40 CFR 61, Subpart Q standard of 20 $pCi/m^2/s$. In 2014, the maximum radon flux monitoring result was 0.028 $pCi/m^2/s$.

6.3 RADON 220 AND RADON 222 PERMITER MONITORING

Rn-220 and Rn-222 monitoring was performed continuously at numerous locations along the site perimeter throughout 2015 (refer to Section 5.2.2). For the first 6 months of the monitoring year, the maximum Rn-220 concentration was 3.42 pCi/L, and 3.81 pCi/L for the last 6 months of the monitoring year. Rn-222 concentrations for 2015 were below the Lower Limit of Detection at all measurement locations: 0.2 pCi/L for the first 6 months of the monitoring year and 0.1 pCi/L for the last 6 months of the monitoring year. The Rn-222 results for the 12-month monitoring period were comparable to the results from previous years. All radon measurement locations will continue to be monitored during the 2016 program.

6.4 AIRBORNE PARTICULATE DOSE

The 2015 airborne particulate dose to an off-site resident with 100% occupancy, considering all site contributions throughout the year, was 8.4×10^{-3} mrem. This is well below the 10 mrem/yr standard specified in 40 CFR 61, Subpart H. The hypothetical airborne particulate collective dose to the population within 50 mi (80 km) of the site was 6.14×10^{-3} person-rem/yr.

6.5 CUMULATIVE DOSE – EXTERNAL GAMMA RADIATION AND AIRBORNE PARTICULATES

The location of the hypothetical maximally exposed individual from direct gamma radiation (external dose) and the location of the hypothetical maximally exposed individual from airborne particulates (internal dose) are different. The hypothetical maximally exposed individual from direct gamma radiation emitted from the MISS in 2015 occurred 50 ft (15.2 m) from Location 21, which is located on the southern perimeter of the site. The annualized dose equivalent from external gamma radiation exposure, calculated at the above location for the hypothetical maximally exposed individual, was 50.0 mrem/yr (see Section 0).

The hypothetical maximally exposed individual from airborne particulates, as determined by the dispersion modeling performed for the Annual NESHAP Compliance Report – Year 2015 (see Appendix B), occurred south-southwest of the MISS. The calculated annual effective dose from airborne particulates to the hypothetical maximally exposed individual was 8.4×10^{-3} mrem/yr. The maximum annual effective dose is almost entirely the result of the internal doses received from the inhalation of dust particles with a small contribution from the ingestion of plant borne dust.

Conservatively combining the annual dose equivalent to the maximally exposed external gamma and internal (inhaled particulate) dose receptors yields 50.0 mrem/yr total effective dose equivalent, representing the worst-case exposure scenario and well below the NRC standard of 100 mrem/yr (from all sources, excluding radon).

6.6 SURFACE WATER

Surface water samples were collected and analyzed for radioactive constituents (Appendix C, Table C-10).

- The gross alpha results ranged from non-detect to a maximum of 3.04 pCi/L at Location SWSD001.
- The gross beta results ranged from non-detect to a maximum of 10.73 pCi/L at Location SWSD002.
- The combined Ra-226 and Ra-228 results ranged from 0.17 pCi/L to a maximum of 0.93 pCi/L at Location SWSD009.
- The $U_{(tot)}$ results ranged from non-detect to a maximum of 1.42 µg/L at Location SWSD008.

The surface water results for 2015 were within the range of results that have been measured during previous years. Surface water will continue to be monitored for radioactive constituents during 2016.

6.7 SEDIMENT

Because there are no radiological standards for sediment, the Soil ROD unrestricted use soil cleanup criteria were used as a basis for evaluating the analytical results. Radionuclide concentrations in sediment samples collected in Westerly Brook (SWSD001, SWSD002, and SWSD003) were within the background concentration range and below the Soil ROD unrestricted use soil cleanup criteria. In Lodi Brook (SWSD006 through SWSD010), radionuclide concentrations in sediment ranged from above background to below the ROD unrestricted use soil cleanup criteria.

The highest combined concentration of Ra-226 and Th-232 was found at Location SWSD009 in Lodi Brook (2.75 pCi/g), which does not exceed the Soil ROD unrestricted use soil cleanup criteria of 5 pCi/g above background (6.64 pCi/g, with background included). The highest U-238 result was identified at Location SWSD008 (0.87 pCi/g), which is well below the Soil ROD soil cleanup criteria of 50 pCi/g above background.

The 2015 sediment sampling results were within the range of results that have been measured during previous years; all results continue to be below the Soil ROD unrestricted use soil cleanup criteria. Sediment will continue to be monitored in 2016 for radioactive constituents.

6.8 GROUNDWATER

During 2015, groundwater was collected from a total of 23 monitoring wells located on-site and off-site at the MISS. The groundwater sample locations are depicted on Appendix A, Figure A-2. Groundwater samples were analyzed for the following radiological constituents: gross alpha, gross beta, Ra-226, Ra-228, Th-228, Th-230, Th-232, $U_{(tot)}$, K-40, and Rn-222. The gross alpha results are not corrected for uranium or radon. The gross total beta results are not corrected for K- 40. Several monitoring wells located on the MISS are installed in or through known areas of radiologically contaminated soil.

Groundwater at the FMSS is being addressed under the groundwater operable unit. The GW ROD establishes the groundwater cleanup levels for arsenic at 3 µg/L, benzene at 1 µg/L, and lithium at 730 µg/L (USACE 2012). The GW ROD also establishes the soil cleanup level to attain groundwater cleanup for arsenic at 19 mg/kg, lithium at 194 mg/kg, and benzene at 0.005 mg/kg (USACE 2012).

- The gross alpha results for the overburden wells ranged from non-detect to a maximum of 4.78 pCi/L at Well MW28S. The gross alpha results for the bedrock wells ranged from non-detect to a maximum of 18.88 pCi/L at Well MW24D. When corrected for total uranium content, the maximum was 8.46 pCi/L at Well B38W24D. Overall, gross alpha concentrations are consistent with past years' data.
- The gross beta results for the overburden wells ranged from 2.54 pCi/L to a maximum of 95.32 pCi/L at well B38W15S. When corrected for K-40, the maximum was 18.92 pCi/L at Well B38W15S. The gross beta results for the bedrock wells ranged from 1.22 pCi/L to a maximum of 923 pCi/L at Well MISS05BR. When corrected for K-40, the maximum was 15.78 pCi/L at Well MW28D. The K-40 result for Well MISS05BR was 914.00 pCi/L.
- The combined Ra-226 and Ra-228 results for the overburden wells ranged from non-detect to a maximum of 1.30 pCi/L at Well MW24S. The combined Ra-226 and Ra-228 results for the bedrock wells ranged from non-detect to a maximum of 1.44 pCi/L in well B38W17B. In general, the combined Ra-226 and Ra-228 results for 2015 were within the historical range.
- The $U_{(tot)}$ results for the overburden wells ranged from non-detect to a maximum of 1.64 µg/L at Well MW28S. The $U_{(tot)}$ results for the bedrock wells ranged from non-detect to a maximum $U_{(tot)}$ level of 17.14 µg/L in Well MW-24D. Monitoring Well MW-24D may be impacted by radon. The radon result for this well was 1,350 pCi/L.
- The K-40 results for the overburden wells ranged from 0.83 to 76.40 pCi/L at Well B38W15S. The K-40 results for the bedrock wells ranged from 1.00 to 914.00 pCi/L at Well MISS05BR.
- The Rn-222 results for the overburden wells ranged from 62 pCi/L to a maximum of 450 pCi/L at Well MISS05AR. The Rn-222 results for the bedrock wells ranged from 88 pCi/L to a maximum of 1,350 pCi/L at Well MW24D. All of the Rn-222 data were qualified and detectable.

- Lithium was detected in all of the 23 wells at concentrations ranging from 5.20 to 5,500 µg/L. The average lithium concentration was 1,314 µg/L. The highest concentration occurred in deep Monitoring Well MISS05BR at a concentration of 5,500 µg/L. The duplicate sample for this well location had a reported lithium concentration of 5,300 µg/L. Ten of the 23 wells sampled had lithium concentrations that exceeded the cleanup level.
- Arsenic concentrations ranged from 0.83 µg/L to a maximum concentration of 72 µg/L in Bedrock Monitoring Well MISS07B. The average arsenic concentration was 4.538 µg/L. Six of the 23 wells had arsenic concentrations that exceeded the cleanup standard.
- Benzene concentrations ranged from 0.96 to 1,000 µg/L in deep Monitoring Well MISS05BR. The benzene cleanup standard was exceeded in three wells.

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Appendix A
Figures

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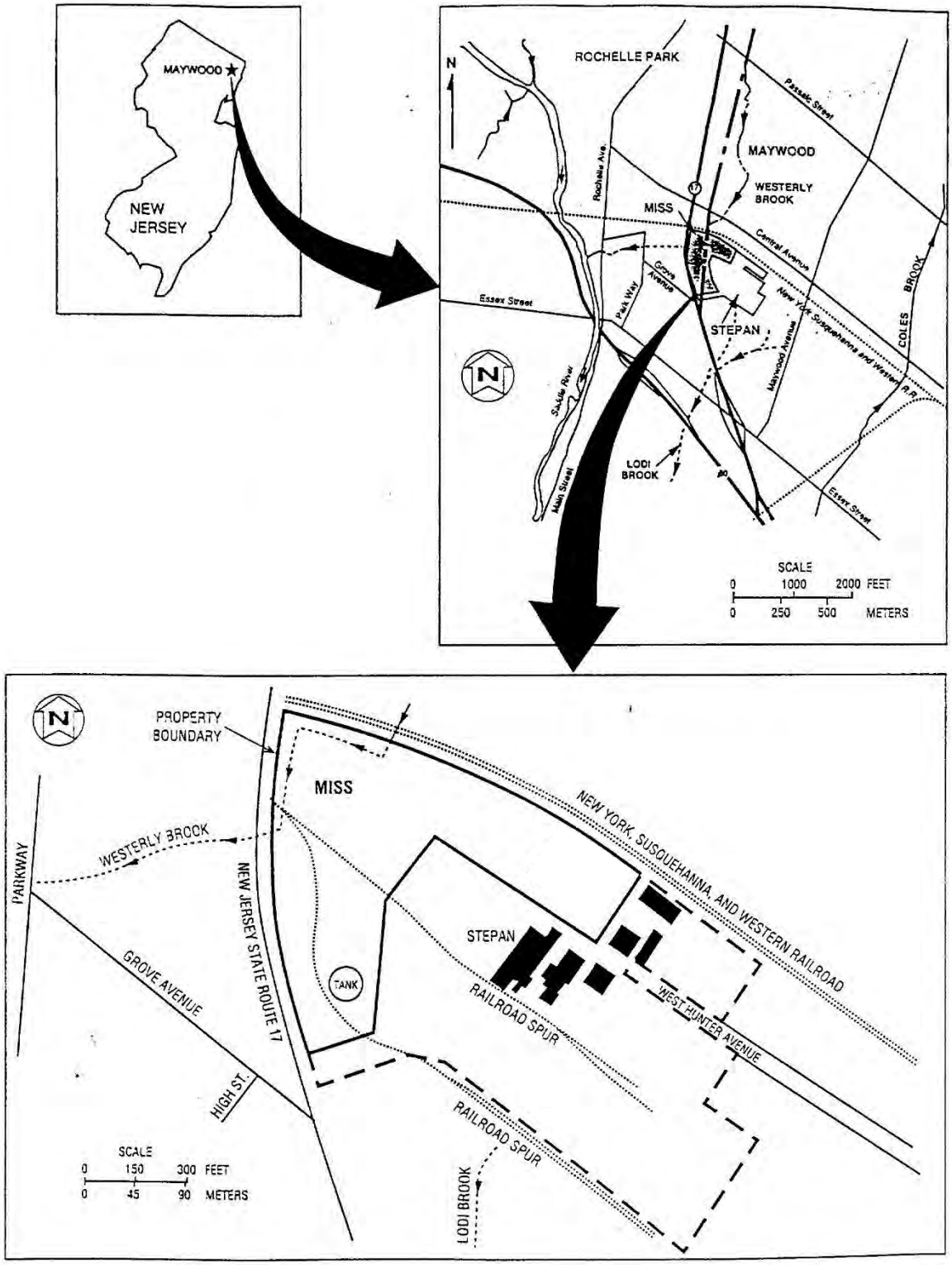

Figure A-1. MISS, Site Location and Map

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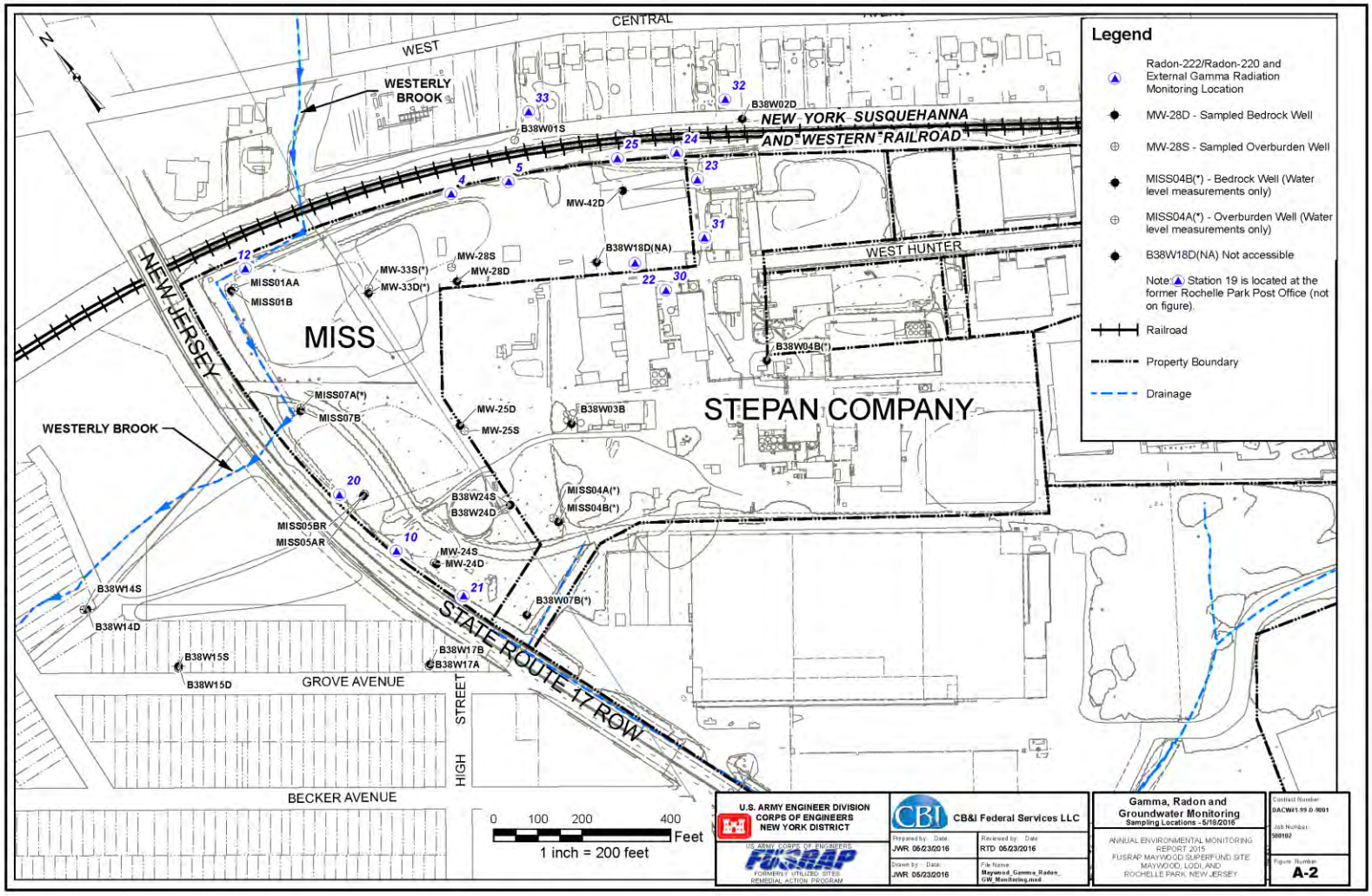

Figure A-2. Gamma, Radon and Groundwater Monitoring-Sampling Locations

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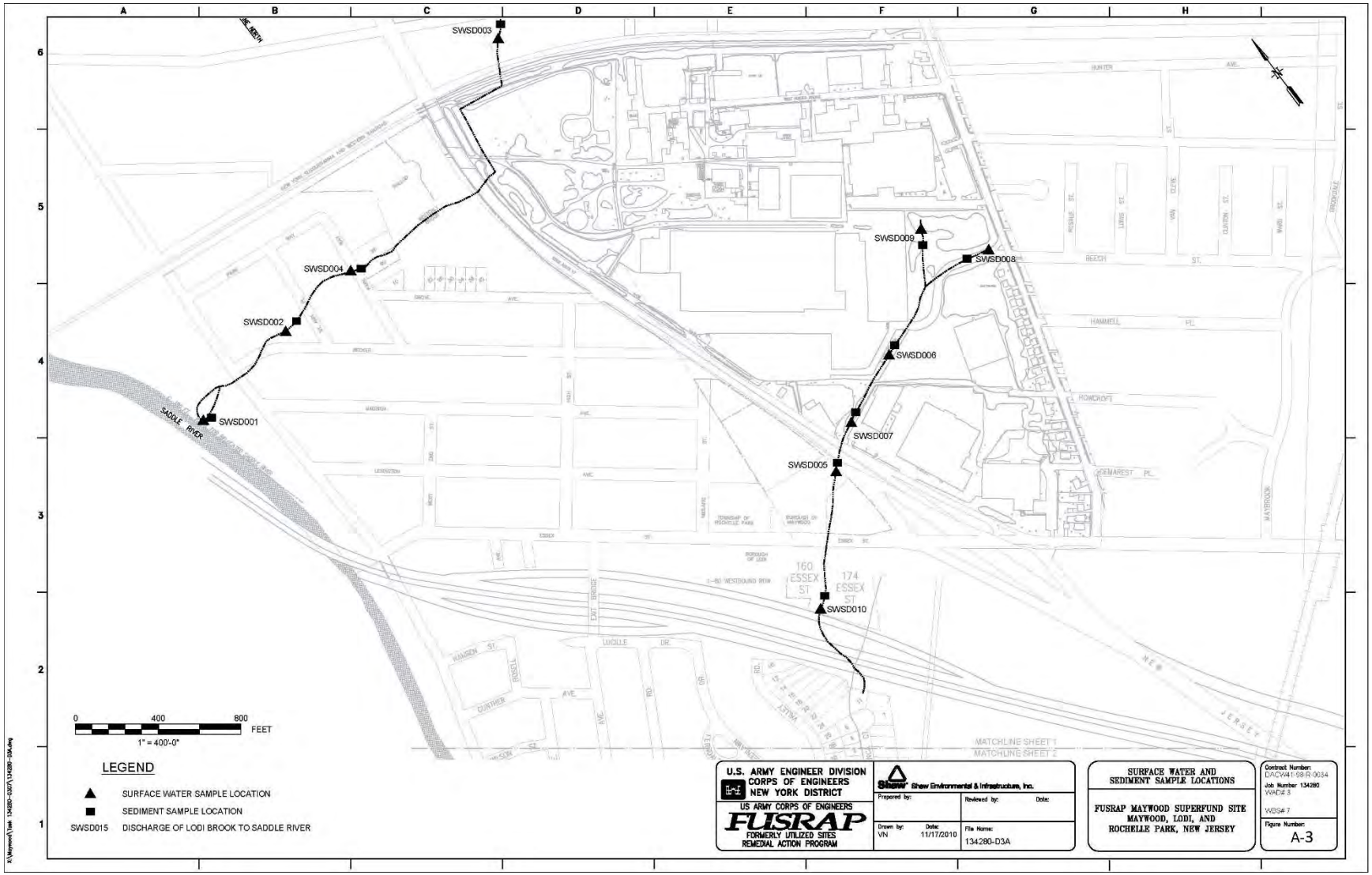

Figure A-3. Northern Surface Water and Sediment Sample Locations

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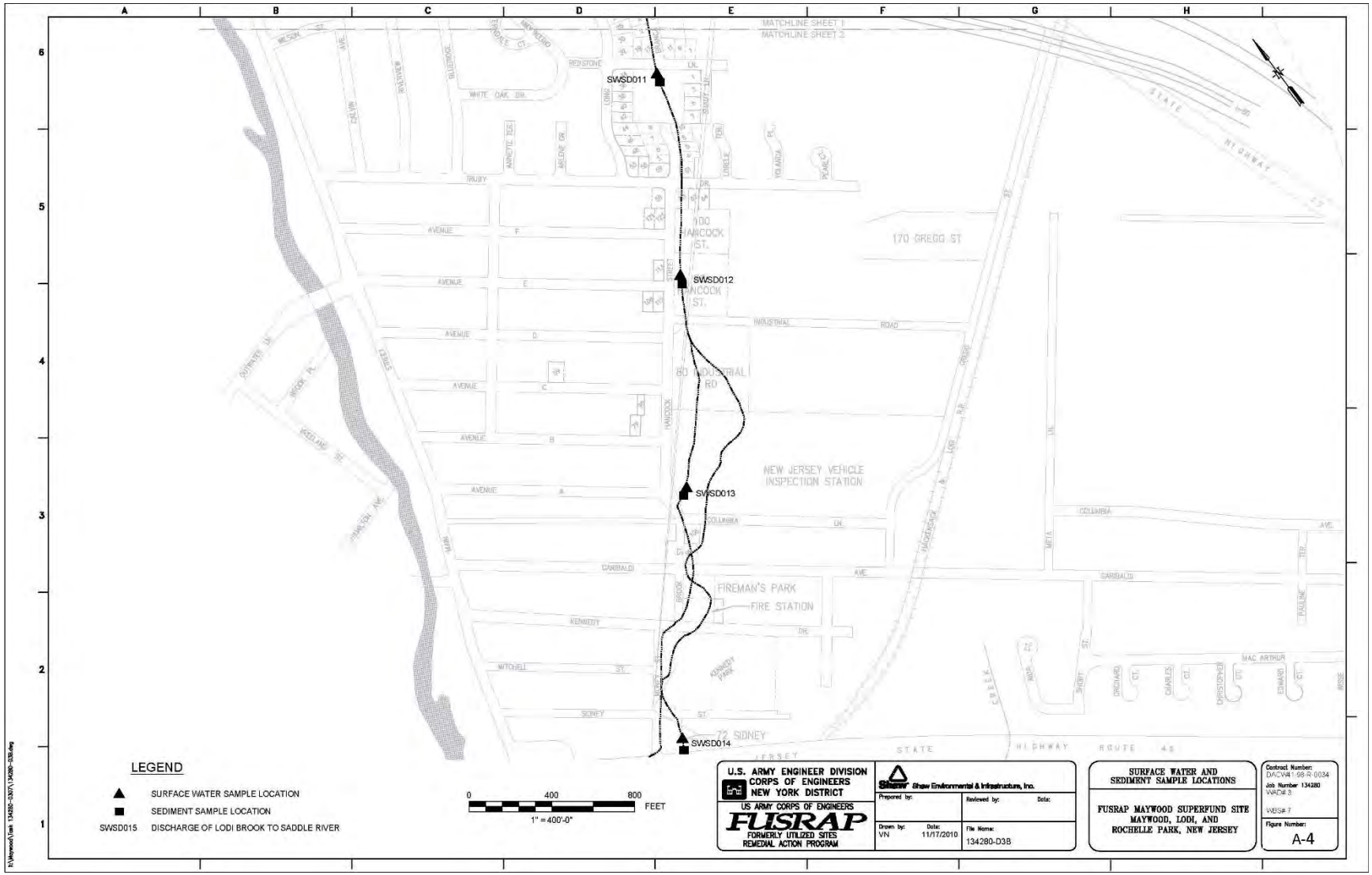

Figure A-4. Southern Surface Water and Sediment Sample Locations

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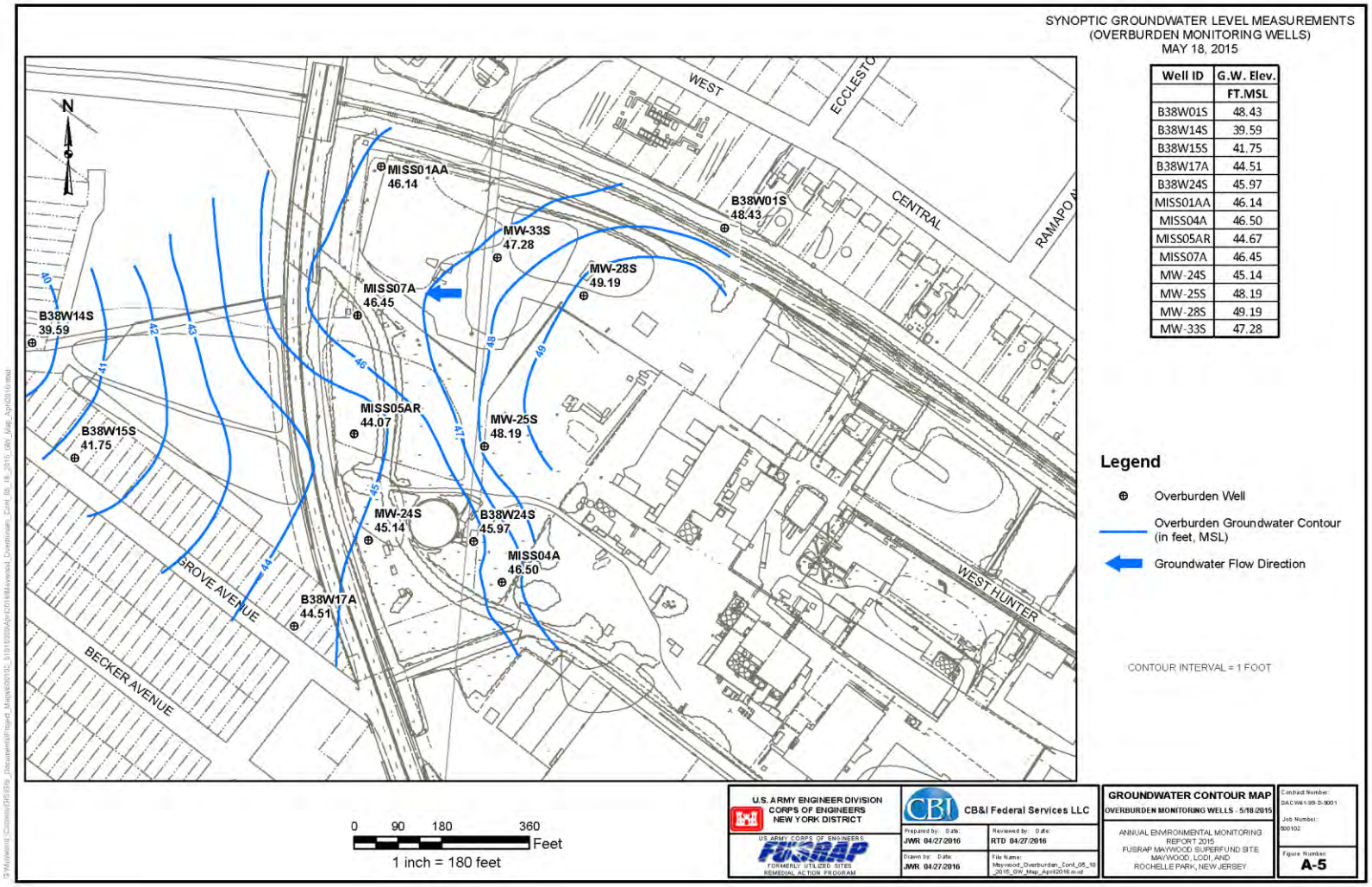

Figure A-5. Synoptic Groundwater Level Measurements, Overburden Monitoring Wells – May 18, 2015

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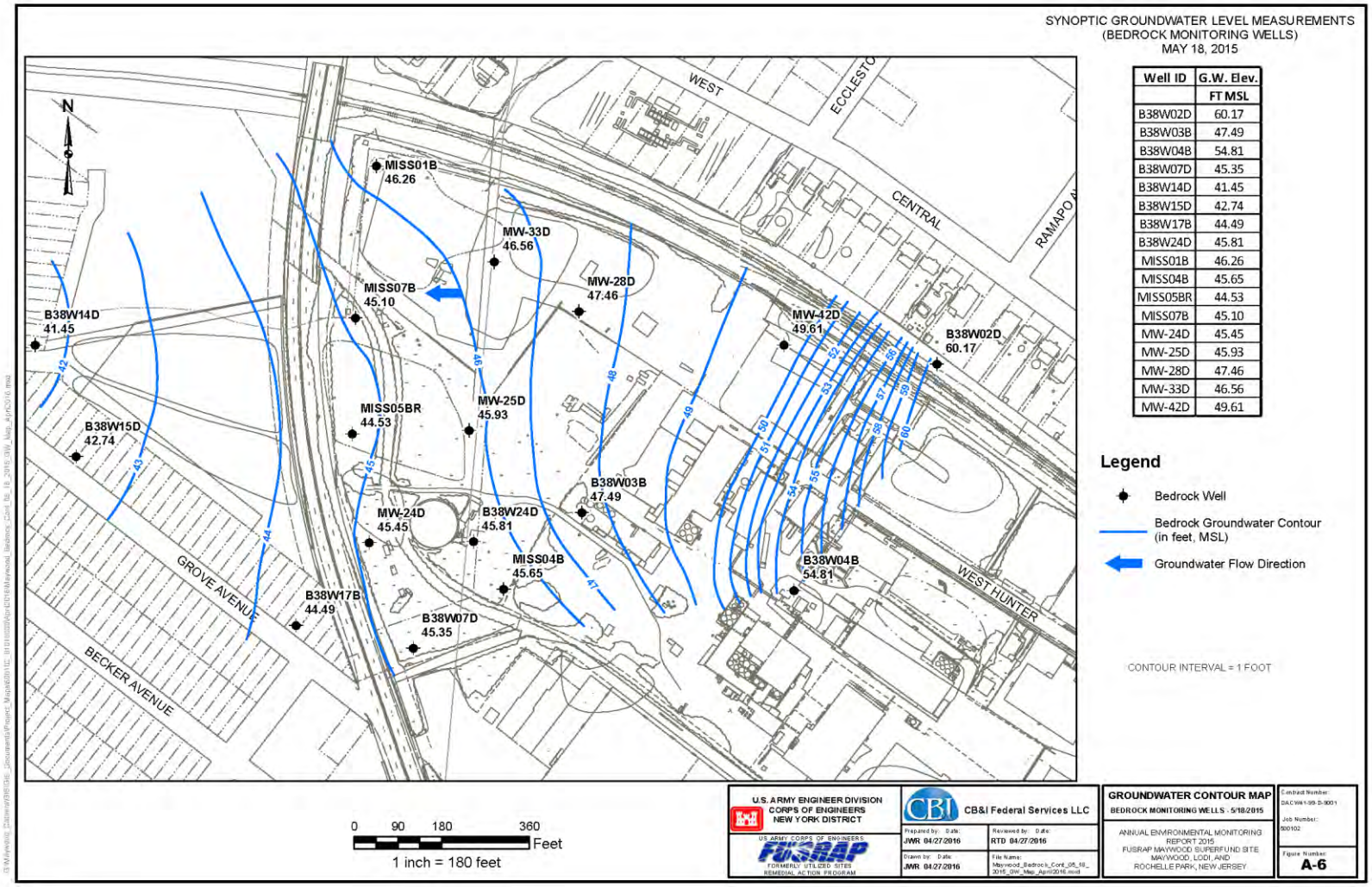

Figure A-6. Synoptic Groundwater Level Measurements, Bedrock Monitoring Wells – May 18, 2015

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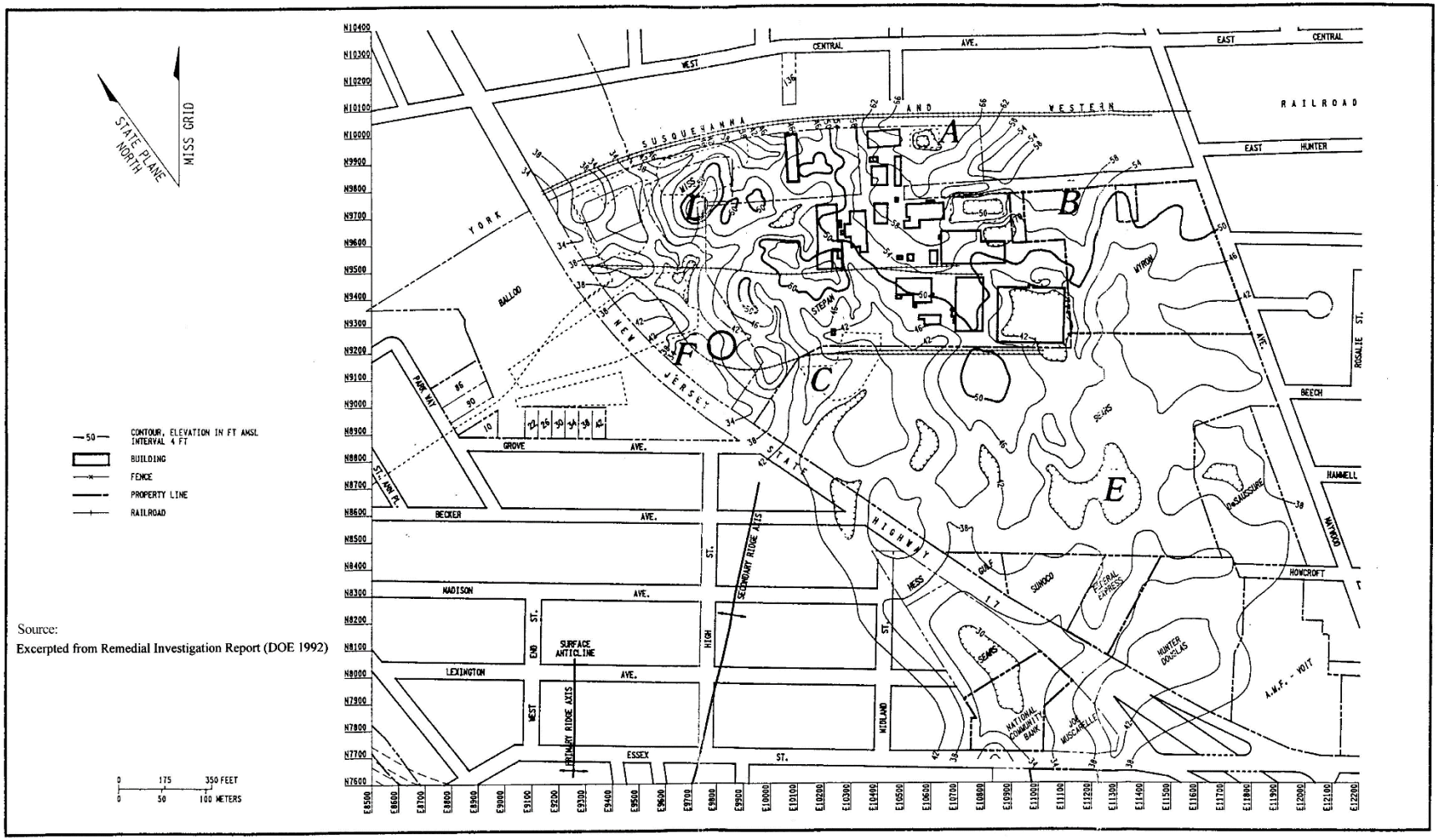

Figure A-7. Contour Map of the Top of Bedrock in the Maywood Area

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Appendix B
Annual NESHAP Compliance Report for the Year 2015

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ANNUAL NESHAP COMPLIANCE REPORT, YEAR 2015

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

SITE-SPECIFIC ENVIRONMENTAL RESTORATION
CONTRACT No. W912DQ-13-D-3016
TASK ORDER No. 0001
TASK 010

Submitted to:

Department of the Army
U.S. Army Engineer District, Kansas City
Corps of Engineers
700 Federal Building
Kansas City, Missouri 64106

Department of the Army
U.S. Army Engineer District, New York
Corps of Engineers
FUSRAP Project Office
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New York, New York 10007

Submitted by:

Cabrera Services
100 West Hunter Avenue
Maywood, NJ 07607

June 2016

Issued to: _____ Date: _____

Copy No. _____ ☐ Controlled ☐ Uncontrolled

ANNUAL NESHAP COMPLIANCE REPORT, YEAR 2015

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

SITE-SPECIFIC ENVIRONMENTAL RESTORATION
CONTRACT No. W912DQ-13-D-3016

TASK ORDER No. 0001
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U.S. Army Engineer District, Kansas City
Corps of Engineers
700 Federal Building
Kansas City, Missouri 64106

Department of the Army
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June 2016

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RECORD OF REVISIONS

Revision No.	Description of Revision	Date
A	Draft issue for internal review and comment	June 2016
B	Draft issue for USACE review and comment	June 2016
0	Issue for the EPA	June 2016

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APPENDIX C CALCULATIONS C-1

ABBREVIATIONS AND ACRONYMS

AEC	Atomic Energy Commission
AIRDOS-PC	Clean Air Act Compliance Software for Personal Computers
°C	degrees Celsius
CAP88-PC	Clean Air Act Assessment Package 1988 – Personal Computer (Version 4.0)
CFR	Code of Federal Regulations
cm	centimeters
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FGR 13	Federal Guidance Report 13
FMSS	FUSRAP Maywood Superfund Site
Fr-223	francium-223
ft	foot or feet
ft^2	square feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
g	gram
HEPA	High Efficiency Particulate Air
ICRP	International Commission on Radiological Protection
km	kilometers
kph	kilometers per hour
m	meters
m^2	square meters
MCW	Maywood Chemical Works
MDA	minimum detected activity
mi	miles
MISS	Maywood Interim Storage Site
mph	miles per hour
mrem	millirems
mrem/yr	millirem per year
mSv	millisieverts
NESHAP	National Emission Standards for Hazardous Air Pollutants
NJ	New Jersey
N/A	Not Applicable
NOAA	National Oceanic and Atmospheric Administration
NRC	Nuclear Regulatory Commission
NYSW	New York, Susquehanna and Western Railway
pCi/g	picocuries per gram
$pCi/m^2/s$	picocuries per square meter per second
QP	quarry processed
Ra	Radium
Ra-226	radium-226
Rn	Radon
Rn-220	radon-220

ABBREVIATIONS AND ACRONYMS (continued)

Rn-222	radon-222
ROW	right-of-way
STAR	Stability Array
Th	Thorium
Th-232	thorium-232
Th-234	thorium-234
U	Uranium
U-238	uranium-238
UFML	USACE, FUSRAP Maywood Laboratory
USACE	U.S. Army Corps of Engineers

EXECUTIVE SUMMARY

Cabrera Services was contracted by the U.S. Army Corps of Engineers (USACE) for the environmental remediation of the Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS). The FMSS is identified on the National Priorities List as the "Maywood Chemical Company" with the Comprehensive Environmental Response, Compensation, and Liability Information System identification number NJD980529762.

Activities at the U.S. Department of Energy (DOE)-owned Maywood Interim Storage Site (MISS) result in the emissions of radiologically-contaminated particulates into the air. Thus, the MISS is subject to the requirements of the National Emission Standards for Hazardous Air Pollutants (NESHAP), as codified in the Code of Federal Regulations, Title 40, Part 61 (40 CFR 61), Subpart H. This *Annual NESHAP Compliance Report, Year 2015* has been prepared to meet those requirements.

SOURCES OF EMISSIONS

The following were the potential sources of radiologically contaminated airborne particulates during the year 2015:

- The performance of soil load-out, transportation, and disposal operations at the MISS in the Borough of Maywood.
- The performance of a remedial action at Cluster No. 10A (100 West Hunter Avenue [Stepan Company]) in the Borough of Maywood and the Township of Rochelle Park.
- The performance of a remedial action at Cluster No. 12A (New York, Susquehanna and Western Railway [NYSW]) in the Borough of Maywood and the Township of Rochelle Park.
- The performance of remedial actions at Cluster No. 12B (100 West Hunter Avenue [MISS]) in the Borough of Maywood and the Township of Rochelle Park.
- The performance of remedial actions at a residence located at 61 Trudy Drive (TR-1) and a commercial property at 205 Main Street (205M-1) in the Borough of Lodi, and at residences located at 126, 130, and 146 West Central Avenue (WC-1) in the Borough of Maywood.
- In situ wind erosion at the MISS in the Borough of Maywood and the Township of Rochelle Park.
- The operation of the soil sample preparation laboratory located in the on-site radiochemistry laboratory at the MISS.

MODELING

The provisions of 40 CFR 61, Subpart H state that emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 millirems per year (mrem/yr).

To determine compliance with this standard, radionuclide emissions were determined and effective dose equivalent values to members of the public were calculated using U.S. Environmental Protection Agency (EPA)-approved sampling procedures and the Clean Air Act Assessment Package 1988 - Personal Computer (Version 4.0) (CAP88-PC) computer model. Compliance was determined by calculating the highest effective dose equivalent to any member of the public at any off-site point where there is a residence, school, business, or office.

COMPLIANCE ASSESSMENT

The annual effective dose to the hypothetical maximally exposed resident and worker, as well as the collective population dose, resulting from total site activities combined during the year 2015 are the following:

- Resident located 33 feet (ft) (10 meters [m]) southeast of 61 Trudy Drive, Lodi (100 percent occupancy): 8.4E-05 millisieverts (mSv) or 8.4E-03 millirems (mrem).
- Worker located 230 ft (70 m) north (N) of MISS Soil Load-outs (27 percent occupancy): 2.08 E-05 mSv or 2.08E-03 mrem.
- Annual effective dose to the public within 50 miles (80 kilometers) of the MISS: 6.14E-03 person-rem.

As the maximum annual effective doses to the individual residents and workers are well below the standard of 10 mrem/yr, the site is operating in compliance with Subpart H of the NESHAP regulations.

1.0 FACILITY INFORMATION

1.1 REGULATORY OVERVIEW

The provisions of the National Emission Standards for Hazardous Air Pollutants (NESHAP), as codified in the Code of Federal Regulations, Title 40, Part 61 (40 CFR 61), Subpart H, apply to operations at any facility owned or operated by the U.S. Department of Energy (DOE) that emits any radionuclides, other than radon–222 (Rn-222) or radon-220 (Rn-220), into the air. These provisions state that emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 millirems per year (mrem/yr).

To determine compliance with the NESHAP-Subpart H standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using U.S. Environmental Protection Agency (EPA)-approved sampling procedures, computer models Clean Air Act Assessment Package 1988 - Personal Computer (CAP88-PC), or Clean Air Act Compliance Software for Personal Computers (AIRDOS-PC), or other procedures for which the EPA has granted prior approval. Compliance with this standard shall be determined by calculating the highest effective dose equivalent to any member of the public at any off-site point where there is a residence, school, business, or office. The owners or operators of an applicable facility shall submit an annual compliance report to both the EPA headquarters and the appropriate regional office by June 30, 2016.

Activities at the DOE-owned Maywood Interim Storage Site (MISS) result in the emissions of radiologically contaminated particulates into the air. Thus, the MISS is an applicable facility and this report has been prepared to satisfy the requirements of 40 CFR 61, Subpart H by the U.S. Army Corps of Engineers (USACE) on behalf of the DOE. A detailed description of the MISS, the site history, and emission sources of radionuclides is provided below.

1.2 SITE DESCRIPTION

The MISS is an 11.7-acre (4.7-hectare) property located in the Borough of Maywood and the Township of Rochelle Park in Bergen County, New Jersey (NJ). The MISS lies approximately 12 miles (mi) (20 kilometers [km]) northwest of New York City and 13 mi (21 km) northeast of Newark, NJ (see **Appendix A, Figure A-1**). The MISS property was previously part of a 30-acre (12-hectare) property owned by the Stepan Company and it was formerly part of the Maywood Chemical Works (MCW). The MISS is bordered on the west by NJ Route 17; on the north by the New York, Susquehanna and Western Railway (NYSW) line; and on the south and east by commercial and industrial properties.

The MISS is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS). The FMSS consists of 88 residential, commercial, municipal, and state or Federal properties designated under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. All 64 residential and municipal properties have been remediated either by the DOE or USACE during Phase I. The remaining 24 properties are being addressed by the USACE in Phase II and were sub-divided into 12 clusters (i.e., sets of contiguous properties) to facilitate the predesign investigation and subsequent removal actions for those properties (see **Appendix A, Figure A-2**). The interim storage of radiologically contaminated material removed from the clusters occurs at the DOE-owned MISS.

Land use in the vicinity of the MISS is primarily commercial and residential (see **Appendix A, Figure A-3**). The nearest schools are located approximately 0.5 mi (0.8 km) northeast and northwest of the MISS. There is no farmland in the vicinity of the MISS.

Based on the National Oceanic and Atmospheric Administration (NOAA) records for the year 2015 for Teterboro Airport (NOAA 2015a), monthly average temperatures ranged from a low of 22.1 degrees Fahrenheit (°F) (-5.5 degrees Celsius [°C]) in February to a high of 78.2°F (25.7°C) in July. The total monthly precipitation ranged from a low of 1.64 inches (4.17 centimeters [cm]) in August to a high of 5.12 inches (13.00 cm) in December. The monthly average wind speeds ranged from a low of 5.6 miles per hour (mph) (9.0 kilometers per hour [kph]) from the east-southeast in September to a high of 8.5 mph (13.7 kph) from the west-northwest in January. The most frequent winds are from the northwest, followed by north and north-northwest (see **Appendix A, Figure A-4**). Additionally, winds with a westerly component occur more frequently than those with an easterly component while east-southeast winds are the least frequent wind direction.

Due to the absence of on-site meteorological monitoring data, observations from Teterboro Airport were used to represent the general climatic conditions at the MISS. Teterboro Airport is located approximately 3 mi (4.8 km) south of the MISS, and thus meteorological data collected at this location is considered to be the best available data to represent the climatic regime at the MISS.

1.3 SITE HISTORY

The MISS was established to provide storage for low level radioactive soils found in the vicinity of the former MCW. From 1916 through 1959, the MCW processed monazite sand (a thorium-containing ore) for industrial uses. Process wastes were placed in surface impoundments on-site. Some of these process wastes migrated off-site via surface water drainage and some were later used as mulch and fill on nearby properties, contaminating them with radioactive thorium (Th), radium (Ra), and uranium (U).

After the enactment of the Atomic Energy Act of 1954, the Atomic Energy Commission (AEC) issued a license to the MCW for the processing and manufacture of radioactive material. The MCW stopped processing Th in 1959 and shortly thereafter was sold to the Stepan Company. Based on AEC inspections and information, remedial actions were performed by the Stepan Company.

Subsequent radiological surveys from 1980 to 1984 identified additional areas of contamination, both on-site and off-site. Through a provision of the Energy and Water Development Appropriations Act of 1984, Congress authorized the DOE to conduct a decontamination research and development project at the former MCW site. The site was subsequently assigned to FUSRAP. In 1984, the DOE negotiated a lease for Stepan Company land on which the MISS would be established. The land was transferred in 1985 to DOE ownership and currently provides interim storage for contaminated materials removed from vicinity properties.

FUSRAP was transferred from DOE to the USACE by Congressional action. The limits of USACE's responsibilities for the FMSS are defined under a Federal Facilities Agreement between DOE and the EPA, Region II, which became effective September 17, 1990. The USACE became a successor to the DOE as of March 17, 1999.

1.4 MODEL SOURCES

The computer program used to model potential off-site exposure from airborne emissions is the CAP88-PC Program, Version 4.0.1.17, dated August 2014 (Rosnick 2014). Airborne emissions

contributing to off-site exposure could occur from areas where radioactively contaminated soil is exposed to the elements and from operations that generate airborne emissions (see **Appendix A, Figure A-5**).

During calendar year 2015, the potential sources of airborne emissions at the MISS and vicinity properties were as follows:

- The performance of soil load-out, transportation, and disposal operations at the MISS during 2015. Specifically, eight (8) soil load-out operations were performed during 2015. The various soil stockpiles consisted of soil that had been transported to the MISS from the remedial actions performed at the following three properties: Cluster No. 10A (100 West Hunter Avenue [Stepan Company]), Cluster No. 12A (NYSW), and Cluster No. 12B (100 West Hunter Avenue [MISS]). Additional soil was transported to the MISS from the remedial actions conducted at a residence located at 61 Trudy Drive (TR-1) and a commercial property at 205 Main Street (205M-1) in the Borough of Lodi, and residences located at 126, 130, and 146 West Central Avenue (WC-1) in the Borough of Maywood These 8 load-outs involved the movement of approximately 80,126 tons of soil. These materials were staged at the MISS and subsequently placed into railcars for transport to a disposal facility in Utah or Idaho. The nearest commercial buildings are located approximately 230 feet (ft) (70 meters [m]) north of the MISS soil load-out area and the nearest residences are located 360 feet (110 m) east-northeast of the MISS soil load-out area.

- The performance of remedial actions at Cluster No. 10A (100 West Hunter Avenue [Stepan Company]), which is located in the Borough of Maywood and the Township of Rochelle Park. This property occupies primarily Block 124, Lots 31, 32, 33, 39, 40, 41, 42, 43, 44, 45, 46, and 47 in the Borough of Maywood, except for a small area in the southwest corner of the property that is in Block 18.02, Lot 2 in the Township of Rochelle Park. The property comprises approximately 19 acres and is owned by the Stepan Company. For the CAP88-PC modeling purposes, Cluster No. 10A was divided into three (3) sub-clusters (i.e., 10A-1, 10A-2, and 10A-3). The remedial action involved the excavation of contaminated soil at the following three (3) locations on the Stepan Company property: a rectangular shaped area adjacent to the MISS/Stepan Company property boundary that extends from the Stepan Company rail spur northeast to the MISS/Stepan Company property boundary (Sub-Cluster No. 10A-1); a rectangular shaped area south of the Stepan Company rail spur that extends southeast from the haul road (Sub-Cluster No. 10A-2); and a small area located adjacent to the southwest corner of the Stepan Company Building No. 7 (Sub-Cluster No. 10A-3). The remedial action involved excavation of approximately 14,561 tons of soil that were loaded into trucks for transport to the MISS. The nearest commercial buildings are located approximately 410 ft (125 m) east-southeast and southeast of Sub-Cluster No. 10A-1. The nearest residences are located approximately 590 ft (180 m) northeast of Sub-Cluster No. 10A-1. The nearest commercial buildings are located approximately 180 ft (55 m) northeast of Sub-Cluster No. 10A-2. The nearest residences are located approximately 640 ft (195 m) west and southwest of Sub-Cluster No. 10A-2. The nearest commercial buildings are located approximately 33 ft (10 m) east, east-northeast, and east-southeast of Sub-Cluster No. 10A-3. The nearest residences are located approximately 820 ft (250 m) west and west-southwest of Sub-Cluster No. 10A-3.

- The performance of a remedial action at Cluster No. 12A (NYSW), which is located in the Borough of Maywood and the Township of Rochelle Park. This property occupies Block 124, Lot 55 in the Borough of Maywood and Block 110, Lot 1 in the Township of Rochelle Park. Cluster No. 12A is approximately 2,800 ft long and 100 ft wide. For the CAP88-PC modeling purposes, Cluster No. 12A was divided into two (2) sub-clusters (i.e., 12A-1 and 12A-2). The

remedial action was performed for a portion of the NYSW right-of-way (ROW) adjacent to the Public Service Electric and Gas Company (PSE&G) Substation and the residential property located at 146 West Central Avenue (Sub-Cluster No. 12A-1) and a portion of the NYSW ROW adjacent to the residential properties located at 122, 126 and 130 West Central Avenue (Sub-Cluster No. 12A-2). This effort involved excavation of approximately 1,124 tons of soil that were loaded into trucks for transport to the soil receiving area at the MISS. The nearest commercial buildings are located approximately 165 ft (50 m) north and north-northwest of Sub-Cluster No. 12A-1. The nearest residences are located approximately 130 ft (40 m) northeast of Sub-Cluster No. 12A-1. The nearest commercial buildings are located approximately 195 ft (60 m) south-southeast of Sub-Cluster No. 12A-2. The nearest residences are located approximately 165 ft (50 m) north, north-northeast, and northeast of Sub-Cluster No. 12A-2.

- The performance of remedial actions at Cluster No. 12B (100 West Hunter Avenue [MISS]), which occupies Block 124, Lot 46 in the Borough of Maywood and Block 20.01, Lot 1 in the township of Rochelle Park. The property is referred to as the MISS, comprises 11.7 acres, and is bisected by the boundary between the Township of Rochelle Park and the Borough of Maywood. The property is bounded by the NYSW (Cluster No. 12A) to the north, Stepan Company's property (Cluster No. 10A) to the south and east, and NJ Route 17 ROW (Cluster No. 12C) to the west. For the CAP88-PC modeling analyses, Cluster No. 12B was divided into two (2) sub-clusters (i.e., 12B-1 and 12B-2). The remedial action involved the excavation of contaminated soil at the following two (2) locations on the MISS: an approximate rectangular shaped area east of NJ Route 17 between the Stepan Company rail spur and the new MISS soil load-out rail spur extending toward the decontamination pad and dump ramp (Sub-Cluster No. 12B-1) and an area adjacent to the MISS access road extending from near the drum storage area/MISS radiochemistry lab southeastward to the Stepan Company Building No. 20 and northward toward the new MISS soil load-out spur (Sub-Cluster No. 12B-2). The remedial action involved the excavation of approximately 56,901 tons of soil that were loaded into trucks for transport to the MISS. The nearest commercial buildings are located approximately 295 ft (90 m) north of Sub-Cluster No. 12B-1. The nearest residences are located approximately 395 ft (120 m) west and west-southwest of Sub-Cluster No. 12B-1. The nearest commercial buildings are located approximately 115 ft (35 m) south and south-southwest of Sub-Cluster No. 12B-2. The nearest residences are located approximately 410 ft (125 m) northeast and north-northeast of Sub-Cluster No. 12B-2.

- The performance of remedial actions at a residence located at 61 Trudy Drive and a commercial property at 205 Main Street in the Borough of Lodi, and at 126, 130, and 146 West Central Avenue residences in the Borough of Maywood. The remedial actions involved the excavation of approximately 7,540 tons of soil from five (5) vicinity properties that were loaded into trucks for transport to the MISS. The nearest commercial buildings are located approximately 165 ft (10 m) southwest and south-southwest and the nearest residences are located approximately 33 ft (10 m) northeast and southeast of 61 Trudy Drive in Lodi. The nearest commercial buildings are located approximately 245 ft (75 m) southwest and south-southwest and the nearest residences are located approximately 33 ft (10 m) northeast and southeast of 61 Trudy Drive in Lodi. The nearest commercial buildings are located approximately 50 ft (15 m) north through west and the nearest residences are located approximately 295 ft (90 m) southeast of 205 Main Street in Lodi. The nearest commercial buildings are located approximately 245 ft (75 m) south-southeast and the nearest residences are located approximately 115 ft (35 m) north, north-northeast, and northeast of WC-1 in Maywood.

- In situ contaminated areas totaling approximately 509,652 square feet (ft^2) (47,348 square meters [m^2]) of the MIS along with excavated soil from the vicinity properties stored in piles on the MISS within the restricted area, were potentially exposed to wind erosion during 2015. The nearest commercial buildings are located approximately 445 ft (135 m) north of the MISS and the nearest residences are located approximately 490 ft (150 m) west and west-southwest of the MISS.

- The operation of the exhaust system for the soil sample preparation laboratory located in the on-site radiochemistry laboratory at the MISS. Soil samples collected for various soil load-outs at the MISS from excavations performed at the vicinity properties were brought to this laboratory to prepare samples for radiological analysis. Individual soil samples were dried, ground, and then placed into sealed containers. Grinding operations were performed on a downdraft table. Air from the downdraft table is routed to a high-efficiency particulate air (HEPA) filter and then exhausted into the general room air of the preparation laboratory. The emissions of particulates to the ambient air from the grinding operations in the soil sample preparation laboratory are nil (see Section 1.5.11).

For modeling purposes, Cluster No. 12A and 12B were divided into two sub-clusters that have "-1" and "-2" designations and Cluster No. 10A was divided into three sub-clusters that have "-1", "-2", and "-3" designations since the excavations were widely spaced. **Figure A-5** shows these sub-cluster designations and depicts the specific areas within the various clusters where the excavation of contaminated soil was performed during 2015. It should be noted that the "-1", "-2", and "-3" sub-cluster designations are used only for modeling purposes and not used for the final status survey of the various properties.

The above sources of radiologically contaminated airborne particulates resulting from the remedial actions at the vicinity properties and soil handling/load-out activities at the MISS are shown on **Appendix A, Figure A-5**, as well as the locations of the surrounding residences and commercial buildings. Photographs of various remedial actions and soil load-outs at the MISS that occurred during 2015 are provided in **Appendix B**. The simulated airborne emissions from these potential sources are used by CAP88-PC to estimate the annual dose from airborne particulates to the population within 50 mi (80 km) of the site (see **Appendix C**). Additionally, for user-defined distances from the center of the emission areas, CAP88-PC estimates individual effective dose equivalents in all compass directions. For specific potentially exposed individuals (workers and residents) at known distances and compass directions from the site, the user can determine and compare the calculated effective dose equivalents. For purposes of these analyses, workers are defined as employees at off-site work locations rather than construction workers involved in the performance of remedial actions at the vicinity properties or activities at the MISS.

Given the differences in receptor locations most affected by each of these areas, analyses were performed separately for the soil load-outs, in situ wind erosion at the MISS, Cluster Nos. 10A, 12A, and 12B remedial actions, and the Lodi and Maywood residential remedial actions. The in situ wind erosion at the MISS and soil preparation laboratory emissions were found to be negligible, and thus these sources were not included in the modeling analyses (see Sections 1.5.10 and 1.5.11). Where individual receptors are affected by more than one emission source, doses caused by those sources are added. The individual (worker or resident) corresponding to the maximum summed effective dose equivalent is identified as the hypothetical maximally exposed individual. Because the dose received from airborne emissions is dependent on the radiological emission rate and prevailing wind direction in addition to the proximity to the site, the hypothetical maximally exposed individual is not necessarily the person nearest the site. The model was used to predict the annual effective dose at numerous receptors resulting from the combined impact of the above sources. Although the model determined the annual effective dose at numerous receptors, only the hypothetical maximally exposed resident and worker are discussed in this report.

The individual effective dose equivalents given in the CAP88-PC output are based on the default assumption that the receptor occupies the location 100 percent of the time (i.e., 24 hours per day, 7 days per week, 52 weeks per year). The occupancy factor of 100 percent, although conservative, is considered to be appropriate for a resident. To estimate the dose to an employee working normal hours, an occupancy factor of 27 percent (i.e., 9 hours per day, 5 days per week, and 52 weeks per year) is applied to the CAP88-PC result. For all site workers, a 9-hour day was conservatively used to estimate the dose since some individuals may remain at their work locations during lunch.

The program calculates the effective dose equivalents by combining the inhalation and ingestion intake rates and the air and ground surface concentrations with dose conversion factors provided in Federal Guidance Report 13 (FGR 13) 1999 (EPA 1999) as implemented in the Oak Ridge National Laboratory DCFPAK Version 2.2 model. Dose and risk conversion factors include the effective dose equivalent calculated according to the methods in the International Commission on Radiological Protection's (ICRP) Publication 72, "Age Dependent Doses to Members of the Public from Intake of Radionuclides, Part 5, Compilation of Ingestion and Inhalation Dose Coefficients" (ICRP 1996). CAP88-PC Version 4 now implements the FGR 13 age-dependent dose and risk factors where previous version of CAP88-PC only used adult dose and risk factors. CAP88-PC calculates dose to the 25 internal organs modeled in FGR 13, in addition to the 50-year effective dose equivalent. Doses can be tabulated as a function of radionuclide, pathway, location, and organ as shown in the output (see **Appendix C**, pages 33 - 186) for the CAP88-PC runs.

1.5 DETAILED SOURCE DESCRIPTIONS

As discussed in the previous section, the potential sources of concern with regard to airborne radioactive particulate releases to the atmosphere during 2015 were the soil load-outs at the MISS; in-situ wind erosion at the MISS; the Cluster Nos. 10A, 12A, and 12B remedial actions; and the Lodi and Maywood residential remedial actions (**Appendix A, Figures A-2 and A-5**). Additionally, the operation of the on-site radiochemistry laboratory was a potential source of radioactive particulates. A more comprehensive discussion of the activities performed at the above sources, including the soil radiological concentrations and the potential pathways for the airborne release of contaminated particulates, is provided below.

1.5.1 Soil Load-Outs at the MISS

During 2015, various stockpiles were created at the MISS consisting of soil and debris from the remedial actions performed at the Cluster Nos. 10A, 12A, and 12B properties and Lodi and Maywood residential areas. The soil and debris were transported from the vicinity properties by dump trucks and were placed in outdoor stockpiles on the MISS within the restricted area. The number of times the soil was handled or dropped at the MISS (i.e., three times) was accounted for in the CAP88-PC dose calculations.

Eight (8) soil load-out, transportation, and disposal operations were performed during 2015. For each soil load-out, **Table 1-1** provides the time period, the tonnage of soil shipped, the vicinity properties from which the soil originated, and the number of railcars used for off-site shipment. Each railcar held approximately 65 to 75 cubic yards (49.7 to 57.3 cubic meters of soil). All soil was transported by rail either to the EnergySolutions facility in Clive, Utah for disposal or the U.S. Ecology facility in Simco, Idaho where it was off-loaded and shipped by truck to Grandview, Idaho for disposal.

Table 1-1
Year 2015 Soil Load-Outs at the MISS – Operational Data

Soil Load-Out	Time Period (2015)	Soil Shipped (tons)	Soil Origin (Cluster)	Number of Railcars Shipped
Number 1	Jan. 22 – Mar. 10	8,440	12B	79
Number 2	Mar. 16 – Apr. 15	6,636	10A, 12B	62
Number 3	Apr. 28 – Jun. 4	11,024	12B, 205 Main St., Lodi	103
Number 4	Jun. 8 – Jul. 7	9,311	12B, 205 Main St., Lodi	87
Number 5	Jul. 13 – Aug. 10	12,625	12B, 205 Main St., Lodi, 126, 130, 146 W. Central Ave., Maywood	118
Number 6	Aug. 12 – Sep. 11	10,593	12B, 205 Main St., Lodi	99
Number 7	Sep. 14 – Sep. 30	11,125	10A, 12B, 205 Main St., Lodi	104
Number 8	Nov. 3 – Dec. 15	10,372	10A, 12A, 12B, 61 Trudy Dr., Lodi	97
	Total	**80,126**		**749**

Upon arrival at the MISS, the soil in the dump trucks from the vicinity properties was emptied at the dump ramp for the soil staging area and subsequently placed into a soil stockpile located in the center of the staging area, just north of the asphalt pavement using a front-end loader or excavator. During soil load-outs, only the working face of the pile was disturbed to minimize dust emissions. Additionally, water was sprayed when necessary to control dust emissions at the soil staging area and during load-out operations on the concrete bulkhead.

Waste materials were carefully loaded into gondola railcars; each wrapped and secured in a specially designed plastic liner to prevent material loss and weather exposure during transport to the designated disposal facility. All railcar shipments were prepared according to U.S. Department of Transportation (DOT) requirements. **Appendix B, Figure B-1** shows various photographs depicting the soil load-out operation.

Prior to loading the soil into the railcars, various soil samples were collected from the soil stockpile. Specifically, a portion of the soil stockpile is segregated and sampled during load-out operations.

These samples were homogenized into composite samples and analyzed by gamma spectroscopy for Th, Ra, and U. One composite sample is collected for every four railcars being loaded with soil at the MISS. Each composite sample was analyzed to provide the soil radionuclide concentrations representative of load-out operations. The average soil radionuclide concentrations of thorium-232 (Th-232), radium-226 (Ra-226), and uranium-238 (U-238) for the various soil load-outs in 2015 are shown in **Table 1-2**.

Additionally, the soil moisture content was determined for each composite sample taken from the soil stockpiles. A portion of the composite sample generated for radiological analysis was used to determine the soil moisture content. If the moisture content of the soil was too high, a pre-determined amount of absorbent material (based upon the soil moisture content) was placed inside the loaded railcars.

Upon completion of loading, the liner was closed and an outgoing radiological release railcar survey performed. Prior to a loaded railcar being shipped off-site for disposal, an inspection of the railcar liner (including photo documentation) was performed by the Contractor Quality Control Systems Manager or

designee, to ensure that the liners were properly secured, no defects were present in the liner, no loose soil was present on the liner, and the proper labels and placards were attached in accordance with the DOT's requirements.

Table 1-2
Year 2015 Soil Load-Outs at the MISS – Average Soil Radionuclide Concentrations

Soil Load-Out	Time Period (2015)	Soil Shipped (tons)	Th-232 Concentration (pCi/g)[1]	Ra-226 Concentration (pCi/g)	U-238 Concentration (pCi/g)
Number 1	Jan. 22 – Mar. 10	8,440	26.71	4.59	3.09
Number 2	Mar. 16 – Apr. 15	6,636	13.74	2.61	1.59
Number 3	Apr. 28 – Jun. 4	11,024	6.26	1.32	1.87
Number 4	Jun. 8 – Jul. 7	9,311	5.50	1.31	1.29
Number 5	Jul. 13 – Aug. 10	12,625	4.84	1.03	1.01
Number 6	Aug. 12 – Sep. 11	10,593	2.50	0.78	1.05
Number 7	Sep. 14 – Sep. 30	11,125	3.31	0.98	0.63
Number 8	Nov. 3 – Dec. 15	10,372	4.82	1.10	0.95
	Total	**80,126**			

Note:
[1](pCi/g) = picocuries per gram.

1.5.2 Soil Radionuclide Concentrations for Evaluation of the MISS Site and Vicinity Property Impacts

The average soil radionuclide concentrations for the excavated soil were assessed from sampling that was conducted during the various load-outs at the MISS. Composite samples were collected from the soil stockpiles prior to loading. These samples were analyzed by gamma spectroscopy for Th, Ra, and U. The average radionuclide source concentrations of Th, Ra, and U were determined at the 95 and 99.7 percent confidence levels for all soil load-out composite samples analyzed in 2015.

The weighted average soil radionuclide concentrations of Th-232, Ra-226, and U-238 were 7.63 picocuries per gram (pCi/g), 1.58 pCi/g, and 1.37 pCi/g, respectively. The weighted average values were used to represent the radionuclide source concentrations of the MISS soil load-out operations. The average soil radionuclide concentrations of Th-232, Ra-226, and U-238 at the 95 percent confidence level were 31.24 pCi/g, 5.29 pCi/g, and 3.98 pCi/g, respectively. The average soil radionuclide concentrations of Th-232, Ra-226, and U-238 at the 99.7 percent confidence level were 43.77 pCi/g, 7.25 pCi/g, and 5.37 pCi/g, respectively.

The average values at the 95 percent confidence level were conservatively used to represent the radionuclide source concentrations of the excavated soil from the various remedial actions for the evaluation of the vicinity property impacts using the CAP88-PC model.

1.5.3 Cluster No. 10A Remedial Action

Cluster No. 10A is located at 100 West Hunter Avenue in the Borough of Maywood. Cluster No. 10A is owned by the Stepan Company and occupies approximately 19 acres. The Stepan Company is located primarily in Block 124, Lots 31, 32, 33, 39, 40, 41, 42, 43, 44, 45, 46, and 47 in the Borough of Maywood, with the exception of a small area in the southwest corner that is in Block 18.02, Lot 2 in the Township of Rochelle Park.

The property is bordered by the NYSW ROW (Cluster No. 12A) to the north and northeast, several businesses along West Hunter Avenue to the east (including Cluster Nos. 11A, 11B, and 11C), the Sears Logistical Services property to the south (Cluster No. 9A), and the MISS property (Cluster No. 12B) and NJ Route 17 ROW (Cluster No. 12C) to the west.

The property consists of a series of filled areas upon which the operating facility was constructed. The difference in elevation between the highest point (at the north side of the property) and the lowest point (at the south side) is approximately 25 ft. The property is developed with operable buildings, aboveground tank farms, other structures, foundations of former structures, and asphalt paving. Currently there are 12 numbered buildings on the property comprising office, support, production, warehouse, and distribution facilities, and four aboveground tank farms (containing from 4 to 12 tanks each). A chain-link fence encloses the property (excluding the main office and parking area). Additionally, a railroad spur transects an undeveloped open area adjacent to the MISS; the spur continues across the MISS.

Chemical production on the property includes esters, lubricants, amides, food ingredients, and specialty products. The facility employs a staff of 80 to 100 and operates 24 hours per day, 7 days per week.

For the CAP88-PC modeling purposes, Cluster No. 10A was divided into three (3) sub-clusters (i.e., 10A-1, 10A-2, and 10A-3). The remedial action involved the excavation of contaminated soil at the following three (3) locations on the Stepan Company property: a rectangular shaped area adjacent to the MISS/Stepan Company property boundary that extends from the Stepan Company rail spur northeast to the MISS/Stepan Company property boundary (Sub-Cluster No. 10A-1); a rectangular shaped area south of the Stepan Company rail spur that extends southeast from the haul road (Sub-Cluster No. 10A-2); and a small area located adjacent to the southwest corner of the Stepan Company Building No. 7 (Sub-Cluster No. 10A-3).

The excavation for the remedial action for the rectangular shaped area adjacent to the MISS/Stepan Company property boundary that extends from the Stepan Company rail spur northeast to the MISS/Stepan Company property boundary commenced on September 15, 2015 and continued through October 13, 2015. The remediated areas were excavated to depths ranging from 2 ft to 8 ft. Approximately 2,451 tons of soil were excavated and transported by trucks to the MISS for off-site disposal.

The excavation for the rectangular shaped area south of the Stepan Company rail spur that extends southeast from the haul road started on August 10, 2015 and was completed on September 22, 2015. The depth of excavation ranged from 2 ft to 8 ft. Approximately 11,754 tons of soil were excavated and transported by trucks to the MISS for off-site disposal.

The excavation for the small area located adjacent to the southwest corner of the Stepan Company Building No. 7 commenced on April 15, 2015 and was finished on April 29, 2015. The depth of excavation ranged from 2 ft to 6 ft. Approximately 356 tons of soil were excavated and transported by trucks to the MISS for off-site disposal. In 2015, a total of 14,561 tons were excavated from Cluster No. 10A and transported by truck to the MISS for disposal. An excavator was used to remove and load soil into dump trucks.

Upon arrival at the MISS, the dump trucks were emptied and the soil transferred to outside storage piles using a dozer or excavator. At both the Cluster No. 10A property and the MISS, water sprays were used for dust suppression. **Appendix B, Figure B-2, Figure B-3,** and **Figure B-4** show selected photographs of the Sub-Cluster Nos. 10A-1, 10A-2, and 10A-3 remedial actions.

Upon completion of the remedial excavation, an approved QP structural fill and/or common fill material was used for backfill. Compaction of the backfill was performed in accordance with project specifications, utilizing soil compactors and other approved compaction methods to ensure specified compaction rates were obtained and verified through testing.

1.5.4 Cluster No. 12A Remedial Action

Cluster No. 12 consists of three properties in the Borough of Maywood and the Township of Rochelle Park. Property No. 12A is the NYSW, Property No. 12B is the property located at 100 West Hunter Avenue (the MISS), and Property No. 12C is NJ Route 17.

Cluster No. 12A occupies Block 124, Lot 55 in the Borough of Maywood and Block 110, Lot 1 in the Township of Rochelle Park. This portion of the railroad is approximately 2,800 ft long and 100 ft wide. It forms the northern boundary for the Ballod Associates property west of NJ Route 17, the MISS property (Cluster No. 12B), the Stepan Company property (Cluster No. 10A), and part of the Myron Manufacturing property (Cluster No. 11B). Two sets of tracks were contained in the ROW.

The northern tracks have been upgraded and are active tracks. The southern tracks have been abandoned and have not been functional for at least three decades; only the ties remained for these tracks. Most of the ties were subsequently removed during the remedial actions for this property.

For the CAP88-PC modeling purposes, Cluster No. 12A was divided into two (2) sub-clusters (i.e., 12A-1 and 12A-2). The remedial action was performed for a portion of the NYSW ROW adjacent to the PSE&G Substation and the residential property located at 146 West Central Avenue (Sub-Cluster No. 12A-1), and a portion of the NYSW right-of-way adjacent to the residential properties located at 122, 126 and 130 West Central Avenue (Sub-Cluster No. 12A-2).

The excavation for the portion of the NYSW ROW adjacent to the PSE&G Substation and the residential property located at 146 West Central Avenue began on November 30, 2015 and was completed on December 15, 2015. The depth of excavation ranged from 2 ft to 4 ft. Approximately 411 tons of soil were excavated and transported by trucks to the MISS for off-site disposal.

The excavation for the portion of the NYSW ROW adjacent to the residential properties located at 122, 126, and 130 West Central Avenue commenced on October 29, 2015 and was completed on November 18, 2015. The depth of excavation ranged from 2 ft to 3 ft. Approximately 713 tons of soil were excavated and transported by trucks to the MISS for off-site disposal.

In 2015, a total of 1,124 tons were excavated from Cluster No. 12A and transported by truck to the MISS for disposal. An excavator was used to remove and load the soil into dump trucks.

Upon arrival at the MISS, the dump trucks were emptied and the soil transferred to the outside storage pile using a dozer or excavator. At both the Cluster No. 12A property and the MISS, water sprays were used for dust suppression. **Appendix B**, **Figure B-5** and **Figure B-6** show selected photographs of the Sub-Cluster Nos. 12A-1 and 12A-2 remedial actions.

1.5.5 Cluster No. 12B Remedial Action

Cluster No. 12 consists of three properties in the Borough of Maywood and the Township of Rochelle Park. Property No. 12A is the NYSW, Property No. 12B is the property located at 100 West Hunter Avenue (the MISS), and Property No. 12C is NJ Route 17. Cluster No. 12B occupies Block 124, Lot 46

in the Borough of Maywood and Block 20.01, Lot 1 in the Township of Rochelle Park. The property, located at 100 West Hunter Avenue and referred to as the MISS, comprises approximately 11.7 acres and is bisected by the boundary between the Township of Rochelle Park and the Borough of Maywood. The property is bounded by the NYSW (Cluster No. 12A) to the north, by the Stepan Company property (Cluster No. 10A) to the south and east, and by NJ Route 17 (Cluster No. 12C) to the west.

For the CAP88-PC modeling analyses, Cluster No. 12B was divided into two (2) sub-clusters (i.e., 12B-1 and 12B-2). The remedial action involved the excavation of contaminated soil at the following two (2) locations on the MISS: an approximate rectangular shaped area east of NJ Route 17 between the Stepan Company rail spur and the new MISS soil load-out rail spur extending toward the decontamination pad and dump ramp (Sub-Cluster No. 12B-1) and an area adjacent to the MISS access road extending from near the drum storage area/MISS radiochemistry lab southeastward to the Stepan Company Building No. 20 and northward toward the new MISS soil load-out spur (Sub-Cluster No. 12B-2).

The excavation for the approximate rectangular shaped area east of NJ Route 17 between the Stepan Company rail spur and the new MISS soil load-out rail spur extending toward the decontamination pad and dump ramp began on January 7, 2015 and continued through December 8, 2015. The depth of excavation ranged from 4 ft to 18 ft. Approximately 43,502 tons of soil were excavated and transported by truck to the soil staging area at the MISS for off-site disposal.

The excavation for the area adjacent to the MISS access road extending from near the drum storage area/MISS radiochemistry lab southeastward to the Stepan Company Building No. 20 and northward toward the new MISS soil load-out spur commenced on January 22, 2015 and continued through August 1, 2015. The depth of excavation ranged from 4 ft to 22 ft. Approximately 13,399 tons of soil were excavated and transported by truck to the soil staging area at the MISS for off-site disposal.

In 2015, a total of approximately 56,901 tons of soil were excavated from Cluster No. 12B. An excavator was used to remove and load the soil into dump truck and brought to the MISS dump ramp. The contaminated soil was then unloaded on to the ground and an excavator was used to transport the contaminated soil to the storage piles. During the remedial actions at the MISS, water sprays were used for dust suppression. **Appendix B, Figure B-7 and Figure B-8** show selected photographs of the Sub-Cluster Nos. 12B-1 and 12B-2 remedial actions.

Upon completion of the remedial excavation, an approved QP structural fill and/or common fill material was used for backfill. Compaction of the backfill was performed in accordance with project specifications, utilizing soil compactors and other approved compaction methods to ensure specified compaction rates were obtained and verified through testing.

1.5.6 Vicinity Residential Property at 61 Trudy Drive, Lodi Remedial Action

A Vicinity Property Investigation performed by USACE at 61 Trudy Drive, Lodi revealed contamination under the house and around the yard. Thus, a remedial action was conducted to address this situation.

The excavation for the remedial action commenced on October 15, 2015 and was completed on December 12, 2015. The depth of excavation ranged from 4 ft to 9 ft. Approximately 2,929 tons of soil was excavated and transported by truck to the soil staging area at the MISS for off-site disposal.

Upon arrival at the MISS, the dump trucks were emptied and the soil transferred to the outside storage pile using a dozer or excavator. At the 61 Trudy Drive property and the MISS, water sprays were used for dust suppression. **Appendix B, Figure B-9** show selected photographs of the remedial action for the residential property at 61 Trudy Drive, Lodi.

Upon completion of the remedial excavation, an approved QP structural fill and/or common fill material was used for backfill. Compaction of the backfill was performed in accordance with project specifications, utilizing soil compactors and other approved compaction methods to ensure specified compaction rates were obtained and verified through testing.

1.5.7 Vicinity Commercial Property at 205 Main Street, Lodi Remedial Action

A Vicinity Property Investigation performed by USACE at 205 Main Street in Lodi found contamination under the location of the existing warehouse and throughout the property. The remedial action performed in 2015 addressed the contaminated soil throughout the property, but not underneath the warehouse.

Subsequent to the completion of the remedial action, the demolition of the warehouse was performed by others parties not associated with the Maywood FUSRAP Superfund Site project. The demolition of the warehouse will facilitate the remediation of the formerly inaccessible contaminated soil during 2016.

On May 5, 2015 the excavation for remedial action at 205 Main Street began and continued through August 15, 2015. The remedial action involved the excavation of contaminated soil throughout the property. The remediated area was excavated to depths ranging from 4 ft to 9 ft. Approximately 4,322 tons of soil were excavated and transported by truck to the soil staging area at the MISS for off-site disposal.

Upon arrival at the MISS, the dump trucks were emptied and the soil transferred to the outside storage pile using a dozer or excavator. At the 205 Main Street property and the MISS, water sprays were used for dust suppression. **Appendix B, Figure B-10** show selected photographs of the remedial action for the commercial property at 205 Main Street, Lodi.

Upon completion of the remedial excavation, an approved QP structural fill and/or common fill material was used for backfill. Compaction of the backfill was performed in accordance with project specifications, utilizing soil compactors and other approved compaction methods to ensure specified compaction rates were obtained and verified through testing.

1.5.8 Vicinity Residential Properties at 126 and 130 West Central Avenue, Maywood Remedial Action

A Vicinity Property Investigation performed by USACE at 126 and 130 West Central Avenue properties found contamination in the backyards. Thus, a remedial action was conducted to address this situation.

On June 4, 2015, the excavation for the remedial action began at the 126 and 130 West Central Avenue properties and continued through June 15, 2015. The remedial action involved the excavation of contaminated soil in the yards throughout both adjacent properties.

The depth of excavation ranged from 2 ft to 3 ft. Approximately 148 tons of soil were excavated and transported by truck to the soil staging area at the MISS for off-site disposal.

Upon arrival at the MISS, the dump trucks were emptied and the soil transferred to the outside storage pile using a dozer or excavator. At the 126 and 130 West Central Avenue properties and the MISS, water sprays were used for dust suppression. **Appendix B, Figure B-11** show selected photographs of the 126 and 130 West Central Avenue properties remedial action.

Upon completion of the remedial excavation, an approved QP structural fill and/or common fill material was used for backfill. Compaction of the backfill was performed in accordance with project specifications, utilizing soil compactors and other approved compaction methods to ensure specified compaction rates were obtained and verified through testing.

1.5.9 Vicinity Residential Property at 146 West Central Avenue, Maywood Remedial Action

A Vicinity Property Investigation performed by USACE revealed contamination in the backyard of the residence located at 146 West Central Avenue. Thus, a remedial action was conducted to address this situation.

On June 16, 2015, the excavation for remedial action at 146 West Central Avenue began and continued through June 25, 2015. The remedial action involved the excavation of contaminated soil from the rear of the property.

The remediated area was excavated to depths ranging from 2 ft to 4 ft. Approximately 141 tons of soil were excavated and transported by truck to the soil staging area at the MISS for off-site disposal.

Upon arrival at the MISS, the dump trucks were emptied and the soil transferred to the outside storage pile using a dozer or excavator. At the 146 West Central Avenue property and the MISS, water sprays were used for dust suppression. **Appendix B, Figure B-12** show selected photographs of the 146 West Central Avenue property remedial action.

Upon completion of remedial excavation, an approved common fill material was used for backfill. Compaction of the backfill was performed in accordance with project specifications utilizing soil compactors. Top soil was placed above the backfill and covered with seed to restore the property to pre remediation conditions.

1.5.10 In Situ Wind Erosion

The MISS consists of approximately 509,652 ft^2 (47,348 m^2) of radiologically-contaminated and non-contaminated areas that were potentially exposed to wind erosion throughout 2015. The MISS has undergone numerous remedial actions over the years and thus, the extent of the radiologically-contaminated areas has decreased substantially compared to past years. The amount of bare soil present at the MISS, which has the greatest wind erosion potential, has also decreased considerably from past years due to the placement of gravel/stone over much of the area. For purposes of determining the maximally exposed individual, only wind erosion from radiologically-contaminated soil is of concern.

At present, the approximate breakdown of radiologically-contaminated soil for the various types of surfaces found at the MISS (see **Appendix A, Figure A-5**) is the following: bare soil is 61,169 ft^2 (5,683 m^2), vegetation is 43,809 ft^2 (4,070 m^2), gravel/stone is 34,773 ft^2 (3,231 m^2), retention pond is 11,131 ft^2 (1,034 m^2) and the Stepan Company Reservoir is 8,428 ft^2 (783 m^2). Approximately 159,310 ft^2 (14,800 m^2) of radiologically-contaminated soil remains at the MISS and potentially exposed to wind erosion.

Other than bare soil, wind erosion potential for the other surfaces at the MISS is negligible. Best management practices such as the spraying of water on the outside storage piles and access roads, as needed, were used during the year to reduce the potential for wind erosion.

In order to assess the amount of wind erosion that occurred during 2015 at the MISS, it is necessary to determine the fastest 2-minute wind speeds over the course of the year and then compare them to the friction velocity most representative of bare soil as defined in EPA Publication AP-42, *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, Chapter 13 "Industrial Wind Erosion" (EPA 2006). The fastest 2-minute wind speed is the highest observed wind speed over a 2-minute averaging period as compared to a peak gust with an averaging time of a few seconds. The fastest 2-minute wind speed is typically on the order of 30 mph, while a peak gust can be 60 mph or more. The threshold friction velocity is that wind speed just above ground level that is capable of causing erodible particles to become airborne.

As mentioned previously, meteorological data from nearby Teterboro Airport were used to represent conditions at the MISS. The results of this analysis showed that the fastest 2-minute wind speeds obtained from Teterboro Airport for 2015 do not result in the threshold friction velocity being exceeded during the year. The fastest 2-minute wind speed at 33 ft above ground level needs to be 44 mph or greater to exceed the threshold friction velocity (EPA 2006) and the highest observed value during 2015 was 37 mph (NOAA 2015a). Thus, by definition, in situ wind erosion did not occur at the MISS during 2015.

1.5.11 Soil Sample Preparation Laboratory

Soil sample preparation activities are performed in the radiochemistry laboratory at the MISS. Soil samples collected for the various soil load-outs at the MISS from excavations performed for Cluster Nos. 10A, 12A, and 12B remedial actions and the Lodi and Maywood residential remedial actions were taken to this facility for radiological analysis. The laboratory is divided into three main functional areas: preparation lab, wet chemistry lab, and the counting room. The preparation lab contains convection ovens, pulverizer grinder, canner, analytic balances, and a downdraft table. **Appendix B, Figure B-13** shows selected photographs depicting operations at the soil sample preparation laboratory in the on-site radiochemistry laboratory.

Soil samples from the field operations or core samples are brought to the Preparation Lab. Samples are dried and homogenized, as necessary, to meet regulatory and industry standards for the analysis of soils. The contents of the samples are emptied into a "drying" pan and placed into an electric convection oven for at least 4 hours to dry the samples. Each sample is weighed before and after drying to establish the moisture content.

The presence of rocks or void spaces in the prepared sample could lead to inaccurate radio-analytical results. Therefore, after drying, the soil samples are transferred to a bench pulverizer grinder positioned on a downdraft table. The purpose of the grinding operation is to reduce the particulate size of the sample and to homogenize it for analysis. Rocks are separated from the sample and are not ground in the pulverizer. The dried and pulverized samples are then transferred to the "sample container" and weighed. The particle size reduction allows for compaction of the soil into the given volume of the "sample container," minimizing void space. A select sample population is also weighed to determine sample loss from the operation. The grinding of the individual soil samples results in very minimal particulate emissions.

The purpose of the downdraft table is to prevent the release of particulate emissions to the laboratory air from the grinding operation. The grinder sits atop the working surface of the downdraft table. The working surface is also where samples are transferred once dried and pulverized into the "sample container." Air flow from the downdraft table is routed to a HEPA filter (particulate removal efficiency of 99.97 percent) and then exhausted into the general room air of the preparation lab.

The types of sample containers used in the preparation lab are the "Marinelli" and "tuna can" styles. The "Marinelli" style is a specially designed plastic container that fits over and around the detector. The "tuna can" style is a metal container that sits on top of the detector.

Approximately 881 "Marinelli" and "tuna can" soil samples were prepared for dry radiological analysis from January 1, 2015, to December 31, 2015. The total time that grinding was performed during soil sample preparation was approximately 163 hours. The average weight of soil samples prior to grinding was 993 grams (g). The average amount of "unrecovered" dried soil during the grinding process was approximately 19 g. At least 99.97 percent (18.99 g) of the "unrecovered" mass was subsequently recovered by the HEPA filtration system.

Based on the above, the total amount of soil lost during sample preparation of all soil samples was approximately 16,739 g. However, after passage through the HEPA filter with a particulate removal efficiency of 99.97 percent, the particulate emissions discharged to the general room air for the year were approximately 5.0 g. The discharge of this miniscule amount of contaminated particulates to the atmosphere would have a negligible impact on off-site radiological exposure; therefore, this source was not included in the CAP88-PC modeling analyses.

2.0 AIR EMISSIONS DATA

The potential radionuclide particulate emission sources and controls for 2015 are summarized in **Table 2-1**.

Table 2-1
Description of Radionuclide Particulate Emissions Sources

Point Sources	Type Control	Efficiency
Soil Sample Preparation Laboratory	HEPA Filter	99.97%
Non-Point Sources	**Type Controls**	**Efficiency**
In situ soil at the MISS	Gravel / Stone Vegetative Cover Bare Soil Dust Suppressant for Outside Storage Piles and Access Roads	99% 99% 0% Highly Effective – No credit taken for dust control
Soil load-outs at the MISS	Water sprays for dust suppression. Use of lined railcars to prevent soil loss.	No credit taken for dust controls
Cluster Nos. 10A, 12A, 12B and Lodi and Maywood residential and commercial properties remedial actions	Water sprays for dust suppression. Use of dump trucks with tarps as necessary when transporting soil to the MISS.	No credit taken for dust controls

Radionuclide emission rates are based on particulate release rates and average radionuclide source concentrations determined from sample measurements. EPA Publication AP-42 (EPA 2006) is used to calculate radioactive particulate release rates from in situ soil wind erosion at the MISS, various soil load-outs at the MISS, and soil handling activities for Cluster Nos. 10A, 12A, and 12B remedial actions, and the Lodi and Maywood residential remedial actions.

Source concentrations for isotopes of Th-232, Ra-226, and U-238 are based on average values for in situ soil that has vegetative cover or stone/gravel (DOE 1987) and weighted average values measured for excavated soil from vicinity properties for the soil load-outs, which also comprises the bare soil stored in piles at the MISS for in situ soil wind erosion. Radionuclide source concentrations for evaluation of the vicinity property impacts are based on average values at the 95 percent confidence level. Unknown radionuclide source concentrations are based on the known source concentrations assuming secular equilibrium in the decay chains. The radionuclide emissions for the year 2015 from each of the above emission sources, with the exception of the sample preparation laboratory, are shown in **Table 2-2**.

Table 2-2
Year 2015 – Airborne Radionuclide Emissions from Various Source Operations
(Curies per year) [1]

Source Radionuclides	Soil Load-Outs[2]	Sub-Cluster No. 10A-1 Remedial Action[3]	Sub-Cluster No. 10A-2 Remedial Action[3]	Sub-Cluster No. 10A-3 Remedial Action[3]	Sub-Cluster No. 12A-1 Remedial Action[4]	Sub-Cluster No. 12A-2 Remedial Action[4]
Uranium-238 (U-238)	2.03E-08	6.02E-10	2.89E-09	8.74E-11	1.01E-10	1.75E-10
Thorium-234 (Th-234)	2.03E-08	6.02E-10	2.89E-09	8.74E-11	1.01E-10	1.75E-10
Protactinium-234 metastable (Pa-234m)	2.03E-08	6.02E-10	2.89E-09	8.74E-11	1.01E-10	1.75E-10
Protactinium-234 (Pa-234)	2.64E-11	7.82E-13	3.75E-12	1.14E-13	1.31E-13	2.28E-13
Uranium-234 (U-234)	2.17E-08	6.43E-10	3.09E-09	9.35E-11	1.08E-10	1.87E-10
Thorium-230 (Th-230)	2.17E-08	6.43E-10	3.09E-09	9.35E-11	1.08E-10	1.87E-10
Radium-226 (Ra-226)	2.34E-08	8.00E-10	3.83E-09	1.16E-10	1.34E-10	2.33E-10
Polonium-218 (Po-218)	2.34E-08	8.00E-10	3.83E-09	1.16E-10	1.34E-10	2.33E-10
Lead-214 (Pb-214)	2.34E-08	8.00E-10	3.83E-09	1.16E-10	1.34E-10	2.33E-10
Bismuth-214 (Bi-214)	2.34E-08	8.00E-10	3.83E-09	1.16E-10	1.34E-10	2.33E-10
Polonium-214 (Po-214)	2.34E-08	8.00E-10	3.83E-09	1.16E-10	1.34E-10	2.33E-10
Lead-210 (Pb-210)	2.34E-08	8.00E-10	3.83E-09	1.16E-10	1.34E-10	2.33E-10
Bismuth-210 (Bi-210)	2.34E-08	8.00E-10	3.83E-09	1.16E-10	1.34E-10	2.33E-10
Polonium-210 (Po-210)	2.34E-08	8.00E-10	3.83E-09	1.16E-10	1.34E-10	2.33E-10
Uranium-235 (U-235)	9.51E-10	2.82E-11	1.35E-10	4.09E-12	4.72E-12	8.19E-12
Thorium-231 (Th-231)	9.51E-10	2.82E-11	1.35E-10	4.09E-12	4.72E-12	8.19E-12
Protactinium-231 (Pa-231)	9.51E-10	2.82E-11	1.35E-10	4.09E-12	4.72E-12	8.19E-12
Actinium-227 (Ac-227)	9.51E-10	2.82E-11	1.35E-10	4.09E-12	4.72E-12	8.19E-12
Thorium-227 (Th-227)	9.38E-10	2.78E-11	1.33E-10	4.03E-12	4.66E-12	8.08E-12
Francium-223 (Fr-223)	1.31E-11	3.89E-13	1.86E-12	5.65E-14	6.52E-14	1.13E-13
Radium-223 (Ra-223)	9.51E-10	2.82E-11	1.35E-10	4.09E-12	4.72E-12	8.19E-12

Table 2-2 (continued)
Year 2015 – Airborne Radionuclide Emissions from Various Source Operations
(Curies per year) [1]

Source Radionuclides	Soil Load-Outs[2]	Sub-Cluster No. 10A-1 Remedial Action[3]	Sub-Cluster No. 10A-2 Remedial Action[3]	Sub-Cluster No. 10A-3 Remedial Action[3]	Sub-Cluster No. 12A-1 Remedial Action[4]	Sub-Cluster No. 12A-2 Remedial Action[4]
Polonium-215 (Po-215)	9.51E-10	2.82E-11	1.35E-10	4.09E-12	4.72E-12	8.19E-12
Lead-211 (Pb-211)	9.51E-10	2.82E-11	1.35E-10	4.09E-12	4.72E-12	8.19E-12
Bismuth-211 (Bi-211)	9.51E-10	2.82E-11	1.35E-10	4.09E-12	4.72E-12	8.19E-12
Polonium-211 (Po-211)	2.60E-12	7.69E-14	3.69E-13	1.12E-14	1.29E-14	2.24E-14
Thallium-207 (Tl-207)	9.48E-10	2.81E-11	1.35E-10	4.08E-12	4.71E-12	8.17E-12
Thorium-232 (Th-232)	1.13E-07	4.72E-09	2.26E-08	6.86E-10	7.92E-10	1.37E-09
Radium-228 (Ra-228)	1.13E-07	4.72E-09	2.26E-08	6.86E-10	7.92E-10	1.37E-09
Actinium-228 (Ac-228)	1.13E-07	4.72E-09	2.26E-08	6.86E-10	7.92E-10	1.37E-09
Thorium-228 (Th-228)	1.13E-07	4.72E-09	2.26E-08	6.86E-10	7.92E-10	1.37E-09
Radium-224 (Ra-224)	1.13E-07	4.72E-09	2.26E-08	6.86E-10	7.92E-10	1.37E-09
Polonium-216 (Po-216)	1.13E-07	4.72E-09	2.26E-08	6.86E-10	7.92E-10	1.37E-09
Lead-212 (Pb-212)	1.13E-07	4.72E-09	2.26E-08	6.86E-10	7.92E-10	1.37E-09
Bismuth-212 (Bi-212)	1.13E-07	4.72E-09	2.26E-08	6.86E-10	7.92E-10	1.37E-09
Polonium-212 (Po-212)	7.25E-08	3.03E-09	1.45E-08	4.39E-10	5.07E-10	8.80E-10
Thallium-208 (Tl-208)	4.06E-08	1.70E-09	8.14E-09	2.46E-10	2.85E-10	4.94E-10

Table 2-2 (continued)
Year 2015 – Airborne Radionuclide Emissions from Various Source Operations
(Curies per year) [1]

Source Radionuclides	Sub-Cluster No. 12B-1 Remedial Action[4]	Sub-Cluster No. 12B-2 Remedial Action[4]	61 Trudy Drive, Lodi Remedial Action (TR-1)	205 Main Street, Lodi Remedial Action (205M-1)	126,130 &146 West Central Ave., Maywood Remedial Action (WC-1)
Uranium-238 (U-238)	1.07E-08	3.29E-09	7.19E-10	1.06E-09	7.09E-11
Thorium-234 (Th-234)	1.07E-08	3.29E-09	7.19E-10	1.06E-09	7.09E-11
Protactinium-234 metastable (Pa-234m)	1.07E-08	3.29E-09	7.19E-10	1.06E-09	7.09E-11
Protactinium-234 (Pa-234)	1.39E-11	4.28E-12	9.35E-13	1.38E-12	9.22E-14
Uranium-234 (U-234)	1.14E-08	3.52E-09	7.69E-10	1.13E-09	7.59E-11
Thorium-230 (Th-230)	1.14E-08	3.52E-09	7.69E-10	1.13E-09	7.59E-11
Radium-226 (Ra-226)	1.42E-08	4.37E-09	9.56E-10	1.41E-09	9.43E-11
Polonium-218 (Po-218)	1.42E-08	4.37E-09	9.56E-10	1.41E-09	9.43E-11
Lead-214 (Pb-214)	1.42E-08	4.37E-09	9.56E-10	1.41E-09	9.43E-11
Bismuth-214 (Bi-214)	1.42E-08	4.37E-09	9.56E-10	1.41E-09	9.43E-11
Polonium-214 (Po-214)	1.42E-08	4.37E-09	9.56E-10	1.41E-09	9.43E-11
Lead-210 (Pb-210)	1.42E-08	4.37E-09	9.56E-10	1.41E-09	9.43E-11
Bismuth-210 (Bi-210)	1.42E-08	4.37E-09	9.56E-10	1.41E-09	9.43E-11
Polonium-210 (Po-210)	1.42E-08	4.37E-09	9.56E-10	1.41E-09	9.43E-11
Uranium-235 (U-235)	5.00E-10	1.54E-10	3.37E-11	4.97E-11	3.32E-12
Thorium-231 (Th-231)	5.00E-10	1.54E-10	3.37E-11	4.97E-11	3.32E-12
Protactinium-231 (Pa-231)	5.00E-10	1.54E-10	3.37E-11	4.97E-11	3.32E-12
Actinium-227 (Ac-227)	5.00E-10	1.54E-10	3.37E-11	4.97E-11	3.32E-12
Thorium-227 (Th-227)	4.93E-10	1.52E-10	3.32E-11	4.90E-11	3.28E-12
Francium-223 (Fr-223)	6.90E-12	2.12E-12	4.64E-13	6.85E-13	4.58E-14
Radium-223 (Ra-223)	5.00E-10	1.54E-10	3.37E-11	4.97E-11	3.32E-12

Table 2-2 (continued)
Year 2015 – Airborne Radionuclide Emissions from Various Source Operations
(Curies per year)[1]

Source Radionuclides	Sub-Cluster No. 12B-1 Remedial Action[4]	Sub-Cluster No. 12B-2 Remedial Action[4]	61 Trudy Drive, Lodi Remedial Action (TR-1)	205 Main Street, Lodi Remedial Action (MS-1)	126,130 &146 West Central Ave., Maywood Remedial Action (WC-1)
Polonium-215 (Po-215)	5.00E-10	1.54E-10	3.37E-11	4.97E-11	3.32E-12
Lead-211 (Pb-211)	5.00E-10	1.54E-10	3.37E-11	4.97E-11	3.32E-12
Bismuth-211 (Bi-211)	5.00E-10	1.54E-10	3.37E-11	4.97E-11	3.32E-12
Polonium-211 (Po-211)	1.36E-12	4.20E-13	9.19E-14	1.36E-13	9.07E-15
Thallium-207 (Tl-207)	4.99E-10	1.54E-10	3.36E-11	4.97E-11	3.31E-12
Thorium-232 (Th-232)	8.38E-08	2.58E-08	5.64E-09	8.33E-09	5.57E-10
Radium-228 (Ra-228)	8.38E-08	2.58E-08	5.64E-09	8.33E-09	5.57E-10
Actinium-228 (Ac-228)	8.38E-08	2.58E-08	5.64E-09	8.33E-09	5.57E-10
Thorium-228 (Th-228)	8.38E-08	2.58E-08	5.64E-09	8.33E-09	5.57E-10
Radium-224 (Ra-224)	8.38E-08	2.58E-08	5.64E-09	8.33E-09	5.57E-10
Polonium-216 (Po-216)	8.38E-08	2.58E-08	5.64E-09	8.33E-09	5.57E-10
Lead-212 (Pb-212)	8.38E-08	2.58E-08	5.64E-09	8.33E-09	5.57E-10
Bismuth-212 (Bi-212)	8.38E-08	2.58E-08	5.64E-09	8.33E-09	5.57E-10
Polonium-212 (Po-212)	5.37E-08	1.65E-08	3.62E-09	5.33E-09	3.57E-10
Thallium-208 (Tl-208)	3.01E-08	9.28E-09	2.03E-09	2.99E-09	2.00E-10

Notes:
[1]The soil sample preparation laboratory is not considered a source due to the miniscule amount of particulates released to the atmosphere.
[2]The number of times the soil is handled or dropped at the MISS (i.e., three times) was accounted for in the CAP88-PC dose calculations.
[3]Cluster No. 10A was divided into three sub-clusters for the CAP88-PC modeling purposes since excavations were performed for widely separated areas. Cluster No. 10A has "-1", "-2", and "-3" designations.
[4]Cluster Nos. 12A and 12B were divided into two sub-clusters for the CAPP88-PC modeling purposes since excavations were performed for widely separately areas. Cluster Nos. 12A and 12B have "-1" and "-2" designations.

3.0 DOSE ASSESSMENTS

3.1 DESCRIPTION OF DOSE MODEL

The effective dose equivalents for the collective population and the hypothetical maximally exposed individual were calculated in a three-step process. The first step was to model the release of particulates from the site using the methodology given in the EPA's "Estimation of Air Impacts from Area Sources of Particulate Matter Emissions at Superfund Sites" (EPA-451/R-93/004) (EPA 1993). Particulate emissions were determined based on the number of times the soil was disturbed (e.g., excavated, stockpiled, loaded into trucks/containers/railcars, unloaded, and moved) at both the source and at the MISS. The second step was to input these particulate release rates in the form of radionuclide emissions based on source concentrations, along with local population and meteorological data, into the CAP88-PC program (Rosnick 2014). The third step involved summing the doses calculated by the CAP88-PC program from the various activities at the individual receptors and determining the dose for the hypothetical maximally exposed individual.

The model was used to predict the annual effective dose at numerous receptors resulting from the combined impacts of radiologically contaminated particulate emissions from the various soil load-outs and the remedial actions for Cluster Nos. 10A, 12A, and 12B and the Lodi and Maywood residential remedial actions. The in-situ wind erosion at the MISS and soil preparation laboratory emissions were found to be negligible, and thus, these source were not included in the modeling analyses. Although the emission of radon (Rn) gas is not considered in this analysis, the daughters of Rn gas generated by the decay of Ra-226 (i.e., Rn-218 and Rn-222) and the decay of Ra-223 (i.e., Rn-219) and Ra-224 (i.e., Rn-220) in dust off-site is accounted for by the model in the computation of the effective dose equivalents for the various internal and external exposure pathways.

The CAP88-PC model uses a modified Gaussian plume equation to estimate the average dispersion of radionuclides released from a site. Assessments are done for a circular grid of distances and directions for a radius of 50 mi (80 km) around the site. The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area.

By coupling the output of the atmospheric transport models with the terrestrial food chain models from the NRC Regulatory Guide 1.109 (NRC 1977), the program estimates the radionuclide concentrations in produce, leafy vegetables, milk, and meat consumed by humans. The population distribution array used in the computer model was calculated from known land uses surrounding the site and year 2010 census figures.

CAP88-PC also uses a database of dose and risk factors provided in FGR 13 for estimating dose and risk as implemented in the Oak Ridge National Laboratory DCFPAK Version 2.2 model. Dose and risk conversion factors include the effective dose equivalent calculated according to the methods in ICRP Publication Number 72. CAP88-PC Version 4 now implements the FGR 13 age-dependent dose and risk factors, where previous version of CAP88-PC only used adult dose and risk factors. Dose and risk factors are provided for the pathways of ingestion and inhalation intake, ground level immersion, and ground surface irradiation.

3.2 SUMMARY OF INPUT PARAMETERS

The required input parameters for the computation of the annual effective dose equivalents to the hypothetical maximally exposed individual, as well as the collective population dose, by the CAP88-PC program include:

- Average annual temperature for 2015: 55.6°F (13.1°C) (NOAA 2015a).
- Total annual precipitation for 2015: 37.6 in. (95.5 cm) (NOAA 2015a).
- Wind speed, wind direction, and atmospheric stability class: Teterboro Airport, NJ – Stability Array (STAR) Data for 2006-2015 (NOAA 2015b).
- Population distribution: calculated from 2010 census data.
- Annual radionuclide emission rates from the various source operations at the MISS and the vicinity properties (see **Table 2-2**).
- Surface areas of individual emission sources.
- Distances to individual resident and worker receptor locations.

3.3 COMPLIANCE ASSESSMENT

The maximum annual effective dose to residents and workers resulting from each of the sources individually during 2015 (various soil load-outs and Cluster Nos. 10A, 12A, and 12B remedial actions and the Lodi and Maywood residential and commercial properties remedial actions) as determined by the CAP88-PC modeling analyses, are given in **Table 3-1** and shown on **Figure A-5**. The annual effective dose to the hypothetical maximally exposed resident and worker, as well as the collective population dose, resulting from total site activities combined during 2015 are the following:

- Resident located 33 ft (10 m) SE of Vicinity Residential Property TR-1 (100 percent occupancy): 8.4E-05 millisieverts (mSv) or 8.4E-03 millirems (mrem).
- Worker located 230 ft (70 m) north (N) of MISS Soil Load-outs (27 percent occupancy): 2.08E-05 mSv or 2.08E-03 mrem.
- Annual effective dose to the public within 50 mi (80 km) of the MISS: 6.14E-03 person-rem.

Although exposures from other directions and distances are reported in the model output, only those directions/distances corresponding to a potential receptor are reported here. The contributions of sub-clusters to the doses caused by other nearby sub-clusters were considered in the analysis. For the maximally exposed resident, no other areas were found to contribute to the maximum dose for the primary contributor (i.e., Vicinity Residential Property TR-1) due to the isolated location of Vicinity Property TR-1 relative to the other clusters.

For the maximally exposed worker, five other sub-clusters were found to contribute to the maximum dose for the primary contributor (i.e., MISS Soil Load-outs). The Sub-Cluster No. 10A-1 contributes 1.67E-5 mrem/yr, Sub-Cluster 10A-2 contributes 3.24E-05 mrem/yr, Sub-Cluster 12A-1 contributes 2.97E-05 mrem/yr, Sub-Cluster No. 12B-1 contributes 2.70E-04 mrem/yr, and Sub-Cluster No. 12B-2 contributes 1.11E-04 mrem/yr to the maximum dose caused by MISS Soil Load-Outs (i.e., 1.62E-03 mrem/yr) for a total dose of 2.08E-03 mrem/yr. All other sub-clusters contribute negligibly to the maximum dose.

All calculated individual receptor exposures were on a similar order of magnitude of those reported above (much less than 1 mrem/yr).

The maximum annual effective dose to the individual residents and workers are well below the NESHAP - Subpart H standard of 10 mrem/yr (40 CFR 61.92). The maximum annual effective doses are almost entirely the result of the internal doses received from the inhalation of dust particles with a small contribution from the ingestion of plant borne dust. Air immersion in the dust plume and ground surface irradiation contributes a negligible amount to the total dose.

Table 3-1
Maximum Annual Effective Dose Equivalents

Source/Receptor	Location of Maximum Impact	Annual Dose Rate (mrem/yr)	Occupancy Factor (%)	Annual Effective Dose (mrem)
MISS Soil Load-outs:				
• Population (person-rem)	N/A	2.63E-03	N/A	2.63E-03
• Maximally Exposed Resident	140 m N	1.6E-03	100	1.6E-03
• Maximally Exposed Worker	70 m N	6.0E-03	27	1.62E-03
Cluster No. 10A-1				
• Population (person-rem)	N/A	1.07E-04	N/A	2.63E-03
• Maximally Exposed Resident	180 m NE	2.3E-05	100	2.3E-05
• Maximally Exposed Worker	125 m SE	5.3E-05	27	1.43E-05
Cluster No. 10A-2				
• Population (person-rem)	N/A	5.14E-04	N/A	5.14E-04
• Maximally Exposed Resident	275 m NNE	8.9E-05	100	8.9E-05
• Maximally Exposed Worker	55 m NE	1.1E-03	27	2.97E-04
Cluster No. 10A-3				
• Population (person-rem)	N/A	1.56E-05	N/A	1.56E-05
• Maximally Exposed Resident	305 m NNE	1.3E-05	100	1.3E-05
• Maximally Exposed Worker	10 m ESE	6.9E-04	27	1.86E-04
Cluster No. 12A-1				
• Population (person-rem)	N/A	1.80E-05	N/A	1.80E-05
• Maximally Exposed Resident	40 m NE	6.6E-05	100	6.6E-05
• Maximally Exposed Worker	50 m N	7.8E-05	27	2.11E-05
Cluster No. 12A-2				
• Population (person-rem)	N/A	3.12E-05	N/A	3.12E-05
• Maximally Exposed Resident	50 m N	1.2E-04	100	1.2E-04
• Maximally Exposed Worker	60 m SSE	7.8E-05	27	2.11E-05
Cluster No. 12B-1				
• Population (person-rem)	N/A	1.91E-03	N/A	1.91E-03
• Maximally Exposed Resident	135 m SW	3.9E-04	100	3.9E-04
• Maximally Exposed Worker	90 m N	2.1E-03	27	5.67E-04
Cluster No. 12B-2				
• Population (person-rem)	N/A	5.87E-04	N/A	5.87E-04
• Maximally Exposed Resident	125 m NNE	4.3E-04	100	4.3E-04
• Maximally Exposed Worker	35 m S	4.5E-03	27	1.22E-03
61 Trudy Drive, Lodi (TR-1)				
• Population (person-rem)	N/A	1.28E-04	N/A	1.28E-04
• Maximally Exposed Resident	10 m SE	8.4E-03	100	8.4E-03
• Maximally Exposed Worker	90 m S	3.1E-04	27	8.37E-05

Table 3-1 (continued)
Maximum Annual Effective Dose Equivalents

Source/Receptor	Location of Maximum Impact	Annual Dose Rate (mrem/yr)	Occupancy Factor (%)	Annual Effective Dose (mrem)
205 Main Street, Lodi (205M-1)				
• Population (person-rem)	N/A	1.90E-04	N/A	1.90E-04
• Maximally Exposed Resident	90 m SE	2.4E-04	100	2.4E-04
• Maximally Exposed Worker	15 m N	5.0E-03	27	1.35E-03
126,130 & 146 West Central Avenue, Maywood (WC-1)	N/A	1.27E-05	N/A	1.27E-05
• Population (person-rem)	35 m N	1.0E-04	100	1.0E-04
• Maximally Exposed Resident	75 m SSE	2.2E-05	27	5.94E-06
• Maximally Exposed Worker				
Total Site				
• **Population (person-rem)**	**N/A**	**6.14E-03**	**N/A**	**6.14E-03**
• **Maximally Exposed Resident**	**10 m SE of 61 Trudy Dr. (TR-1)**	**8.4E-03**	**100**	**8.4E-03**
• **Maximally Exposed Worker**	**70 m N of MISS Soil Loadouts**	**7.7E-03**	**27**	**2.08E-03**

Notes:
1. Although exposures from other directions and distances are reported in the model output, only those directions/distances corresponding to a potential receptor are reported here. Note: All calculated exposures were on a similar order of magnitude of those reported here (much less than 1 mrem/yr).
2. The total site doses for the maximally exposed resident and worker represent the combined impacts of radiologically contaminated particulate emissions from the various soil load-outs at the MISS and the Cluster Nos. 10A, 12A, and 12B remedial actions, and the Lodi and Maywood residential and commercial properties remedial actions.
3. The collective population dose is the total dose received by the public living within 50 mi (80 km) of the MISS. The total site population dose was calculated by summing the population doses resulting from the radiologically contaminated particulate emissions from the various soil load-outs at the MISS and the Cluster Nos. 10A, 12A, and 12B remedial actions, and the Lodi and Maywood residential and commercial properties remedial actions.
4. A central reference point was established at each cluster and the MISS soil load-out area for modeling purposes; the distance to the maximum impact from the excavations and soil handling operations is relative to the central reference point.
5. Appendix C contains the detailed calculation for determining the maximum annual effective dose equivalents.
6. The contributions of clusters to the doses caused by other nearby clusters were considered in the modeling analyses.

3.4 CERTIFICATION

I certify under penalty of law that I have personally examined, and am familiar with, the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment (see 18 U.S.C. 1001).

Name / Title: _____

Signature: _____ Date: _____

4.0 RADON-222 FLUX MONITORING

Rn-222 flux monitoring is typically performed to determine compliance with 40 CFR 61, Subpart Q for stockpiles that are present for a significant period of time, such as 6 months or greater. During 2015, soil was stockpiled at the MISS for approximately 6 months. Thus, it was deemed prudent to perform Rn-222 flux monitoring for a soil stockpile to assess regulatory compliance.

Rn-222 flux monitoring was performed over a 24-hour period between December 9, 2015 and December 10, 2015 to determine compliance with 40 CFR 61, Subpart Q. To determine the Rn-222 flux from the storage pile, charcoal canisters were placed at six locations on a soil stockpile that was located within the staging area at the MISS. The volume of the soil stockpile at the time radon flux monitoring was conducted was approximately 4,500 cubic yards.

The Rn-222 flux measurement locations on the soil stockpile at the MISS are shown in **Appendix A** on **Figure A-6**. The analysis of the Rn-222 flux canisters was performed by Eberline Services of Oak Ridge, Tennessee.

The results of the Rn-222 flux monitoring are presented in **Table 4-1**. The measured concentrations from the storage pile were well in compliance with the 20 picocuries per square meter per second ($pCi/m^2/s$) Rn-222 flux standard specified in 40 CFR 61, Subpart Q.

Table 4-1
Year 2015 – Rn-222 Flux Monitoring Results for the Soil Stockpile at the MISS

Sample ID[1]	Date Collected	Date Analyzed	Analyte	Result ($pCi/m^2/s$)	Error[2] ($pCi/m^2/s$)	MDA[3] ($pCi/m^2/s$)
RC-1	12/10/15	12/11/15	Rn-222	2.38E-02	2.55E-02	4.15E-02
RC-2	12/10/15	12/11/15	Rn-222	5.47E-03	2.43E-02	4.78E-02
RC-3	12/10/15	12/11/15	Rn-222	4.26E-03	2.41E-02	4.51E-02
RC-4	12/10/15	12/11/15	Rn-222	2.40E-02	1.86E-02	3.80E-02
RC-5	12/10/15	12/11/15	Rn-222	-5.86E-03	3.19E-02	4.74E-02
RC-6	12/10/15	12/11/15	Rn-222	3.43E-02	5.73E-02	7.06E-02

Notes: 1. All monitoring locations for the storage piles are shown on **Figure A-6**.
2. The error is reported at the 95 percent uncertainty level ($k = 1.96$).
3. The minimum detected activity (MDA) is reported at the 95 percent confidence level.

5.0 REFERENCES / BIBLIOGRAPHY

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APPENDIX A
SELECTED FUSRAP MAYWOOD SUPERFUND SITE FIGURES

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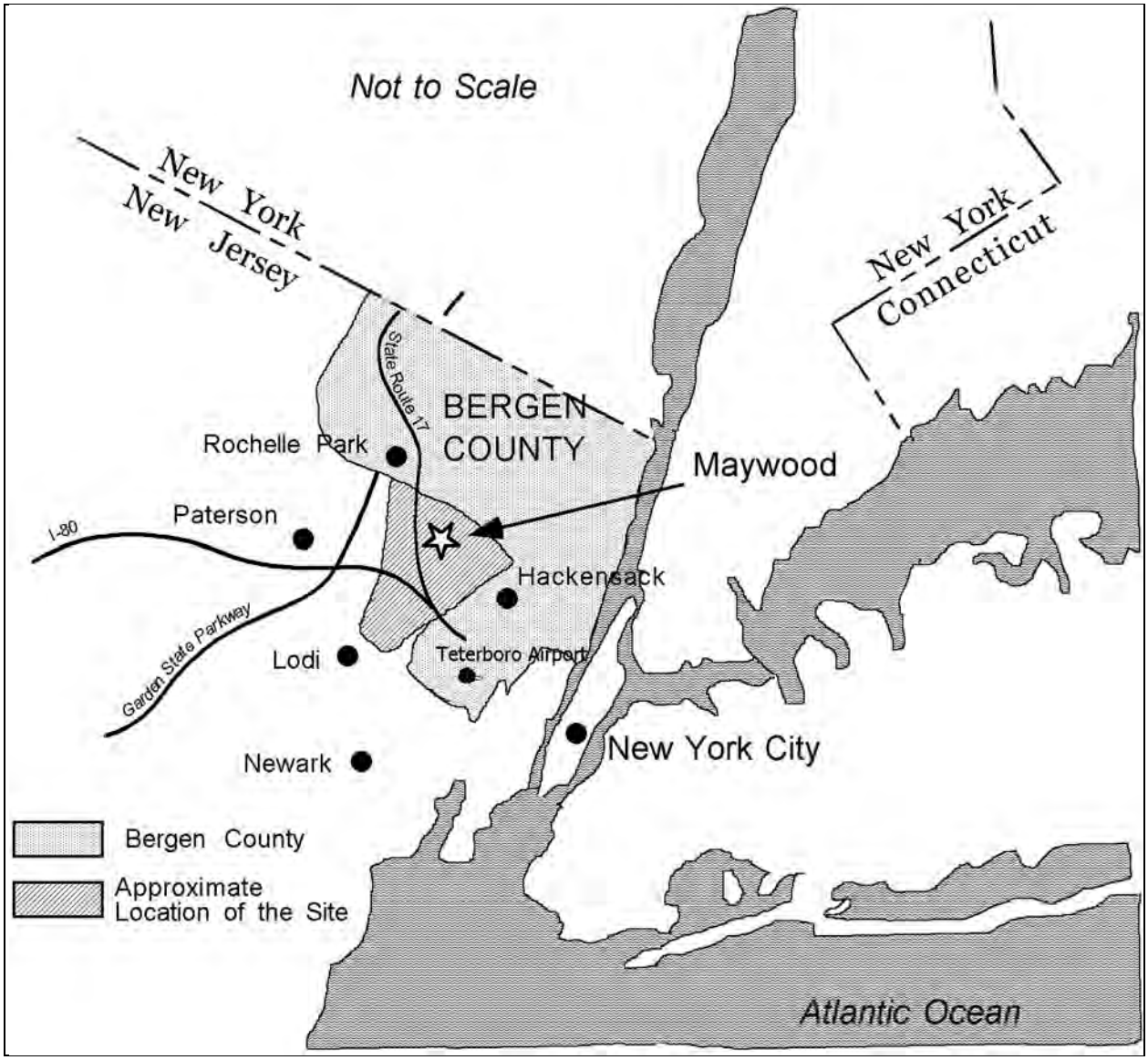

Figure A-1
FMSS and MISS General Location Map

Figure A-2

Phase II Vicinity Property Clusters

- Cluster 1
- Cluster 2
- Cluster 3
- Cluster 4
- Cluster 5
- Cluster 6
- Cluster 7
- Cluster 8
- Cluster 9
- Cluster 10
- Cluster 11
- Cluster 12

Cluster Number	Property Address	ID #
1	72 Sidney Street	01a
2	100 Hancock Street	02a
2	80 Hancock Street	02b
2	80 Industrial Road	02c
2	8 Mill Street	02d
3	170 Gregg Street	03a
4	160/174 Essex Street	04a
4	I-80 Westbound ROW	04b
5	99 Essex Street	05a
5	113 Essex Street	05b
5	200 NJ Rt. 17 South	05c
6	85-103 NJ Rt. 17 North	06a
6	137 NJ Rt. 17 North	06b
6	167 NJ Rt. 17 North	06c
6	239 NJ Rt. 17 North	06d
7	111 Essex Street	07a
7	Hackensack & Lodi Railroad	07b
8	23 West Howcroft Road	08a
9	149-151 Maywood Avenue	09a
10	100 West Hunter Avenue (Stepan)	10a
11	205 Maywood Avenue	11a
11	61 West Hunter Avenue	11b
11	50 West Hunter Avenue	11c
12	NY, Susquehanna,& Western Railroad	12a
12	100 West Hunter Avenue (MISS)	12b
12	NJ Rt. 17 ROW	12c

Note: Per the *Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site* dated August 2003, the properties located at 50 West Hunter Avenue, 61 West Hunter Avenue, and 205 Maywood Avenue are listed as one property.

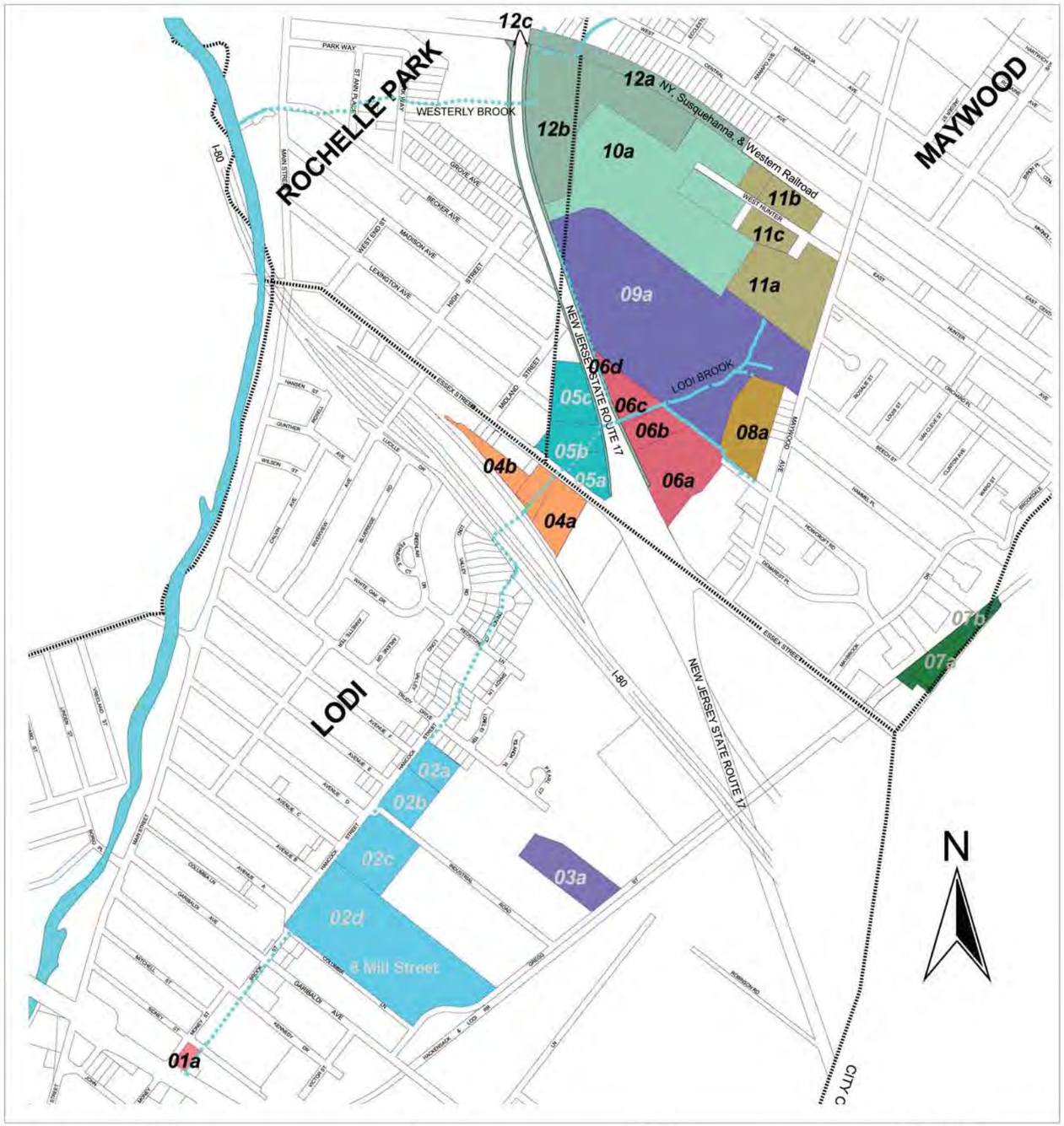

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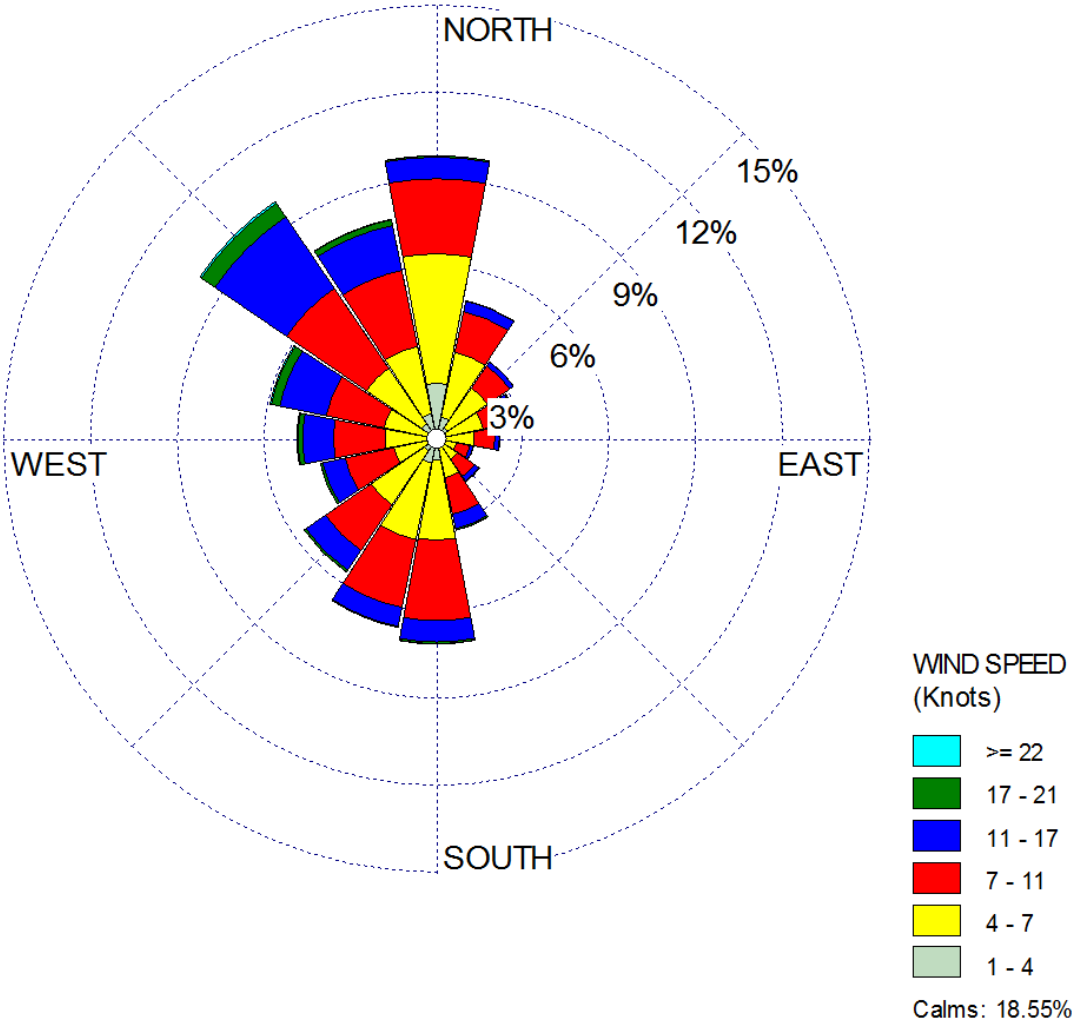
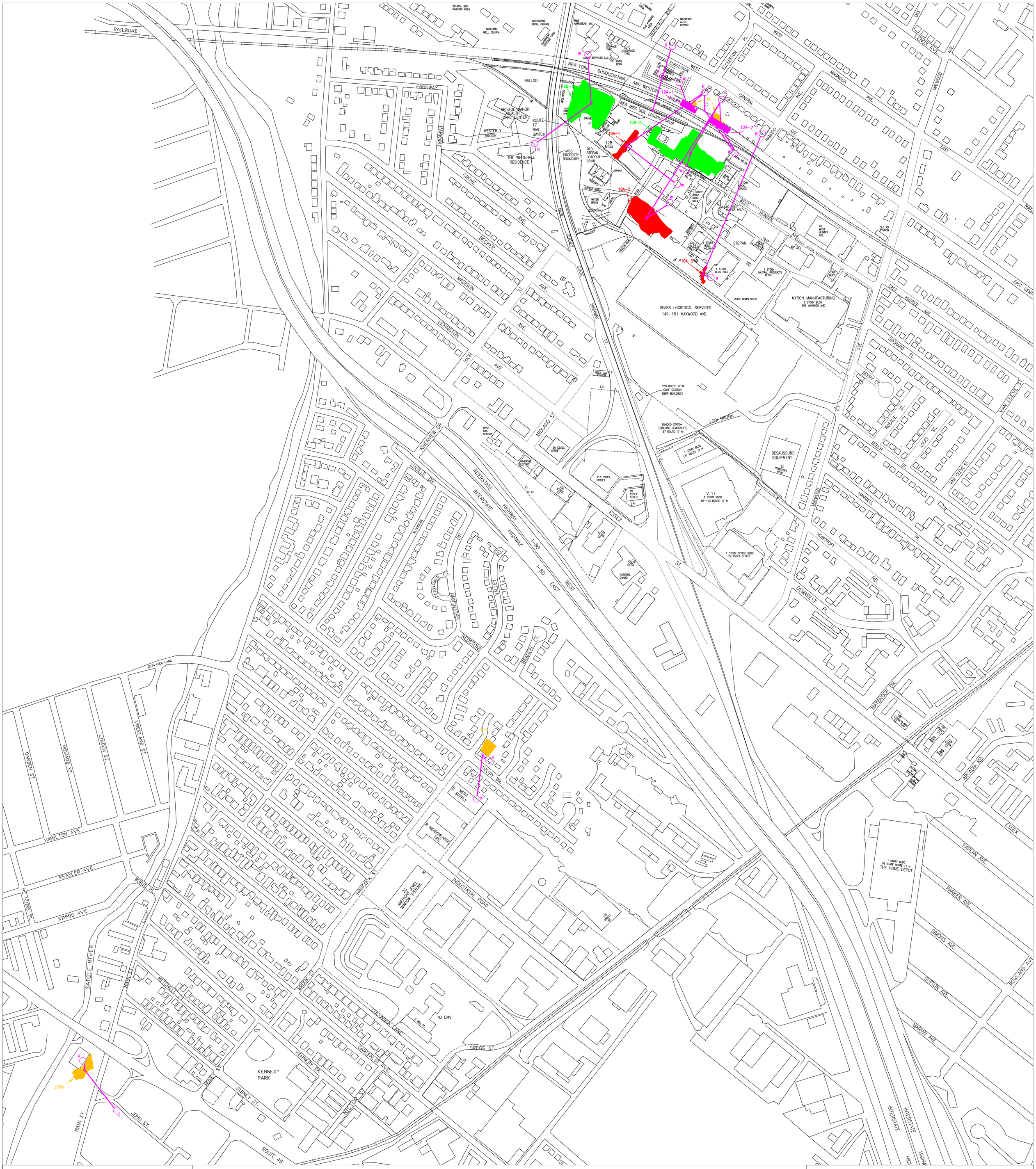
Figure A-3
Aerial View of MISS and Adjacent Properties



NOTES:
Diagram of the frequency of occurrence for each wind direction. Wind direction is the direction from which the wind is blowing. Example – Wind is blowing from the north 9.8 percent of the time.

Figure A-4
Windrose, Teterboro, NJ (2006-2015)



Key:

OR = Maximally Exposed Resident

OW = Maximally Exposed Worker

= Areas Excavated in 2015

NOTE: For the CAP88–PC modeling analyses, given that the excavations are spread–out over a large area, the clusters were divided into the following sub–clusters:

Cluster No. 10A (10A–1; 10A–2; 10A–3); and
Cluster No. 12A (12A–1; 12A–2); and
Cluster No. 12B (12B–1; 12B–2); and
Vicinity Properties (WC–1; 205M–1; TR–1)

0 200 400 FEET

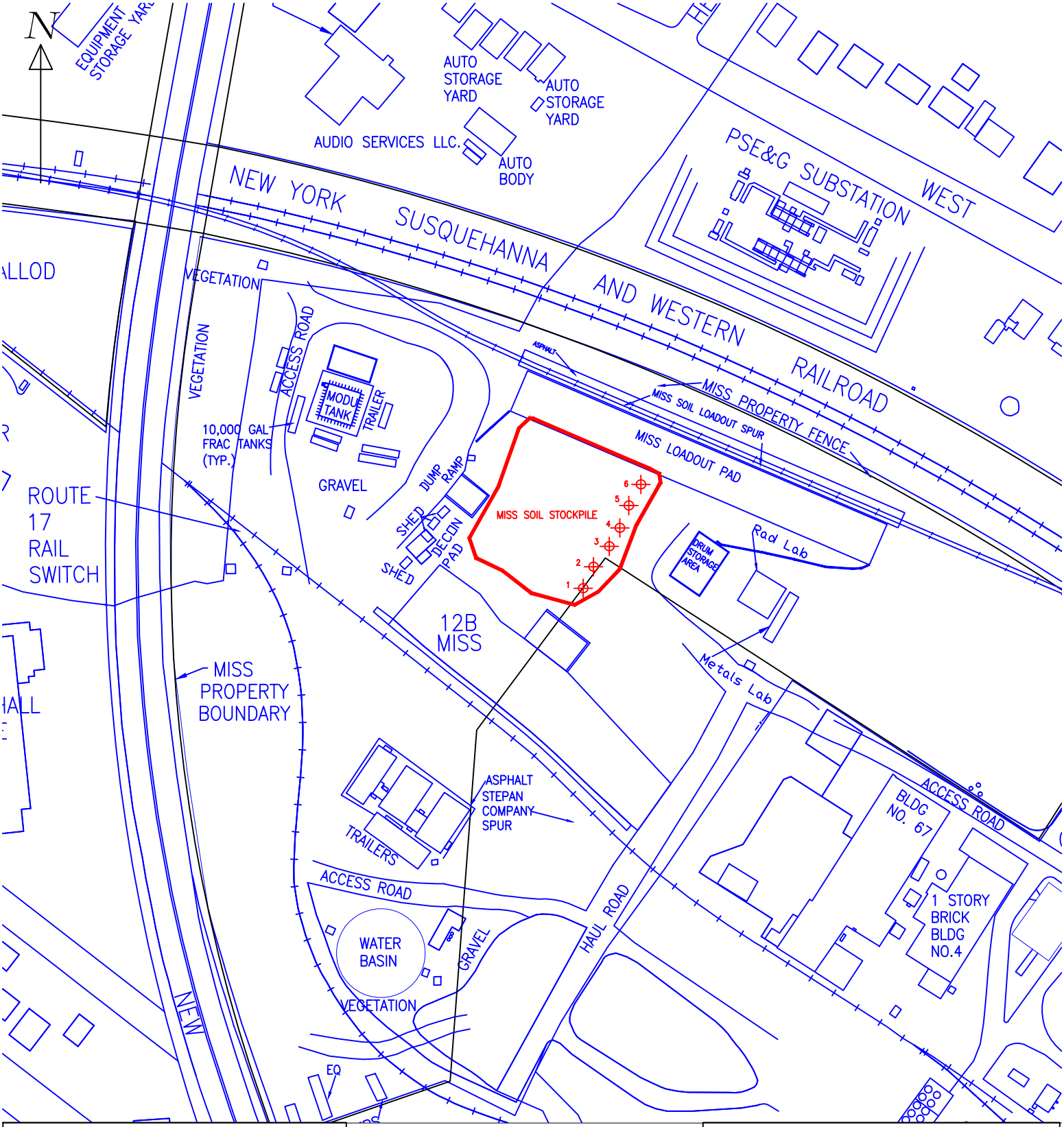
1" = 200'–0"

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, LODI AND ROCHELLE PARK
NEW JERSEY

PROJECT NUMBER: 50010201010000

FIGURE A–5
SITE LOCATION PLAN SHOWING THE LOCATIONS OF MAXIMALLY EXPOSED INDIVIDUALS

CB&I FEDERAL SERVICES



Key:

= Approx. location of Radon Flux Monitor

= Approx. location of MISS soil stockpile

0 37.5 75 150

SCALE: 1" = 150'

Verify Scale

bar is one inch on original drawing.

0 1"

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, LODI AND ROCHELLE PARK
NEW JERSEY
PROJECT NUMBER: 50010201010000

FIGURE A-6
LOCATION OF RADON-222 FLUX MONITORS
ON THE SOIL STOCKPILE AT THE MISS

CB&I FEDERAL SERVICES

APPENDIX B
SELECTED PHOTOGRAPHS

APPENDIX B
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Figure B-12 Vicinity Residential Property at 146 West Central Avenue, Maywood Remedial Action B-29

Figure B-13 On Site UFML at the MISS B-31

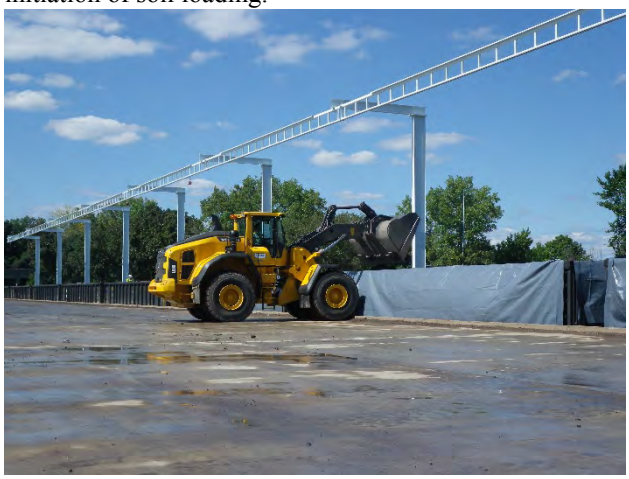
View of a dump truck unloading contaminated soil at the soil staging area at the MISS.

Worker performing dust monitoring at the MISS during soil receipt, handling, and loading activities.

Calibration of bucket scale prior to soil loading activities.

View of dust suppression being performed prior to the initiation of soil loading.

View of a worker installing a liner into a railcar in preparation for the loading of contaminated soil.

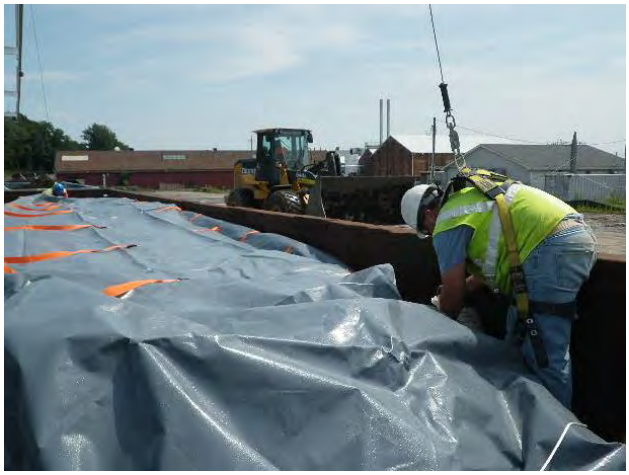


View of a front end loader placing soil into lined railcars for offsite disposal.

FIGURE B-1
Soil Load-Out Activities at the MISS

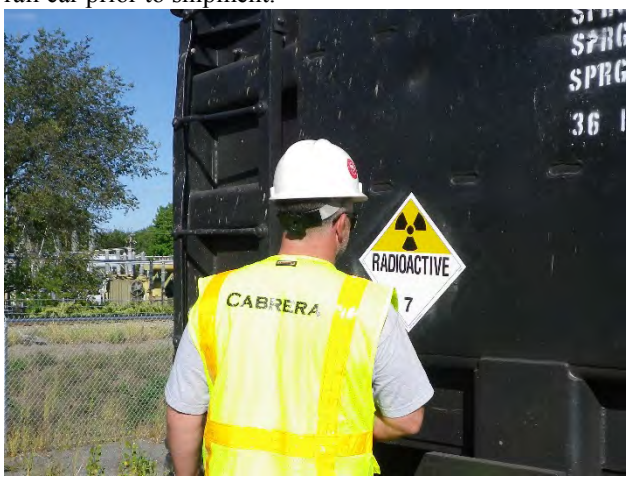
View of a front end loader applying absorbent material on contaminated soil that has been loaded into a railcar.

Another view of absorbent material that has been applied on a shipment of contaminated soil.



Worker wearing fall protection is sealing the liner for the rail car prior to shipment.

Worker conducting a radiological dose survey of a railcar prior to the transport of the contaminated material.



View of a worker affixing a Class 7 radioactive label to a rail car prior to shipment for offsite disposal.

View of the sealed railcars that have been released for shipment to an offsite disposal facility.

FIGURE B-1
Soil Load-Out Activities at the MISS

View of the pre-remediation conditions.

View of the direct casting of contaminated soil to soil storage area at the MISS.

View of excavation activities in progress.

View of excavation activities and a worker spraying water for dust suppression.

View of an excavator loading a dump truck for the transport of soil to MISS soil receiving area for disposal.

Dust monitoring activities in progress.

FIGURE B-2
Sub-Cluster No. 10A-1 Remedial Action

View of the placement of structural fill and grading of the area.

View of compaction activities using a Volvo roller.

FIGURE B-2
Sub-Cluster No. 10A-1 Remedial Action

View of the soil stockpile prior to removal.

View of the removal of the stockpile using an excavator and dust control measure.

Another view of the soil stockpile removal prior to remediation.

View showing the completion of the removal of the soil stockpile.

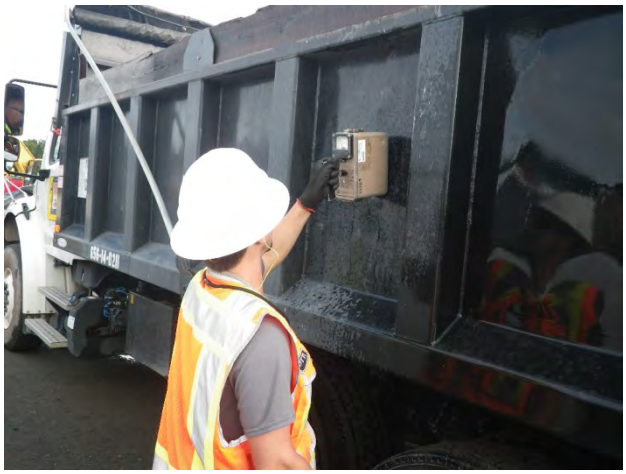
Another view of the initial conditions prior to remediation for a different portion of Sub-Cluster 10A-1.

View of an excavation activities and dust suppression in progress.

FIGURE B-3
Sub-Cluster No. 10A-2 Remedial Action

Another view of the excavation activities.

View of workers manually locating a water line.



Truck radiological survey in progress.

Gamma walkover survey performed by the Final Status Survey (FSS) crew.

View showing the placement of fill and grading.

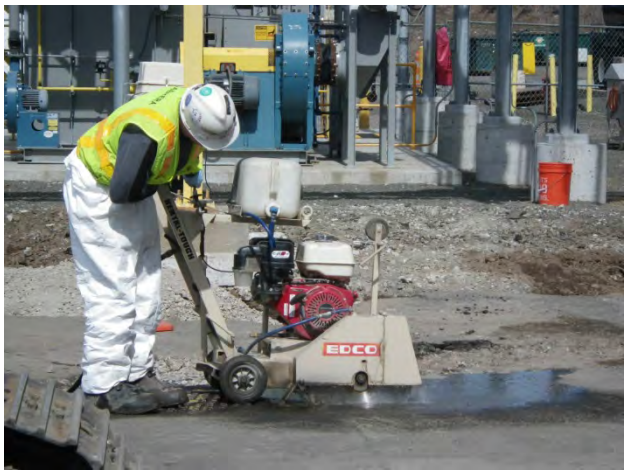
View showing the compaction of the fill using a Volvo SD100 roller.

FIGURE B-3
Sub-Cluster No. 10A-2 Remedial Action

A temporary fence boundary was established prior to the commencement of excavation.

A test pit was dug prior to remediation.

View of a boundary delineation survey being performed.



View of a worker cutting asphalt prior to remediation.

View of excavation in progress.

Radiological survey being performed by a radiation technician.

FIGURE B-4
Sub-Cluster No. 10A-3 Remedial Action

View of an excavator loading a dump loading truck for transport to the MISS soil receiving area.

View of a worker serving as a spotter guiding the excavation activities.

Conditions prior to the Final Status Survey (FSS) entry.

Gamma walkover survey being performed by the FSS crew.

View of structural fill being placed and compacted.

View of the post-remediation conditions.

FIGURE B-4
Sub-Cluster No. 10A-3 Remedial Action

View of the conditions prior to remediation.

A test pit was dug as part of the remediation process.

View of worker setting up the contamination controls in the remediated area.

Dewatering activities after a rain event.

View of soil excavation activities adjacent to the PSE&G Substation.

Loading the contaminated soil into a dump truck for transport to the MISS soil receiving area.

FIGURE B-5
Sub-Cluster No. 12A-1 Remedial Action

View of the placement of fill using a long reach excavator.

View of the post-remediation conditions.

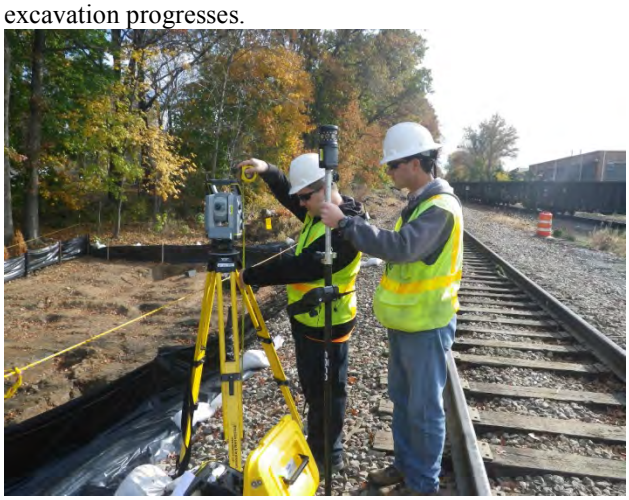
FIGURE B-5
Sub-Cluster No. 12A-1 Remedial Action

View of the pre-remediation condition.

View showing the start of the remedial action using a long reach excavator.

View of a worker spraying water for dust control as the excavation progresses.

Radiological survey being performed by technician.



Total station configured for As-Built survey.

Gamma walkover performed by the final status survey crew.

FIGURE B-6
Sub-Cluster No. 12A-2 Remedial Action

View of the placement of fill using a long reach excavator.

View of the planting of trees for the final restoration conditions.

FIGURE B-6
Sub-Cluster No. 12A-2 Remedial Action

View of the pre-remediation conditions.

View showing the performance of the initial conditions survey using a GPS rover.

View of the excavation in progress and dust control.

View of the sludge found during the excavation of the sidewall.

Radiological survey being conducted by a field technician.

Dewatering being performed after a rain event.

FIGURE B-7
Sub-Cluster No. 12B-1 Remedial Action

View of the benching of the side slopes during excavation activities.

Radiological technician scanning the dump truck prior to transport to the MISS soil dumping area.

View of the contamination controls that were installed between excavations.

View of the gamma walkover survey being performed by the final status survey crew.

Post remedial view taken from the northern slope of the excavation.

Truck delivering an approved quarry backfill.

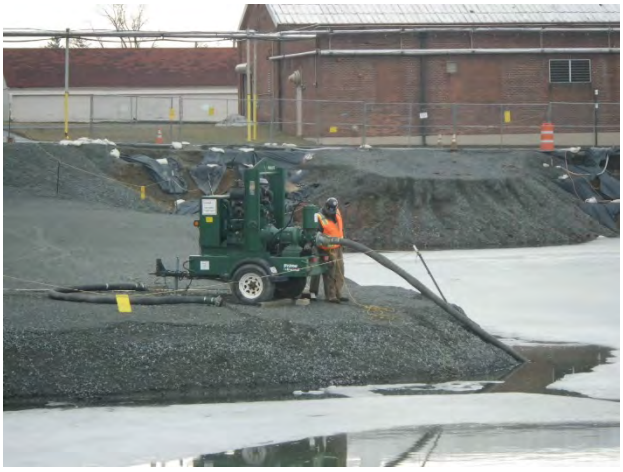
FIGURE B-7
Sub-Cluster No. 12B-1 Remedial Action

View of fill placement activities.

View of the final compaction showing post-remedial conditions.

FIGURE B-7
Sub-Cluster No. 12B-1 Remedial Action

View of the post-winter break conditions on the eastern side of Sub-Cluster No. 12B-2.



View of the dewatering activities being conducted on the eastern side of Sub-Cluster No. 12B-2 as the ice melts.

View showing the stockpiling of previously placed fill adjacent to an area to be remediated.

Remediated area in the western section of Sub-Cluster No. 12B-2 showing an insulated water line.

Fill being placed and compacted in the western section of Sub-Cluster No. 12B-2.

View of dewatering activities in progress in the eastern section of Sub-Cluster No. 12B-2.

FIGURE B-8
Sub-Cluster No. 12B-2 Remedial Action

View of the installation of a water shutoff valve adjacent to lab building.

View showing the relocation of the water treatment plant to the east of the lab building.

Ramp construction for machine access in eastern Sub-Cluster No. 12B-2 prior to the remediation activities.

View of excavation activities and dust control.

View showing the construction of access pads for machine movement during remediation activities.

View of the ramp for the construction preparation area.

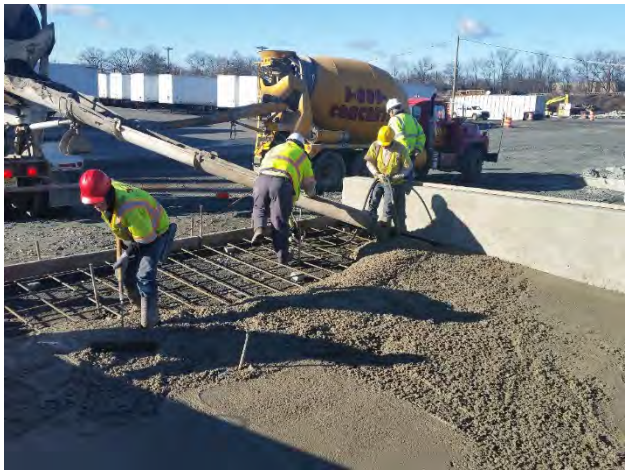
FIGURE B-8
Sub-Cluster No. 12B-2 Remedial Action

Radiological survey being performed by technician.

View of the receipt of fill and the grading of the eastern portion of Sub-Cluster No. 12B-2.

View showing the post-compaction for the area.

View of the construction of forms for the storage warehouse slab.



View showing the pouring of the concrete slab for the warehouse. The warehouse will be built in 2016.

View showing the ramp construction for the warehouse and the tying of rebar.

FIGURE B-8
Sub-Cluster No. 12B-2 Remedial Action

View of the installation of a security fence, privacy screen, and silt fence at the property.

View of the demolition of the existing house.

View of the excavator loading demolition debris.

View of the basement removal and the initiation of remediation.

View of the excavation of the contaminated soil.

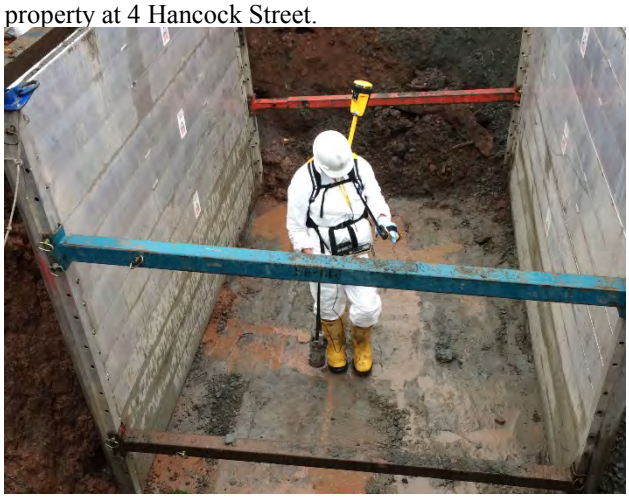
View of the field confirmation screening in progress.

FIGURE B-9
Vicinity Residential Property At 61 Trudy Drive, Lodi Remedial Action

View of the gamma walkover survey in progress.

Contamination controls on benching adjacent to the property at 4 Hancock Street.

View of the removal of contaminated material in the former bench areas.



Gamma walkover survey in progress in the former bench area.

View of the grading of the placed fill.

View of the compaction testing of the placed fill.

FIGURE B-9
Vicinity Residential Property At 61 Trudy Drive, Lodi Remedial Action

View of direct push sampling being performed.

View of well abandonment being performed prior to soil removal.

View of excavation activities in progress.

Another view of the excavation activities and dust suppression.

View of the installation of contamination controls.

View of the area conditions around the abandoned structure.

FIGURE B-10
Vicinity Commercial Property At 205 Main Street, Lodi Commercial Property

Gamma walkover survey being performed by the final status survey crew (FSS).

View of the soil sampling being conducted by the FSS.

View of ramp construction and fill placement.

Dust suppression and fill placement activities in progress.

View of the fill compaction.

View of the compaction testing of the placed fill.

FIGURE B-10
Vicinity Commercial Property At 205 Main Street, Lodi Commercial Property

View of the 130 West Central Avenue property – Pre-remediation conditions.

Another view of the130 West Central Avenue property – Pre-remediation conditions.

View of the130 West Central Avenue property – contamination controls.

View of the130 West Central Avenue –contamination controls.

View of the130 West Central Avenue property– soil removal.

Another view of the 130 West Central Avenue property – soil removal.

FIGURE B-11
Vicinity Residential Properties at 126 and 130 West Central Avenue, Maywood Remedial Action

View of the 130 West Central Avenue property – soil transfer.

View of the 130 West Central Avenue property – confirmation sampling.

View of the 130 West Central Avenue property – post remediation.

View of the 130 West Central Avenue property – placing and grading of fill.

View of the 130 West Central Avenue property – spreading topsoil.

View of the 130 West Central Avenue property – raking topsoil.

FIGURE B-11

Vicinity Residential Properties at 126 and 130 West Central Avenue, Maywood Remedial Action

View of the 130 West Central Avenue property – restoration of the composter.

View of the 130 West Central Avenue property – lawn restoration.

View of the 126 West Central Avenue property – excavation area.

View of the 126 West Central Avenue property – soil transfer.

View of the 126 West Central Avenue property – soil transfer to dump truck.

View of the 126 West Central Avenue property – Auger sampling in tree roots.

FIGURE B-11
Vicinity Residential Properties at 126 and 130 West Central Avenue, Maywood Remedial Action

View of the 126 West Central Avenue property – gamma walkover survey.

View of the 126 West Central Avenue property – excavation area / restoration.

View of the 126 West Central Avenue property – lawn restoration.

View of the 126 West Central Avenue property– shrub planting.

FIGURE B-11
Vicinity Residential Properties at 126 and 130 West Central Avenue, Maywood Remedial Action

View of the pre-remediation conditions.

View of an excavator being used to prepare an access route to the property.

View of the removal of the existing vegetation on the property.

Truck loading prior to the transport of the excavated soil to the MISS soil receiving area.

View of an excavated area on the property.

View of the contamination controls for the excavation.

FIGURE B-12
Vicinity Residential Property at 146 West Central Avenue, Maywood Residential Property

View of the as-built survey being conducted.

View of the completed restoration of the property.

FIGURE B-12
Vicinity Residential Property at 146 West Central Avenue, Maywood Residential Property

View of west side of radiochemistry laboratory at the MISS. The exhaust stack for the fume hoods is visible.

Soil Preparation Laboratory. View of the vented drying ovens and muffle furnace (center).

The downdraft table and pulverizer in the Soil Preparation Laboratory.

View of downdraft table and adjacent unit containing the High Efficiency Particulate Air (HEPA) filter.

View of soil digestion microwaves and condenser units.

View of fume hoods with centrifuge on table in the forefront.

FIGURE B-13
On-Site UFML Lab at the MISS

APPENDIX C
CALCULATIONS

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CALCULATION TITLE PAGE

CLIENT & PROJECT: U.S. ARMY CORPS OF ENGINEERS/FUSRAP-MISS	PAGE 1 of 186 Total Pages: 199 w/attachments
CALCULATION TITLE: 2015 Annual NESHAP Compliance Report – Supporting Calculation	QA CATEGORY (✓) ☐ I ✓ III ☐ II

CALCULATION IDENTIFICATION NUMBER				OPTIONAL WORK PACKAGE NO.
JOB ORDER NO.	DISCIPLINE	CURRENT CALC NO	OPTIONAL TASK CODE	
500102	E(B)	23		

APPROVALS - SIGNATURE & DATE			REVISION NO. OR NEW CALCULATION NO.	SUPERSEDES CALCULATION NO. OR REVISON NO.	CONFIRMATION REQUIRED (✓)	
PREPARES(S) / DATE(S)	REVIEWER(S) / DATES(S)	INDEPENDENT REVIEWER(S) / DATE(S)			YES	NO
Stephen A. Vigeant	Joseph McLaughlin		0			✓

DISTRIBUTION

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Specialist	Stephen A. Vigeant: Canton, MA	cc			

CALCULATION IDENTIFICATION NUMBER				
JOB ORDER NO. 500102	DISCIPLINE E(B)	CALCULATION NO. 23	REVISION NUMBER 0	PAGE 2 OF 186

CHANGE HISTORY PAGE

REVISION NO.	DESCRIPTION OF CHANGES	PAGES REVISED	PAGES ADDED	PAGES REPLACED
0	N/A	N/A	N/A	N/A

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11. CAP88-PC OUTPUT (Population) ..... 110 - 186

ATTACHMENT A - Excel Spreadsheet Results A1-A13

1. OBJECTIVE

The objective is to estimate the annual effective dose to nearby residents and off-site workers from airborne releases of radioactive particulates at the Maywood Interim Storage Site (MISS) and vicinity properties generated during the calendar year 2015. The activities generating these potential releases include: MISS in situ wind erosion; soil load-out operations at the MISS; the remedial actions at Cluster Nos. 10A, 12A, and 12B; the remedial actions at five vicinity properties located in Lodi and Maywood; and operation of the exhaust system for the soil sample preparation laboratory.

2. METHODOLOGY

During calendar year 2015, the potential sources of airborne emissions of radioactive particulates at the MISS and nearby properties were:

- *In situ* contaminated areas totaling approximately 509,652 square feet (ft^2) (47,349 square meters [m^2]) of the MISS along with excavated soil from the vicinity properties stored in piles that were potentially exposed to wind erosion during calendar year 2015. The nearest commercial buildings are located approximately 445 feet (ft) (135 meters [m]) north of the MISS and the nearest residences are located approximately 490 ft (150 m) west and west-southwest of the MISS.

- The performance of soil load-out, transportation, and disposal operations at the MISS during the year 2015. Specifically, eight (8) soil load-out operations were performed during the year 2015. The various soil stockpiles consisted of soil that had been transported to the MISS from the remedial actions performed at the following three properties: Cluster No. 10A (100 West Hunter Avenue [Stepan Company]); Cluster No. 12A (NYSW); and Cluster No. 12B (100 West Hunter Avenue [MISS]). Additional soil was transported to the MISS from the remedial actions conducted at a residence located at 61 Trudy Drive (TR-1) and a commercial property at 205 Main Street (205M-1) in the Borough of Lodi and residences located at 126, 130, and 146 West Central Avenue (WC-1) in the Borough of Maywood. These eight load-outs involved the movement of approximately 80,126 tons of soil. These materials were staged at the MISS and subsequently placed into railcars for transport to a disposal facility in Utah or Idaho. The nearest commercial buildings are located approximately 230 ft (70 m) north of the MISS soil load-out area, while the nearest residential buildings are located approximately 360 ft (110 m) east-northeast of the MISS soil load-out area.

- The performance of remedial actions at Cluster No. 10A (100 West Hunter Avenue [Stepan Company]), which is located in the Borough of Maywood and the Township of Rochelle Park. This property occupies primarily Block 124, Lots 31, 32, 33, 39, 40, 41, 42, 43, 44, 45, 46, and 47 in the Borough of Maywood, except for a small area in the southwest corner of the property that is in Block 18.02, Lot 2 in the Township of Rochelle Park. The property comprises approximately 19 acres and is owned by the Stepan Company. For the CAP88-PC modeling purposes, Cluster No. 10A was divided into three (3) sub-clusters (i.e., 10A-1, 10A-2 and 10A-3). The remedial action involved the excavation of contaminated soil at the following three (3) locations on the Stepan Company property: a rectangular shaped area adjacent to the MISS/Stepan Company property boundary that extends from the Stepan Company rail spur northeast to the MISS/Stepan Company property boundary (Sub-Cluster No. 10A-1); a rectangular shaped area south of the Stepan Company rail spur that extends southeast from the haul road (Sub-Cluster No. 10A-2); and a small area located adjacent to the southwest corner of the Stepan Company Building No. 7 (Sub-Cluster No. 10A-3). The remedial action involved the excavation of approximately 14,561 tons of soil that were loaded into trucks for transport to the MISS. The nearest commercial buildings are located approximately 410 ft (125 m) southeast and east-southeast of Sub-Cluster No. 10A-1. The nearest residences are located approximately 590 ft (180 m) northeast of Sub-Cluster No. 10A-1. The nearest commercial buildings are located approximately 180 ft (55 m) northeast of Sub-Cluster No. 10A-2. The nearest residences

are located approximately 640 ft (195 m) west and southwest of Sub-Cluster No. 10A-2. The nearest commercial buildings are located approximately 33 ft (10 m) east, east-northeast, and east-southeast of Sub-Cluster No. 10A-3. The nearest residences are located approximately 820 ft (250 m) west and west-southwest of Sub-Cluster No. 10A-3.

- The performance of a remedial action at Cluster No. 12A (NYSW), which is located in the Borough of Maywood and the Township of Rochelle Park. This property occupies Block 124, Lot 55 in the Borough of Maywood and Block 110, Lot 1 in the Township of Rochelle Park. Cluster No. 12A is approximately 2,800 ft long and 100 ft wide. For the CAP88-PC modeling purposes, Cluster No. 12A was divided into two (2) sub-clusters (i.e., 12A-1 and 12A-2). The remedial action was performed for a portion of the NYSW right-of-way (ROW) adjacent to the PSE&G Substation and the residential property located at 146 West Central Avenue (Sub-Cluster No. 12A-1), and a portion of the NYSW right-of-way adjacent to the residential properties located at 122, 126 and 130 West Central Avenue (Sub-Cluster No. 12A-2). This effort involved the excavation of approximately 1,124 tons of soil that were loaded into trucks for transport to the soil receiving area at the MISS. The nearest commercial buildings are located approximately 165 ft (50 m) north and north-northwest of Sub-Cluster No. 12A-1. The nearest residences are located approximately 130 ft (40 m) northeast of Sub-Cluster No. 12A-1. The nearest commercial buildings are located approximately 195 ft (60 m) south-southeast of Sub-Cluster No. 12A-2. The nearest residences are located approximately 165 ft (50 m) north, north-northeast, and northeast of Sub-Cluster No. 12A-2.

- The performance of remedial actions at Cluster No. 12B (100 West Hunter Avenue [MISS]), which occupies Block 124, Lot 46 in the Borough of Maywood and Block 20.01, Lot 1 in the township of Rochelle Park. The property, referred to as the MISS, comprises 11.7 acres, and is bisected by the boundary between the Township of Rochelle Park and the Borough of Maywood. The property is bounded by the NYSW (Cluster No. 12A) to the north, Stepan Company's property (Cluster No. 10A) to the south and east, and NJ Route 17 ROW (Cluster No. 12C) to the west. For the CAP88-PC modeling analyses, Cluster No. 12B was divided into two (2) sub-clusters (i.e., 12B-1 and 12B-2). The remedial action involved the excavation of contaminated soil at the following two (2) locations on the MISS: an approximate rectangular shaped area east of NJ Route 17 between the Stepan Company rail spur and the new MISS soil load-out rail spur extending toward the decontamination pad and dump ramp (Sub-Cluster No. 12B-1) and an area adjacent to the MISS access road extending from near the drum storage area/MISS radiochemistry lab southeastward to the Stepan Company Building No. 20 and northward toward the new MISS soil load-out spur (Sub-Cluster No. 12B-2). The remedial action involved the excavation of approximately 56,901 tons of soil that were loaded into trucks for transport to the MISS. The nearest commercial buildings are located approximately 295 ft (90 m) north of Cluster No. 12B-1. The nearest residences are located approximately 395 ft (120 m) west and west-southwest of Sub-Cluster No. 12B-1. The nearest commercial buildings are located approximately 115 ft (35 m) south and south-southwest of Cluster No. 12B-2. The nearest residences are located approximately 410 ft (125 m) northeast and north-northeast of Sub-Cluster No. 12B-2.

- The performance of remedial actions at the vicinity residential property located at 61 Trudy Drive (TR-1) and the commercial property at 205 Main Street (205M-1) in the Borough of Lodi and at the vicinity residential properties at 126, 130, and 146 West Central Avenue (WC-1) in the Borough of Maywood. The remedial actions involved the excavation of approximately 7,540 tons of soil from the five (5) vicinity properties that were loaded into trucks for transport to the MISS. The nearest commercial buildings are located approximately 245 ft (75 m) southwest and south-southwest and the nearest residences are located approximately 33 ft (10 m) northeast and southeast of 61 Trudy Drive in Lodi. The nearest commercial buildings are located approximately 50 ft (15 m) north through west and the nearest residences are located approximately 295 ft (90 m) southeast of 205 Main Street in Lodi. The nearest commercial buildings are located approximately 245 ft (75 m) south-southeast and the

nearest residences are located approximately 115 ft (35 m) north, north-northeast, and northeast of WC-1 in Maywood.

- The operation of the exhaust system for the soil sample preparation laboratory located in the on-site radiochemistry laboratory at the MISS. Soil samples collected for the various soil load-outs at the MISS from excavations performed at the vicinity properties were brought to this laboratory to prepare the samples for radiological analysis. The individual soil samples were dried and then ground before placing the soil into sealed containers. The grinding operations were performed on a downdraft table. Air from the downdraft table is routed to a high efficiency particulate air (HEPA) filter and then exhausted into the general room air of the preparation laboratory. The emissions of particulates to the ambient air from the grinding operations in the soil sample preparation laboratory are nil.

The calculation is performed using the U.S. Environmental Protection Agency (EPA) Clean Air Act Assessment Package - 1988 (CAP88-PC), Version 4.0.1.17 model (Ref. 9.1) to estimate air doses to the population and hypothetical maximally exposed individuals. The radioactive particulate release rates from in situ wind erosion and other load-out and remediation/excavation activities are calculated using EPA's Compilation of Air Pollutant Emission Factors - Volume 1: Stationary Point and Area Sources, also known as AP-42 (Ref. 9.2). The AP-42 expressions used to perform these calculations are provided in the "Equations" section of this calculation. The actual calculations are performed using an Excel spreadsheet, the results of which are provided in Attachment A.

Radionuclide emission rates are based on the particulate release rates and average radionuclide source concentrations based on sample measurements. Source concentrations for isotopes of uranium (U_{238}), radium (Ra_{226}), and thorium (Th_{232}) are based on average values for in situ soil (Ref. 9.9) and weighted average values measured during the load-outs. Radionuclide source concentrations for the evaluation of the vicinity property impacts are based on average values at the 95 percent confidence level. Unknown radionuclide source concentrations are based on the known source concentrations assuming secular equilibrium in the decay chains (Ref. 9.6).

The CAP88-PC computer model is a set of computer programs, databases, and associated utility programs developed by the EPA for estimation of dose and risk from radionuclide emissions to air. CAP88-PC is used for the purpose of demonstrating compliance with Subpart H of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) as codified in 40 CFR 61.93a. CAP88-PC performs dose and risk assessments for both collective populations and maximally-exposed individuals.

This computer code estimates the annual average dispersion of radionuclides released from up to six sources. The sources may be either elevated stacks or uniform area sources. All sources are modeled as if located at the same point. Uniform contamination is assumed for area sources. Plume rise can be calculated assuming either a momentum or buoyancy driven plume. Assessments are done for a circular grid of distances and directions with a radius of 80 kilometers around the facility. The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area.

CAP88-PC uses a modified version of the AIRDOS-EPA (Mo79) program to calculate environmental transport. Plume dispersion is based on the Gaussian plume equation of Pasquill as modified by Gifford, using sector-average concentrations. Plume rise is calculated using either Rupp's equation for momentum dominated plume rise or Briggs equation for buoyancy dominated plume rise. Dry deposition is handled using a proportionality constant applied to the ground-level concentration of the radionuclide and wet deposition is based on a scavenging coefficient related to the rainfall rate. Radionuclides are depleted from the plume by precipitation scavenging, dry deposition, and radioactive decay.

CAP88-PC uses a database of dose and risk factors provided in Federal Guidance Report 13 (FGR13, Ref. 9.3) for estimating dose and risk as implemented in the Oak Ridge National Laboratory DCFPAK Version 2.2 model. Dose and risk conversion factors include the effective dose equivalent calculated according to the methods in ICRP Publication Number 72 (Ref. 9.4). CAP88-PC Version 4 now implements the FGR 13 age-dependent dose and risk factors, where previous version of CAP88-PC only used adult dose and risk factors. The risk factors used are those for lifetime fatal cancer risk (mortality) per FGR 13. Dose and risk factors are provided for the pathways of: ingestion and inhalation intake; ground level immersion; and ground surface irradiation. Factors are further broken down by particle size, clearance category, chemical form, and gut-to-blood transfer factors. These factors are stored in a database for use by the program.
CAP88-PC calculates dose to the 25 internal organs modeled in FGR 13, in addition to the 50-year effective dose equivalent. Doses can be tabulated as a function of radionuclide, pathway, location, and organ.

For a given distance, the CAP88-PC model computes the annual effective dose equivalent for all compass directions. Specifically, the model computes the annual dose at a user-defined distance for all 22.5-degree compass point sectors (i.e., N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW). The CAP88-PC model computes an average sector concentration; thus, the annual dose computed for receptors at a given distance within a sector will be the same.

A review of land use surrounding the site and the prevailing wind directions was performed to select the appropriate receptors for inclusion in the modeling analyses. Analyses were performed separately for in situ wind erosion emissions, the soil load-outs, Cluster Nos. 10A, 12A, and 12B remedial actions, and the Lodi and Maywood residential remedial actions. The exhaust hood emissions were found to be negligible and thus, this source was not included in the modeling analyses. Where individual receptors are affected by more than one emission source, doses caused by those sources are added.

The individual (i.e., worker and resident) corresponding to the maximum effective dose equivalent is identified as the hypothetical maximally exposed individual. Because the annual dose received from airborne emissions is dependent on prevailing wind direction in addition to proximity to the site, the hypothetical maximally exposed individual is not necessarily the person nearest the site. The model was used to predict the annual effective dose at numerous receptors resulting from the combined impact of the above sources. Although the model determined the annual effective dose at numerous receptors, only the hypothetical maximally exposed resident and worker are discussed in this calculation.

Based on this information, residences and commercial properties located to the north, northeast, and east of the MISS along West Central Avenue were selected as the receptors of most concern for the MISS activities. Receptor locations in other compass directions such as west and west-southwest of the MISS (i.e., west of Route 17) were also selected for the analysis, along with commercial receptors south and southeast of the MISS.

The residential receptors relative to Cluster No. 10A are closest in the northeast and east-northeast directions with some residences in the west and east directions. The commercial receptors are found in essentially all directions. The residential receptors relative to Cluster No. 12A are closest in the northeast and north-northeast directions while the commercial receptors are found in the northeast and east-northeast directions. The residential receptors relative to Cluster No. 12B are closest in the west and west-southwest directions while the commercial receptors are closest in the south, south-southwest, and southwest directions.

The residential receptors relative to 61 Trudy Drive, Lodi are closest in the northeast and southeast directions with the commercial receptors being closest in the south through southwest directions. The residential receptors relative to 205 Main Street, Lodi are closest in the east and east-southeast directions while the commercial receptors are closest in the east, north, and north-northeast directions. The residential receptors relative to WC-1 in Maywood are closest in the north through east directions while the commercial receptors are closest in the south, west, and west-northwest directions.

These receptor locations were used to establish the downwind distances that were input into the model to capture the maximally exposed individual (see Assumption 3.4 below for specific receptor locations). Cluster 10A was divided into three (3) sub-clusters (i.e., 10A-1, 10A-2, and 10B-3), Cluster 12A was divided into two (2) sub-clusters (i.e., 12A-1 and 12A-2) and Cluster 12B was divided into two (2) sub-clusters (i.e., 12B-1 and 12B-2) for the purpose of establishing the receptor distances given that the excavations are spread out over a large area.

3. ASSUMPTIONS

3.1 The contamination is uniformly distributed over a symmetrical land area with the concentration in respirable particles (i.e., PM-10) equaling the bulk contamination concentration in the surface material.

3.2 The erodibility classification of the site is “limited reservoir” characterized by a finite availability of erodible particles impregnated with non-erodible elements.

3.3 Emissions due to wind erosion and mechanical entrainment processes are continuous and steady state.

3.4 The locations of potential maximally exposed individuals (i.e., nearest residents and off-site workers) are based on a central point representative of each of the MISS site and nearby property emission areas (Ref. 9.12) as follows:

Area	Distance (meters)	Direction
MISS In Situ Wind Erosion (covered & bare soil/load-out piles)		
Residents:	150	West
	150	West-southwest
	165	West-northwest
	195	Southwest
	195	East-northeast
	210	North-northeast
	225	Northeast
	255	South-southwest
Workers:	135	North
	150	West
	150	West-southwest
	150	North-northwest
	150	Northeast
	150	North-northeast
	165	West-northwest
	165	East-southeast
	165	Southeast
	255	South-southeast
	255	East
	300	South

Area	Distance (meters)	Direction
MISS Soil Load-outs		
Residents:	110	East-northeast
	135	East
	135	North-northeast
	140	North
	140	Northeast
	240	West-southwest
	245	West
	270	Southwest
	310	East-southeast
Workers:	70	North-northeast
	70	North
	70	Northeast
	120	Northwest
	120	North-northwest
	135	South-southeast
	180	East-southeast
	190	Southeast
	240	West-southwest
	245	West
	280	South
Cluster No. 10A-1		
Residents:	180	Northeast
	185	West
	190	West-southwest
	200	East-northeast
	215	North-northeast
	220	Southwest
	250	East
Workers:	125	East-southeast
	125	Southeast
	150	North-northeast
	150	Northeast
	160	North
	185	North-northwest
	185	West
	190	West-southwest
	200	East
	220	South-southeast
	225	South
	225	West-northwest

Area	Distance (meters)	Direction
Cluster No. 10A-2		
Residents:	195	West
	195	Southwest
	200	West-southwest
	230	West-northwest
	255	Northwest
	255	South-southwest
	275	Northeast
	275	North-northeast
Workers:	55	Northeast
	85	South
	85	South-southeast
	100	East-northeast
	100	East
	110	East-southeast
	150	Southeast
Cluster No. 10A-3		
Residents:	250	West-southwest
	250	West
	265	Southwest
	305	Northeast
	305	North-northeast
	325	North
Workers:	10	East
	10	East-northeast
	10	East-southeast
	30	Southwest
	30	South-southwest
	35	West-northwest
	35	West
	35	South
	40	North
	40	North-northeast
	40	North-northwest
	45	South-southeast
Cluster No. 12A-1		
Residents:	40	Northeast
	65	East-northeast
	65	East
	90	North-northeast
	100	North
	120	North-northwest
	135	East-southeast

Area	Distance (meters)	Direction
Workers:	50	North
	50	North-northwest
	130	Southeast
	140	South-southeast
	150	South
	170	Northwest
Cluster No. 12A-2		
Residents:	50	Northeast
	50	North-northeast
	50	North
	55	East-northeast
	65	North-northwest
	65	East
	85	East-southeast
Workers:	60	South-southeast
	65	Southeast
	90	South
	105	Southwest
	110	North-northwest
	110	Northwest
	120	South-southwest
Cluster No. 12B-1		
Residents:	120	West
	120	West-southwest
	135	Southwest
	190	North-northwest
	195	Northeast
	200	East-northeast
	220	East
Workers:		
	90	North
	100	North-northeast
	115	West
	120	West-southwest
	135	Southwest
	135	East-northeast
	150	Northeast
	170	East
Cluster No. 12B-2		
Residents:	125	Northeast
	125	North-northeast
	135	East-northeast
	135	North
	170	East
	220	North-northwest

Area	**Distance** (meters)	**Direction**
Workers:	35	South
	35	South-southwest
	55	South-southeast
	65	East
	65	East-southeast
	65	Southeast
	145	North-northwest
	145	North
61 Trudy Drive, Lodi		
Residents:	10	Northeast
	10	Southeast
	30	South-southwest
	30	Southwest
	35	Northwest
	35	North-northwest
	40	South
	40	East
	50	South-southeast
	55	West
Workers:	75	Southwest
	75	South-southwest
	90	South
	120	South-southeast
205 Main Street, Lodi		
Residents:	90	Southeast
	100	East-southeast
	165	South
	150	Northeast
	150	East-northeast
	200	South-southeast
	260	West
Workers:	15	West
	15	West-northwest
	15	Northwest
	15	North-northwest
	15	North
	45	South
	45	South-southeast
	100	North-northeast
	100	Northeast
	120	East

Area	Distance (meters)	Direction
WC-1, Maywood		
Residents:	35	North
	35	North-northeast
	35	Northeast
	40	East-northeast
	45	East
	50	North-northwest
	65	East-southeast
Workers:	75	South-southeast
	100	South
	100	West-northwest
	100	Northwest
	120	South-southwest
	120	Southwest

3.5 The occupancy factor for the residents is 100 percent while the occupancy factor for workers is 27 percent (i.e., 45-hour work-week x 52 weeks per year = 2,340 hours/8,760 hours).

3.6 The number of disturbances relative to wind erosion of in situ soil is 4 times per week for the entire year for a total of 208 disturbances per year (4 x 52 weeks/yr). The highest 2-minute wind speed for a given week is conservatively used for the 4 disturbances per week. A separate calculation is performed for soils covered by vegetation/gravel and for bare soils and load-out piles.

3.7 Daughters in the decay chain of radionuclides are considered to be in secular equilibrium with their parents until a radionuclide in the chain is encountered with a measured concentration, whereupon the measured concentration is used (Ref. 9.6). Although the direct emission of radon gas is not considered in the analysis, the daughters of radon generated by the decay of Ra-226 in dust offsite is accounted for by the model in the computation of the effective dose equivalents for the various internal and external exposure pathways.

3.8 The fastest mile wind speed required as input by the AP-42 methodology for the calculation of in situ wind erosion emissions is reasonably represented by the maximum 2-minute wind speed from Ref. 9.5.

3.9 The 2006-2015 Teterboro, New Jersey meteorological data are reasonably representative of conditions at the MISS site and vicinity properties in both the spatial and temporal sense.

4. EQUATIONS

4.1 In Situ Wind Erosion Emissions: (Ref. 9.2, Section 13.2.5, "Industrial Wind Erosion")

The wind speed profile in the surface boundary layer is found to follow a logarithmic distribution:

$$u(z) = \frac{u^*}{0.4} \ln\frac{z}{z_o} \qquad (z > z_o) \qquad (1)$$

where:

u = wind speed (cm/s)
u^* = friction velocity (cm/s)
z = height above test surface (cm)
z_o = roughness height (cm)
0.4 = von Karman's constant (dimensionless)

The friction velocity (u^*) is a measure of wind shear stress on the erodible surface, as determined from the slope of the logarithmic velocity profile. The roughness height (z_o) is a measure of the roughness of the exposed surface as determined from the y intercept of the velocity profile (i.e., the height at which the wind speed is zero).

Emissions generated by wind erosion are also dependent on the frequency of disturbance of the erodible surface because each time that a surface is disturbed, its erosion potential is restored. A disturbance is defined as an action that results in the exposure of fresh surface material. On a storage pile, this would occur whenever aggregate material is either added to or removed from the old surface. A disturbance of an exposed area may also result from the turning of surface material to a depth exceeding the size of the largest pieces of material present.

The emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance may be expressed in units of grams per square meter (g/m^2) per year as follows:

$$\text{Emission factor} = k \sum_{i=1}^{N} P_i \qquad (2)$$

where:

k = particle size multiplier
N = number of disturbances per year
P_i = erosion potential corresponding to the observed (or probable) fastest mile of wind for the period between disturbances (g/m^2)

The particle size multiplier (k) for Equation 2 varies with aerodynamic particle size as follows:

Aerodynamic Particle Size Multipliers For Equation 2			
30 μm	<15 μm	<10 μm	<2.5 μm
1.0	0.6	0.5	0.075

This distribution of particle size within the under 30 micrometer (μm) fraction is comparable to the distributions reported for other fugitive dust sources where wind speed is a factor. This is illustrated, for example, in the distributions for batch and continuous drop operations encompassing a number of test aggregate materials (see AP-42 Section 13.2.4).

In calculating emission factors, each area of an erodible surface that is subject to a different frequency of disturbance should be treated separately. For a surface disturbed daily, N = 365 per year and for a surface disturbance once every 6 months, N = 2 per year.

The erosion potential function for a dry, exposed surface is:

$$P = 58\,(u^* - u_t^*)^2 + 25(u^* - u_t^*) \qquad (3)$$

$$P = 0 \text{ for } u^* \le u_t^*$$

where:

u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

Because of the nonlinear form of the erosion potential function, each erosion event must be treated separately. Equations 2 and 3 apply only to dry, exposed materials with limited erosion potential. The resulting calculation is valid only for a time period as long as or longer than the period between disturbances.

Threshold friction velocities for several surface types have been determined by field measurements with a portable wind tunnel. These values are presented below:

THRESHOLD FRICTION VELOCITIES

Material	Threshold Friction Velocity (m/s)	Roughness Height (cm)	Threshold Wind Velocity at 10 m (m/s)	
			z_o = Act	z_o = 0.5 cm
Overburden[a]	1.02	0.3	21	19
Scoria (roadbed material)[a]	1.33	0.3	27	25
Ground coal (surrounding coal pile)[a]	0.55	0.01	16	10
Uncrusted coal pile[a]	1.12	0.3	23	21
Scraper tracks on coal pile[a,b]	0.62	0.06	15	12
Fine coal dust on concrete pad[c]	0.54	0.2	11	10

[a] Western surface coal mine.
[b] Lightly crusted.
[c] Eastern power plant.

The fastest mile of wind for the periods between disturbances may be obtained from the monthly Local Climatological Data (LCD) summaries for the nearest reporting weather station that is representative of the site in question. These summaries report actual fastest mile values for each day of a given month. Because the erosion potential is a highly nonlinear function of the fastest mile, mean values of the fastest mile are inappropriate. The anemometer heights of reporting weather should be corrected to a 10-m reference height using Equation 1.

To convert the fastest mile of wind (u^+) from a reference anemometer height of 10 m to the equivalent friction velocity (u^*), the logarithmic wind speed profile may be used to yield the following equation:

$$u^* = 0.053\, u^+_{10} \qquad (4)$$

where:

u^* = friction velocity (m/s)
u^+_{10} = fastest mile of reference anemometer for period between disturbances (m/s)

This assumes a typical roughness height of 0.5 centimeters (cm) for open terrain. Equation 4 is restricted to large relatively flat piles or exposed areas with little penetration into the surface wind layer.

Implementation of the above procedure is carried out in the following steps:

1. Determine threshold friction velocity for erodible material of interest (see above table or determine from mode of aggregate size distribution);

2. Divide the exposed surface area into subareas of constant frequency of disturbance (N);

3. Tabulate fastest mile values (u^+) for each frequency of disturbance and correct them to 10 m (u^+) using Equation 1;

4. Convert fastest mile values (u_{10}) to equivalent friction velocities (u^*), taking into account (a) the uniform wind exposure of nonelevated surfaces, using Equation 4; and

5. Multiply the resulting emission factor for each subarea by the size of the subarea, and add the emission contributions of all subareas. Note that the highest 24-hour (hr) emissions would be expected to occur on the windiest day of the year. Maximum emissions are calculated assuming a single event with the highest fastest mile value for the annual period.

4.2 Drop Operations Emissions: (Ref. 9.2, Section 13.2.4, "Aggregate Handling and Storage Piles")

$$E = k\,(0.0032)[U/5]^{1.3}/\,[M/2]^{1.4} \qquad (5)$$

where:

E = emission factor (lb/ton)
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (mph)
M = material moisture content (%)

The particle size multiplier in Equation 5, k, varies with aerodynamic particle size range as follows:

Aerodynamic Particle Size Multiplier (k) For Equation 5				
< 30 μm	< 15 μm	< 10 μm	< 5 μm	< 2.5 μm
0.74	0.48	0.35	0.20	0.053

4.3 Radionuclide Emission Rates

The radionuclide source concentrations (S) for isotopes of uranium (U_{238}), radium (Ra_{226}), and thorium (Th_{232}) are based on average values for in situ soil that has vegetative cover or gravel (i.e., covered) from Ref. 9.9 and weighted average values measured for the excavated soil from the vicinity properties for the soil load-outs, which also comprises the bare soil stored in piles at the MISS for in situ wind erosion. Radionuclide source concentrations for the evaluation of the vicinity property impacts are based on average values at the 95 percent confidence level. These values are as follows:

Emission Source	S_{U238} (pCi/g)	S_{Ra226} (pCi/g)	S_{Th232} (pCi/g)
• In situ soil (covered)	27.5	4.30	24.8
• In situ soil (bare soil)	1.37	1.58	7.63
• MISS Soil Load-outs	1.37	1.58	7.63
• Clusters 10A, 12A, 12B	3.98	5.29	31.24
• Vicinity Properties (Lodi & Maywood)	3.98	5.29	31.24

Ratios of uranium isotopes are calculated from the percentage of activity of U_{238}, U_{234}, and U_{235} in natural uranium as these components make up total uranium. The percentage (P) of each isotope comprising total uranium activity (Ref. 9.10) is:

Emission Source	P_{U238}	P_{U234}	P_{U235}
All sources (%)	47.249	50.539	2.212

The values of S for total uranium, U_{234}, and U_{235} are then given by, for example:

$S_{Utot} = (S_{U238}/ P_{U238}) = (27.5/0.47249) =$ 58.2 pCi/g (In situ soil - covered)
$S_{U234} = (S_{Utot} \times P_{U234}) = (58.2$ pCi/g) x 0.50539 = 29.4 pCi/g (In situ soil - covered)
$S_{U235} = (S_{Utot} \times P_{U235}) = (58.2$ pCi/g) x 0.02212 = 1.29 pCi/g (In situ soil - covered)

The annual radionuclide emissions (R) are then the individual S values multiplied by the annual particulate emissions rate (E) for the in situ wind erosion and the other load-out and remediation/excavation activities (R = S x E). Unknown radionuclide source emission rates are based on the known source emission rates assuming secular equilibrium in the five decay chains (Ref. 9.6) as follows:

U_{238}	U_{234}	Ra_{226}	U_{235}	Th_{232}
$R_{Th234} = R_{U238}$	$R_{Th230} = R_{U234}$	$R_{Po218} = R_{Ra226}$	$R_{Th231} = R_{U235}$	$R_{Ra228} = R_{Th232}$
$R_{Pa234m} = R_{U238}$		$R_{Pb214} = R_{Po218}$	$R_{Pa231} = R_{Th231}$	$R_{Ac228} = R_{Ra228}$
$R_{Pa234} = 0.0013R_{Pa234m}$		$R_{Bi214} = R_{Po218}$	$R_{Ac227} = R_{Pa231}$	$R_{Th228} = R_{Ac228}$
		$R_{Po214} = R_{Bi214}$	$R_{Th227} = 0.9862R_{Ac227}$	$R_{Ra224} = R_{Th228}$
		$R_{Pb210} = R_{Bi214}$	$R_{Fr223} = 0.0138R_{Ac227}$	$R_{Po216} = R_{Ra224}$
		$R_{Bi210} = R_{Pb210}$	$R_{Ra223} = R_{Ac227}$	$R_{Pb212} = R_{Po216}$
		$R_{Po210} = R_{Bi210}$	$R_{Po215} = R_{Ra223}$	$R_{Bi212} = R_{Pb212}$
			$R_{Pb211} = R_{Po215}$	$R_{Po212} = 0.6407R_{Bi212}$
			$R_{Bi211} = R_{Po215}$	$R_{Tl208} = 0.3593R_{Bi212}$
			$R_{Po211} = 0.00273R_{Bi211}$	
			$R_{Tl207} = 0.99727R_{Bi211}$	

Secular equilibrium is a condition in which the parent species in a radioactive series has a much longer half-life than its succeeding species, such that there is no significant change in its concentration during the time interval over which the shorter-lived species attain their equilibria, whereupon all species appear to decay at the same rate.

Although the direct emission of radon gas is not considered in this analysis, the daughters of radon generated by the decay of Ra-226 (i.e., Rn-218 and Rn-222) and the decay of Ra-223 (i.e., Rn-219) and Ra-224 (i.e., Rn-220) in dust offsite is accounted for by the model in the computation of the effective dose equivalents for the various internal and external exposure pathways.

5. INPUT DATA

5.1 In Situ Soil Wind Erosion Emissions:

- k = 0.50 (PM-10) - (Ref. 9.2, Section 13.2.5)
- No. of Disturbances = 208 per year (See Assumption 3.6)
- Surface Area of MISS vegetative soil = 4,070 m^2 (Ref. 9.12)
- Surface Area of MISS bare soil = 5,683 m^2 (Ref. 9.12)
- Surface Area of Load-out Pile = 1560.8 m^2 (Ref. 9.12)
- Surface Area of gravel/crushed stone = 3,231 m^2 (Ref. 9.12)
- u^* = 1.02 m/sec - (Ref. 9.2, Section 13.2.5 – value for "overburden" from page 13.2.5-5)
- Anemometer Height = 10 m (Ref. 9.5)

Month	Week	Maximum 2-Minute Wind Speed (mph)[1]
Jan.	1	29
	2	22
	3	28
	4	29
Feb.	1	31
	2	26
	3	33
	4	26
Mar.	1	26
	2	29
	3	37
	4	23
	5	23
Apr.	1	32
	2	25
	3	23
	4	35
May	1	22
	2	24
	3	21
	4	23
	5	23
Jun.	1	20
	2	22
	3	26
	4	23
Jul.	1	22
	2	24
	3	22
	4	24
	5	24
Aug.	1	23
	2	21

Month	Week	Maximum 2-Minute Wind Speed (mph)[1]
	3	21
	4	20
	5	20
Sep.	1	26
	2	21
	3	16
	4	22
Oct.	1	21
	2	22
	3	22
	4	28
Nov.	1	22
	2	28
	3	24
	4	18
Dec.	1	23
	2	16
	3	26
	4	24

1. Fastest mile wind speed required by the AP-42 methodology is represented by the maximum 2-minute wind speed from Ref. 9.5.

5.2 Drop Operations Emissions:

- k = 0.35 (PM-10) - (Ref. 9.2, Section 13.2.4)
- U = 6.8 mph - (Ref. 9.5)
- M =12.0 % - (Ref. 9.2, Section 13.2.4, Municipal Solid Waste Landfill Cover)

	Soil Moved (tons) (Ref. 9.14)	No. Times Dropped	Soil Handled (tons)	Surface Area (m^2)
• MISS Soil Load-outs	80,126	3	240,378	163.5 (Ref. 9.12)
• Cluster No. 10A-1	2,451	1	2,451	753 (Ref. 9.15)
• Cluster No. 10A-2	11,754	1	11,754	3,389 (Ref. 9.15)
• Cluster No. 10A-3	356	1	356	203 (Ref. 9.15)
• Cluster No. 12A-1	411	1	411	397 (Ref. 9.16)
• Cluster No. 12A-2	713	1	712	577 (Ref. 9.16)
• Cluster No. 12B-1	43,502	1	43,502	5,089 (Ref. 9.17)
• Cluster No. 12B-2	13,399	1	13,399	5,433 (Ref. 9.17)
• 61 Trudy Drive, Lodi	2,929	1	2,929	573 (Ref. 9.18)
• 205 Main Street, Lodi	4,322	1	4,322	879 (Ref. 9.19)
• WC-1, Maywood	289	1	289	238 (Ref. 9.20)

The “soil-handled” amounts account for the total tonnage of soil that is moved and the number of times that it is dropped. For example, the total amount of soil moved during the MISS soil load-outs was 80,126 tons, but it was handled or dropped 3 times for a total amount handled of 3 x 80,126 tons or 240,378 tons.

Upon arrival at the MISS, the soil in the dump trucks was emptied on the ground (first drop) at the dump ramp for the soil staging area and then placed into a soil stockpile located in the center of the staging area just north of the asphalt pavement using a front-end loader or excavator (second drop). A front-end loader was used to transport soil directly from the stockpiles into railcars containing liners (third drop). Thus, the soil load-out activities were represented by three drops to account for the entire soil transfer process at the MISS.

Not all of the soil excavated and stored at the MISS is loaded out in the same calendar year. The remaining volume of material is relatively similar each year due to the operational constraints and site storage limitations; thus, the potential dose from the previous year's excavations (being loaded out in the current NESHAP year, i.e. 3 drops) conservatively accounts for (overestimates) the potential dose from the soil placed in the storage pile (2 drops), but not loaded out in the current NESHAP year. Given that the calculated dose is very low, the USACE accepts this conservatism.

5.3 CAP88-PC Input Data

- Meteorological Data (2006-2015 Teterboro, NJ data, Ref. 9.11):

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	1.151	2.767	4.016	4.115	3.713	1.470	0.000
NNW	1.183	2.629	4.232	4.271	3.499	1.386	0.000
NW	1.029	2.193	3.773	3.767	3.269	1.302	0.000
WNW	1.197	2.469	3.428	3.545	3.307	1.399	0.000
W	1.160	2.365	3.288	3.264	2.961	1.329	0.000
WSW	1.132	2.433	3.042	3.261	3.073	1.222	0.000
SW	1.231	2.241	3.008	3.012	3.131	1.312	0.000
SSW	1.112	2.191	3.107	3.300	3.438	1.377	0.000
S	1.064	2.260	3.385	3.713	3.774	1.341	0.000
SSE	1.085	2.513	3.886	5.325	4.092	1.438	0.000
SE	1.184	2.656	3.992	6.110	4.173	1.499	0.000
ESE	1.162	2.457	3.994	6.094	4.132	1.508	0.000
E	1.149	2.674	4.093	5.609	3.991	1.547	0.000
ENE	1.100	2.653	4.372	5.209	4.035	1.601	0.000
NE	1.202	2.593	4.233	4.488	3.819	1.533	0.000
NNE	1.095	2.515	3.858	4.145	3.791	1.424	0.000

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.0137	0.0603	0.1566	0.3294	0.0901	0.3499	0.0000
NNW	0.0216	0.0782	0.1905	0.4511	0.0529	0.2056	0.0000
NW	0.0142	0.1134	0.1455	0.5173	0.0473	0.1623	0.0000
WNW	0.0377	0.1318	0.1421	0.4983	0.0522	0.1380	0.0000
W	0.0139	0.0973	0.1285	0.6019	0.0443	0.1140	0.0000
WSW	0.0179	0.0692	0.0937	0.6482	0.0397	0.1313	0.0000
SW	0.0145	0.0649	0.1050	0.5494	0.0541	0.2122	0.0000
SSW	0.0066	0.0477	0.0965	0.4611	0.0731	0.3151	0.0000
S	0.0069	0.0427	0.0913	0.3886	0.0705	0.4001	0.0000
SSE	0.0049	0.0417	0.0982	0.3761	0.1236	0.3556	0.0000
SE	0.0078	0.0405	0.1097	0.4642	0.1241	0.2537	0.0000
ESE	0.0119	0.0631	0.1315	0.4229	0.1185	0.2520	0.0000
E	0.0155	0.0751	0.1398	0.3673	0.1179	0.2844	0.0000
ENE	0.0242	0.0750	0.1434	0.3321	0.1436	0.2817	0.0000
NE	0.0072	0.0536	0.1135	0.3164	0.1256	0.3837	0.0000
NNE	0.0096	0.0546	0.1151	0.2955	0.1156	0.4096	0.0000
TOTAL	0.0117	0.0595	0.1215	0.4066	0.0977	0.3031	0.0000

- Annual average temperature = 55.6 ˚F (13.1 ˚C) - Ref. 9.5
- Annual precipitation = 37.6 inches (95.5 cm) - Ref. 9.5

- Radionuclide Emission Rates:

  - See Attachment A (Excel spreadsheet)

- Population Data Based on 2010 Census (Ref. 9.13):

  - 2000 population distribution adjusted for the 4.5 percent increase from 2000 to 2010 for the New York-New Jersey Area (see page 112)

- Individual Receptors:

Area	Distance (meters)	Direction
MISS In Situ Wind Erosion (covered & bare soil/load-out piles)		
Residents:	150	West
	150	West-southwest
	165	West-northwest
	195	Southwest
	195	East-northeast
	210	North-northeast
	225	Northeast
	255	South-southwest
Workers:	135	North
	150	West
	150	West-southwest
	150	North-northwest
	150	Northeast
	150	North-northeast
	165	West-northwest
	165	East-southeast
	165	Southeast
	255	South-southeast
	255	East
	300	South
MISS Soil Load-outs		
Residents:	110	East-northeast
	135	East
	135	North-northeast
	140	North
	140	Northeast
	240	West-southwest
	245	West
	270	Southwest
	310	East-southeast

Area	Distance (meters)	Direction
Workers:	70	North-northeast
	70	North
	70	Northeast
	120	Northwest

	120	North-northwest
	135	South-southeast
	180	East-southeast
	190	Southeast
	240	West-southwest
	245	West
	280	South
Cluster No. 10A-1		
Residents:	180	Northeast
	185	West
	190	West-southwest
	200	East-northeast
	215	North-northeast
	220	Southwest
	250	East
Workers:	125	East-southeast
	125	Southeast
	150	North-northeast
	150	Northeast
	160	North
	185	North-northwest
	185	West
	190	West-southwest
	200	East
	220	South-southeast
	225	South
	225	West-northwest
Cluster No. 10A-2		
Residents:	195	West
	195	Southwest
	200	West-southwest
	230	West-northwest
	255	Northwest
	255	South-southwest
	275	Northeast
	275	North-northeast
Workers:	55	Northeast
	85	South
	85	South-southeast
	100	East-northeast
	100	East
	110	East-southeast
	150	Southeast

Area	**Distance** (meters)	**Direction**
Cluster No. 10A-3		
Residents:	250	West-southwest
	250	West
	265	Southwest

	305	Northeast
	305	North-northeast
	325	North
Workers:	10	East
	10	East-northeast
	10	East-southeast
	30	Southwest
	30	South-southwest
	35	West-northwest
	35	West
	35	South
	40	North
	40	North-northeast
	40	North-northwest
	45	South-southeast
Cluster No. 12A-1		
Residents:	40	Northeast
	65	East-northeast
	65	East
	90	North-northeast
	100	North
	120	North-northwest
	135	East-southeast
Workers:	50	North
	50	North-northwest
	130	Southeast
	140	South-southeast
	150	South
	170	Northwest
Cluster No. 12A-2		
Residents:	50	Northeast
	50	North-northeast
	50	North
	55	East-northeast
	65	North-northwest
	65	East
	85	East-southeast
Workers:	60	South-southeast
	65	Southeast
	90	South
	105	Southwest

Area	**Distance** (meters)	**Direction**
	110	North-northwest
	110	Northwest
	120	South-southwest
Cluster No. 12B-1		

Residents:	120	West
	120	West-southwest
	135	Southwest
	190	North-northwest
	195	Northeast
	200	East-northeast
	220	East
Workers:		
	90	North
	100	North-northeast
	115	West
	120	West-southwest
	135	Southwest
	135	East-northeast
	150	Northeast
	170	East

Cluster No. 12B-2

Residents:	125	Northeast
	125	North-northeast
	135	East-northeast
	135	North
	170	East
	220	North-northwest
Workers:	35	South
	35	South-southwest
	55	South-southeast
	65	East
	65	East-southeast
	65	Southeast
	145	North-northwest
	145	North

61 Trudy Drive, Lodi

Residents:	10	Northeast
	10	Southeast
	30	South-southwest
	30	Southwest
	35	Northwest
	35	North-northwest
	40	South
	40	East
	50	South-southeast
	55	West

Area	**Distance** (meters)	**Direction**
Workers:	75	Southwest
	75	South-southwest
	90	South

	120	South-southeast
205 Main Street, Lodi		
Residents:	90	Southeast
	100	East-southeast
	150	Northeast
	150	East-northeast
	165	South
	200	South-southeast
	260	West
Workers:	15	West
	15	West-northwest
	15	Northwest
	15	North-northwest
	15	North
	45	South
	45	South-southeast
	100	North-northeast
	100	Northeast
	120	East
WC-1, Maywood		
Residents:	35	North
	35	North-northeast
	35	Northeast
	40	East-northeast
	45	East
	50	North-northwest
	65	East-southeast
Workers:	75	South-southeast
	100	South
	100	West-northwest
	100	Northwest
	120	South-southwest
	120	Southwest

6. CALCULATION

The actual radionuclide emission rate calculations for the soil handling activities are performed using an Excel spreadsheet, a printout of which is provided in Attachment A. The dose calculations to identify the maximally exposed individual for the off-site transport of radioactive particulates are performed by the CAP88-PC model, the output of which is provided on pages 33-186.

7. RESULTS

The CAP88-PC output for the annual doses to the maximally exposed individuals (MEI) and population (POP) within 80 km of MISS is provided on pages 33 - 186 as follows:

Release Area	Page Numbers	
	MEI	POP
MISS Soil Load-outs	33 - 39	110 - 116
Cluster No. 10A-1	40 - 46	117 – 123
Cluster No. 10A-2	47 - 53	124 – 130
Cluster No. 10A-3	54 - 60	131 – 137
Cluster No. 12A-1	61 - 67	138 – 144
Cluster No. 12A-2	68 - 74	145 – 151
Cluster No. 12B-1	75 - 81	152 - 158
Cluster No. 12B-2	82 - 88	159 - 165
61 Trudy Drive, Lodi	89 - 95	166 – 172
205 Main Street, Lodi	96 - 102	173 – 179
WC-1, Maywood	103 - 109	180 – 186

As stated earlier, analyses are performed separately for the various release areas given the differences in receptor locations most affected by each of these areas. Where individual receptors are affected by more than one emission source, doses caused by those sources are added. The individual receptor locations (i.e., nearest residences and workers) are highlighted in yellow in the CAP88-PC output in the tables labeled INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y).

The MEI doses are summarized in Table 7-1, first by individual activities and then for all activities combined. The MEI site doses are the result of the combination of doses from the individual activities causing the highest dose at a particular receptor.

For the maximally exposed resident, no other areas were found to contribute to the maximum dose for the primary contributor (i.e., Vicinity Residential Property TR-1) due to the isolated location of Vicinity Property TR-1 relative to the other clusters.

For the maximally exposed worker, five other sub-clusters were found to contribute to the maximum dose for the primary contributor (i.e., MISS Soil Load-outs). The Sub-Cluster No. 10A-1 contributes 1.67E-05 mrem/yr, Sub-Cluster 10A-2 contributes 3.24E-05, Sub-Cluster 12A-1 contributes 2.97E-05, Sub-Cluster No. 12B-1 contributes 2.70E-04 mrem/yr, and Sub-Cluster No. 12B-2 contributes 1.11E-04 mrem/yr to the maximum dose caused by MISS Soil Load-outs (i.e., 1.62E-03 mrem/yr) for a total dose of 2.08E-03 mrem/yr. All other sub-clusters contribute negligibly to the maximum dose.

Table 7-1
MEI Annual Effective Doses

Receptor	Location	Annual Dose Rate[1] (mrem/yr)	Occupancy Factor (%)	Annual Effective Dose (mrem)
MISS Soil Load-outs:				
• Population (person-rem)	N/A	2.63E-03	N/A	2.63E-03
• Maximally Exposed Resident	140 m N	1.6E-03	100	1.6E-03
• Maximally Exposed Worker	70 m N	6.0E-03	27	1.62E-03
Cluster No. 10A-1				
• Population (person-rem)	N/A	1.07E-04	N/A	2.63E-03
• Maximally Exposed Resident	180 m NE	2.3E-05	100	2.3E-05
• Maximally Exposed Worker	125 m SE	5.3E-05	27	1.43E-05
Cluster No. 10A-2				
• Population (person-rem)	N/A	5.14E-04	N/A	5.14E-04
• Maximally Exposed Resident	275 m NNE	8.9E-05	100	8.9E-05
• Maximally Exposed Worker	55 m NE	1.1E-03	27	2.97E-04
Cluster No. 10A-3				
• Population (person-rem)	N/A	1.56E-05	N/A	1.56E-05
• Maximally Exposed Resident	305 m NNE	1.3E-05	100	1.3E-05
• Maximally Exposed Worker	10 m ESE	6.9E-04	27	1.86E-04
Cluster No. 12A-1				
• Population (person-rem)	N/A	1.80E-05	N/A	1.80E-05
• Maximally Exposed Resident	40 m NE	6.6E-05	100	6.6E-05
• Maximally Exposed Worker	50 m N	7.8E-05	27	2.11E-05
Cluster No. 12A-2				
• Population (person-rem)	N/A	3.12E-05	N/A	3.12E-05
• Maximally Exposed Resident	50 m N	1.2E-04	100	1.2E-04
• Maximally Exposed Worker	60 m SSE	7.8E-05	27	2.11E-05
Cluster No. 12B-1				
• Population (person-rem)	N/A	1.91E-03	N/A	1.91E-03
• Maximally Exposed Resident	135 m SW	3.9E-04	100	3.9E-04
• Maximally Exposed Worker	90 m N	2.1E-03	27	5.67E-04
Cluster No. 12B-2				
• Population (person-rem)	N/A	5.87E-04	N/A	5.87E-04
• Maximally Exposed Resident	125 m NNE	4.3E-04	100	4.3E-04
• Maximally Exposed Worker	35 m S	4.5E-03	27	1.22E-03
61 Trudy Drive, Lodi (TR-1)				
• Population (person-rem)	N/A	1.28E-04	N/A	1.28E-04
• Maximally Exposed Resident	10 m SE	8.4E-03	100	8.4E-03
• Maximally Exposed Worker	90 m S	3.1E-04	27	8.37E-05
205 Main Street, Lodi (205M-1)				
• Population (person-rem)	N/A	1.90E-04	N/A	1.90E-04
• Maximally Exposed Resident	90 m SE	2.4E-04	100	2.4E-04
• Maximally Exposed Worker	15 m N	5.0E-03	27	1.35E-03
WC-1, Maywood				
• Population (person-rem)	N/A	1.27E-05	N/A	1.27E-05
• Maximally Exposed Resident	35 m N	1.0E-04	100	1.0E-04
• Maximally Exposed Worker	75 m SSE	2.2E-05	27	5.94E-06
Total Site				
• **Population (person-rem)**	**N/A**	**6.14E-03**	**N/A**	**6.14E-03**
• **Maximally Exposed Resident**	**10 m SE of Vicinity Property TR-1**	**8.4E-03**	**100**	**8.4E-03**
• **Maximally Exposed Worker**	**70 m N of MISS Soil Load-outs**	**7.7E-03**	**27**	**2.08E-03**

1. Note that the Annual Dose Rate values reported in the table for the maximally exposed resident and worker are taken from the CAP88-PC output, which is reported to one decimal place (see Section 10, CAP88-PC Output).

The maximum annual effective doses are almost entirely the result of the internal doses from the inhalation of dust particles and the ingestion of plant borne dust. The air immersion in the dust plume and ground surface irradiation from dust deposition pathways contributes a negligible amount to the total dose. As an illustration, below is CAP88-PC output that shows the percent contribution of the various pathways to the total effective dose, based on the dose calculated at the closest distance from the MISS Load-outs analyzed (no actual receptor at this location):

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected. Individual (mrem)
INGESTION	1.42E-04
INHALATION	5.64E-03
AIR IMMERSION	6.36E-08
GROUND SURFACE	5.72E-04
INTERNAL	5.78E-03
EXTERNAL	5.72E-04
TOTAL	6.35E-03

The “Internal” dose is the sum of the “Ingestion” and “Inhalation” pathways while the “External” dose is the sum of the “Air Immersion” and “Ground Surface” pathways.

8. CONCLUSIONS

The annual effective dose to the public within 80 km of MISS from airborne particulate releases during 2015 was **6.14E-03 person-rem**. The annual effective dose to the maximally exposed resident (located SE of Vicinity Property TR-1) was **8.4E-03 mrem** while the annual effective dose to the maximally exposed worker (located north of the MISS Soil Loadouts) was **2.08E-03 mrem** during 2015. These annual effective doses are due primarily to inhalation of airborne particulate releases.

These doses are well below the NESHAPS, Subpart H standard of 10 mrem/yr (40 CFR 61.92).

9. REFERENCES

9.1 Rosnick, Reid, “CAP88-PC Version 4.0 User Guide.” Prepared for the U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington, D.C by Trinity Engineering Associates, Inc., August 2014.

9.2 U. S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources", 5th Edition, AP-42, November 2006 (Sections 13.2.4 and 13.2.5).

9.3 U. S. Environmental Protection Agency, Federal Guidance Report 13, “Cancer Risk Coefficients for Environmental Exposure to Radionuclides”, EPA-402-R-99-001, Office of Radiation and Indoor Air, Washington, D.C, 1999.

9.4 ICRP72 International Commission on Radiological Protection, “Age Dependent Doses to Members of the Public from Intake of Radionuclides, Part 5. Compilation of Ingestion and Inhalation Dose Coefficients” ICRP Publication 72, Pergamon Press, Oxford, 1996.

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9.7 U.S. Environmental Protection Agency, “Rapid Assessment of Exposure to Particulate Emissions from Surface Contaminated Sites”. EPA Report No. EPA-600/8-85/002, Office of Health and Environmental Assessment, Washington, D.C., February, 1985.

9.8 U.S. Environmental Protection Agency, “Estimation of Impacts from Area Sources of Particulate Matter Emissions at Superfund Sites”. EPA Report No. EPA-451/R-93/004, Office of Air Quality Planning and Standards, Research Triangle Park, NC, April, 1993.

9.9 Bechtel National, Inc. (BNI), “Characterization Report for the Maywood Interim Storage Site, Maywood, New Jersey”. DOE/OR/20722-139, Oak Ridge, TN, June, 1987.

9.10 Bechtel National, Inc. (BNI), “Natural Uranium Specific Activity”, 14501-191-CV-005, Rev. 2, Oak Ridge, TN, 1995.

9.11 2006-2015 Stability Array (STAR) data for Teterboro, NJ derived from the hourly Integrated Surface Database (ISD) supplied by the National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC using the Stability Array (STAR) program, Technology Transfer Network, Support Center for Regulatory Atmospheric Modeling, Meteorological Processors and Accessory Programs (http://www.epa.gov/ttn/scram/metobsdata_procaccprogs.htm).

9.12 Figure A5 - Site Location Plan, FUSRAP Maywood Superfund Site - Maywood, Lodi and Rochelle Park. Prepared by Environmental Solutions, April 2016.

9.13 U.S. Census Bureau, Population and Distribution Change: 2000 – 2010, 2010 Census Briefs, C2010BR-01, March 2011.

9.14 FUSRAP Maywood Superfund Site – 2015 Remedial Actions, Amount of Soil Excavated for Each Cluster/Vicinity Property, May 2016.

9.15 Drawing Number 10A-ASBLT_NESHAP2015.dwg, NESHAP 2015 Cluster 10A, 100 West Hunter Avenue, FUSRAP Maywood Superfund Site - Maywood, Lodi and Rochelle Park. Prepared by Cabrera Services, April 2016.

9.16 Drawing Number 12A-ASBLT_NESHAP2015.dwg, NESHAP 2015 Cluster 12A, 100 West Hunter Avenue, FUSRAP Maywood Superfund Site - Maywood, Lodi and Rochelle Park. Prepared by Cabrera Services, April 2016.

9.17 Drawing Number 12B-ASBLT_NESHAP2015.dwg, NESHAP 2015 Cluster 12B, 100 West Hunter Avenue, FUSRAP Maywood Superfund Site - Maywood, Lodi and Rochelle Park. Prepared by Cabrera Services, April 2016.

9.18 Drawing Number TR1-ASBLT_NESHAP2015.dwg, NESHAP 2015 TR-1, 61Trudy Drive, Lodi, NJ, FUSRAP Maywood Superfund Site - Maywood, Lodi and Rochelle Park. Prepared by Cabrera Services, April 2016.

9.19 Drawing Number 205M-ASBLT_NESHAP2015.dwg, NESHAP 2015 205M, 205 Main Street, Lodi, NJ, FUSRAP Maywood Superfund Site - Maywood, Lodi and Rochelle Park. Prepared by Cabrera Services, April 2016.

9.20 Drawing Number WC-1-ASBLT_NESHAP2015.dwg, NESHAP 2015 WC-1, 126/130/146 West Central Avenue, Maywood, NJ, FUSRAP Maywood Superfund Site - Maywood, Lodi and Rochelle Park. Prepared by Cabrera Services, April 2016.

10. CAP88-PC OUTPUT (Maximally Exposed Individual)

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                                C A P 8 8 - P C

                                Version 4.0


                    Clean Air Act Assessment Package - 1988


                         S Y N O P S I S   R E P O R T

                        Non-Radon Individual Assessment
                             Tue Apr 12 11:33:22 2016


        Facility:  Maywood Interim Storage Site - MISS Soil Load
         Address:  100 W. Hunter Avenue
            City:  Maywood
           State:  NJ          Zip:  07607


        Source Category:  Particulate Emission w radon daughters
            Source Type:  Area
          Emission Year:  2015
         DOSE Age Group:  Adult

        Comments:  CB&I for
                   U.S. Army Corps of Engineers


                 Committed Effective Dose Equivalent
                               (mrem)
                 ___________________________________

                              6.35E-03
                 ___________________________________


        At This Location:     70 Meters South

 Dataset Name:  missld15.
 Dataset Date:  Apr 12, 2016 11:32 AM
    Wind File:  C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
```

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 70 Meters South
Lifetime Fatal Cancer Risk: 1.97E-09

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	6.20E-04
UB_Wall	6.50E-04
Bone_Sur	4.55E-02
Brain	6.42E-04
Breasts	7.02E-04
St_Wall	6.49E-04
SI_Wall	6.39E-04
ULI_Wall	6.67E-04
LLI_Wall	7.33E-04
Kidneys	1.53E-03
Liver	1.89E-03
Muscle	7.18E-04
Ovaries	8.98E-04
Pancreas	6.11E-04
R_Marrow	2.94E-03
Skin	4.18E-03
Spleen	8.10E-04
Testes	9.95E-04
Thymus	6.35E-04
Thyroid	6.81E-04
GB_Wall	6.15E-04
Ht_Wall	6.43E-04
Uterus	6.32E-04
ET_Reg	1.17E-02
Lung_66	4.06E-02
Effectiv	6.35E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	2.0E-08	2.0E-08
Th-234	S	1.000	2.0E-08	2.0E-08
Pa-234m	B	0.000	2.0E-08	2.0E-08
Pa-234	M	1.000	2.6E-11	2.6E-11
U-234	M	1.000	2.2E-08	2.2E-08
Th-230	S	1.000	2.2E-08	2.2E-08
Ra-226	M	1.000	2.3E-08	2.3E-08
Po-218	B	0.000	2.3E-08	2.3E-08
Pb-214	M	1.000	2.3E-08	2.3E-08
Bi-214	M	1.000	2.3E-08	2.3E-08
Po-214	B	0.000	2.3E-08	2.3E-08
Pb-210	M	1.000	2.3E-08	2.3E-08
Bi-210	M	1.000	2.3E-08	2.3E-08
Po-210	B	0.000	2.3E-08	2.3E-08
U-235	M	1.000	9.5E-10	9.5E-10
Th-231	S	1.000	9.5E-10	9.5E-10
Pa-231	M	1.000	9.5E-10	9.5E-10
Ac-227	M	1.000	9.5E-10	9.5E-10
Th-227	S	1.000	9.4E-10	9.4E-10
Fr-223	M	1.000	1.3E-11	1.3E-11
Ra-223	M	1.000	9.5E-10	9.5E-10
Po-215	B	0.000	9.5E-10	9.5E-10
Pb-211	M	1.000	9.5E-10	9.5E-10
Bi-211	B	0.000	9.5E-10	9.5E-10
Tl-207	B	0.000	9.5E-10	9.5E-10
Po-211	B	0.000	2.6E-12	2.6E-12
Th-232	S	1.000	1.1E-07	1.1E-07
Ra-228	M	1.000	1.1E-07	1.1E-07
Ac-228	M	1.000	1.1E-07	1.1E-07
Th-228	S	1.000	1.1E-07	1.1E-07
Ra-224	M	1.000	1.1E-07	1.1E-07
Po-216	B	0.000	1.1E-07	1.1E-07
Pb-212	M	1.000	1.1E-07	1.1E-07
Bi-212	M	1.000	1.1E-07	1.1E-07
Po-212	B	0.000	7.3E-08	7.3E-08
Tl-208	B	0.000	4.1E-08	4.1E-08

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 163.50

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

70	110	120	135	140	180	190
240	245	270	280	310		

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	6.20E-04
UB_Wall	6.50E-04
Bone_Sur	4.55E-02
Brain	6.42E-04
Breasts	7.02E-04
St_Wall	6.49E-04
SI_Wall	6.39E-04
ULI_Wall	6.67E-04
LLI_Wall	7.33E-04
Kidneys	1.53E-03
Liver	1.89E-03
Muscle	7.18E-04
Ovaries	8.98E-04
Pancreas	6.11E-04
R_Marrow	2.94E-03
Skin	4.18E-03
Spleen	8.10E-04
Testes	9.95E-04
Thymus	6.35E-04
Thyroid	6.81E-04
GB_Wall	6.15E-04
Ht_Wall	6.43E-04
Uterus	6.32E-04
ET_Reg	1.17E-02
Lung_66	4.06E-02
Effectiv	6.35E-03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	1.42E-04
INHALATION	5.64E-03
AIR IMMERSION	6.36E-08
GROUND SURFACE	5.72E-04
INTERNAL	5.78E-03
EXTERNAL	5.72E-04
TOTAL	6.35E-03

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	3.37E-05
Th-234	1.01E-06
Pa-234m	1.22E-05
Pa-234	2.41E-07
U-234	4.34E-05
Th-230	2.11E-04
Ra-226	5.90E-05
Rn-222	4.67E-08
Po-218	8.35E-13
Pb-214	3.07E-05
At-218	3.10E-12
Bi-214	1.86E-07
Rn-218	3.80E-19
Po-214	4.13E-13
Tl-210	1.47E-12
Pb-210	2.99E-05
Bi-210	3.17E-06
Hg-206	1.60E-13
Po-210	4.65E-05
Tl-206	4.63E-12
U-235	2.45E-06
Th-231	7.78E-08
Pa-231	6.33E-05
Ac-227	4.80E-05
Th-227	5.78E-06
Fr-223	5.52E-09
Ra-223	4.37E-06
Rn-219	1.25E-07
Po-215	2.37E-12
Pb-211	7.87E-09
At-219	0.00E+00
Bi-215	1.86E-18
Bi-211	2.46E-10
Tl-207	2.65E-12
Po-211	4.50E-15
Th-232	2.02E-03
Ra-228	2.88E-04
Ac-228	5.10E-04
Th-228	2.74E-03
Ra-224	1.81E-04
Rn-220	7.91E-08
Po-216	5.36E-10
Pb-212	1.48E-05
Bi-212	1.83E-06
Po-212	0.00E+00
Tl-208	5.82E-08
TOTAL	6.35E-03

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	70	110	120	135	140	180	190
N	6.0E-03	2.5E-03	2.2E-03	1.7E-03	1.6E-03	1.0E-03	9.4E-04
NNW	1.2E-03	5.5E-04	4.8E-04	4.0E-04	3.8E-04	2.7E-04	2.5E-04
NW	7.3E-04	3.6E-04	3.2E-04	2.7E-04	2.6E-04	1.9E-04	1.8E-04
WNW	5.1E-04	2.7E-04	2.4E-04	2.1E-04	2.0E-04	1.6E-04	1.5E-04
W	1.1E-03	5.3E-04	4.6E-04	3.9E-04	3.7E-04	2.6E-04	2.5E-04
WSW	1.2E-03	5.4E-04	4.7E-04	4.0E-04	3.8E-04	2.7E-04	2.5E-04
SW	1.5E-03	6.8E-04	5.9E-04	4.9E-04	4.6E-04	3.2E-04	3.0E-04
SSW	2.9E-03	1.3E-03	1.1E-03	8.7E-04	8.2E-04	5.4E-04	4.9E-04
S	6.4E-03	2.7E-03	2.3E-03	1.8E-03	1.7E-03	1.1E-03	9.9E-04
SSE	4.7E-03	2.0E-03	1.7E-03	1.4E-03	1.3E-03	8.3E-04	7.5E-04
SE	3.9E-03	1.7E-03	1.4E-03	1.2E-03	1.1E-03	7.1E-04	6.5E-04
ESE	2.6E-03	1.1E-03	9.6E-04	7.9E-04	7.4E-04	4.9E-04	4.5E-04
E	3.2E-03	1.4E-03	1.2E-03	9.6E-04	9.0E-04	5.9E-04	5.4E-04
ENE	1.9E-03	8.4E-04	7.3E-04	6.0E-04	5.6E-04	3.8E-04	3.5E-04
NE	3.3E-03	1.4E-03	1.2E-03	9.9E-04	9.3E-04	6.0E-04	5.5E-04
NNE	4.6E-03	2.0E-03	1.7E-03	1.4E-03	1.3E-03	8.1E-04	7.4E-04

	Distance (m)				
Direction	240	245	270	280	310
N	6.3E-04	6.1E-04	5.2E-04	4.9E-04	4.2E-04
NNW	1.9E-04	1.9E-04	1.7E-04	1.7E-04	1.5E-04
NW	1.5E-04	1.5E-04	1.4E-04	1.3E-04	1.3E-04
WNW	1.3E-04	1.3E-04	1.2E-04	1.2E-04	1.1E-04
W	1.9E-04	1.9E-04	1.7E-04	1.6E-04	1.5E-04
WSW	1.9E-04	1.9E-04	1.7E-04	1.7E-04	1.5E-04
SW	2.2E-04	2.2E-04	1.9E-04	1.9E-04	1.7E-04
SSW	3.5E-04	3.4E-04	2.9E-04	2.8E-04	2.5E-04
S	6.6E-04	6.4E-04	5.4E-04	5.1E-04	4.4E-04
SSE	5.1E-04	5.0E-04	4.2E-04	4.0E-04	3.5E-04
SE	4.4E-04	4.3E-04	3.7E-04	3.5E-04	3.0E-04
ESE	3.2E-04	3.1E-04	2.7E-04	2.6E-04	2.3E-04
E	3.8E-04	3.6E-04	3.2E-04	3.0E-04	2.6E-04
ENE	2.6E-04	2.5E-04	2.2E-04	2.1E-04	1.9E-04
NE	3.8E-04	3.7E-04	3.2E-04	3.1E-04	2.7E-04
NNE	5.0E-04	4.9E-04	4.2E-04	3.9E-04	3.4E-04

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Tue May 03 09:05:58 2016

Facility: Maywood Interim Storage Site - Cluster 10A-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
8.55E-05

At This Location: 125 Meters South

Dataset Name: miss10A115.
Dataset Date: May 3, 2016 09:05 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 125 Meters South
Lifetime Fatal Cancer Risk: 2.65E-11

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	8.51E-06
UB_Wall	8.92E-06
Bone_Sur	6.19E-04
Brain	8.80E-06
Breasts	9.61E-06
St_Wall	8.90E-06
SI_Wall	8.77E-06
ULI_Wall	9.20E-06
LLI_Wall	1.02E-05
Kidneys	2.11E-05
Liver	2.55E-05
Muscle	9.83E-06
Ovaries	1.21E-05
Pancreas	8.39E-06
R_Marrow	4.16E-05
Skin	5.26E-05
Spleen	1.14E-05
Testes	1.34E-05
Thymus	8.71E-06
Thyroid	9.33E-06
GB_Wall	8.45E-06
Ht_Wall	8.82E-06
Uterus	8.68E-06
ET_Reg	1.57E-04
Lung_66	5.44E-04
Effectiv	8.55E-05

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	6.0E-10	6.0E-10
Th-234	S	1.000	6.0E-10	6.0E-10
Pa-234m	B	0.000	6.0E-10	6.0E-10
Pa-234	M	1.000	7.8E-13	7.8E-13
U-234	M	1.000	6.4E-10	6.4E-10
Th-230	S	1.000	6.4E-10	6.4E-10
Ra-226	M	1.000	8.0E-10	8.0E-10
Po-218	B	0.000	8.0E-10	8.0E-10
Pb-214	M	1.000	8.0E-10	8.0E-10
Bi-214	M	1.000	8.0E-10	8.0E-10
Po-214	B	0.000	8.0E-10	8.0E-10
Pb-210	M	1.000	8.0E-10	8.0E-10
Bi-210	M	1.000	8.0E-10	8.0E-10
Po-210	B	0.000	8.0E-10	8.0E-10
U-235	M	1.000	2.8E-11	2.8E-11
Th-231	S	1.000	2.8E-11	2.8E-11
Pa-231	M	1.000	2.8E-11	2.8E-11
Ac-227	M	1.000	2.8E-11	2.8E-11
Th-227	S	1.000	2.8E-11	2.8E-11
Fr-223	M	1.000	3.9E-13	3.9E-13
Ra-223	M	1.000	2.8E-11	2.8E-11
Po-215	B	0.000	2.8E-11	2.8E-11
Pb-211	M	1.000	2.8E-11	2.8E-11
Bi-211	B	0.000	2.8E-11	2.8E-11
Tl-207	B	0.000	2.8E-11	2.8E-11
Po-211	B	0.000	7.7E-14	7.7E-14
Th-232	S	1.000	4.7E-09	4.7E-09
Ra-228	M	1.000	4.7E-09	4.7E-09
Ac-228	M	1.000	4.7E-09	4.7E-09
Th-228	S	1.000	4.7E-09	4.7E-09
Ra-224	M	1.000	4.7E-09	4.7E-09
Po-216	B	0.000	4.7E-09	4.7E-09
Pb-212	M	1.000	4.7E-09	4.7E-09
Bi-212	M	1.000	4.7E-09	4.7E-09
Po-212	B	0.000	3.0E-09	3.0E-09
Tl-208	B	0.000	1.7E-09	1.7E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 753.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

125 150 160 180 185 190 200
215 220 225 250

Tue May 03 09:05:58 2016 SUMMARY
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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	8.51E-06
UB_Wall	8.92E-06
Bone_Sur	6.19E-04
Brain	8.80E-06
Breasts	9.61E-06
St_Wall	8.90E-06
SI_Wall	8.77E-06
ULI_Wall	9.20E-06
LLI_Wall	1.02E-05
Kidneys	2.11E-05
Liver	2.55E-05
Muscle	9.83E-06
Ovaries	1.21E-05
Pancreas	8.39E-06
R_Marrow	4.16E-05
Skin	5.26E-05
Spleen	1.14E-05
Testes	1.34E-05
Thymus	8.71E-06
Thyroid	9.33E-06
GB_Wall	8.45E-06
Ht_Wall	8.82E-06
Uterus	8.68E-06
ET_Reg	1.57E-04
Lung_66	5.44E-04
Effectiv	8.55E-05

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	2.96E-06
INHALATION	7.48E-05
AIR IMMERSION	8.43E-10
GROUND SURFACE	7.69E-06
INTERNAL	7.78E-05
EXTERNAL	7.69E-06
TOTAL	8.55E-05

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	3.29E-07
Th-234	9.98E-09
Pa-234m	1.19E-07
Pa-234	2.34E-09
U-234	4.24E-07
Th-230	2.05E-06
Ra-226	7.46E-07
Rn-222	5.23E-10
Po-218	9.35E-15
Pb-214	3.43E-07
At-218	3.47E-14
Bi-214	2.08E-09
Rn-218	8.12E-21
Po-214	4.60E-15
Tl-210	1.84E-14
Pb-210	4.18E-07
Bi-210	3.55E-08
Hg-206	1.79E-15
Po-210	5.54E-07
Tl-206	5.19E-14
U-235	2.40E-08
Th-231	7.57E-10
Pa-231	6.13E-07
Ac-227	4.64E-07
Th-227	5.58E-08
Fr-223	5.37E-11
Ra-223	4.24E-08
Rn-219	1.22E-09
Po-215	2.30E-14
Pb-211	7.61E-11
At-219	0.00E+00
Bi-215	2.12E-20
Bi-211	2.40E-12
Tl-207	2.45E-14
Po-211	4.78E-17
Th-232	2.77E-05
Ra-228	4.63E-06
Ac-228	6.99E-06
Th-228	3.73E-05
Ra-224	2.46E-06
Rn-220	1.08E-09
Po-216	7.34E-12
Pb-212	2.02E-07
Bi-212	2.49E-08
Po-212	0.00E+00
Tl-208	7.95E-10
TOTAL	8.55E-05

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	125	150	160	180	185	190	200
N	8.0E-05	5.7E-05	5.1E-05	4.1E-05	3.9E-05	3.7E-05	3.4E-05
NNW	1.7E-05	1.3E-05	1.1E-05	9.6E-06	9.2E-06	8.9E-06	8.2E-06
NW	1.1E-05	8.3E-06	7.6E-06	6.5E-06	6.3E-06	6.1E-06	5.7E-06
WNW	8.0E-06	6.3E-06	5.8E-06	5.1E-06	5.0E-06	4.8E-06	4.6E-06
W	1.6E-05	1.2E-05	1.1E-05	9.4E-06	9.0E-06	8.7E-06	8.1E-06
WSW	1.7E-05	1.2E-05	1.1E-05	9.5E-06	9.1E-06	8.8E-06	8.2E-06
SW	2.1E-05	1.6E-05	1.4E-05	1.2E-05	1.1E-05	1.1E-05	1.0E-05
SSW	3.9E-05	2.8E-05	2.5E-05	2.1E-05	2.0E-05	1.9E-05	1.7E-05
S	8.5E-05	6.1E-05	5.4E-05	4.3E-05	4.1E-05	3.9E-05	3.6E-05
SSE	6.4E-05	4.5E-05	4.0E-05	3.2E-05	3.1E-05	2.9E-05	2.7E-05
SE	5.3E-05	3.8E-05	3.4E-05	2.8E-05	2.6E-05	2.5E-05	2.3E-05
ESE	3.5E-05	2.5E-05	2.3E-05	1.9E-05	1.8E-05	1.7E-05	1.6E-05
E	4.4E-05	3.1E-05	2.8E-05	2.3E-05	2.2E-05	2.1E-05	1.9E-05
ENE	2.6E-05	1.9E-05	1.7E-05	1.4E-05	1.4E-05	1.3E-05	1.2E-05
NE	4.5E-05	3.2E-05	2.9E-05	2.3E-05	2.2E-05	2.1E-05	1.9E-05
NNE	6.2E-05	4.4E-05	3.9E-05	3.2E-05	3.0E-05	2.9E-05	2.6E-05

	Distance (m)			
Direction	215	220	225	250
N	2.9E-05	2.8E-05	2.7E-05	2.3E-05
NNW	7.5E-06	7.2E-06	7.0E-06	6.2E-06
NW	5.3E-06	5.2E-06	5.0E-06	4.5E-06
WNW	4.3E-06	4.2E-06	4.1E-06	3.8E-06
W	7.3E-06	7.1E-06	6.9E-06	6.1E-06
WSW	7.4E-06	7.2E-06	7.0E-06	6.1E-06
SW	9.0E-06	8.7E-06	8.4E-06	7.3E-06
SSW	1.5E-05	1.5E-05	1.4E-05	1.2E-05
S	3.1E-05	3.0E-05	2.9E-05	2.4E-05
SSE	2.4E-05	2.3E-05	2.2E-05	1.8E-05
SE	2.0E-05	1.9E-05	1.9E-05	1.6E-05
ESE	1.4E-05	1.3E-05	1.3E-05	1.1E-05
E	1.7E-05	1.6E-05	1.6E-05	1.3E-05
ENE	1.1E-05	1.0E-05	1.0E-05	8.5E-06
NE	1.7E-05	1.6E-05	1.6E-05	1.3E-05
NNE	2.3E-05	2.2E-05	2.1E-05	1.8E-05

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

C A P 8 8 - P C

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Tue May 03 09:07:51 2016

Facility: Maywood Interim Storage Site - Cluster 10A-2
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
1.62E-03

At This Location: 55 Meters South Southeast

Dataset Name: miss10A215.
Dataset Date: May 2, 2016 03:14 PM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 55 Meters South Southeast
Lifetime Fatal Cancer Risk: 5.05E-10

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	1.59E-04
UB_Wall	1.66E-04
Bone_Sur	1.13E-02
Brain	1.64E-04
Breasts	1.80E-04
St_Wall	1.66E-04
SI_Wall	1.64E-04
ULI_Wall	1.71E-04
LLI_Wall	1.88E-04
Kidneys	3.81E-04
Liver	4.61E-04
Muscle	1.84E-04
Ovaries	2.26E-04
Pancreas	1.56E-04
R_Marrow	7.46E-04
Skin	9.96E-04
Spleen	2.04E-04
Testes	2.51E-04
Thymus	1.62E-04
Thyroid	1.74E-04
GB_Wall	1.58E-04
Ht_Wall	1.65E-04
Uterus	1.62E-04
ET_Reg	3.00E-03
Lung_66	1.04E-02
Effectiv	1.62E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	2.9E-09	2.9E-09
Th-234	S	1.000	2.9E-09	2.9E-09
Pa-234m	B	0.000	2.9E-09	2.9E-09
Pa-234	M	1.000	3.7E-12	3.7E-12
U-234	M	1.000	3.1E-09	3.1E-09
Th-230	S	1.000	3.1E-09	3.1E-09
Ra-226	M	1.000	3.8E-09	3.8E-09
Po-218	B	0.000	3.8E-09	3.8E-09
Pb-214	M	1.000	3.8E-09	3.8E-09
Bi-214	M	1.000	3.8E-09	3.8E-09
Po-214	B	0.000	3.8E-09	3.8E-09
Pb-210	M	1.000	3.8E-09	3.8E-09
Bi-210	M	1.000	3.8E-09	3.8E-09
Po-210	B	0.000	3.8E-09	3.8E-09
U-235	M	1.000	1.3E-10	1.3E-10
Th-231	S	1.000	1.3E-10	1.3E-10
Pa-231	M	1.000	1.3E-10	1.3E-10
Ac-227	M	1.000	1.3E-10	1.3E-10
Th-227	S	1.000	1.3E-10	1.3E-10
Fr-223	M	1.000	1.9E-12	1.9E-12
Ra-223	M	1.000	1.3E-10	1.3E-10
Po-215	B	0.000	1.3E-10	1.3E-10
Pb-211	M	1.000	1.3E-10	1.3E-10
Bi-211	B	0.000	1.3E-10	1.3E-10
Tl-207	B	0.000	1.3E-10	1.3E-10
Po-211	B	0.000	3.7E-13	3.7E-13
Th-232	S	1.000	2.3E-08	2.3E-08
Ra-228	M	1.000	2.3E-08	2.3E-08
Ac-228	M	1.000	2.3E-08	2.3E-08
Th-228	S	1.000	2.3E-08	2.3E-08
Ra-224	M	1.000	2.3E-08	2.3E-08
Po-216	B	0.000	2.3E-08	2.3E-08
Pb-212	M	1.000	2.3E-08	2.3E-08
Bi-212	M	1.000	2.3E-08	2.3E-08
Po-212	B	0.000	1.5E-08	1.5E-08
Tl-208	B	0.000	8.1E-09	8.1E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 3389.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

55 85 100 110 150 195 200
230 255 275

Tue May 03 09:07:51 2016 SUMMARY
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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	1.59E-04
UB_Wall	1.66E-04
Bone_Sur	1.13E-02
Brain	1.64E-04
Breasts	1.80E-04
St_Wall	1.66E-04
SI_Wall	1.64E-04
ULI_Wall	1.71E-04
LLI_Wall	1.88E-04
Kidneys	3.81E-04
Liver	4.61E-04
Muscle	1.84E-04
Ovaries	2.26E-04
Pancreas	1.56E-04
R_Marrow	7.46E-04
Skin	9.96E-04
Spleen	2.04E-04
Testes	2.51E-04
Thymus	1.62E-04
Thyroid	1.74E-04
GB_Wall	1.58E-04
Ht_Wall	1.65E-04
Uterus	1.62E-04
ET_Reg	3.00E-03
Lung_66	1.04E-02
Effectiv	1.62E-03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	4.04E-05
INHALATION	1.43E-03
AIR IMMERSION	1.62E-08
GROUND SURFACE	1.46E-04
INTERNAL	1.48E-03
EXTERNAL	1.46E-04
TOTAL	1.62E-03

Tue May 03 09:07:51 2016 SUMMARY
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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	6.27E-06
Th-234	1.88E-07
Pa-234m	2.26E-06
Pa-234	4.46E-08
U-234	8.09E-06
Th-230	3.92E-05
Ra-226	1.30E-05
Rn-222	9.92E-09
Po-218	1.77E-13
Pb-214	6.52E-06
At-218	6.59E-13
Bi-214	3.98E-08
Rn-218	1.02E-19
Po-214	8.82E-14
Tl-210	2.26E-13
Pb-210	6.77E-06
Bi-210	6.76E-07
Hg-206	3.40E-14
Po-210	1.01E-05
Tl-206	9.85E-13
U-235	4.55E-07
Th-231	1.44E-08
Pa-231	1.17E-05
Ac-227	8.88E-06
Th-227	1.07E-06
Fr-223	1.02E-09
Ra-223	8.09E-07
Rn-219	2.31E-08
Po-215	4.37E-13
Pb-211	1.46E-09
At-219	0.00E+00
Bi-215	3.54E-19
Bi-211	4.55E-11
Tl-207	4.86E-13
Po-211	7.23E-16
Th-232	5.28E-04
Ra-228	7.84E-05
Ac-228	1.33E-04
Th-228	7.14E-04
Ra-224	4.72E-05
Rn-220	2.06E-08
Po-216	1.39E-10
Pb-212	3.85E-06
Bi-212	4.77E-07
Po-212	0.00E+00
Tl-208	1.52E-08
TOTAL	1.62E-03

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	55	85	100	110	150	195	200
N	1.3E-03	6.5E-04	5.1E-04	4.5E-04	2.9E-04	1.8E-04	1.8E-04
NNW	8.3E-04	3.0E-04	2.1E-04	1.6E-04	7.7E-05	5.7E-05	5.6E-05
NW	2.6E-04	1.2E-04	9.5E-05	8.3E-05	5.6E-05	4.5E-05	4.4E-05
WNW	2.5E-04	1.1E-04	8.4E-05	7.2E-05	4.7E-05	3.9E-05	3.8E-05
W	3.1E-04	1.5E-04	1.2E-04	1.1E-04	7.6E-05	5.6E-05	5.5E-05
WSW	4.1E-04	1.8E-04	1.4E-04	1.2E-04	7.7E-05	5.7E-05	5.6E-05
SW	5.9E-04	2.5E-04	1.9E-04	1.6E-04	9.2E-05	6.6E-05	6.4E-05
SSW	1.2E-03	4.7E-04	3.4E-04	2.8E-04	1.5E-04	1.0E-04	9.9E-05
S	1.5E-03	7.4E-04	5.7E-04	4.9E-04	3.1E-04	1.9E-04	1.9E-04
SSE	1.6E-03	6.8E-04	5.0E-04	4.2E-04	2.3E-04	1.5E-04	1.4E-04
SE	1.2E-03	5.4E-04	4.0E-04	3.4E-04	2.0E-04	1.3E-04	1.3E-04
ESE	1.0E-03	4.2E-04	3.1E-04	2.5E-04	1.4E-04	9.4E-05	9.1E-05
E	8.4E-04	4.0E-04	3.1E-04	2.6E-04	1.7E-04	1.1E-04	1.1E-04
ENE	8.9E-04	3.5E-04	2.5E-04	2.0E-04	1.1E-04	7.6E-05	7.3E-05
NE	1.1E-03	4.6E-04	3.4E-04	2.9E-04	1.7E-04	1.1E-04	1.1E-04
NNE	1.5E-03	6.5E-04	4.8E-04	4.0E-04	2.3E-04	1.5E-04	1.4E-04

	Distance (m)		
Direction	230	255	275
N	1.4E-04	1.2E-04	1.1E-04
NNW	4.9E-05	4.5E-05	4.3E-05
NW	4.0E-05	3.8E-05	3.6E-05
WNW	3.6E-05	3.4E-05	3.3E-05
W	4.9E-05	4.5E-05	4.2E-05
WSW	4.9E-05	4.5E-05	4.3E-05
SW	5.5E-05	5.0E-05	4.7E-05
SSW	8.2E-05	7.2E-05	6.6E-05
S	1.5E-04	1.3E-04	1.1E-04
SSE	1.2E-04	1.0E-04	9.1E-05
SE	1.0E-04	8.9E-05	8.0E-05
ESE	7.6E-05	6.7E-05	6.2E-05
E	8.8E-05	7.7E-05	7.0E-05
ENE	6.3E-05	5.6E-05	5.2E-05
NE	9.0E-05	7.8E-05	7.1E-05
NNE	1.1E-04	9.9E-05	8.9E-05

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Mon May 09 12:31:30 2016

Facility: Maywood Interim Storage Site - Cluster 10A-3
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent
(mrem)

9.64E-04

At This Location: 10 Meters South Southeast

Dataset Name: miss10A315.
Dataset Date: May 9, 2016 12:31 PM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

Mon May 09 12:31:30 2016 SYNOPSIS
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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 10 Meters South Southeast
Lifetime Fatal Cancer Risk: 3.01E-10

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	9.34E-05
UB_Wall	9.80E-05
Bone_Sur	6.56E-03
Brain	9.67E-05
Breasts	1.06E-04
St_Wall	9.77E-05
SI_Wall	9.63E-05
ULI_Wall	1.00E-04
LLI_Wall	1.10E-04
Kidneys	2.20E-04
Liver	2.67E-04
Muscle	1.08E-04
Ovaries	1.33E-04
Pancreas	9.20E-05
R_Marrow	4.30E-04
Skin	5.90E-04
Spleen	1.17E-04
Testes	1.48E-04
Thymus	9.56E-05
Thyroid	1.03E-04
GB_Wall	9.27E-05
Ht_Wall	9.69E-05
Uterus	9.53E-05
ET_Reg	1.79E-03
Lung_66	6.23E-03
Effectiv	9.64E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	8.7E-11	8.7E-11
Th-234	S	1.000	8.7E-11	8.7E-11
Pa-234m	B	0.000	8.7E-11	8.7E-11
Pa-234	M	1.000	1.1E-13	1.1E-13
U-234	M	1.000	9.3E-11	9.3E-11
Th-230	S	1.000	9.3E-11	9.3E-11
Ra-226	M	1.000	1.2E-10	1.2E-10
Po-218	B	0.000	1.2E-10	1.2E-10
Pb-214	M	1.000	1.2E-10	1.2E-10
Bi-214	M	1.000	1.2E-10	1.2E-10
Po-214	B	0.000	1.2E-10	1.2E-10
Pb-210	M	1.000	1.2E-10	1.2E-10
Bi-210	M	1.000	1.2E-10	1.2E-10
Po-210	B	0.000	1.2E-10	1.2E-10
U-235	M	1.000	4.1E-12	4.1E-12
Th-231	S	1.000	4.1E-12	4.1E-12
Pa-231	M	1.000	4.1E-12	4.1E-12
Ac-227	M	1.000	4.1E-12	4.1E-12
Th-227	S	1.000	4.0E-12	4.0E-12
Fr-223	M	1.000	5.7E-14	5.7E-14
Ra-223	M	1.000	4.1E-12	4.1E-12
Po-215	B	0.000	4.1E-12	4.1E-12
Pb-211	M	1.000	4.1E-12	4.1E-12
Bi-211	B	0.000	4.1E-12	4.1E-12
Tl-207	B	0.000	4.1E-12	4.1E-12
Po-211	B	0.000	1.1E-14	1.1E-14
Th-232	S	1.000	6.9E-10	6.9E-10
Ra-228	M	1.000	6.9E-10	6.9E-10
Ac-228	M	1.000	6.9E-10	6.9E-10
Th-228	S	1.000	6.9E-10	6.9E-10
Ra-224	M	1.000	6.9E-10	6.9E-10
Po-216	B	0.000	6.9E-10	6.9E-10
Pb-212	M	1.000	6.9E-10	6.9E-10
Bi-212	M	1.000	6.9E-10	6.9E-10
Po-212	B	0.000	4.4E-10	4.4E-10
Tl-208	B	0.000	2.5E-10	2.5E-10

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

Mon May 09 12:31:30 2016 SYNOPSIS
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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 203.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

10 30 35 40 45 250 265
305 325

Mon May 09 12:31:30 2016 SUMMARY
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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	9.34E-05
UB_Wall	9.80E-05
Bone_Sur	6.56E-03
Brain	9.67E-05
Breasts	1.06E-04
St_Wall	9.77E-05
SI_Wall	9.63E-05
ULI_Wall	1.00E-04
LLI_Wall	1.10E-04
Kidneys	2.20E-04
Liver	2.67E-04
Muscle	1.08E-04
Ovaries	1.33E-04
Pancreas	9.20E-05
R_Marrow	4.30E-04
Skin	5.90E-04
Spleen	1.17E-04
Testes	1.48E-04
Thymus	9.56E-05
Thyroid	1.03E-04
GB_Wall	9.27E-05
Ht_Wall	9.69E-05
Uterus	9.53E-05
ET_Reg	1.79E-03
Lung_66	6.23E-03
Effectiv	9.64E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	1.90E-05
INHALATION	8.58E-04
AIR IMMERSION	9.63E-09
GROUND SURFACE	8.66E-05
INTERNAL	8.77E-04
EXTERNAL	8.66E-05
TOTAL	9.64E-04

Mon May 09 12:31:30 2016 SUMMARY
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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	3.71E-06
Th-234	1.11E-07
Pa-234m	1.34E-06
Pa-234	2.64E-08
U-234	4.80E-06
Th-230	2.33E-05
Ra-226	7.36E-06
Rn-222	5.88E-09
Po-218	1.05E-13
Pb-214	3.86E-06
At-218	3.91E-13
Bi-214	2.37E-08
Rn-218	5.29E-22
Po-214	5.27E-14
Tl-210	4.81E-14
Pb-210	3.65E-06
Bi-210	4.01E-07
Hg-206	2.02E-14
Po-210	5.86E-06
Tl-206	5.84E-13
U-235	2.70E-07
Th-231	8.52E-09
Pa-231	6.99E-06
Ac-227	5.30E-06
Th-227	6.37E-07
Fr-223	6.04E-10
Ra-223	4.82E-07
Rn-219	1.37E-08
Po-215	2.56E-13
Pb-211	8.69E-10
At-219	0.00E+00
Bi-215	2.07E-19
Bi-211	2.70E-11
Tl-207	2.95E-13
Po-211	4.96E-16
Th-232	3.15E-04
Ra-228	4.36E-05
Ac-228	7.88E-05
Th-228	4.27E-04
Ra-224	2.82E-05
Rn-220	1.22E-08
Po-216	8.27E-11
Pb-212	2.30E-06
Bi-212	2.85E-07
Po-212	0.00E+00
Tl-208	9.02E-09
TOTAL	9.64E-04

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	10	30	35	40	45	250	265
N	7.5E-04	1.7E-04	1.4E-04	1.1E-04	9.2E-05	1.4E-05	1.4E-05
NNW	5.5E-04	5.4E-05	3.8E-05	3.0E-05	2.6E-05	1.2E-05	1.2E-05
NW	2.7E-04	3.0E-05	2.6E-05	2.2E-05	2.0E-05	1.2E-05	1.2E-05
WNW	1.7E-04	2.6E-05	2.1E-05	1.9E-05	1.7E-05	1.1E-05	1.1E-05
W	1.9E-04	4.0E-05	3.4E-05	2.9E-05	2.6E-05	1.2E-05	1.2E-05
WSW	2.7E-04	4.3E-05	3.5E-05	3.0E-05	2.6E-05	1.2E-05	1.2E-05
SW	4.5E-04	5.5E-05	4.3E-05	3.6E-05	3.1E-05	1.2E-05	1.2E-05
SSW	7.2E-04	9.8E-05	7.4E-05	5.9E-05	5.0E-05	1.3E-05	1.2E-05
S	9.0E-04	1.8E-04	1.5E-04	1.2E-04	9.8E-05	1.4E-05	1.4E-05
SSE	9.6E-04	1.5E-04	1.2E-04	9.1E-05	7.5E-05	1.4E-05	1.3E-05
SE	8.3E-04	1.2E-04	9.7E-05	7.8E-05	6.4E-05	1.3E-05	1.3E-05
ESE	6.9E-04	8.9E-05	6.7E-05	5.4E-05	4.5E-05	1.2E-05	1.2E-05
E	5.8E-04	9.8E-05	8.0E-05	6.5E-05	5.4E-05	1.3E-05	1.3E-05
ENE	6.2E-04	7.1E-05	5.3E-05	4.2E-05	3.6E-05	1.2E-05	1.2E-05
NE	7.4E-04	1.0E-04	8.3E-05	6.7E-05	5.5E-05	1.3E-05	1.3E-05
NNE	8.6E-04	1.4E-04	1.1E-04	9.0E-05	7.4E-05	1.3E-05	1.3E-05

	Distance (m)	
Direction	305	325
N	1.3E-05	1.3E-05
NNW	1.2E-05	1.2E-05
NW	1.1E-05	1.1E-05
WNW	1.1E-05	1.1E-05
W	1.2E-05	1.2E-05
WSW	1.2E-05	1.2E-05
SW	1.2E-05	1.2E-05
SSW	1.2E-05	1.2E-05
S	1.3E-05	1.3E-05
SSE	1.3E-05	1.3E-05
SE	1.3E-05	1.2E-05
ESE	1.2E-05	1.2E-05
E	1.2E-05	1.2E-05
ENE	1.2E-05	1.2E-05
NE	1.2E-05	1.2E-05
NNE	1.3E-05	1.3E-05

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

C A P 8 8 - P C

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Tue May 03 09:11:37 2016

Facility: Maywood Interim Storage Site - Cluster 12A-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
1.17E-04

At This Location: 40 Meters South

Dataset Name: miss12A115.
Dataset Date: May 2, 2016 03:53 PM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 40 Meters South
Lifetime Fatal Cancer Risk: 3.65E-11

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	1.15E-05
UB_Wall	1.20E-05
Bone_Sur	8.13E-04
Brain	1.19E-05
Breasts	1.30E-05
St_Wall	1.20E-05
SI_Wall	1.18E-05
ULI_Wall	1.23E-05
LLI_Wall	1.36E-05
Kidneys	2.74E-05
Liver	3.32E-05
Muscle	1.33E-05
Ovaries	1.63E-05
Pancreas	1.13E-05
R_Marrow	5.37E-05
Skin	7.19E-05
Spleen	1.46E-05
Testes	1.81E-05
Thymus	1.17E-05
Thyroid	1.26E-05
GB_Wall	1.14E-05
Ht_Wall	1.19E-05
Uterus	1.17E-05
ET_Reg	2.17E-04
Lung_66	7.55E-04
Effectiv	1.17E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	1.0E-10	1.0E-10
Th-234	S	1.000	1.0E-10	1.0E-10
Pa-234m	B	0.000	1.0E-10	1.0E-10
Pa-234	M	1.000	1.3E-13	1.3E-13
U-234	M	1.000	1.1E-10	1.1E-10
Th-230	S	1.000	1.1E-10	1.1E-10
Ra-226	M	1.000	1.3E-10	1.3E-10
Po-218	B	0.000	1.3E-10	1.3E-10
Pb-214	M	1.000	1.3E-10	1.3E-10
Bi-214	M	1.000	1.3E-10	1.3E-10
Po-214	B	0.000	1.3E-10	1.3E-10
Pb-210	M	1.000	1.3E-10	1.3E-10
Bi-210	M	1.000	1.3E-10	1.3E-10
Po-210	B	0.000	1.3E-10	1.3E-10
U-235	M	1.000	4.7E-12	4.7E-12
Th-231	S	1.000	4.7E-12	4.7E-12
Pa-231	M	1.000	4.7E-12	4.7E-12
Ac-227	M	1.000	4.7E-12	4.7E-12
Th-227	S	1.000	4.7E-12	4.7E-12
Fr-223	M	1.000	6.5E-14	6.5E-14
Ra-223	M	1.000	4.7E-12	4.7E-12
Po-215	B	0.000	4.7E-12	4.7E-12
Pb-211	M	1.000	4.7E-12	4.7E-12
Bi-211	B	0.000	4.7E-12	4.7E-12
Tl-207	B	0.000	4.7E-12	4.7E-12
Po-211	B	0.000	1.3E-14	1.3E-14
Th-232	S	1.000	7.9E-10	7.9E-10
Ra-228	M	1.000	7.9E-10	7.9E-10
Ac-228	M	1.000	7.9E-10	7.9E-10
Th-228	S	1.000	7.9E-10	7.9E-10
Ra-224	M	1.000	7.9E-10	7.9E-10
Po-216	B	0.000	7.9E-10	7.9E-10
Pb-212	M	1.000	7.9E-10	7.9E-10
Bi-212	M	1.000	7.9E-10	7.9E-10
Po-212	B	0.000	5.1E-10	5.1E-10
Tl-208	B	0.000	2.8E-10	2.8E-10

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 397.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

40 50 65 90 100 120 130
135 140 150 170

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	1.15E-05
UB_Wall	1.20E-05
Bone_Sur	8.13E-04
Brain	1.19E-05
Breasts	1.30E-05
St_Wall	1.20E-05
SI_Wall	1.18E-05
ULI_Wall	1.23E-05
LLI_Wall	1.36E-05
Kidneys	2.74E-05
Liver	3.32E-05
Muscle	1.33E-05
Ovaries	1.63E-05
Pancreas	1.13E-05
R_Marrow	5.37E-05
Skin	7.19E-05
Spleen	1.46E-05
Testes	1.81E-05
Thymus	1.17E-05
Thyroid	1.26E-05
GB_Wall	1.14E-05
Ht_Wall	1.19E-05
Uterus	1.17E-05
ET_Reg	2.17E-04
Lung_66	7.55E-04
Effectiv	1.17E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	2.81E-06
INHALATION	1.04E-04
AIR IMMERSION	1.16E-09
GROUND SURFACE	1.05E-05
INTERNAL	1.07E-04
EXTERNAL	1.05E-05
TOTAL	1.17E-04

Tue May 03 09:11:37 2016 SUMMARY
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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	4.52E-07
Th-234	1.36E-08
Pa-234m	1.63E-07
Pa-234	3.21E-09
U-234	5.84E-07
Th-230	2.83E-06
Ra-226	9.31E-07
Rn-222	7.16E-10
Po-218	1.28E-14
Pb-214	4.70E-07
At-218	4.76E-14
Bi-214	2.88E-09
Rn-218	1.53E-19
Po-214	6.38E-15
Tl-210	1.03E-14
Pb-210	4.81E-07
Bi-210	4.88E-08
Hg-206	2.45E-15
Po-210	7.27E-07
Tl-206	7.11E-14
U-235	3.28E-08
Th-231	1.04E-09
Pa-231	8.47E-07
Ac-227	6.42E-07
Th-227	7.73E-08
Fr-223	7.35E-11
Ra-223	5.85E-08
Rn-219	1.67E-09
Po-215	3.14E-14
Pb-211	1.05E-10
At-219	0.00E+00
Bi-215	2.48E-20
Bi-211	3.28E-12
Tl-207	3.47E-14
Po-211	6.10E-17
Th-232	3.83E-05
Ra-228	5.61E-06
Ac-228	9.59E-06
Th-228	5.17E-05
Ra-224	3.41E-06
Rn-220	1.49E-09
Po-216	1.01E-11
Pb-212	2.79E-07
Bi-212	3.45E-08
Po-212	0.00E+00
Tl-208	1.09E-09
TOTAL	1.17E-04

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	40	50	65	90	100	120	130
N	1.1E-04	7.8E-05	4.8E-05	2.7E-05	2.2E-05	1.6E-05	1.4E-05
NNW	3.3E-05	1.7E-05	1.1E-05	6.5E-06	5.7E-06	4.6E-06	4.2E-06
NW	1.5E-05	1.0E-05	6.9E-06	4.6E-06	4.1E-06	3.4E-06	3.2E-06
WNW	1.2E-05	7.5E-06	5.2E-06	3.7E-06	3.3E-06	2.9E-06	2.8E-06
W	2.1E-05	1.5E-05	1.0E-05	6.3E-06	5.5E-06	4.4E-06	4.1E-06
WSW	2.4E-05	1.6E-05	1.0E-05	6.4E-06	5.6E-06	4.5E-06	4.1E-06
SW	3.2E-05	2.0E-05	1.3E-05	7.8E-06	6.8E-06	5.3E-06	4.8E-06
SSW	6.2E-05	3.8E-05	2.4E-05	1.4E-05	1.1E-05	8.6E-06	7.6E-06
S	1.2E-04	8.4E-05	5.1E-05	2.8E-05	2.3E-05	1.7E-05	1.5E-05
SSE	9.7E-05	6.3E-05	3.8E-05	2.1E-05	1.8E-05	1.3E-05	1.1E-05
SE	7.8E-05	5.2E-05	3.2E-05	1.8E-05	1.5E-05	1.1E-05	9.8E-06
ESE	5.6E-05	3.5E-05	2.1E-05	1.2E-05	1.0E-05	7.9E-06	7.0E-06
E	6.0E-05	4.2E-05	2.6E-05	1.5E-05	1.3E-05	9.4E-06	8.3E-06
ENE	4.4E-05	2.6E-05	1.6E-05	9.5E-06	8.1E-06	6.2E-06	5.6E-06
NE	6.6E-05	4.4E-05	2.7E-05	1.5E-05	1.3E-05	9.6E-06	8.5E-06
NNE	9.3E-05	6.1E-05	3.8E-05	2.1E-05	1.7E-05	1.3E-05	1.1E-05

	Distance (m)			
Direction	135	140	150	170
N	1.3E-05	1.2E-05	1.1E-05	9.1E-06
NNW	4.0E-06	3.9E-06	3.6E-06	3.2E-06
NW	3.1E-06	3.0E-06	2.9E-06	2.7E-06
WNW	2.7E-06	2.6E-06	2.5E-06	2.4E-06
W	3.9E-06	3.8E-06	3.5E-06	3.2E-06
WSW	4.0E-06	3.8E-06	3.6E-06	3.2E-06
SW	4.6E-06	4.4E-06	4.1E-06	3.6E-06
SSW	7.2E-06	6.9E-06	6.2E-06	5.3E-06
S	1.4E-05	1.3E-05	1.2E-05	9.5E-06
SSE	1.1E-05	1.0E-05	9.1E-06	7.5E-06
SE	9.3E-06	8.8E-06	7.9E-06	6.6E-06
ESE	6.6E-06	6.3E-06	5.8E-06	4.9E-06
E	7.8E-06	7.4E-06	6.7E-06	5.7E-06
ENE	5.3E-06	5.1E-06	4.7E-06	4.1E-06
NE	8.0E-06	7.6E-06	6.9E-06	5.8E-06
NNE	1.1E-05	9.9E-06	8.9E-06	7.4E-06

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Tue May 03 09:12:55 2016

Facility: Maywood Interim Storage Site - Cluster 12A-2
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
1.36E-04

At This Location: 50 Meters South

Dataset Name: miss12A215.
Dataset Date: May 2, 2016 04:06 PM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

Tue May 03 09:12:55 2016 SYNOPSIS
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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 50 Meters South
Lifetime Fatal Cancer Risk: 4.20E-11

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	1.35E-05
UB_Wall	1.41E-05
Bone_Sur	9.91E-04
Brain	1.39E-05
Breasts	1.52E-05
St_Wall	1.41E-05
SI_Wall	1.39E-05
ULI_Wall	1.46E-05
LLI_Wall	1.62E-05
Kidneys	3.37E-05
Liver	4.07E-05
Muscle	1.55E-05
Ovaries	1.92E-05
Pancreas	1.33E-05
R_Marrow	6.67E-05
Skin	8.27E-05
Spleen	1.81E-05
Testes	2.13E-05
Thymus	1.38E-05
Thyroid	1.48E-05
GB_Wall	1.34E-05
Ht_Wall	1.39E-05
Uterus	1.37E-05
ET_Reg	2.49E-04
Lung_66	8.64E-04
Effectiv	1.36E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	1.8E-10	1.8E-10
Th-234	S	1.000	1.8E-10	1.8E-10
Pa-234m	B	0.000	1.8E-10	1.8E-10
Pa-234	M	1.000	2.3E-13	2.3E-13
U-234	M	1.000	1.9E-10	1.9E-10
Th-230	S	1.000	1.9E-10	1.9E-10
Ra-226	M	1.000	2.3E-10	2.3E-10
Po-218	B	0.000	2.3E-10	2.3E-10
Pb-214	M	1.000	2.3E-10	2.3E-10
Bi-214	M	1.000	2.3E-10	2.3E-10
Po-214	B	0.000	2.3E-10	2.3E-10
Pb-210	M	1.000	2.3E-10	2.3E-10
Bi-210	M	1.000	2.3E-10	2.3E-10
Po-210	B	0.000	2.3E-10	2.3E-10
U-235	M	1.000	8.2E-12	8.2E-12
Th-231	S	1.000	8.2E-12	8.2E-12
Pa-231	M	1.000	8.2E-12	8.2E-12
Ac-227	M	1.000	8.2E-12	8.2E-12
Th-227	S	1.000	8.1E-12	8.1E-12
Fr-223	M	1.000	1.1E-13	1.1E-13
Ra-223	M	1.000	8.2E-12	8.2E-12
Po-215	B	0.000	8.2E-12	8.2E-12
Pb-211	M	1.000	8.2E-12	8.2E-12
Bi-211	B	0.000	8.2E-12	8.2E-12
Tl-207	B	0.000	8.2E-12	8.2E-12
Po-211	B	0.000	2.2E-14	2.2E-14
Th-232	S	1.000	1.4E-09	1.4E-09
Ra-228	M	1.000	1.4E-09	1.4E-09
Ac-228	M	1.000	1.4E-09	1.4E-09
Th-228	S	1.000	1.4E-09	1.4E-09
Ra-224	M	1.000	1.4E-09	1.4E-09
Po-216	B	0.000	1.4E-09	1.4E-09
Pb-212	M	1.000	1.4E-09	1.4E-09
Bi-212	M	1.000	1.4E-09	1.4E-09
Po-212	B	0.000	8.8E-10	8.8E-10
Tl-208	B	0.000	4.9E-10	4.9E-10

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

Tue May 03 09:12:55 2016 SYNOPSIS
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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 577.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

50 55 60 65 85 90 105
110 120

Tue May 03 09:12:55 2016 SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	1.35E-05
UB_Wall	1.41E-05
Bone_Sur	9.91E-04
Brain	1.39E-05
Breasts	1.52E-05
St_Wall	1.41E-05
SI_Wall	1.39E-05
ULI_Wall	1.46E-05
LLI_Wall	1.62E-05
Kidneys	3.37E-05
Liver	4.07E-05
Muscle	1.55E-05
Ovaries	1.92E-05
Pancreas	1.33E-05
R_Marrow	6.67E-05
Skin	8.27E-05
Spleen	1.81E-05
Testes	2.13E-05
Thymus	1.38E-05
Thyroid	1.48E-05
GB_Wall	1.34E-05
Ht_Wall	1.39E-05
Uterus	1.37E-05
ET_Reg	2.49E-04
Lung_66	8.64E-04
Effectiv	1.36E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	4.95E-06
INHALATION	1.19E-04
AIR IMMERSION	1.33E-09
GROUND SURFACE	1.21E-05
INTERNAL	1.24E-04
EXTERNAL	1.21E-05
TOTAL	1.36E-04

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	5.25E-07
Th-234	1.57E-08
Pa-234m	1.87E-07
Pa-234	3.69E-09
U-234	6.76E-07
Th-230	3.27E-06
Ra-226	1.21E-06
Rn-222	8.24E-10
Po-218	1.47E-14
Pb-214	5.41E-07
At-218	5.48E-14
Bi-214	3.31E-09
Rn-218	1.32E-19
Po-214	7.34E-15
Tl-210	1.42E-14
Pb-210	6.85E-07
Bi-210	5.62E-08
Hg-206	2.83E-15
Po-210	8.91E-07
Tl-206	8.19E-14
U-235	3.80E-08
Th-231	1.19E-09
Pa-231	9.75E-07
Ac-227	7.38E-07
Th-227	8.86E-08
Fr-223	8.44E-11
Ra-223	6.72E-08
Rn-219	1.92E-09
Po-215	3.62E-14
Pb-211	1.21E-10
At-219	0.00E+00
Bi-215	2.83E-20
Bi-211	3.77E-12
Tl-207	3.99E-14
Po-211	7.10E-17
Th-232	4.40E-05
Ra-228	7.51E-06
Ac-228	1.10E-05
Th-228	5.92E-05
Ra-224	3.91E-06
Rn-220	1.70E-09
Po-216	1.15E-11
Pb-212	3.19E-07
Bi-212	3.95E-08
Po-212	0.00E+00
Tl-208	1.25E-09
TOTAL	1.36E-04

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	50	55	60	65	85	90	105
N	1.2E-04	1.1E-04	9.7E-05	8.4E-05	5.2E-05	4.7E-05	3.6E-05
NNW	3.8E-05	2.9E-05	2.2E-05	1.9E-05	1.3E-05	1.2E-05	9.9E-06
NW	1.9E-05	1.6E-05	1.4E-05	1.3E-05	9.1E-06	8.5E-06	7.3E-06
WNW	1.5E-05	1.3E-05	1.1E-05	9.7E-06	7.3E-06	7.0E-06	6.2E-06
W	2.6E-05	2.3E-05	2.0E-05	1.8E-05	1.2E-05	1.2E-05	9.6E-06
WSW	2.9E-05	2.4E-05	2.1E-05	1.9E-05	1.3E-05	1.2E-05	9.7E-06
SW	3.8E-05	3.2E-05	2.7E-05	2.3E-05	1.5E-05	1.4E-05	1.2E-05
SSW	7.1E-05	5.9E-05	4.9E-05	4.2E-05	2.7E-05	2.4E-05	1.9E-05
S	1.4E-04	1.2E-04	1.0E-04	9.0E-05	5.5E-05	5.0E-05	3.8E-05
SSE	1.1E-04	9.2E-05	7.8E-05	6.7E-05	4.1E-05	3.7E-05	2.9E-05
SE	9.0E-05	7.6E-05	6.5E-05	5.6E-05	3.5E-05	3.2E-05	2.5E-05
ESE	6.4E-05	5.3E-05	4.4E-05	3.8E-05	2.4E-05	2.2E-05	1.7E-05
E	7.1E-05	6.1E-05	5.3E-05	4.6E-05	2.9E-05	2.7E-05	2.1E-05
ENE	5.0E-05	4.1E-05	3.3E-05	2.9E-05	1.9E-05	1.7E-05	1.4E-05
NE	7.6E-05	6.4E-05	5.5E-05	4.8E-05	3.0E-05	2.7E-05	2.1E-05
NNE	1.1E-04	9.0E-05	7.6E-05	6.6E-05	4.1E-05	3.7E-05	2.8E-05

	Distance (m)	
Direction	110	120
N	3.3E-05	2.8E-05
NNW	9.4E-06	8.5E-06
NW	7.1E-06	6.6E-06
WNW	6.0E-06	5.7E-06
W	9.1E-06	8.3E-06
WSW	9.2E-06	8.4E-06
SW	1.1E-05	9.8E-06
SSW	1.8E-05	1.6E-05
S	3.5E-05	3.0E-05
SSE	2.7E-05	2.3E-05
SE	2.3E-05	2.0E-05
ESE	1.6E-05	1.4E-05
E	1.9E-05	1.7E-05
ENE	1.3E-05	1.1E-05
NE	2.0E-05	1.7E-05
NNE	2.6E-05	2.3E-05

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

C A P 8 8 - P C

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Tue May 03 09:15:03 2016

Facility: Maywood Interim Storage Site - Cluster 12B-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
2.35E-03

At This Location: 90 Meters South

Dataset Name: miss12B115.
Dataset Date: May 3, 2016 08:00 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 90 Meters South
Lifetime Fatal Cancer Risk: 7.25E-10

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	2.34E-04
UB_Wall	2.45E-04
Bone_Sur	1.72E-02
Brain	2.42E-04
Breasts	2.63E-04
St_Wall	2.44E-04
SI_Wall	2.41E-04
ULI_Wall	2.53E-04
LLI_Wall	2.82E-04
Kidneys	5.88E-04
Liver	7.09E-04
Muscle	2.70E-04
Ovaries	3.33E-04
Pancreas	2.30E-04
R_Marrow	1.16E-03
Skin	1.43E-03
Spleen	3.16E-04
Testes	3.69E-04
Thymus	2.39E-04
Thyroid	2.56E-04
GB_Wall	2.32E-04
Ht_Wall	2.42E-04
Uterus	2.38E-04
ET_Reg	4.29E-03
Lung_66	1.49E-02
Effectiv	2.35E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	1.1E-08	1.1E-08
Th-234	S	1.000	1.1E-08	1.1E-08
Pa-234m	B	0.000	1.1E-08	1.1E-08
Pa-234	M	1.000	1.4E-11	1.4E-11
U-234	M	1.000	1.1E-08	1.1E-08
Th-230	S	1.000	1.1E-08	1.1E-08
Ra-226	M	1.000	1.4E-08	1.4E-08
Po-218	B	0.000	1.4E-08	1.4E-08
Pb-214	M	1.000	1.4E-08	1.4E-08
Bi-214	M	1.000	1.4E-08	1.4E-08
Po-214	B	0.000	1.4E-08	1.4E-08
Pb-210	M	1.000	1.4E-08	1.4E-08
Bi-210	M	1.000	1.4E-08	1.4E-08
Po-210	B	0.000	1.4E-08	1.4E-08
U-235	M	1.000	5.0E-10	5.0E-10
Th-231	S	1.000	5.0E-10	5.0E-10
Pa-231	M	1.000	5.0E-10	5.0E-10
Ac-227	M	1.000	5.0E-10	5.0E-10
Th-227	S	1.000	4.9E-10	4.9E-10
Fr-223	M	1.000	6.9E-12	6.9E-12
Ra-223	M	1.000	5.0E-10	5.0E-10
Po-215	B	0.000	5.0E-10	5.0E-10
Pb-211	M	1.000	5.0E-10	5.0E-10
Bi-211	B	0.000	5.0E-10	5.0E-10
Tl-207	B	0.000	5.0E-10	5.0E-10
Po-211	B	0.000	1.4E-12	1.4E-12
Th-232	S	1.000	8.4E-08	8.4E-08
Ra-228	M	1.000	8.4E-08	8.4E-08
Ac-228	M	1.000	8.4E-08	8.4E-08
Th-228	S	1.000	8.4E-08	8.4E-08
Ra-224	M	1.000	8.4E-08	8.4E-08
Po-216	B	0.000	8.4E-08	8.4E-08
Pb-212	M	1.000	8.4E-08	8.4E-08
Bi-212	M	1.000	8.4E-08	8.4E-08
Po-212	B	0.000	5.4E-08	5.4E-08
Tl-208	B	0.000	3.0E-08	3.0E-08

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 5089.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

90 100 115 120 135 150 170
190 195 200 220

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	2.34E-04
UB_Wall	2.45E-04
Bone_Sur	1.72E-02
Brain	2.42E-04
Breasts	2.63E-04
St_Wall	2.44E-04
SI_Wall	2.41E-04
ULI_Wall	2.53E-04
LLI_Wall	2.82E-04
Kidneys	5.88E-04
Liver	7.09E-04
Muscle	2.70E-04
Ovaries	3.33E-04
Pancreas	2.30E-04
R_Marrow	1.16E-03
Skin	1.43E-03
Spleen	3.16E-04
Testes	3.69E-04
Thymus	2.39E-04
Thyroid	2.56E-04
GB_Wall	2.32E-04
Ht_Wall	2.42E-04
Uterus	2.38E-04
ET_Reg	4.29E-03
Lung_66	1.49E-02
Effectiv	2.35E-03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	8.98E-05
INHALATION	2.05E-03
AIR IMMERSION	2.31E-08
GROUND SURFACE	2.09E-04
INTERNAL	2.14E-03
EXTERNAL	2.09E-04
TOTAL	2.35E-03

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	9.05E-06
Th-234	2.73E-07
Pa-234m	3.24E-06
Pa-234	6.39E-08
U-234	1.16E-05
Th-230	5.62E-05
Ra-226	2.11E-05
Rn-222	1.42E-08
Po-218	2.55E-13
Pb-214	9.35E-06
At-218	9.45E-13
Bi-214	5.68E-08
Rn-218	1.08E-19
Po-214	1.26E-13
Tl-210	5.11E-13
Pb-210	1.21E-05
Bi-210	9.68E-07
Hg-206	4.88E-14
Po-210	1.54E-05
Tl-206	1.41E-12
U-235	6.55E-07
Th-231	2.06E-08
Pa-231	1.68E-05
Ac-227	1.27E-05
Th-227	1.52E-06
Fr-223	1.46E-09
Ra-223	1.16E-06
Rn-219	3.31E-08
Po-215	6.27E-13
Pb-211	2.08E-09
At-219	0.00E+00
Bi-215	5.08E-19
Bi-211	6.52E-11
Tl-207	6.98E-13
Po-211	1.18E-15
Th-232	7.58E-04
Ra-228	1.32E-04
Ac-228	1.90E-04
Th-228	1.02E-03
Ra-224	6.73E-05
Rn-220	2.95E-08
Po-216	2.00E-10
Pb-212	5.51E-06
Bi-212	6.81E-07
Po-212	0.00E+00
Tl-208	2.17E-08
TOTAL	2.35E-03

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	90	100	115	120	135	150	170
N	2.1E-03	1.7E-03	1.4E-03	1.3E-03	1.1E-03	9.6E-04	8.1E-04
NNW	1.1E-03	8.4E-04	6.1E-04	5.5E-04	4.1E-04	3.2E-04	2.4E-04
NW	3.9E-04	3.3E-04	2.7E-04	2.5E-04	2.1E-04	1.8E-04	1.6E-04
WNW	3.6E-04	3.0E-04	2.4E-04	2.2E-04	1.8E-04	1.6E-04	1.3E-04
W	4.8E-04	4.1E-04	3.4E-04	3.2E-04	2.7E-04	2.4E-04	2.1E-04
WSW	6.0E-04	5.0E-04	3.9E-04	3.7E-04	3.0E-04	2.6E-04	2.2E-04
SW	8.4E-04	6.8E-04	5.3E-04	4.9E-04	3.9E-04	3.3E-04	2.6E-04
SSW	1.6E-03	1.3E-03	9.7E-04	8.9E-04	7.0E-04	5.7E-04	4.5E-04
S	2.3E-03	2.0E-03	1.6E-03	1.5E-03	1.2E-03	1.0E-03	8.7E-04
SSE	2.3E-03	1.9E-03	1.4E-03	1.3E-03	1.0E-03	8.5E-04	6.8E-04
SE	1.8E-03	1.4E-03	1.1E-03	1.0E-03	8.5E-04	7.1E-04	5.7E-04
ESE	1.4E-03	1.2E-03	8.7E-04	8.0E-04	6.3E-04	5.1E-04	4.0E-04
E	1.3E-03	1.1E-03	8.5E-04	7.9E-04	6.6E-04	5.6E-04	4.7E-04
ENE	1.2E-03	9.7E-04	7.2E-04	6.6E-04	5.1E-04	4.1E-04	3.2E-04
NE	1.5E-03	1.3E-03	9.7E-04	9.0E-04	7.3E-04	6.0E-04	4.9E-04
NNE	2.1E-03	1.8E-03	1.3E-03	1.2E-03	1.0E-03	8.3E-04	6.6E-04

	Distance (m)			
Direction	190	195	200	220
N	6.9E-04	6.6E-04	6.3E-04	5.3E-04
NNW	1.9E-04	1.8E-04	1.8E-04	1.6E-04
NW	1.4E-04	1.4E-04	1.3E-04	1.2E-04
WNW	1.2E-04	1.1E-04	1.1E-04	1.1E-04
W	1.9E-04	1.8E-04	1.7E-04	1.6E-04
WSW	1.9E-04	1.8E-04	1.8E-04	1.6E-04
SW	2.2E-04	2.2E-04	2.1E-04	1.8E-04
SSW	3.7E-04	3.5E-04	3.4E-04	2.9E-04
S	7.3E-04	7.0E-04	6.7E-04	5.6E-04
SSE	5.6E-04	5.3E-04	5.1E-04	4.3E-04
SE	4.8E-04	4.6E-04	4.4E-04	3.7E-04
ESE	3.3E-04	3.2E-04	3.1E-04	2.7E-04
E	4.0E-04	3.8E-04	3.7E-04	3.2E-04
ENE	2.6E-04	2.5E-04	2.4E-04	2.1E-04
NE	4.1E-04	3.9E-04	3.8E-04	3.2E-04
NNE	5.5E-04	5.2E-04	5.0E-04	4.3E-04

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Tue May 03 09:16:29 2016

Facility: Maywood Interim Storage Site - Cluster 12B-2
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
4.91E-03

At This Location: 35 Meters Southeast

Dataset Name: miss12B215.
Dataset Date: May 3, 2016 08:07 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 35 Meters Southeast
Lifetime Fatal Cancer Risk: 1.53E-09

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	4.80E-04
UB_Wall	5.03E-04
Bone_Sur	3.44E-02
Brain	4.97E-04
Breasts	5.43E-04
St_Wall	5.02E-04
SI_Wall	4.95E-04
ULI_Wall	5.17E-04
LLI_Wall	5.71E-04
Kidneys	1.16E-03
Liver	1.41E-03
Muscle	5.55E-04
Ovaries	6.85E-04
Pancreas	4.73E-04
R_Marrow	2.28E-03
Skin	3.00E-03
Spleen	6.21E-04
Testes	7.60E-04
Thymus	4.91E-04
Thyroid	5.27E-04
GB_Wall	4.76E-04
Ht_Wall	4.98E-04
Uterus	4.90E-04
ET_Reg	9.07E-03
Lung_66	3.15E-02
Effectiv	4.91E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	3.3E-09	3.3E-09
Th-234	S	1.000	3.3E-09	3.3E-09
Pa-234m	B	0.000	3.3E-09	3.3E-09
Pa-234	M	1.000	4.3E-12	4.3E-12
U-234	M	1.000	3.5E-09	3.5E-09
Th-230	S	1.000	3.5E-09	3.5E-09
Ra-226	M	1.000	4.4E-09	4.4E-09
Po-218	B	0.000	4.4E-09	4.4E-09
Pb-214	M	1.000	4.4E-09	4.4E-09
Bi-214	M	1.000	4.4E-09	4.4E-09
Po-214	B	0.000	4.4E-09	4.4E-09
Pb-210	M	1.000	4.4E-09	4.4E-09
Bi-210	M	1.000	4.4E-09	4.4E-09
Po-210	B	0.000	4.4E-09	4.4E-09
U-235	M	1.000	1.5E-10	1.5E-10
Th-231	S	1.000	1.5E-10	1.5E-10
Pa-231	M	1.000	1.5E-10	1.5E-10
Ac-227	M	1.000	1.5E-10	1.5E-10
Th-227	S	1.000	1.5E-10	1.5E-10
Fr-223	M	1.000	2.1E-12	2.1E-12
Ra-223	M	1.000	1.5E-10	1.5E-10
Po-215	B	0.000	1.5E-10	1.5E-10
Pb-211	M	1.000	1.5E-10	1.5E-10
Bi-211	B	0.000	1.5E-10	1.5E-10
Tl-207	B	0.000	1.5E-10	1.5E-10
Po-211	B	0.000	4.2E-13	4.2E-13
Th-232	S	1.000	2.6E-08	2.6E-08
Ra-228	M	1.000	2.6E-08	2.6E-08
Ac-228	M	1.000	2.6E-08	2.6E-08
Th-228	S	1.000	2.6E-08	2.6E-08
Ra-224	M	1.000	2.6E-08	2.6E-08
Po-216	B	0.000	2.6E-08	2.6E-08
Pb-212	M	1.000	2.6E-08	2.6E-08
Bi-212	M	1.000	2.6E-08	2.6E-08
Po-212	B	0.000	1.6E-08	1.6E-08
Tl-208	B	0.000	9.3E-09	9.3E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

Tue May 03 09:16:29 2016 SYNOPSIS
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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 5433.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

35 55 65 125 135 145 170
220

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	4.80E-04
UB_Wall	5.03E-04
Bone_Sur	3.44E-02
Brain	4.97E-04
Breasts	5.43E-04
St_Wall	5.02E-04
SI_Wall	4.95E-04
ULI_Wall	5.17E-04
LLI_Wall	5.71E-04
Kidneys	1.16E-03
Liver	1.41E-03
Muscle	5.55E-04
Ovaries	6.85E-04
Pancreas	4.73E-04
R_Marrow	2.28E-03
Skin	3.00E-03
Spleen	6.21E-04
Testes	7.60E-04
Thymus	4.91E-04
Thyroid	5.27E-04
GB_Wall	4.76E-04
Ht_Wall	4.98E-04
Uterus	4.90E-04
ET_Reg	9.07E-03
Lung_66	3.15E-02
Effectiv	4.91E-03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	1.32E-04
INHALATION	4.33E-03
AIR IMMERSION	4.88E-08
GROUND SURFACE	4.39E-04
INTERNAL	4.47E-03
EXTERNAL	4.39E-04
TOTAL	4.91E-03

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	1.89E-05
Th-234	5.67E-07
Pa-234m	6.79E-06
Pa-234	1.34E-07
U-234	2.44E-05
Th-230	1.18E-04
Ra-226	4.00E-05
Rn-222	2.98E-08
Po-218	5.34E-13
Pb-214	1.96E-05
At-218	1.98E-12
Bi-214	1.20E-07
Rn-218	1.08E-18
Po-214	2.66E-13
Tl-210	4.60E-13
Pb-210	2.12E-05
Bi-210	2.04E-06
Hg-206	1.02E-13
Po-210	3.08E-05
Tl-206	2.96E-12
U-235	1.37E-06
Th-231	4.32E-08
Pa-231	3.54E-05
Ac-227	2.68E-05
Th-227	3.23E-06
Fr-223	3.07E-09
Ra-223	2.44E-06
Rn-219	6.95E-08
Po-215	1.31E-12
Pb-211	4.39E-09
At-219	0.00E+00
Bi-215	1.02E-18
Bi-211	1.37E-10
Tl-207	1.48E-12
Po-211	2.57E-15
Th-232	1.60E-03
Ra-228	2.43E-04
Ac-228	3.99E-04
Th-228	2.16E-03
Ra-224	1.42E-04
Rn-220	6.19E-08
Po-216	4.19E-10
Pb-212	1.16E-05
Bi-212	1.44E-06
Po-212	0.00E+00
Tl-208	4.58E-08
TOTAL	4.91E-03

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	35	55	65	125	135	145	170
N	3.6E-03	1.5E-03	1.1E-03	4.5E-04	4.1E-04	3.8E-04	3.2E-04
NNW	3.2E-03	1.1E-03	7.8E-04	2.3E-04	2.0E-04	1.8E-04	1.5E-04
NW	2.5E-03	5.0E-04	2.9E-04	1.4E-04	1.4E-04	1.3E-04	1.2E-04
WNW	1.6E-03	3.8E-04	2.8E-04	1.3E-04	1.3E-04	1.2E-04	1.1E-04
W	1.4E-03	4.3E-04	3.2E-04	1.6E-04	1.5E-04	1.5E-04	1.3E-04
WSW	2.1E-03	5.6E-04	4.1E-04	1.8E-04	1.6E-04	1.5E-04	1.4E-04
SW	3.2E-03	8.6E-04	5.7E-04	2.1E-04	1.9E-04	1.8E-04	1.5E-04
SSW	4.0E-03	1.4E-03	1.0E-03	3.2E-04	2.9E-04	2.6E-04	2.1E-04
S	4.5E-03	1.8E-03	1.3E-03	4.9E-04	4.4E-04	4.0E-04	3.3E-04
SSE	4.8E-03	1.9E-03	1.4E-03	4.4E-04	3.9E-04	3.5E-04	2.8E-04
SE	4.9E-03	1.5E-03	1.1E-03	3.7E-04	3.3E-04	3.0E-04	2.5E-04
ESE	4.3E-03	1.3E-03	9.4E-04	3.0E-04	2.7E-04	2.4E-04	2.0E-04
E	3.9E-03	1.1E-03	7.7E-04	3.0E-04	2.7E-04	2.5E-04	2.1E-04
ENE	4.1E-03	1.2E-03	8.2E-04	2.6E-04	2.3E-04	2.1E-04	1.7E-04
NE	4.4E-03	1.4E-03	9.6E-04	3.3E-04	2.9E-04	2.7E-04	2.2E-04
NNE	4.0E-03	1.7E-03	1.3E-03	4.3E-04	3.8E-04	3.4E-04	2.7E-04

	Distance (m)
Direction	220
N	2.3E-04
NNW	1.2E-04
NW	1.1E-04
WNW	1.0E-04
W	1.2E-04
WSW	1.2E-04
SW	1.3E-04
SSW	1.6E-04
S	2.4E-04
SSE	2.0E-04
SE	1.9E-04
ESE	1.5E-04
E	1.7E-04
ENE	1.4E-04
NE	1.7E-04
NNE	2.0E-04

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Tue May 03 09:18:12 2016

Facility: Maywood Interim Storage Site - Vic. Prop.TR-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
8.71E-03

At This Location: 10 Meters East Southeast

Dataset Name: missTR-115.
Dataset Date: May 3, 2016 08:24 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 10 Meters East Southeast
Lifetime Fatal Cancer Risk: 2.72E-09

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	8.46E-04
UB_Wall	8.87E-04
Bone_Sur	5.99E-02
Brain	8.76E-04
Breasts	9.57E-04
St_Wall	8.85E-04
SI_Wall	8.72E-04
ULI_Wall	9.10E-04
LLI_Wall	9.98E-04
Kidneys	2.01E-03
Liver	2.44E-03
Muscle	9.80E-04
Ovaries	1.21E-03
Pancreas	8.34E-04
R_Marrow	3.94E-03
Skin	5.32E-03
Spleen	1.07E-03
Testes	1.34E-03
Thymus	8.66E-04
Thyroid	9.30E-04
GB_Wall	8.40E-04
Ht_Wall	8.77E-04
Uterus	8.63E-04
ET_Reg	1.62E-02
Lung_66	5.62E-02
Effectiv	8.71E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	7.2E-10	7.2E-10
Th-234	S	1.000	7.2E-10	7.2E-10
Pa-234m	B	0.000	7.2E-10	7.2E-10
Pa-234	M	1.000	9.4E-13	9.4E-13
U-234	M	1.000	7.7E-10	7.7E-10
Th-230	S	1.000	7.7E-10	7.7E-10
Ra-226	M	1.000	9.6E-10	9.6E-10
Po-218	B	0.000	9.6E-10	9.6E-10
Pb-214	M	1.000	9.6E-10	9.6E-10
Bi-214	M	1.000	9.6E-10	9.6E-10
Po-214	B	0.000	9.6E-10	9.6E-10
Pb-210	M	1.000	9.6E-10	9.6E-10
Bi-210	M	1.000	9.6E-10	9.6E-10
Po-210	B	0.000	9.6E-10	9.6E-10
U-235	M	1.000	3.4E-11	3.4E-11
Th-231	S	1.000	3.4E-11	3.4E-11
Pa-231	M	1.000	3.4E-11	3.4E-11
Ac-227	M	1.000	3.4E-11	3.4E-11
Th-227	S	1.000	3.3E-11	3.3E-11
Fr-223	M	1.000	4.6E-13	4.6E-13
Ra-223	M	1.000	3.4E-11	3.4E-11
Po-215	B	0.000	3.4E-11	3.4E-11
Pb-211	M	1.000	3.4E-11	3.4E-11
Bi-211	B	0.000	3.4E-11	3.4E-11
Tl-207	B	0.000	3.4E-11	3.4E-11
Po-211	B	0.000	9.2E-14	9.2E-14
Th-232	S	1.000	5.6E-09	5.6E-09
Ra-228	M	1.000	5.6E-09	5.6E-09
Ac-228	M	1.000	5.6E-09	5.6E-09
Th-228	S	1.000	5.6E-09	5.6E-09
Ra-224	M	1.000	5.6E-09	5.6E-09
Po-216	B	0.000	5.6E-09	5.6E-09
Pb-212	M	1.000	5.6E-09	5.6E-09
Bi-212	M	1.000	5.6E-09	5.6E-09
Po-212	B	0.000	3.6E-09	3.6E-09
Tl-208	B	0.000	2.0E-09	2.0E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 573.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

10 30 35 40 50 55 75
90 120

Tue May 03 09:18:12 2016 SUMMARY
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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	8.46E-04
UB_Wall	8.87E-04
Bone_Sur	5.99E-02
Brain	8.76E-04
Breasts	9.57E-04
St_Wall	8.85E-04
SI_Wall	8.72E-04
ULI_Wall	9.10E-04
LLI_Wall	9.98E-04
Kidneys	2.01E-03
Liver	2.44E-03
Muscle	9.80E-04
Ovaries	1.21E-03
Pancreas	8.34E-04
R_Marrow	3.94E-03
Skin	5.32E-03
Spleen	1.07E-03
Testes	1.34E-03
Thymus	8.66E-04
Thyroid	9.30E-04
GB_Wall	8.40E-04
Ht_Wall	8.77E-04
Uterus	8.63E-04
ET_Reg	1.62E-02
Lung_66	5.62E-02
Effectiv	8.71E-03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	1.91E-04
INHALATION	7.74E-03
AIR IMMERSION	8.71E-08
GROUND SURFACE	7.81E-04
INTERNAL	7.93E-03
EXTERNAL	7.81E-04
TOTAL	8.71E-03

Tue May 03 09:18:12 2016 SUMMARY
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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	3.36E-05
Th-234	1.00E-06
Pa-234m	1.21E-05
Pa-234	2.38E-07
U-234	4.34E-05
Th-230	2.11E-04
Ra-226	6.81E-05
Rn-222	5.31E-08
Po-218	9.50E-13
Pb-214	3.49E-05
At-218	3.53E-12
Bi-214	2.15E-07
Rn-218	4.32E-21
Po-214	4.76E-13
Tl-210	4.13E-13
Pb-210	3.45E-05
Bi-210	3.63E-06
Hg-206	1.82E-13
Po-210	5.36E-05
Tl-206	5.28E-12
U-235	2.44E-06
Th-231	7.69E-08
Pa-231	6.32E-05
Ac-227	4.79E-05
Th-227	5.75E-06
Fr-223	5.46E-09
Ra-223	4.36E-06
Rn-219	1.24E-07
Po-215	2.32E-12
Pb-211	7.85E-09
At-219	0.00E+00
Bi-215	1.85E-18
Bi-211	2.44E-10
Tl-207	2.65E-12
Po-211	4.43E-15
Th-232	2.85E-03
Ra-228	4.06E-04
Ac-228	7.10E-04
Th-228	3.85E-03
Ra-224	2.54E-04
Rn-220	1.10E-07
Po-216	7.46E-10
Pb-212	2.07E-05
Bi-212	2.57E-06
Po-212	0.00E+00
Tl-208	8.16E-08
TOTAL	8.71E-03

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	10	30	35	40	50	55	75
N	6.0E-03	1.2E-03	9.7E-04	8.2E-04	6.2E-04	5.6E-04	3.7E-04
NNW	5.7E-03	6.6E-04	5.0E-04	3.9E-04	2.6E-04	2.2E-04	1.7E-04
NW	5.1E-03	2.9E-04	2.5E-04	2.2E-04	1.8E-04	1.7E-04	1.5E-04
WNW	4.2E-03	2.8E-04	2.3E-04	2.0E-04	1.7E-04	1.6E-04	1.4E-04
W	3.4E-03	3.4E-04	2.9E-04	2.6E-04	2.1E-04	2.0E-04	1.7E-04
WSW	4.7E-03	4.0E-04	3.3E-04	2.8E-04	2.2E-04	2.1E-04	1.7E-04
SW	6.0E-03	5.3E-04	4.2E-04	3.5E-04	2.6E-04	2.4E-04	1.8E-04
SSW	7.0E-03	9.3E-04	7.2E-04	5.7E-04	4.0E-04	3.5E-04	2.4E-04
S	7.6E-03	1.3E-03	1.1E-03	9.0E-04	6.7E-04	5.9E-04	3.9E-04
SSE	8.2E-03	1.3E-03	1.0E-03	8.1E-04	5.6E-04	4.8E-04	3.2E-04
SE	8.4E-03	1.0E-03	8.1E-04	6.6E-04	4.8E-04	4.2E-04	2.8E-04
ESE	8.7E-03	8.5E-04	6.6E-04	5.3E-04	3.7E-04	3.2E-04	2.3E-04
E	8.4E-03	7.6E-04	6.2E-04	5.2E-04	4.0E-04	3.6E-04	2.5E-04
ENE	8.5E-03	7.3E-04	5.6E-04	4.5E-04	3.1E-04	2.7E-04	2.0E-04
NE	7.6E-03	9.0E-04	7.1E-04	5.8E-04	4.2E-04	3.7E-04	2.6E-04
NNE	6.9E-03	1.2E-03	9.7E-04	7.7E-04	5.5E-04	4.7E-04	3.1E-04

	Distance (m)	
Direction	90	120
N	3.0E-04	2.2E-04
NNW	1.5E-04	1.4E-04
NW	1.4E-04	1.3E-04
WNW	1.3E-04	1.3E-04
W	1.5E-04	1.4E-04
WSW	1.5E-04	1.4E-04
SW	1.6E-04	1.5E-04
SSW	2.0E-04	1.7E-04
S	3.1E-04	2.3E-04
SSE	2.6E-04	2.0E-04
SE	2.4E-04	1.9E-04
ESE	2.0E-04	1.6E-04
E	2.1E-04	1.7E-04
ENE	1.8E-04	1.5E-04
NE	2.2E-04	1.8E-04
NNE	2.6E-04	2.0E-04

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

C A P 8 8 - P C

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Mon May 09 13:56:16 2016

Facility: Maywood Interim Storage Site - Vic. Prop.205M-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent
(mrem)

6.56E-03

At This Location: 15 Meters Southeast

Dataset Name: miss205M-115.
Dataset Date: May 9, 2016 01:56 PM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

Mon May 09 13:56:16 2016 SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 15 Meters Southeast
Lifetime Fatal Cancer Risk: 2.05E-09

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	6.35E-04
UB_Wall	6.66E-04
Bone_Sur	4.46E-02
Brain	6.58E-04
Breasts	7.20E-04
St_Wall	6.65E-04
SI_Wall	6.55E-04
ULI_Wall	6.82E-04
LLI_Wall	7.46E-04
Kidneys	1.50E-03
Liver	1.81E-03
Muscle	7.37E-04
Ovaries	9.06E-04
Pancreas	6.26E-04
R_Marrow	2.92E-03
Skin	4.02E-03
Spleen	7.95E-04
Testes	1.01E-03
Thymus	6.50E-04
Thyroid	6.99E-04
GB_Wall	6.31E-04
Ht_Wall	6.59E-04
Uterus	6.48E-04
ET_Reg	1.22E-02
Lung_66	4.24E-02
Effectiv	6.56E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	1.1E-09	1.1E-09
Th-234	S	1.000	1.1E-09	1.1E-09
Pa-234m	B	0.000	1.1E-09	1.1E-09
Pa-234	M	1.000	1.4E-12	1.4E-12
U-234	M	1.000	1.1E-09	1.1E-09
Th-230	S	1.000	1.1E-09	1.1E-09
Ra-226	M	1.000	1.4E-09	1.4E-09
Po-218	B	0.000	1.4E-09	1.4E-09
Pb-214	M	1.000	1.4E-09	1.4E-09
Bi-214	M	1.000	1.4E-09	1.4E-09
Po-214	B	0.000	1.4E-09	1.4E-09
Pb-210	M	1.000	1.4E-09	1.4E-09
Bi-210	M	1.000	1.4E-09	1.4E-09
Po-210	B	0.000	1.4E-09	1.4E-09
U-235	M	1.000	5.0E-11	5.0E-11
Th-231	S	1.000	5.0E-11	5.0E-11
Pa-231	M	1.000	5.0E-11	5.0E-11
Ac-227	M	1.000	5.0E-11	5.0E-11
Th-227	S	1.000	4.9E-11	4.9E-11
Fr-223	M	1.000	6.9E-13	6.9E-13
Ra-223	M	1.000	5.0E-11	5.0E-11
Po-215	B	0.000	5.0E-11	5.0E-11
Pb-211	M	1.000	5.0E-11	5.0E-11
Bi-211	B	0.000	5.0E-11	5.0E-11
Tl-207	B	0.000	5.0E-11	5.0E-11
Po-211	B	0.000	1.4E-13	1.4E-13
Th-232	S	1.000	8.3E-09	8.3E-09
Ra-228	M	1.000	8.3E-09	8.3E-09
Ac-228	M	1.000	8.3E-09	8.3E-09
Th-228	S	1.000	8.3E-09	8.3E-09
Ra-224	M	1.000	8.3E-09	8.3E-09
Po-216	B	0.000	8.3E-09	8.3E-09
Pb-212	M	1.000	8.3E-09	8.3E-09
Bi-212	M	1.000	8.3E-09	8.3E-09
Po-212	B	0.000	5.3E-09	5.3E-09
Tl-208	B	0.000	3.0E-09	3.0E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 879.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

15 45 90 100 120 150 165
200 260

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	6.35E-04
UB_Wall	6.66E-04
Bone_Sur	4.46E-02
Brain	6.58E-04
Breasts	7.20E-04
St_Wall	6.65E-04
SI_Wall	6.55E-04
ULI_Wall	6.82E-04
LLI_Wall	7.46E-04
Kidneys	1.50E-03
Liver	1.81E-03
Muscle	7.37E-04
Ovaries	9.06E-04
Pancreas	6.26E-04
R_Marrow	2.92E-03
Skin	4.02E-03
Spleen	7.95E-04
Testes	1.01E-03
Thymus	6.50E-04
Thyroid	6.99E-04
GB_Wall	6.31E-04
Ht_Wall	6.59E-04
Uterus	6.48E-04
ET_Reg	1.22E-02
Lung_66	4.24E-02
Effectiv	6.56E-03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	1.26E-04
INHALATION	5.84E-03
AIR IMMERSION	6.57E-08
GROUND SURFACE	5.90E-04
INTERNAL	5.97E-03
EXTERNAL	5.90E-04
TOTAL	6.56E-03

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	2.52E-05
Th-234	7.55E-07
Pa-234m	9.10E-06
Pa-234	1.79E-07
U-234	3.25E-05
Th-230	1.58E-04
Ra-226	4.98E-05
Rn-222	4.01E-08
Po-218	7.17E-13
Pb-214	2.63E-05
At-218	2.66E-12
Bi-214	1.62E-07
Rn-218	3.24E-21
Po-214	3.59E-13
Tl-210	3.83E-13
Pb-210	2.46E-05
Bi-210	2.74E-06
Hg-206	1.37E-13
Po-210	3.98E-05
Tl-206	3.98E-12
U-235	1.84E-06
Th-231	5.81E-08
Pa-231	4.76E-05
Ac-227	3.61E-05
Th-227	4.34E-06
Fr-223	4.12E-09
Ra-223	3.29E-06
Rn-219	9.34E-08
Po-215	1.76E-12
Pb-211	5.92E-09
At-219	0.00E+00
Bi-215	1.41E-18
Bi-211	1.84E-10
Tl-207	2.00E-12
Po-211	3.35E-15
Th-232	2.15E-03
Ra-228	2.95E-04
Ac-228	5.37E-04
Th-228	2.91E-03
Ra-224	1.92E-04
Rn-220	8.32E-08
Po-216	5.63E-10
Pb-212	1.57E-05
Bi-212	1.94E-06
Po-212	0.00E+00
Tl-208	6.15E-08
TOTAL	6.56E-03

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	15	45	90	100	120	150	165
N	5.0E-03	8.6E-04	3.3E-04	2.8E-04	2.2E-04	1.7E-04	1.5E-04
NNW	4.1E-03	4.1E-04	1.2E-04	1.1E-04	1.0E-04	9.1E-05	8.8E-05
NW	3.0E-03	1.9E-04	1.0E-04	9.6E-05	8.9E-05	8.3E-05	8.2E-05
WNW	1.5E-03	1.7E-04	9.2E-05	8.8E-05	8.4E-05	8.0E-05	7.9E-05
W	1.5E-03	2.3E-04	1.2E-04	1.1E-04	1.0E-04	9.0E-05	8.8E-05
WSW	2.2E-03	2.6E-04	1.2E-04	1.1E-04	1.0E-04	9.1E-05	8.8E-05
SW	4.0E-03	3.5E-04	1.4E-04	1.2E-04	1.1E-04	9.6E-05	9.2E-05
SSW	5.2E-03	6.2E-04	2.0E-04	1.7E-04	1.4E-04	1.2E-04	1.1E-04
S	6.1E-03	9.7E-04	3.5E-04	3.0E-04	2.3E-04	1.8E-04	1.6E-04
SSE	6.4E-03	8.9E-04	2.8E-04	2.4E-04	1.9E-04	1.5E-04	1.4E-04
SE	6.6E-03	7.1E-04	2.4E-04	2.1E-04	1.7E-04	1.4E-04	1.3E-04
ESE	5.2E-03	5.6E-04	1.8E-04	1.6E-04	1.4E-04	1.1E-04	1.1E-04
E	4.8E-03	5.4E-04	2.1E-04	1.9E-04	1.5E-04	1.2E-04	1.2E-04
ENE	5.0E-03	4.7E-04	1.5E-04	1.4E-04	1.2E-04	1.0E-04	9.8E-05
NE	6.0E-03	6.2E-04	2.1E-04	1.9E-04	1.5E-04	1.3E-04	1.2E-04
NNE	5.4E-03	8.5E-04	2.7E-04	2.4E-04	1.9E-04	1.5E-04	1.3E-04

	Distance (m)	
Direction	200	260
N	1.3E-04	1.1E-04
NNW	8.3E-05	7.9E-05
NW	7.9E-05	7.7E-05
WNW	7.7E-05	7.5E-05
W	8.3E-05	7.9E-05
WSW	8.3E-05	7.9E-05
SW	8.6E-05	8.1E-05
SSW	9.9E-05	8.9E-05
S	1.3E-04	1.1E-04
SSE	1.2E-04	9.9E-05
SE	1.1E-04	9.5E-05
ESE	9.6E-05	8.7E-05
E	1.0E-04	9.0E-05
ENE	9.0E-05	8.3E-05
NE	1.0E-04	9.1E-05
NNE	1.2E-04	9.8E-05

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Tue May 03 09:41:41 2016

Facility: Maywood Interim Storage Site - Vic. Prop.WC-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent
(mrem)

1.12E-04

At This Location: 35 Meters South

Dataset Name: missWC-115.
Dataset Date: May 3, 2016 08:31 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 35 Meters South
Lifetime Fatal Cancer Risk: 3.47E-11

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	1.10E-05
UB_Wall	1.16E-05
Bone_Sur	8.06E-04
Brain	1.14E-05
Breasts	1.25E-05
St_Wall	1.15E-05
SI_Wall	1.14E-05
ULI_Wall	1.19E-05
LLI_Wall	1.32E-05
Kidneys	2.74E-05
Liver	3.31E-05
Muscle	1.27E-05
Ovaries	1.58E-05
Pancreas	1.09E-05
R_Marrow	5.40E-05
Skin	6.81E-05
Spleen	1.47E-05
Testes	1.75E-05
Thymus	1.13E-05
Thyroid	1.21E-05
GB_Wall	1.10E-05
Ht_Wall	1.14E-05
Uterus	1.13E-05
ET_Reg	2.06E-04
Lung_66	7.14E-04
Effectiv	1.12E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	7.1E-11	7.1E-11
Th-234	S	1.000	7.1E-11	7.1E-11
Pa-234m	B	0.000	7.1E-11	7.1E-11
Pa-234	M	1.000	9.2E-14	9.2E-14
U-234	M	1.000	7.6E-11	7.6E-11
Th-230	S	1.000	7.6E-11	7.6E-11
Ra-226	M	1.000	9.4E-11	9.4E-11
Po-218	B	0.000	9.4E-11	9.4E-11
Pb-214	M	1.000	9.4E-11	9.4E-11
Bi-214	M	1.000	9.4E-11	9.4E-11
Po-214	B	0.000	9.4E-11	9.4E-11
Pb-210	M	1.000	9.4E-11	9.4E-11
Bi-210	M	1.000	9.4E-11	9.4E-11
Po-210	B	0.000	9.4E-11	9.4E-11
U-235	M	1.000	3.3E-12	3.3E-12
Th-231	S	1.000	3.3E-12	3.3E-12
Pa-231	M	1.000	3.3E-12	3.3E-12
Ac-227	M	1.000	3.3E-12	3.3E-12
Th-227	S	1.000	3.3E-12	3.3E-12
Fr-223	M	1.000	4.6E-14	4.6E-14
Ra-223	M	1.000	3.3E-12	3.3E-12
Po-215	B	0.000	3.3E-12	3.3E-12
Pb-211	M	1.000	3.3E-12	3.3E-12
Bi-211	B	0.000	3.3E-12	3.3E-12
Tl-207	B	0.000	3.3E-12	3.3E-12
Po-211	B	0.000	9.1E-15	9.1E-15
Th-232	S	1.000	5.6E-10	5.6E-10
Ra-228	M	1.000	5.6E-10	5.6E-10
Ac-228	M	1.000	5.6E-10	5.6E-10
Th-228	S	1.000	5.6E-10	5.6E-10
Ra-224	M	1.000	5.6E-10	5.6E-10
Po-216	B	0.000	5.6E-10	5.6E-10
Pb-212	M	1.000	5.6E-10	5.6E-10
Bi-212	M	1.000	5.6E-10	5.6E-10
Po-212	B	0.000	3.6E-10	3.6E-10
Tl-208	B	0.000	2.0E-10	2.0E-10

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 238.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

35 40 45 50 65 75 100
120

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)
Adrenal	1.10E-05
UB_Wall	1.16E-05
Bone_Sur	8.06E-04
Brain	1.14E-05
Breasts	1.25E-05
St_Wall	1.15E-05
SI_Wall	1.14E-05
ULI_Wall	1.19E-05
LLI_Wall	1.32E-05
Kidneys	2.74E-05
Liver	3.31E-05
Muscle	1.27E-05
Ovaries	1.58E-05
Pancreas	1.09E-05
R_Marrow	5.40E-05
Skin	6.81E-05
Spleen	1.47E-05
Testes	1.75E-05
Thymus	1.13E-05
Thyroid	1.21E-05
GB_Wall	1.10E-05
Ht_Wall	1.14E-05
Uterus	1.13E-05
ET_Reg	2.06E-04
Lung_66	7.14E-04
Effectiv	1.12E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)
INGESTION	3.74E-06
INHALATION	9.83E-05
AIR IMMERSION	1.10E-09
GROUND SURFACE	9.96E-06
INTERNAL	1.02E-04
EXTERNAL	9.96E-06
TOTAL	1.12E-04

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem)
U-238	4.31E-07
Th-234	1.29E-08
Pa-234m	1.54E-07
Pa-234	3.03E-09
U-234	5.56E-07
Th-230	2.69E-06
Ra-226	9.66E-07
Rn-222	6.77E-10
Po-218	1.21E-14
Pb-214	4.45E-07
At-218	4.50E-14
Bi-214	2.72E-09
Rn-218	9.50E-20
Po-214	6.03E-15
Tl-210	8.88E-15
Pb-210	5.37E-07
Bi-210	4.62E-08
Hg-206	2.32E-15
Po-210	7.22E-07
Tl-206	6.72E-14
U-235	3.12E-08
Th-231	9.79E-10
Pa-231	8.03E-07
Ac-227	6.08E-07
Th-227	7.31E-08
Fr-223	6.95E-11
Ra-223	5.54E-08
Rn-219	1.58E-09
Po-215	2.97E-14
Pb-211	9.96E-11
At-219	0.00E+00
Bi-215	2.35E-20
Bi-211	3.10E-12
Tl-207	3.38E-14
Po-211	5.73E-17
Th-232	3.63E-05
Ra-228	5.99E-06
Ac-228	9.06E-06
Th-228	4.89E-05
Ra-224	3.23E-06
Rn-220	1.41E-09
Po-216	9.51E-12
Pb-212	2.64E-07
Bi-212	3.27E-08
Po-212	0.00E+00
Tl-208	1.03E-09
TOTAL	1.12E-04

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	35	40	45	50	65	75	100
N	1.0E-04	8.6E-05	6.9E-05	5.7E-05	3.5E-05	2.8E-05	1.7E-05
NNW	2.7E-05	1.8E-05	1.5E-05	1.3E-05	9.0E-06	7.5E-06	5.5E-06
NW	1.5E-05	1.2E-05	1.0E-05	8.7E-06	6.4E-06	5.5E-06	4.4E-06
WNW	1.1E-05	8.8E-06	7.6E-06	6.7E-06	5.2E-06	4.6E-06	3.9E-06
W	2.1E-05	1.7E-05	1.4E-05	1.2E-05	8.6E-06	7.3E-06	5.4E-06
WSW	2.2E-05	1.8E-05	1.5E-05	1.3E-05	8.8E-06	7.4E-06	5.5E-06
SW	2.9E-05	2.3E-05	1.9E-05	1.6E-05	1.1E-05	8.8E-06	6.3E-06
SSW	5.5E-05	4.2E-05	3.4E-05	2.8E-05	1.8E-05	1.5E-05	9.6E-06
S	1.1E-04	9.1E-05	7.3E-05	6.0E-05	3.8E-05	2.9E-05	1.8E-05
SSE	8.8E-05	6.8E-05	5.5E-05	4.5E-05	2.8E-05	2.2E-05	1.4E-05
SE	7.2E-05	5.7E-05	4.6E-05	3.8E-05	2.4E-05	1.9E-05	1.2E-05
ESE	5.0E-05	3.8E-05	3.1E-05	2.6E-05	1.7E-05	1.3E-05	8.8E-06
E	5.8E-05	4.7E-05	3.8E-05	3.1E-05	2.0E-05	1.6E-05	1.0E-05
ENE	3.8E-05	2.8E-05	2.3E-05	1.9E-05	1.3E-05	1.0E-05	7.2E-06
NE	6.1E-05	4.8E-05	3.9E-05	3.2E-05	2.1E-05	1.6E-05	1.1E-05
NNE	8.5E-05	6.7E-05	5.4E-05	4.4E-05	2.8E-05	2.2E-05	1.4E-05

	Distance (m)
Direction	120
N	1.3E-05
NNW	4.7E-06
NW	3.9E-06
WNW	3.6E-06
W	4.7E-06
WSW	4.7E-06
SW	5.3E-06
SSW	7.6E-06
S	1.3E-05
SSE	1.1E-05
SE	9.4E-06
ESE	7.1E-06
E	8.1E-06
ENE	5.9E-06
NE	8.3E-06
NNE	1.1E-05

Green shading = residents, Yellow shading = workers, Blue shading = residents & workers

11. CAP88-PC OUTPUT (Population)

```
                                C A P 8 8 - P C

                                 Version 4.0


                        Clean Air Act Assessment Package - 1988


                             S Y N O P S I S   R E P O R T

                           Non-Radon Population Assessment
                                Tue Apr 12 11:57:25 2016


        Facility:  Maywood Interim Storage Site - MISS Soil Load
         Address:  100 W. Hunter Avenue
            City:  Maywood
           State:  NJ          Zip:  07607


        Source Category:  Particulate Emission w radon daughters
            Source Type:  Area
          Emission Year:  2015
         DOSE Age Group:  Adult

        Comments:  CB&I for
                   U.S. Army Corps of Engineers


                Committed Effective Dose Equivalent
                              (mrem)
                ___________________________________

                             5.26E-04
                ___________________________________


        At This Location:    250 Meters South

 Dataset Name:  mispld15.
 Dataset Date:  Apr 12, 2016 11:57 AM
    Wind File:  C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File:  C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw
```

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 1.65E-10

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	5.11E-05	3.37E-04
UB_Wall	5.37E-05	3.55E-04
Bone_Sur	3.44E-03	1.75E-02
Brain	5.30E-05	3.50E-04
Breasts	5.82E-05	3.86E-04
St_Wall	5.36E-05	3.54E-04
SI_Wall	5.27E-05	3.48E-04
ULI_Wall	5.44E-05	3.59E-04
LLI_Wall	5.82E-05	3.84E-04
Kidneys	1.14E-04	6.74E-04
Liver	1.43E-04	8.14E-04
Muscle	5.96E-05	3.96E-04
Ovaries	7.33E-05	4.48E-04
Pancreas	5.03E-05	3.32E-04
R_Marrow	2.15E-04	1.20E-03
Skin	3.59E-04	2.47E-03
Spleen	5.97E-05	4.00E-04
Testes	8.17E-05	5.05E-04
Thymus	5.24E-05	3.46E-04
Thyroid	5.64E-05	3.74E-04
GB_Wall	5.07E-05	3.35E-04
Ht_Wall	5.31E-05	3.51E-04
Uterus	5.22E-05	3.45E-04
ET_Reg	9.88E-04	4.79E-03
Lung_66	3.43E-03	1.64E-02
Effectiv	5.26E-04	2.63E-03

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	2.0E-08	2.0E-08
Th-234	S	1.000	2.0E-08	2.0E-08
Pa-234m	B	0.000	2.0E-08	2.0E-08
Pa-234	M	1.000	2.6E-11	2.6E-11
U-234	M	1.000	2.2E-08	2.2E-08
Th-230	S	1.000	2.2E-08	2.2E-08
Ra-226	M	1.000	2.3E-08	2.3E-08
Po-218	B	0.000	2.3E-08	2.3E-08
Pb-214	M	1.000	2.3E-08	2.3E-08
Bi-214	M	1.000	2.3E-08	2.3E-08
Po-214	B	0.000	2.3E-08	2.3E-08
Pb-210	M	1.000	2.3E-08	2.3E-08
Bi-210	M	1.000	2.3E-08	2.3E-08
Po-210	B	0.000	2.3E-08	2.3E-08
U-235	M	1.000	9.5E-10	9.5E-10
Th-231	S	1.000	9.5E-10	9.5E-10
Pa-231	M	1.000	9.5E-10	9.5E-10
Ac-227	M	1.000	9.5E-10	9.5E-10
Th-227	S	1.000	9.4E-10	9.4E-10
Fr-223	M	1.000	1.3E-11	1.3E-11
Ra-223	M	1.000	9.5E-10	9.5E-10
Po-215	B	0.000	9.5E-10	9.5E-10
Pb-211	M	1.000	9.5E-10	9.5E-10
Bi-211	B	0.000	9.5E-10	9.5E-10
Tl-207	B	0.000	9.5E-10	9.5E-10
Po-211	B	0.000	2.6E-12	2.6E-12
Th-232	S	1.000	1.1E-07	1.1E-07
Ra-228	M	1.000	1.1E-07	1.1E-07
Ac-228	M	1.000	1.1E-07	1.1E-07
Th-228	S	1.000	1.1E-07	1.1E-07
Ra-224	M	1.000	1.1E-07	1.1E-07
Po-216	B	0.000	1.1E-07	1.1E-07
Pb-212	M	1.000	1.1E-07	1.1E-07
Bi-212	M	1.000	1.1E-07	1.1E-07
Po-212	B	0.000	7.3E-08	7.3E-08
Tl-208	B	0.000	4.1E-08	4.1E-08

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 163.50

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	5.11E-05	3.37E-04
UB_Wall	5.37E-05	3.55E-04
Bone_Sur	3.44E-03	1.75E-02
Brain	5.30E-05	3.50E-04
Breasts	5.82E-05	3.86E-04
St_Wall	5.36E-05	3.54E-04
SI_Wall	5.27E-05	3.48E-04
ULI_Wall	5.44E-05	3.59E-04
LLI_Wall	5.82E-05	3.84E-04
Kidneys	1.14E-04	6.74E-04
Liver	1.43E-04	8.14E-04
Muscle	5.96E-05	3.96E-04
Ovaries	7.33E-05	4.48E-04
Pancreas	5.03E-05	3.32E-04
R_Marrow	2.15E-04	1.20E-03
Skin	3.59E-04	2.47E-03
Spleen	5.97E-05	4.00E-04
Testes	8.17E-05	5.05E-04
Thymus	5.24E-05	3.46E-04
Thyroid	5.64E-05	3.74E-04
GB_Wall	5.07E-05	3.35E-04
Ht_Wall	5.31E-05	3.51E-04
Uterus	5.22E-05	3.45E-04
ET_Reg	9.88E-04	4.79E-03
Lung_66	3.43E-03	1.64E-02
Effectiv	5.26E-04	2.63E-03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	6.84E-07	3.01E-05
INHALATION	4.76E-04	2.26E-03
AIR IMMERSION	5.36E-09	2.18E-08
GROUND SURFACE	4.94E-05	3.41E-04
INTERNAL	4.76E-04	2.29E-03
EXTERNAL	4.94E-05	3.42E-04
TOTAL	5.26E-04	2.63E-03

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	2.78E-06	1.34E-05
Th-234	8.57E-08	5.78E-07
Pa-234m	1.06E-06	7.30E-06
Pa-234	2.08E-08	1.44E-07
U-234	3.59E-06	1.73E-05
Th-230	1.75E-05	8.41E-05
Ra-226	3.96E-06	2.14E-05
Rn-222	4.03E-09	2.79E-08
Po-218	7.21E-14	4.99E-13
Pb-214	2.65E-06	1.82E-05
At-218	2.67E-13	1.85E-12
Bi-214	1.57E-08	2.36E-08
Rn-218	2.83E-20	1.78E-20
Po-214	3.46E-14	5.05E-14
Tl-210	2.26E-13	3.52E-13
Pb-210	1.50E-06	9.63E-06
Bi-210	2.71E-07	1.66E-06
Hg-206	1.38E-14	9.55E-14
Po-210	3.53E-06	1.76E-05
Tl-206	4.00E-13	2.77E-12
U-235	2.06E-07	1.13E-06
Th-231	6.72E-09	4.65E-08
Pa-231	5.31E-06	2.54E-05
Ac-227	4.03E-06	1.92E-05
Th-227	4.88E-07	2.43E-06
Fr-223	4.77E-10	3.28E-09
Ra-223	3.69E-07	1.88E-06
Rn-219	1.08E-08	7.48E-08
Po-215	2.05E-13	1.41E-12
Pb-211	6.67E-10	3.46E-09
At-219	0.00E+00	0.00E+00
Bi-215	1.71E-19	1.54E-18
Bi-211	2.13E-11	1.44E-10
Tl-207	2.22E-13	3.19E-13
Po-211	3.68E-16	4.85E-16
Th-232	1.69E-04	8.09E-04
Ra-228	1.77E-05	9.98E-05
Ac-228	4.41E-05	3.05E-04
Th-228	2.30E-04	1.10E-03
Ra-224	1.53E-05	7.37E-05
Rn-220	6.84E-09	4.73E-08
Po-216	4.63E-11	3.20E-10
Pb-212	1.26E-06	6.89E-06
Bi-212	1.54E-07	7.38E-07
Po-212	0.00E+00	0.00E+00
Tl-208	4.97E-09	2.46E-08
TOTAL	5.26E-04	2.63E-03

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S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Tue May 03 11:27:57 2016

Facility: Maywood Interim Storage Site - Cluster 10A-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
2.14E-05

At This Location: 250 Meters South

Dataset Name: misp10A115.
Dataset Date: May 3, 2016 11:19 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 6.78E-12

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.09E-06	1.38E-05
UB_Wall	2.20E-06	1.46E-05
Bone_Sur	1.34E-04	6.83E-04
Brain	2.17E-06	1.43E-05
Breasts	2.38E-06	1.58E-05
St_Wall	2.19E-06	1.45E-05
SI_Wall	2.15E-06	1.43E-05
ULI_Wall	2.22E-06	1.47E-05
LLI_Wall	2.38E-06	1.57E-05
Kidneys	4.50E-06	2.67E-05
Liver	5.48E-06	3.16E-05
Muscle	2.44E-06	1.62E-05
Ovaries	2.94E-06	1.81E-05
Pancreas	2.06E-06	1.36E-05
R_Marrow	8.55E-06	4.81E-05
Skin	1.37E-05	9.41E-05
Spleen	2.40E-06	1.61E-05
Testes	3.29E-06	2.04E-05
Thymus	2.14E-06	1.42E-05
Thyroid	2.30E-06	1.53E-05
GB_Wall	2.07E-06	1.37E-05
Ht_Wall	2.17E-06	1.44E-05
Uterus	2.13E-06	1.41E-05
ET_Reg	4.05E-05	1.96E-04
Lung_66	1.41E-04	6.74E-04
Effectiv	2.14E-05	1.07E-04

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	6.0E-10	6.0E-10
Th-234	S	1.000	6.0E-10	6.0E-10
Pa-234m	B	0.000	6.0E-10	6.0E-10
Pa-234	M	1.000	7.8E-13	7.8E-13
U-234	M	1.000	6.4E-10	6.4E-10
Th-230	S	1.000	6.4E-10	6.4E-10
Ra-226	M	1.000	8.0E-10	8.0E-10
Po-218	B	0.000	8.0E-10	8.0E-10
Pb-214	M	1.000	8.0E-10	8.0E-10
Bi-214	M	1.000	8.0E-10	8.0E-10
Po-214	B	0.000	8.0E-10	8.0E-10
Pb-210	M	1.000	8.0E-10	8.0E-10
Bi-210	M	1.000	8.0E-10	8.0E-10
Po-210	B	0.000	8.0E-10	8.0E-10
U-235	M	1.000	2.8E-11	2.8E-11
Th-231	S	1.000	2.8E-11	2.8E-11
Pa-231	M	1.000	2.8E-11	2.8E-11
Ac-227	M	1.000	2.8E-11	2.8E-11
Th-227	S	1.000	2.8E-11	2.8E-11
Fr-223	M	1.000	3.9E-13	3.9E-13
Ra-223	M	1.000	2.8E-11	2.8E-11
Po-215	B	0.000	2.8E-11	2.8E-11
Pb-211	M	1.000	2.8E-11	2.8E-11
Bi-211	B	0.000	2.8E-11	2.8E-11
Tl-207	B	0.000	2.8E-11	2.8E-11
Po-211	B	0.000	7.7E-14	7.7E-14
Th-232	S	1.000	4.7E-09	4.7E-09
Ra-228	M	1.000	4.7E-09	4.7E-09
Ac-228	M	1.000	4.7E-09	4.7E-09
Th-228	S	1.000	4.7E-09	4.7E-09
Ra-224	M	1.000	4.7E-09	4.7E-09
Po-216	B	0.000	4.7E-09	4.7E-09
Pb-212	M	1.000	4.7E-09	4.7E-09
Bi-212	M	1.000	4.7E-09	4.7E-09
Po-212	B	0.000	3.0E-09	3.0E-09
Tl-208	B	0.000	1.7E-09	1.7E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 753.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.09E-06	1.38E-05
UB_Wall	2.20E-06	1.46E-05
Bone_Sur	1.34E-04	6.83E-04
Brain	2.17E-06	1.43E-05
Breasts	2.38E-06	1.58E-05
St_Wall	2.19E-06	1.45E-05
SI_Wall	2.15E-06	1.43E-05
ULI_Wall	2.22E-06	1.47E-05
LLI_Wall	2.38E-06	1.57E-05
Kidneys	4.50E-06	2.67E-05
Liver	5.48E-06	3.16E-05
Muscle	2.44E-06	1.62E-05
Ovaries	2.94E-06	1.81E-05
Pancreas	2.06E-06	1.36E-05
R_Marrow	8.55E-06	4.81E-05
Skin	1.37E-05	9.41E-05
Spleen	2.40E-06	1.61E-05
Testes	3.29E-06	2.04E-05
Thymus	2.14E-06	1.42E-05
Thyroid	2.30E-06	1.53E-05
GB_Wall	2.07E-06	1.37E-05
Ht_Wall	2.17E-06	1.44E-05
Uterus	2.13E-06	1.41E-05
ET_Reg	4.05E-05	1.96E-04
Lung_66	1.41E-04	6.74E-04
Effectiv	2.14E-05	1.07E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	2.71E-08	1.19E-06
INHALATION	1.94E-05	9.22E-05
AIR IMMERSION	2.18E-10	9.00E-10
GROUND SURFACE	2.02E-06	1.40E-05
INTERNAL	1.94E-05	9.34E-05
EXTERNAL	2.02E-06	1.40E-05
TOTAL	2.14E-05	1.07E-04

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	8.25E-08	3.97E-07
Th-234	2.54E-09	1.72E-08
Pa-234m	3.13E-08	2.16E-07
Pa-234	6.17E-10	4.27E-09
U-234	1.06E-07	5.12E-07
Th-230	5.20E-07	2.49E-06
Ra-226	1.35E-07	7.33E-07
Rn-222	1.38E-10	9.52E-10
Po-218	2.46E-15	1.70E-14
Pb-214	9.04E-08	6.22E-07
At-218	9.14E-15	6.32E-14
Bi-214	5.38E-10	8.07E-10
Rn-218	2.48E-22	3.45E-22
Po-214	1.19E-15	1.73E-15
Tl-210	7.50E-15	1.15E-14
Pb-210	5.13E-08	3.29E-07
Bi-210	9.28E-09	5.68E-08
Hg-206	4.72E-16	3.26E-15
Po-210	1.21E-07	6.00E-07
Tl-206	1.37E-14	9.45E-14
U-235	6.09E-09	3.34E-08
Th-231	1.99E-10	1.38E-09
Pa-231	1.57E-07	7.52E-07
Ac-227	1.19E-07	5.70E-07
Th-227	1.45E-08	7.20E-08
Fr-223	1.41E-11	9.68E-11
Ra-223	1.09E-08	5.57E-08
Rn-219	3.21E-10	2.19E-09
Po-215	6.07E-15	4.16E-14
Pb-211	1.98E-11	1.02E-10
At-219	0.00E+00	0.00E+00
Bi-215	6.59E-21	5.16E-20
Bi-211	6.33E-13	4.28E-12
Tl-207	6.24E-15	9.42E-15
Po-211	1.25E-17	1.53E-17
Th-232	7.07E-06	3.38E-05
Ra-228	7.40E-07	4.17E-06
Ac-228	1.84E-06	1.27E-05
Th-228	9.63E-06	4.59E-05
Ra-224	6.37E-07	3.08E-06
Rn-220	2.86E-10	1.97E-09
Po-216	1.93E-12	1.34E-11
Pb-212	5.25E-08	2.88E-07
Bi-212	6.45E-09	3.08E-08
Po-212	0.00E+00	0.00E+00
Tl-208	2.08E-10	1.03E-09
TOTAL	2.14E-05	1.07E-04

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Tue May 03 11:28:30 2016

Facility: Maywood Interim Storage Site - Cluster 10A-2
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
1.03E-04

At This Location: 250 Meters South

Dataset Name: misp10A215.
Dataset Date: May 3, 2016 11:20 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 3.25E-11

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	9.99E-06	6.61E-05
UB_Wall	1.05E-05	6.97E-05
Bone_Sur	6.43E-04	3.27E-03
Brain	1.04E-05	6.87E-05
Breasts	1.14E-05	7.57E-05
St_Wall	1.05E-05	6.95E-05
SI_Wall	1.03E-05	6.83E-05
ULI_Wall	1.06E-05	7.04E-05
LLI_Wall	1.14E-05	7.52E-05
Kidneys	2.16E-05	1.28E-04
Liver	2.62E-05	1.51E-04
Muscle	1.17E-05	7.76E-05
Ovaries	1.41E-05	8.66E-05
Pancreas	9.85E-06	6.51E-05
R_Marrow	4.10E-05	2.30E-04
Skin	6.56E-05	4.51E-04
Spleen	1.15E-05	7.71E-05
Testes	1.57E-05	9.79E-05
Thymus	1.02E-05	6.78E-05
Thyroid	1.10E-05	7.33E-05
GB_Wall	9.92E-06	6.56E-05
Ht_Wall	1.04E-05	6.87E-05
Uterus	1.02E-05	6.76E-05
ET_Reg	1.94E-04	9.41E-04
Lung_66	6.74E-04	3.23E-03
Effectiv	1.03E-04	5.14E-04

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	2.9E-09	2.9E-09
Th-234	S	1.000	2.9E-09	2.9E-09
Pa-234m	B	0.000	2.9E-09	2.9E-09
Pa-234	M	1.000	3.7E-12	3.7E-12
U-234	M	1.000	3.1E-09	3.1E-09
Th-230	S	1.000	3.1E-09	3.1E-09
Ra-226	M	1.000	3.8E-09	3.8E-09
Po-218	B	0.000	3.8E-09	3.8E-09
Pb-214	M	1.000	3.8E-09	3.8E-09
Bi-214	M	1.000	3.8E-09	3.8E-09
Po-214	B	0.000	3.8E-09	3.8E-09
Pb-210	M	1.000	3.8E-09	3.8E-09
Bi-210	M	1.000	3.8E-09	3.8E-09
Po-210	B	0.000	3.8E-09	3.8E-09
U-235	M	1.000	1.3E-10	1.3E-10
Th-231	S	1.000	1.3E-10	1.3E-10
Pa-231	M	1.000	1.3E-10	1.3E-10
Ac-227	M	1.000	1.3E-10	1.3E-10
Th-227	S	1.000	1.3E-10	1.3E-10
Fr-223	M	1.000	1.9E-12	1.9E-12
Ra-223	M	1.000	1.3E-10	1.3E-10
Po-215	B	0.000	1.3E-10	1.3E-10
Pb-211	M	1.000	1.3E-10	1.3E-10
Bi-211	B	0.000	1.3E-10	1.3E-10
Tl-207	B	0.000	1.3E-10	1.3E-10
Po-211	B	0.000	3.7E-13	3.7E-13
Th-232	S	1.000	2.3E-08	2.3E-08
Ra-228	M	1.000	2.3E-08	2.3E-08
Ac-228	M	1.000	2.3E-08	2.3E-08
Th-228	S	1.000	2.3E-08	2.3E-08
Ra-224	M	1.000	2.3E-08	2.3E-08
Po-216	B	0.000	2.3E-08	2.3E-08
Pb-212	M	1.000	2.3E-08	2.3E-08
Bi-212	M	1.000	2.3E-08	2.3E-08
Po-212	B	0.000	1.5E-08	1.5E-08
Tl-208	B	0.000	8.1E-09	8.1E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 3389.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	9.99E-06	6.61E-05
UB_Wall	1.05E-05	6.97E-05
Bone_Sur	6.43E-04	3.27E-03
Brain	1.04E-05	6.87E-05
Breasts	1.14E-05	7.57E-05
St_Wall	1.05E-05	6.95E-05
SI_Wall	1.03E-05	6.83E-05
ULI_Wall	1.06E-05	7.04E-05
LLI_Wall	1.14E-05	7.52E-05
Kidneys	2.16E-05	1.28E-04
Liver	2.62E-05	1.51E-04
Muscle	1.17E-05	7.76E-05
Ovaries	1.41E-05	8.66E-05
Pancreas	9.85E-06	6.51E-05
R_Marrow	4.10E-05	2.30E-04
Skin	6.56E-05	4.51E-04
Spleen	1.15E-05	7.71E-05
Testes	1.57E-05	9.79E-05
Thymus	1.02E-05	6.78E-05
Thyroid	1.10E-05	7.33E-05
GB_Wall	9.92E-06	6.56E-05
Ht_Wall	1.04E-05	6.87E-05
Uterus	1.02E-05	6.76E-05
ET_Reg	1.94E-04	9.41E-04
Lung_66	6.74E-04	3.23E-03
Effectiv	1.03E-04	5.14E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	1.30E-07	5.72E-06
INHALATION	9.28E-05	4.42E-04
AIR IMMERSION	1.05E-09	4.31E-09
GROUND SURFACE	9.69E-06	6.70E-05
INTERNAL	9.30E-05	4.47E-04
EXTERNAL	9.69E-06	6.70E-05
TOTAL	1.03E-04	5.14E-04

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	3.96E-07	1.90E-06
Th-234	1.22E-08	8.24E-08
Pa-234m	1.50E-07	1.04E-06
Pa-234	2.96E-09	2.05E-08
U-234	5.12E-07	2.46E-06
Th-230	2.50E-06	1.20E-05
Ra-226	6.47E-07	3.51E-06
Rn-222	6.59E-10	4.56E-09
Po-218	1.18E-14	8.15E-14
Pb-214	4.33E-07	2.98E-06
At-218	4.38E-14	3.03E-13
Bi-214	2.57E-09	3.86E-09
Rn-218	3.79E-21	2.64E-21
Po-214	5.67E-15	8.26E-15
Tl-210	3.44E-14	5.59E-14
Pb-210	2.46E-07	1.58E-06
Bi-210	4.44E-08	2.72E-07
Hg-206	2.26E-15	1.56E-14
Po-210	5.78E-07	2.87E-06
Tl-206	6.54E-14	4.53E-13
U-235	2.92E-08	1.60E-07
Th-231	9.54E-10	6.60E-09
Pa-231	7.53E-07	3.60E-06
Ac-227	5.72E-07	2.73E-06
Th-227	6.92E-08	3.45E-07
Fr-223	6.77E-11	4.65E-10
Ra-223	5.24E-08	2.67E-07
Rn-219	1.54E-09	1.06E-08
Po-215	2.90E-14	1.99E-13
Pb-211	9.45E-11	4.90E-10
At-219	0.00E+00	0.00E+00
Bi-215	2.94E-20	2.44E-19
Bi-211	3.02E-12	2.05E-11
Tl-207	3.13E-14	4.55E-14
Po-211	5.36E-17	7.30E-17
Th-232	3.39E-05	1.62E-04
Ra-228	3.54E-06	2.00E-05
Ac-228	8.81E-06	6.09E-05
Th-228	4.61E-05	2.20E-04
Ra-224	3.05E-06	1.47E-05
Rn-220	1.37E-09	9.45E-09
Po-216	9.26E-12	6.40E-11
Pb-212	2.51E-07	1.38E-06
Bi-212	3.09E-08	1.48E-07
Po-212	0.00E+00	0.00E+00
Tl-208	9.94E-10	4.92E-09
TOTAL	1.03E-04	5.14E-04

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Mon May 09 12:41:54 2016

Facility: Maywood Interim Storage Site - Cluster 10A-3
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
3.12E-06

At This Location: 250 Meters South

Dataset Name: misp10A315.
Dataset Date: May 9, 2016 12:41 PM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 9.85E-13

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.03E-07	2.00E-06
UB_Wall	3.19E-07	2.12E-06
Bone_Sur	1.95E-05	9.92E-05
Brain	3.15E-07	2.09E-06
Breasts	3.45E-07	2.30E-06
St_Wall	3.18E-07	2.11E-06
SI_Wall	3.13E-07	2.07E-06
ULI_Wall	3.23E-07	2.14E-06
LLI_Wall	3.45E-07	2.28E-06
Kidneys	6.54E-07	3.88E-06
Liver	7.96E-07	4.59E-06
Muscle	3.54E-07	2.36E-06
Ovaries	4.28E-07	2.63E-06
Pancreas	2.99E-07	1.97E-06
R_Marrow	1.24E-06	6.99E-06
Skin	1.99E-06	1.37E-05
Spleen	3.49E-07	2.34E-06
Testes	4.78E-07	2.97E-06
Thymus	3.11E-07	2.06E-06
Thyroid	3.35E-07	2.23E-06
GB_Wall	3.01E-07	1.99E-06
Ht_Wall	3.15E-07	2.09E-06
Uterus	3.10E-07	2.05E-06
ET_Reg	5.89E-06	2.85E-05
Lung_66	2.05E-05	9.79E-05
Effectiv	3.12E-06	1.56E-05

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	8.7E-11	8.7E-11
Th-234	S	1.000	8.7E-11	8.7E-11
Pa-234m	B	0.000	8.7E-11	8.7E-11
Pa-234	M	1.000	1.1E-13	1.1E-13
U-234	M	1.000	9.3E-11	9.3E-11
Th-230	S	1.000	9.3E-11	9.3E-11
Ra-226	M	1.000	1.2E-10	1.2E-10
Po-218	B	0.000	1.2E-10	1.2E-10
Pb-214	M	1.000	1.2E-10	1.2E-10
Bi-214	M	1.000	1.2E-10	1.2E-10
Po-214	B	0.000	1.2E-10	1.2E-10
Pb-210	M	1.000	1.2E-10	1.2E-10
Bi-210	M	1.000	1.2E-10	1.2E-10
Po-210	B	0.000	1.2E-10	1.2E-10
U-235	M	1.000	4.1E-12	4.1E-12
Th-231	S	1.000	4.1E-12	4.1E-12
Pa-231	M	1.000	4.1E-12	4.1E-12
Ac-227	M	1.000	4.1E-12	4.1E-12
Th-227	S	1.000	4.0E-12	4.0E-12
Fr-223	M	1.000	5.7E-14	5.7E-14
Ra-223	M	1.000	4.1E-12	4.1E-12
Po-215	B	0.000	4.1E-12	4.1E-12
Pb-211	M	1.000	4.1E-12	4.1E-12
Bi-211	B	0.000	4.1E-12	4.1E-12
Tl-207	B	0.000	4.1E-12	4.1E-12
Po-211	B	0.000	1.1E-14	1.1E-14
Th-232	S	1.000	6.9E-10	6.9E-10
Ra-228	M	1.000	6.9E-10	6.9E-10
Ac-228	M	1.000	6.9E-10	6.9E-10
Th-228	S	1.000	6.9E-10	6.9E-10
Ra-224	M	1.000	6.9E-10	6.9E-10
Po-216	B	0.000	6.9E-10	6.9E-10
Pb-212	M	1.000	6.9E-10	6.9E-10
Bi-212	M	1.000	6.9E-10	6.9E-10
Po-212	B	0.000	4.4E-10	4.4E-10
Tl-208	B	0.000	2.5E-10	2.5E-10

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 203.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.03E-07	2.00E-06
UB_Wall	3.19E-07	2.12E-06
Bone_Sur	1.95E-05	9.92E-05
Brain	3.15E-07	2.09E-06
Breasts	3.45E-07	2.30E-06
St_Wall	3.18E-07	2.11E-06
SI_Wall	3.13E-07	2.07E-06
ULI_Wall	3.23E-07	2.14E-06
LLI_Wall	3.45E-07	2.28E-06
Kidneys	6.54E-07	3.88E-06
Liver	7.96E-07	4.59E-06
Muscle	3.54E-07	2.36E-06
Ovaries	4.28E-07	2.63E-06
Pancreas	2.99E-07	1.97E-06
R_Marrow	1.24E-06	6.99E-06
Skin	1.99E-06	1.37E-05
Spleen	3.49E-07	2.34E-06
Testes	4.78E-07	2.97E-06
Thymus	3.11E-07	2.06E-06
Thyroid	3.35E-07	2.23E-06
GB_Wall	3.01E-07	1.99E-06
Ht_Wall	3.15E-07	2.09E-06
Uterus	3.10E-07	2.05E-06
ET_Reg	5.89E-06	2.85E-05
Lung_66	2.05E-05	9.79E-05
Effectiv	3.12E-06	1.56E-05

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	3.94E-09	1.73E-07
INHALATION	2.82E-06	1.34E-05
AIR IMMERSION	3.15E-11	1.31E-10
GROUND SURFACE	2.94E-07	2.03E-06
INTERNAL	2.82E-06	1.36E-05
EXTERNAL	2.94E-07	2.03E-06
TOTAL	3.12E-06	1.56E-05

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	1.20E-08	5.76E-08
Th-234	3.69E-10	2.49E-09
Pa-234m	4.54E-09	3.14E-08
Pa-234	8.96E-11	6.20E-10
U-234	1.55E-08	7.45E-08
Th-230	7.56E-08	3.62E-07
Ra-226	1.96E-08	1.06E-07
Rn-222	2.00E-11	1.38E-10
Po-218	3.57E-16	2.47E-15
Pb-214	1.31E-08	9.03E-08
At-218	1.33E-15	9.17E-15
Bi-214	7.85E-11	1.17E-10
Rn-218	3.46E-22	3.53E-22
Po-214	1.73E-16	2.51E-16
Tl-210	7.65E-16	1.58E-15
Pb-210	7.44E-09	4.77E-08
Bi-210	1.35E-09	8.21E-09
Hg-206	6.84E-17	4.72E-16
Po-210	1.75E-08	8.70E-08
Tl-206	1.98E-15	1.37E-14
U-235	8.84E-10	4.85E-09
Th-231	2.89E-11	2.00E-10
Pa-231	2.28E-08	1.09E-07
Ac-227	1.73E-08	8.26E-08
Th-227	2.10E-09	1.04E-08
Fr-223	2.05E-12	1.39E-11
Ra-223	1.59E-09	8.06E-09
Rn-219	4.65E-11	3.11E-10
Po-215	8.80E-16	6.02E-15
Pb-211	2.87E-12	1.50E-11
At-219	0.00E+00	0.00E+00
Bi-215	7.15E-22	6.25E-21
Bi-211	9.13E-14	6.20E-13
Tl-207	9.80E-16	1.55E-15
Po-211	1.58E-18	2.31E-18
Th-232	1.03E-06	4.91E-06
Ra-228	1.08E-07	6.06E-07
Ac-228	2.68E-07	1.85E-06
Th-228	1.40E-06	6.66E-06
Ra-224	9.26E-08	4.47E-07
Rn-220	4.15E-11	2.87E-10
Po-216	2.81E-13	1.94E-12
Pb-212	7.63E-09	4.18E-08
Bi-212	9.37E-10	4.48E-09
Po-212	0.00E+00	0.00E+00
Tl-208	2.99E-11	1.49E-10
TOTAL	3.12E-06	1.56E-05

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Tue May 03 11:29:20 2016

Facility: Maywood Interim Storage Site - Cluster 12A-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
3.60E-06

At This Location: 250 Meters South

Dataset Name: misp12A115.
Dataset Date: May 3, 2016 11:21 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 1.14E-12

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.50E-07	2.31E-06
UB_Wall	3.68E-07	2.44E-06
Bone_Sur	2.25E-05	1.15E-04
Brain	3.63E-07	2.41E-06
Breasts	3.99E-07	2.65E-06
St_Wall	3.67E-07	2.43E-06
SI_Wall	3.61E-07	2.39E-06
ULI_Wall	3.73E-07	2.47E-06
LLI_Wall	3.99E-07	2.64E-06
Kidneys	7.56E-07	4.48E-06
Liver	9.19E-07	5.29E-06
Muscle	4.09E-07	2.72E-06
Ovaries	4.94E-07	3.03E-06
Pancreas	3.45E-07	2.28E-06
R_Marrow	1.44E-06	8.07E-06
Skin	2.30E-06	1.58E-05
Spleen	4.03E-07	2.70E-06
Testes	5.52E-07	3.43E-06
Thymus	3.59E-07	2.37E-06
Thyroid	3.87E-07	2.57E-06
GB_Wall	3.48E-07	2.30E-06
Ht_Wall	3.64E-07	2.41E-06
Uterus	3.58E-07	2.37E-06
ET_Reg	6.80E-06	3.30E-05
Lung_66	2.36E-05	1.13E-04
Effectiv	3.60E-06	1.80E-05

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	1.0E-10	1.0E-10
Th-234	S	1.000	1.0E-10	1.0E-10
Pa-234m	B	0.000	1.0E-10	1.0E-10
Pa-234	M	1.000	1.3E-13	1.3E-13
U-234	M	1.000	1.1E-10	1.1E-10
Th-230	S	1.000	1.1E-10	1.1E-10
Ra-226	M	1.000	1.3E-10	1.3E-10
Po-218	B	0.000	1.3E-10	1.3E-10
Pb-214	M	1.000	1.3E-10	1.3E-10
Bi-214	M	1.000	1.3E-10	1.3E-10
Po-214	B	0.000	1.3E-10	1.3E-10
Pb-210	M	1.000	1.3E-10	1.3E-10
Bi-210	M	1.000	1.3E-10	1.3E-10
Po-210	B	0.000	1.3E-10	1.3E-10
U-235	M	1.000	4.7E-12	4.7E-12
Th-231	S	1.000	4.7E-12	4.7E-12
Pa-231	M	1.000	4.7E-12	4.7E-12
Ac-227	M	1.000	4.7E-12	4.7E-12
Th-227	S	1.000	4.7E-12	4.7E-12
Fr-223	M	1.000	6.5E-14	6.5E-14
Ra-223	M	1.000	4.7E-12	4.7E-12
Po-215	B	0.000	4.7E-12	4.7E-12
Pb-211	M	1.000	4.7E-12	4.7E-12
Bi-211	B	0.000	4.7E-12	4.7E-12
Tl-207	B	0.000	4.7E-12	4.7E-12
Po-211	B	0.000	1.3E-14	1.3E-14
Th-232	S	1.000	7.9E-10	7.9E-10
Ra-228	M	1.000	7.9E-10	7.9E-10
Ac-228	M	1.000	7.9E-10	7.9E-10
Th-228	S	1.000	7.9E-10	7.9E-10
Ra-224	M	1.000	7.9E-10	7.9E-10
Po-216	B	0.000	7.9E-10	7.9E-10
Pb-212	M	1.000	7.9E-10	7.9E-10
Bi-212	M	1.000	7.9E-10	7.9E-10
Po-212	B	0.000	5.1E-10	5.1E-10
Tl-208	B	0.000	2.8E-10	2.8E-10

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 397.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.50E-07	2.31E-06
UB_Wall	3.68E-07	2.44E-06
Bone_Sur	2.25E-05	1.15E-04
Brain	3.63E-07	2.41E-06
Breasts	3.99E-07	2.65E-06
St_Wall	3.67E-07	2.43E-06
SI_Wall	3.61E-07	2.39E-06
ULI_Wall	3.73E-07	2.47E-06
LLI_Wall	3.99E-07	2.64E-06
Kidneys	7.56E-07	4.48E-06
Liver	9.19E-07	5.29E-06
Muscle	4.09E-07	2.72E-06
Ovaries	4.94E-07	3.03E-06
Pancreas	3.45E-07	2.28E-06
R_Marrow	1.44E-06	8.07E-06
Skin	2.30E-06	1.58E-05
Spleen	4.03E-07	2.70E-06
Testes	5.52E-07	3.43E-06
Thymus	3.59E-07	2.37E-06
Thyroid	3.87E-07	2.57E-06
GB_Wall	3.48E-07	2.30E-06
Ht_Wall	3.64E-07	2.41E-06
Uterus	3.58E-07	2.37E-06
ET_Reg	6.80E-06	3.30E-05
Lung_66	2.36E-05	1.13E-04
Effectiv	3.60E-06	1.80E-05

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	4.54E-09	2.00E-07
INHALATION	3.25E-06	1.55E-05
AIR IMMERSION	3.64E-11	1.51E-10
GROUND SURFACE	3.40E-07	2.35E-06
INTERNAL	3.26E-06	1.57E-05
EXTERNAL	3.40E-07	2.35E-06
TOTAL	3.60E-06	1.80E-05

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	1.38E-08	6.66E-08
Th-234	4.26E-10	2.88E-09
Pa-234m	5.25E-09	3.63E-08
Pa-234	1.03E-10	7.16E-10
U-234	1.79E-08	8.60E-08
Th-230	8.73E-08	4.19E-07
Ra-226	2.27E-08	1.23E-07
Rn-222	2.31E-11	1.59E-10
Po-218	4.12E-16	2.85E-15
Pb-214	1.51E-08	1.04E-07
At-218	1.53E-15	1.06E-14
Bi-214	9.06E-11	1.35E-10
Rn-218	3.69E-22	3.46E-22
Po-214	2.00E-16	3.10E-16
Tl-210	9.27E-16	1.88E-15
Pb-210	8.60E-09	5.51E-08
Bi-210	1.55E-09	9.49E-09
Hg-206	7.91E-17	5.45E-16
Po-210	2.02E-08	1.01E-07
Tl-206	2.29E-15	1.58E-14
U-235	1.02E-09	5.59E-09
Th-231	3.34E-11	2.31E-10
Pa-231	2.63E-08	1.26E-07
Ac-227	2.00E-08	9.53E-08
Th-227	2.43E-09	1.21E-08
Fr-223	2.37E-12	1.61E-11
Ra-223	1.83E-09	9.30E-09
Rn-219	5.37E-11	3.60E-10
Po-215	1.02E-15	6.96E-15
Pb-211	3.31E-12	1.73E-11
At-219	0.00E+00	0.00E+00
Bi-215	8.35E-22	7.21E-21
Bi-211	1.05E-13	7.16E-13
Tl-207	1.01E-15	1.71E-15
Po-211	1.86E-18	2.66E-18
Th-232	1.19E-06	5.67E-06
Ra-228	1.24E-07	7.00E-07
Ac-228	3.09E-07	2.14E-06
Th-228	1.62E-06	7.69E-06
Ra-224	1.07E-07	5.17E-07
Rn-220	4.79E-11	3.31E-10
Po-216	3.24E-13	2.24E-12
Pb-212	8.81E-09	4.83E-08
Bi-212	1.08E-09	5.17E-09
Po-212	0.00E+00	0.00E+00
Tl-208	3.46E-11	1.72E-10
TOTAL	3.60E-06	1.80E-05

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Tue May 03 11:29:38 2016

Facility: Maywood Interim Storage Site - Cluster 12A-2
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent
(mrem)

6.22E-06

At This Location: 250 Meters South

Dataset Name: misp12A215.
Dataset Date: May 3, 2016 11:22 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 1.97E-12

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	6.06E-07	4.00E-06
UB_Wall	6.37E-07	4.23E-06
Bone_Sur	3.90E-05	1.98E-04
Brain	6.29E-07	4.17E-06
Breasts	6.90E-07	4.59E-06
St_Wall	6.36E-07	4.21E-06
SI_Wall	6.25E-07	4.14E-06
ULI_Wall	6.45E-07	4.27E-06
LLI_Wall	6.90E-07	4.56E-06
Kidneys	1.31E-06	7.76E-06
Liver	1.59E-06	9.16E-06
Muscle	7.07E-07	4.71E-06
Ovaries	8.54E-07	5.25E-06
Pancreas	5.97E-07	3.95E-06
R_Marrow	2.48E-06	1.40E-05
Skin	3.98E-06	2.73E-05
Spleen	6.97E-07	4.67E-06
Testes	9.55E-07	5.93E-06
Thymus	6.21E-07	4.11E-06
Thyroid	6.69E-07	4.44E-06
GB_Wall	6.01E-07	3.98E-06
Ht_Wall	6.30E-07	4.17E-06
Uterus	6.19E-07	4.10E-06
ET_Reg	1.18E-05	5.70E-05
Lung_66	4.09E-05	1.96E-04
Effectiv	6.22E-06	3.12E-05

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	1.8E-10	1.8E-10
Th-234	S	1.000	1.8E-10	1.8E-10
Pa-234m	B	0.000	1.8E-10	1.8E-10
Pa-234	M	1.000	2.3E-13	2.3E-13
U-234	M	1.000	1.9E-10	1.9E-10
Th-230	S	1.000	1.9E-10	1.9E-10
Ra-226	M	1.000	2.3E-10	2.3E-10
Po-218	B	0.000	2.3E-10	2.3E-10
Pb-214	M	1.000	2.3E-10	2.3E-10
Bi-214	M	1.000	2.3E-10	2.3E-10
Po-214	B	0.000	2.3E-10	2.3E-10
Pb-210	M	1.000	2.3E-10	2.3E-10
Bi-210	M	1.000	2.3E-10	2.3E-10
Po-210	B	0.000	2.3E-10	2.3E-10
U-235	M	1.000	8.2E-12	8.2E-12
Th-231	S	1.000	8.2E-12	8.2E-12
Pa-231	M	1.000	8.2E-12	8.2E-12
Ac-227	M	1.000	8.2E-12	8.2E-12
Th-227	S	1.000	8.1E-12	8.1E-12
Fr-223	M	1.000	1.1E-13	1.1E-13
Ra-223	M	1.000	8.2E-12	8.2E-12
Po-215	B	0.000	8.2E-12	8.2E-12
Pb-211	M	1.000	8.2E-12	8.2E-12
Bi-211	B	0.000	8.2E-12	8.2E-12
Tl-207	B	0.000	8.2E-12	8.2E-12
Po-211	B	0.000	2.2E-14	2.2E-14
Th-232	S	1.000	1.4E-09	1.4E-09
Ra-228	M	1.000	1.4E-09	1.4E-09
Ac-228	M	1.000	1.4E-09	1.4E-09
Th-228	S	1.000	1.4E-09	1.4E-09
Ra-224	M	1.000	1.4E-09	1.4E-09
Po-216	B	0.000	1.4E-09	1.4E-09
Pb-212	M	1.000	1.4E-09	1.4E-09
Bi-212	M	1.000	1.4E-09	1.4E-09
Po-212	B	0.000	8.8E-10	8.8E-10
Tl-208	B	0.000	4.9E-10	4.9E-10

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 577.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	6.06E-07	4.00E-06
UB_Wall	6.37E-07	4.23E-06
Bone_Sur	3.90E-05	1.98E-04
Brain	6.29E-07	4.17E-06
Breasts	6.90E-07	4.59E-06
St_Wall	6.36E-07	4.21E-06
SI_Wall	6.25E-07	4.14E-06
ULI_Wall	6.45E-07	4.27E-06
LLI_Wall	6.90E-07	4.56E-06
Kidneys	1.31E-06	7.76E-06
Liver	1.59E-06	9.16E-06
Muscle	7.07E-07	4.71E-06
Ovaries	8.54E-07	5.25E-06
Pancreas	5.97E-07	3.95E-06
R_Marrow	2.48E-06	1.40E-05
Skin	3.98E-06	2.73E-05
Spleen	6.97E-07	4.67E-06
Testes	9.55E-07	5.93E-06
Thymus	6.21E-07	4.11E-06
Thyroid	6.69E-07	4.44E-06
GB_Wall	6.01E-07	3.98E-06
Ht_Wall	6.30E-07	4.17E-06
Uterus	6.19E-07	4.10E-06
ET_Reg	1.18E-05	5.70E-05
Lung_66	4.09E-05	1.96E-04
Effectiv	6.22E-06	3.12E-05

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	7.87E-09	3.47E-07
INHALATION	5.63E-06	2.68E-05
AIR IMMERSION	6.33E-11	2.61E-10
GROUND SURFACE	5.87E-07	4.06E-06
INTERNAL	5.64E-06	2.71E-05
EXTERNAL	5.88E-07	4.06E-06
TOTAL	6.22E-06	3.12E-05

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	2.40E-08	1.15E-07
Th-234	7.39E-10	4.99E-09
Pa-234m	9.10E-09	6.29E-08
Pa-234	1.79E-10	1.24E-09
U-234	3.10E-08	1.49E-07
Th-230	1.51E-07	7.25E-07
Ra-226	3.94E-08	2.13E-07
Rn-222	4.01E-11	2.77E-10
Po-218	7.17E-16	4.96E-15
Pb-214	2.63E-08	1.81E-07
At-218	2.66E-15	1.84E-14
Bi-214	1.57E-10	2.35E-10
Rn-218	2.77E-22	2.79E-22
Po-214	3.46E-16	5.45E-16
Tl-210	1.83E-15	3.21E-15
Pb-210	1.49E-08	9.59E-08
Bi-210	2.70E-09	1.65E-08
Hg-206	1.37E-16	9.49E-16
Po-210	3.52E-08	1.75E-07
Tl-206	3.98E-15	2.75E-14
U-235	1.77E-09	9.70E-09
Th-231	5.79E-11	4.00E-10
Pa-231	4.57E-08	2.18E-07
Ac-227	3.47E-08	1.65E-07
Th-227	4.21E-09	2.09E-08
Fr-223	4.11E-12	2.80E-11
Ra-223	3.18E-09	1.61E-08
Rn-219	9.31E-11	6.28E-10
Po-215	1.76E-15	1.21E-14
Pb-211	5.74E-12	2.96E-11
At-219	0.00E+00	0.00E+00
Bi-215	1.53E-21	1.32E-20
Bi-211	1.83E-13	1.24E-12
Tl-207	1.78E-15	2.74E-15
Po-211	3.22E-18	4.38E-18
Th-232	2.05E-06	9.81E-06
Ra-228	2.15E-07	1.21E-06
Ac-228	5.34E-07	3.69E-06
Th-228	2.79E-06	1.33E-05
Ra-224	1.85E-07	8.94E-07
Rn-220	8.29E-11	5.73E-10
Po-216	5.61E-13	3.88E-12
Pb-212	1.52E-08	8.35E-08
Bi-212	1.87E-09	8.95E-09
Po-212	0.00E+00	0.00E+00
Tl-208	6.01E-11	2.98E-10
TOTAL	6.22E-06	3.12E-05

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Tue May 03 11:29:57 2016

Facility: Maywood Interim Storage Site - Cluster 12B-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
3.81E-04

At This Location: 250 Meters South

Dataset Name: misp12B115.
Dataset Date: May 3, 2016 11:23 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 1.20E-10

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.71E-05	2.45E-04
UB_Wall	3.90E-05	2.58E-04
Bone_Sur	2.38E-03	1.21E-02
Brain	3.84E-05	2.55E-04
Breasts	4.22E-05	2.81E-04
St_Wall	3.89E-05	2.58E-04
SI_Wall	3.82E-05	2.53E-04
ULI_Wall	3.95E-05	2.61E-04
LLI_Wall	4.22E-05	2.79E-04
Kidneys	8.00E-05	4.74E-04
Liver	9.72E-05	5.60E-04
Muscle	4.32E-05	2.88E-04
Ovaries	5.23E-05	3.21E-04
Pancreas	3.65E-05	2.41E-04
R_Marrow	1.52E-04	8.54E-04
Skin	2.43E-04	1.67E-03
Spleen	4.26E-05	2.86E-04
Testes	5.84E-05	3.63E-04
Thymus	3.80E-05	2.51E-04
Thyroid	4.09E-05	2.72E-04
GB_Wall	3.68E-05	2.43E-04
Ht_Wall	3.85E-05	2.55E-04
Uterus	3.79E-05	2.51E-04
ET_Reg	7.19E-04	3.49E-03
Lung_66	2.50E-03	1.20E-02
Effectiv	3.81E-04	1.91E-03

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	1.1E-08	1.1E-08
Th-234	S	1.000	1.1E-08	1.1E-08
Pa-234m	B	0.000	1.1E-08	1.1E-08
Pa-234	M	1.000	1.4E-11	1.4E-11
U-234	M	1.000	1.1E-08	1.1E-08
Th-230	S	1.000	1.1E-08	1.1E-08
Ra-226	M	1.000	1.4E-08	1.4E-08
Po-218	B	0.000	1.4E-08	1.4E-08
Pb-214	M	1.000	1.4E-08	1.4E-08
Bi-214	M	1.000	1.4E-08	1.4E-08
Po-214	B	0.000	1.4E-08	1.4E-08
Pb-210	M	1.000	1.4E-08	1.4E-08
Bi-210	M	1.000	1.4E-08	1.4E-08
Po-210	B	0.000	1.4E-08	1.4E-08
U-235	M	1.000	5.0E-10	5.0E-10
Th-231	S	1.000	5.0E-10	5.0E-10
Pa-231	M	1.000	5.0E-10	5.0E-10
Ac-227	M	1.000	5.0E-10	5.0E-10
Th-227	S	1.000	4.9E-10	4.9E-10
Fr-223	M	1.000	6.9E-12	6.9E-12
Ra-223	M	1.000	5.0E-10	5.0E-10
Po-215	B	0.000	5.0E-10	5.0E-10
Pb-211	M	1.000	5.0E-10	5.0E-10
Bi-211	B	0.000	5.0E-10	5.0E-10
Tl-207	B	0.000	5.0E-10	5.0E-10
Po-211	B	0.000	1.4E-12	1.4E-12
Th-232	S	1.000	8.4E-08	8.4E-08
Ra-228	M	1.000	8.4E-08	8.4E-08
Ac-228	M	1.000	8.4E-08	8.4E-08
Th-228	S	1.000	8.4E-08	8.4E-08
Ra-224	M	1.000	8.4E-08	8.4E-08
Po-216	B	0.000	8.4E-08	8.4E-08
Pb-212	M	1.000	8.4E-08	8.4E-08
Bi-212	M	1.000	8.4E-08	8.4E-08
Po-212	B	0.000	5.4E-08	5.4E-08
Tl-208	B	0.000	3.0E-08	3.0E-08

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 5089.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.71E-05	2.45E-04
UB_Wall	3.90E-05	2.58E-04
Bone_Sur	2.38E-03	1.21E-02
Brain	3.84E-05	2.55E-04
Breasts	4.22E-05	2.81E-04
St_Wall	3.89E-05	2.58E-04
SI_Wall	3.82E-05	2.53E-04
ULI_Wall	3.95E-05	2.61E-04
LLI_Wall	4.22E-05	2.79E-04
Kidneys	8.00E-05	4.74E-04
Liver	9.72E-05	5.60E-04
Muscle	4.32E-05	2.88E-04
Ovaries	5.23E-05	3.21E-04
Pancreas	3.65E-05	2.41E-04
R_Marrow	1.52E-04	8.54E-04
Skin	2.43E-04	1.67E-03
Spleen	4.26E-05	2.86E-04
Testes	5.84E-05	3.63E-04
Thymus	3.80E-05	2.51E-04
Thyroid	4.09E-05	2.72E-04
GB_Wall	3.68E-05	2.43E-04
Ht_Wall	3.85E-05	2.55E-04
Uterus	3.79E-05	2.51E-04
ET_Reg	7.19E-04	3.49E-03
Lung_66	2.50E-03	1.20E-02
Effectiv	3.81E-04	1.91E-03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	4.81E-07	2.12E-05
INHALATION	3.44E-04	1.64E-03
AIR IMMERSION	3.87E-09	1.60E-08
GROUND SURFACE	3.59E-05	2.48E-04
INTERNAL	3.45E-04	1.66E-03
EXTERNAL	3.59E-05	2.49E-04
TOTAL	3.81E-04	1.91E-03

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	1.47E-06	7.05E-06
Th-234	4.52E-08	3.05E-07
Pa-234m	5.56E-07	3.85E-06
Pa-234	1.10E-08	7.58E-08
U-234	1.89E-06	9.08E-06
Th-230	9.21E-06	4.42E-05
Ra-226	2.40E-06	1.30E-05
Rn-222	2.44E-09	1.69E-08
Po-218	4.37E-14	3.02E-13
Pb-214	1.60E-06	1.10E-05
At-218	1.62E-13	1.12E-12
Bi-214	9.53E-09	1.43E-08
Rn-218	1.60E-20	1.41E-20
Po-214	2.10E-14	3.06E-14
Tl-210	1.38E-13	2.15E-13
Pb-210	9.11E-07	5.84E-06
Bi-210	1.65E-07	1.01E-06
Hg-206	8.38E-15	5.79E-14
Po-210	2.14E-06	1.07E-05
Tl-206	2.43E-13	1.68E-12
U-235	1.08E-07	5.92E-07
Th-231	3.53E-09	2.44E-08
Pa-231	2.79E-06	1.33E-05
Ac-227	2.12E-06	1.01E-05
Th-227	2.57E-07	1.28E-06
Fr-223	2.51E-10	1.73E-09
Ra-223	1.94E-07	9.88E-07
Rn-219	5.69E-09	3.93E-08
Po-215	1.08E-13	7.39E-13
Pb-211	3.51E-10	1.82E-09
At-219	0.00E+00	0.00E+00
Bi-215	9.51E-20	1.44E-18
Bi-211	1.12E-11	7.59E-11
Tl-207	1.17E-13	1.68E-13
Po-211	1.95E-16	2.56E-16
Th-232	1.26E-04	6.00E-04
Ra-228	1.31E-05	7.40E-05
Ac-228	3.27E-05	2.26E-04
Th-228	1.71E-04	8.14E-04
Ra-224	1.13E-05	5.47E-05
Rn-220	5.07E-09	3.51E-08
Po-216	3.43E-11	2.37E-10
Pb-212	9.32E-07	5.11E-06
Bi-212	1.14E-07	5.47E-07
Po-212	0.00E+00	0.00E+00
Tl-208	3.68E-09	1.83E-08
TOTAL	3.81E-04	1.91E-03

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Tue May 03 11:30:23 2016

Facility: Maywood Interim Storage Site - Cluster 12B-2
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
1.17E-04

At This Location: 250 Meters South

Dataset Name: misp12B215.
Dataset Date: May 3, 2016 11:23 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 3.71E-11

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	1.14E-05	7.54E-05
UB_Wall	1.20E-05	7.96E-05
Bone_Sur	7.34E-04	3.73E-03
Brain	1.18E-05	7.84E-05
Breasts	1.30E-05	8.64E-05
St_Wall	1.20E-05	7.93E-05
SI_Wall	1.18E-05	7.80E-05
ULI_Wall	1.22E-05	8.03E-05
LLI_Wall	1.30E-05	8.59E-05
Kidneys	2.46E-05	1.46E-04
Liver	2.99E-05	1.73E-04
Muscle	1.33E-05	8.86E-05
Ovaries	1.61E-05	9.88E-05
Pancreas	1.12E-05	7.43E-05
R_Marrow	4.68E-05	2.63E-04
Skin	7.48E-05	5.14E-04
Spleen	1.31E-05	8.80E-05
Testes	1.80E-05	1.12E-04
Thymus	1.17E-05	7.74E-05
Thyroid	1.26E-05	8.37E-05
GB_Wall	1.13E-05	7.49E-05
Ht_Wall	1.19E-05	7.85E-05
Uterus	1.17E-05	7.72E-05
ET_Reg	2.21E-04	1.07E-03
Lung_66	7.69E-04	3.68E-03
Effectiv	1.17E-04	5.87E-04

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Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	3.3E-09	3.3E-09
Th-234	S	1.000	3.3E-09	3.3E-09
Pa-234m	B	0.000	3.3E-09	3.3E-09
Pa-234	M	1.000	4.3E-12	4.3E-12
U-234	M	1.000	3.5E-09	3.5E-09
Th-230	S	1.000	3.5E-09	3.5E-09
Ra-226	M	1.000	4.4E-09	4.4E-09
Po-218	B	0.000	4.4E-09	4.4E-09
Pb-214	M	1.000	4.4E-09	4.4E-09
Bi-214	M	1.000	4.4E-09	4.4E-09
Po-214	B	0.000	4.4E-09	4.4E-09
Pb-210	M	1.000	4.4E-09	4.4E-09
Bi-210	M	1.000	4.4E-09	4.4E-09
Po-210	B	0.000	4.4E-09	4.4E-09
U-235	M	1.000	1.5E-10	1.5E-10
Th-231	S	1.000	1.5E-10	1.5E-10
Pa-231	M	1.000	1.5E-10	1.5E-10
Ac-227	M	1.000	1.5E-10	1.5E-10
Th-227	S	1.000	1.5E-10	1.5E-10
Fr-223	M	1.000	2.1E-12	2.1E-12
Ra-223	M	1.000	1.5E-10	1.5E-10
Po-215	B	0.000	1.5E-10	1.5E-10
Pb-211	M	1.000	1.5E-10	1.5E-10
Bi-211	B	0.000	1.5E-10	1.5E-10
Tl-207	B	0.000	1.5E-10	1.5E-10
Po-211	B	0.000	4.2E-13	4.2E-13
Th-232	S	1.000	2.6E-08	2.6E-08
Ra-228	M	1.000	2.6E-08	2.6E-08
Ac-228	M	1.000	2.6E-08	2.6E-08
Th-228	S	1.000	2.6E-08	2.6E-08
Ra-224	M	1.000	2.6E-08	2.6E-08
Po-216	B	0.000	2.6E-08	2.6E-08
Pb-212	M	1.000	2.6E-08	2.6E-08
Bi-212	M	1.000	2.6E-08	2.6E-08
Po-212	B	0.000	1.6E-08	1.6E-08
Tl-208	B	0.000	9.3E-09	9.3E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 5433.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	1.14E-05	7.54E-05
UB_Wall	1.20E-05	7.96E-05
Bone_Sur	7.34E-04	3.73E-03
Brain	1.18E-05	7.84E-05
Breasts	1.30E-05	8.64E-05
St_Wall	1.20E-05	7.93E-05
SI_Wall	1.18E-05	7.80E-05
ULI_Wall	1.22E-05	8.03E-05
LLI_Wall	1.30E-05	8.59E-05
Kidneys	2.46E-05	1.46E-04
Liver	2.99E-05	1.73E-04
Muscle	1.33E-05	8.86E-05
Ovaries	1.61E-05	9.88E-05
Pancreas	1.12E-05	7.43E-05
R_Marrow	4.68E-05	2.63E-04
Skin	7.48E-05	5.14E-04
Spleen	1.31E-05	8.80E-05
Testes	1.80E-05	1.12E-04
Thymus	1.17E-05	7.74E-05
Thyroid	1.26E-05	8.37E-05
GB_Wall	1.13E-05	7.49E-05
Ht_Wall	1.19E-05	7.85E-05
Uterus	1.17E-05	7.72E-05
ET_Reg	2.21E-04	1.07E-03
Lung_66	7.69E-04	3.68E-03
Effectiv	1.17E-04	5.87E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	1.48E-07	6.53E-06
INHALATION	1.06E-04	5.04E-04
AIR IMMERSION	1.19E-09	4.92E-09
GROUND SURFACE	1.11E-05	7.65E-05
INTERNAL	1.06E-04	5.11E-04
EXTERNAL	1.11E-05	7.65E-05
TOTAL	1.17E-04	5.87E-04

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	4.51E-07	2.17E-06
Th-234	1.39E-08	9.38E-08
Pa-234m	1.71E-07	1.18E-06
Pa-234	3.37E-09	2.33E-08
U-234	5.83E-07	2.80E-06
Th-230	2.85E-06	1.36E-05
Ra-226	7.39E-07	4.00E-06
Rn-222	7.52E-10	5.20E-09
Po-218	1.34E-14	9.30E-14
Pb-214	4.94E-07	3.40E-06
At-218	4.99E-14	3.45E-13
Bi-214	2.93E-09	4.40E-09
Rn-218	4.35E-21	3.07E-21
Po-214	6.47E-15	9.42E-15
Tl-210	3.93E-14	6.39E-14
Pb-210	2.80E-07	1.80E-06
Bi-210	5.07E-08	3.10E-07
Hg-206	2.58E-15	1.78E-14
Po-210	6.60E-07	3.28E-06
Tl-206	7.47E-14	5.16E-13
U-235	3.33E-08	1.82E-07
Th-231	1.09E-09	7.52E-09
Pa-231	8.59E-07	4.11E-06
Ac-227	6.52E-07	3.11E-06
Th-227	7.91E-08	3.94E-07
Fr-223	7.72E-11	5.31E-10
Ra-223	5.97E-08	3.04E-07
Rn-219	1.75E-09	1.21E-08
Po-215	3.32E-14	2.28E-13
Pb-211	1.08E-10	5.59E-10
At-219	0.00E+00	0.00E+00
Bi-215	3.30E-20	3.24E-19
Bi-211	3.45E-12	2.34E-11
Tl-207	3.58E-14	5.18E-14
Po-211	6.10E-17	8.28E-17
Th-232	3.87E-05	1.85E-04
Ra-228	4.05E-06	2.28E-05
Ac-228	1.01E-05	6.95E-05
Th-228	5.26E-05	2.51E-04
Ra-224	3.48E-06	1.68E-05
Rn-220	1.56E-09	1.08E-08
Po-216	1.06E-11	7.31E-11
Pb-212	2.87E-07	1.57E-06
Bi-212	3.52E-08	1.69E-07
Po-212	0.00E+00	0.00E+00
Tl-208	1.13E-09	5.62E-09
TOTAL	1.17E-04	5.87E-04

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Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Tue May 03 11:30:41 2016

Facility: Maywood Interim Storage Site - Vic. Prop.TR-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
2.56E-05

At This Location: 250 Meters South

Dataset Name: mispTR-115.
Dataset Date: May 3, 2016 11:24 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 8.10E-12

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.49E-06	1.65E-05
UB_Wall	2.62E-06	1.74E-05
Bone_Sur	1.60E-04	8.16E-04
Brain	2.59E-06	1.71E-05
Breasts	2.84E-06	1.89E-05
St_Wall	2.62E-06	1.73E-05
SI_Wall	2.57E-06	1.70E-05
ULI_Wall	2.66E-06	1.76E-05
LLI_Wall	2.84E-06	1.88E-05
Kidneys	5.38E-06	3.19E-05
Liver	6.54E-06	3.77E-05
Muscle	2.91E-06	1.94E-05
Ovaries	3.52E-06	2.16E-05
Pancreas	2.46E-06	1.62E-05
R_Marrow	1.02E-05	5.75E-05
Skin	1.64E-05	1.12E-04
Spleen	2.87E-06	1.92E-05
Testes	3.93E-06	2.44E-05
Thymus	2.56E-06	1.69E-05
Thyroid	2.75E-06	1.83E-05
GB_Wall	2.48E-06	1.64E-05
Ht_Wall	2.59E-06	1.72E-05
Uterus	2.55E-06	1.69E-05
ET_Reg	4.84E-05	2.35E-04
Lung_66	1.68E-04	8.05E-04
Effectiv	2.56E-05	1.28E-04

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	7.2E-10	7.2E-10
Th-234	S	1.000	7.2E-10	7.2E-10
Pa-234m	B	0.000	7.2E-10	7.2E-10
Pa-234	M	1.000	9.4E-13	9.4E-13
U-234	M	1.000	7.7E-10	7.7E-10
Th-230	S	1.000	7.7E-10	7.7E-10
Ra-226	M	1.000	9.6E-10	9.6E-10
Po-218	B	0.000	9.6E-10	9.6E-10
Pb-214	M	1.000	9.6E-10	9.6E-10
Bi-214	M	1.000	9.6E-10	9.6E-10
Po-214	B	0.000	9.6E-10	9.6E-10
Pb-210	M	1.000	9.6E-10	9.6E-10
Bi-210	M	1.000	9.6E-10	9.6E-10
Po-210	B	0.000	9.6E-10	9.6E-10
U-235	M	1.000	3.4E-11	3.4E-11
Th-231	S	1.000	3.4E-11	3.4E-11
Pa-231	M	1.000	3.4E-11	3.4E-11
Ac-227	M	1.000	3.4E-11	3.4E-11
Th-227	S	1.000	3.3E-11	3.3E-11
Fr-223	M	1.000	4.6E-13	4.6E-13
Ra-223	M	1.000	3.4E-11	3.4E-11
Po-215	B	0.000	3.4E-11	3.4E-11
Pb-211	M	1.000	3.4E-11	3.4E-11
Bi-211	B	0.000	3.4E-11	3.4E-11
Tl-207	B	0.000	3.4E-11	3.4E-11
Po-211	B	0.000	9.2E-14	9.2E-14
Th-232	S	1.000	5.6E-09	5.6E-09
Ra-228	M	1.000	5.6E-09	5.6E-09
Ac-228	M	1.000	5.6E-09	5.6E-09
Th-228	S	1.000	5.6E-09	5.6E-09
Ra-224	M	1.000	5.6E-09	5.6E-09
Po-216	B	0.000	5.6E-09	5.6E-09
Pb-212	M	1.000	5.6E-09	5.6E-09
Bi-212	M	1.000	5.6E-09	5.6E-09
Po-212	B	0.000	3.6E-09	3.6E-09
Tl-208	B	0.000	2.0E-09	2.0E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 573.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.49E-06	1.65E-05
UB_Wall	2.62E-06	1.74E-05
Bone_Sur	1.60E-04	8.16E-04
Brain	2.59E-06	1.71E-05
Breasts	2.84E-06	1.89E-05
St_Wall	2.62E-06	1.73E-05
SI_Wall	2.57E-06	1.70E-05
ULI_Wall	2.66E-06	1.76E-05
LLI_Wall	2.84E-06	1.88E-05
Kidneys	5.38E-06	3.19E-05
Liver	6.54E-06	3.77E-05
Muscle	2.91E-06	1.94E-05
Ovaries	3.52E-06	2.16E-05
Pancreas	2.46E-06	1.62E-05
R_Marrow	1.02E-05	5.75E-05
Skin	1.64E-05	1.12E-04
Spleen	2.87E-06	1.92E-05
Testes	3.93E-06	2.44E-05
Thymus	2.56E-06	1.69E-05
Thyroid	2.75E-06	1.83E-05
GB_Wall	2.48E-06	1.64E-05
Ht_Wall	2.59E-06	1.72E-05
Uterus	2.55E-06	1.69E-05
ET_Reg	4.84E-05	2.35E-04
Lung_66	1.68E-04	8.05E-04
Effectiv	2.56E-05	1.28E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	3.24E-08	1.43E-06
INHALATION	2.32E-05	1.10E-04
AIR IMMERSION	2.61E-10	1.08E-09
GROUND SURFACE	2.42E-06	1.67E-05
INTERNAL	2.32E-05	1.12E-04
EXTERNAL	2.42E-06	1.67E-05
TOTAL	2.56E-05	1.28E-04

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	9.85E-08	4.74E-07
Th-234	3.03E-09	2.05E-08
Pa-234m	3.74E-08	2.59E-07
Pa-234	7.37E-10	5.10E-09
U-234	1.27E-07	6.12E-07
Th-230	6.22E-07	2.98E-06
Ra-226	1.62E-07	8.75E-07
Rn-222	1.65E-10	1.14E-09
Po-218	2.94E-15	2.03E-14
Pb-214	1.08E-07	7.44E-07
At-218	1.09E-14	7.56E-14
Bi-214	6.42E-10	9.64E-10
Rn-218	5.86E-22	5.02E-22
Po-214	1.42E-15	2.06E-15
Tl-210	9.04E-15	1.38E-14
Pb-210	6.13E-08	3.93E-07
Bi-210	1.11E-08	6.78E-08
Hg-206	5.64E-16	3.90E-15
Po-210	1.44E-07	7.17E-07
Tl-206	1.63E-14	1.13E-13
U-235	7.28E-09	3.99E-08
Th-231	2.38E-10	1.65E-09
Pa-231	1.88E-07	8.99E-07
Ac-227	1.43E-07	6.81E-07
Th-227	1.73E-08	8.60E-08
Fr-223	1.69E-11	1.16E-10
Ra-223	1.31E-08	6.65E-08
Rn-219	3.83E-10	2.62E-09
Po-215	7.25E-15	4.97E-14
Pb-211	2.36E-11	1.22E-10
At-219	0.00E+00	0.00E+00
Bi-215	8.20E-21	6.07E-20
Bi-211	7.55E-13	5.11E-12
Tl-207	7.61E-15	1.13E-14
Po-211	1.43E-17	1.78E-17
Th-232	8.45E-06	4.04E-05
Ra-228	8.85E-07	4.98E-06
Ac-228	2.20E-06	1.52E-05
Th-228	1.15E-05	5.48E-05
Ra-224	7.62E-07	3.68E-06
Rn-220	3.41E-10	2.36E-09
Po-216	2.31E-12	1.60E-11
Pb-212	6.28E-08	3.44E-07
Bi-212	7.71E-09	3.68E-08
Po-212	0.00E+00	0.00E+00
Tl-208	2.48E-10	1.23E-09
TOTAL	2.56E-05	1.28E-04

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S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Mon May 09 14:33:01 2016

Facility: Maywood Interim Storage Site - Vic. Prop.205M-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent (mrem)
3.78E-05

At This Location: 250 Meters South

Dataset Name: misp205M-115.
Dataset Date: May 9, 2016 02:32 PM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

Mon May 09 14:33:01 2016 SYNOPSIS
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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 1.20E-11

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.68E-06	2.43E-05
UB_Wall	3.87E-06	2.57E-05
Bone_Sur	2.37E-04	1.20E-03
Brain	3.82E-06	2.53E-05
Breasts	4.19E-06	2.79E-05
St_Wall	3.86E-06	2.56E-05
SI_Wall	3.80E-06	2.52E-05
ULI_Wall	3.92E-06	2.59E-05
LLI_Wall	4.19E-06	2.77E-05
Kidneys	7.95E-06	4.71E-05
Liver	9.66E-06	5.57E-05
Muscle	4.30E-06	2.86E-05
Ovaries	5.19E-06	3.19E-05
Pancreas	3.63E-06	2.40E-05
R_Marrow	1.51E-05	8.48E-05
Skin	2.41E-05	1.66E-04
Spleen	4.24E-06	2.84E-05
Testes	5.80E-06	3.61E-05
Thymus	3.78E-06	2.50E-05
Thyroid	4.07E-06	2.70E-05
GB_Wall	3.66E-06	2.42E-05
Ht_Wall	3.83E-06	2.53E-05
Uterus	3.76E-06	2.49E-05
ET_Reg	7.15E-05	3.47E-04
Lung_66	2.48E-04	1.19E-03
Effectiv	3.78E-05	1.90E-04

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	1.1E-09	1.1E-09
Th-234	S	1.000	1.1E-09	1.1E-09
Pa-234m	B	0.000	1.1E-09	1.1E-09
Pa-234	M	1.000	1.4E-12	1.4E-12
U-234	M	1.000	1.1E-09	1.1E-09
Th-230	S	1.000	1.1E-09	1.1E-09
Ra-226	M	1.000	1.4E-09	1.4E-09
Po-218	B	0.000	1.4E-09	1.4E-09
Pb-214	M	1.000	1.4E-09	1.4E-09
Bi-214	M	1.000	1.4E-09	1.4E-09
Po-214	B	0.000	1.4E-09	1.4E-09
Pb-210	M	1.000	1.4E-09	1.4E-09
Bi-210	M	1.000	1.4E-09	1.4E-09
Po-210	B	0.000	1.4E-09	1.4E-09
U-235	M	1.000	5.0E-11	5.0E-11
Th-231	S	1.000	5.0E-11	5.0E-11
Pa-231	M	1.000	5.0E-11	5.0E-11
Ac-227	M	1.000	5.0E-11	5.0E-11
Th-227	S	1.000	4.9E-11	4.9E-11
Fr-223	M	1.000	6.9E-13	6.9E-13
Ra-223	M	1.000	5.0E-11	5.0E-11
Po-215	B	0.000	5.0E-11	5.0E-11
Pb-211	M	1.000	5.0E-11	5.0E-11
Bi-211	B	0.000	5.0E-11	5.0E-11
Tl-207	B	0.000	5.0E-11	5.0E-11
Po-211	B	0.000	1.4E-13	1.4E-13
Th-232	S	1.000	8.3E-09	8.3E-09
Ra-228	M	1.000	8.3E-09	8.3E-09
Ac-228	M	1.000	8.3E-09	8.3E-09
Th-228	S	1.000	8.3E-09	8.3E-09
Ra-224	M	1.000	8.3E-09	8.3E-09
Po-216	B	0.000	8.3E-09	8.3E-09
Pb-212	M	1.000	8.3E-09	8.3E-09
Bi-212	M	1.000	8.3E-09	8.3E-09
Po-212	B	0.000	5.3E-09	5.3E-09
Tl-208	B	0.000	3.0E-09	3.0E-09

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 879.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.68E-06	2.43E-05
UB_Wall	3.87E-06	2.57E-05
Bone_Sur	2.37E-04	1.20E-03
Brain	3.82E-06	2.53E-05
Breasts	4.19E-06	2.79E-05
St_Wall	3.86E-06	2.56E-05
SI_Wall	3.80E-06	2.52E-05
ULI_Wall	3.92E-06	2.59E-05
LLI_Wall	4.19E-06	2.77E-05
Kidneys	7.95E-06	4.71E-05
Liver	9.66E-06	5.57E-05
Muscle	4.30E-06	2.86E-05
Ovaries	5.19E-06	3.19E-05
Pancreas	3.63E-06	2.40E-05
R_Marrow	1.51E-05	8.48E-05
Skin	2.41E-05	1.66E-04
Spleen	4.24E-06	2.84E-05
Testes	5.80E-06	3.61E-05
Thymus	3.78E-06	2.50E-05
Thyroid	4.07E-06	2.70E-05
GB_Wall	3.66E-06	2.42E-05
Ht_Wall	3.83E-06	2.53E-05
Uterus	3.76E-06	2.49E-05
ET_Reg	7.15E-05	3.47E-04
Lung_66	2.48E-04	1.19E-03
Effectiv	3.78E-05	1.90E-04

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	4.78E-08	2.11E-06
INHALATION	3.42E-05	1.63E-04
AIR IMMERSION	3.85E-10	1.59E-09
GROUND SURFACE	3.57E-06	2.47E-05
INTERNAL	3.43E-05	1.65E-04
EXTERNAL	3.57E-06	2.47E-05
TOTAL	3.78E-05	1.90E-04

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	1.45E-07	6.99E-07
Th-234	4.47E-09	3.02E-08
Pa-234m	5.51E-08	3.81E-07
Pa-234	1.09E-09	7.51E-09
U-234	1.87E-07	9.00E-07
Th-230	9.13E-07	4.38E-06
Ra-226	2.38E-07	1.29E-06
Rn-222	2.43E-10	1.68E-09
Po-218	4.34E-15	3.00E-14
Pb-214	1.59E-07	1.10E-06
At-218	1.61E-14	1.11E-13
Bi-214	9.47E-10	1.42E-09
Rn-218	3.39E-22	4.69E-22
Po-214	2.09E-15	3.04E-15
Tl-210	1.33E-14	2.06E-14
Pb-210	9.05E-08	5.80E-07
Bi-210	1.64E-08	1.00E-07
Hg-206	8.32E-16	5.75E-15
Po-210	2.13E-07	1.06E-06
Tl-206	2.41E-14	1.67E-13
U-235	1.07E-08	5.89E-08
Th-231	3.51E-10	2.43E-09
Pa-231	2.77E-07	1.33E-06
Ac-227	2.11E-07	1.00E-06
Th-227	2.55E-08	1.27E-07
Fr-223	2.49E-11	1.71E-10
Ra-223	1.93E-08	9.82E-08
Rn-219	5.65E-10	3.88E-09
Po-215	1.07E-14	7.34E-14
Pb-211	3.48E-11	1.80E-10
At-219	0.00E+00	0.00E+00
Bi-215	1.34E-20	9.30E-20
Bi-211	1.11E-12	7.54E-12
Tl-207	1.13E-14	1.66E-14
Po-211	2.05E-17	2.60E-17
Th-232	1.25E-05	5.96E-05
Ra-228	1.31E-06	7.36E-06
Ac-228	3.25E-06	2.25E-05
Th-228	1.70E-05	8.09E-05
Ra-224	1.12E-06	5.43E-06
Rn-220	5.04E-10	3.49E-09
Po-216	3.41E-12	2.36E-11
Pb-212	9.27E-08	5.08E-07
Bi-212	1.14E-08	5.44E-08
Po-212	0.00E+00	0.00E+00
Tl-208	3.66E-10	1.81E-09
TOTAL	3.78E-05	1.90E-04

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Tue May 03 11:31:19 2016

Facility: Maywood Interim Storage Site - Vic. Prop.WC-1
Address: 100 W. Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Particulate Emission w radon daughters
Source Type: Area
Emission Year: 2015
DOSE Age Group: Adult

Comments: CB&I for
U.S. Army Corps of Engineers

Committed Effective Dose Equivalent
(mrem)

2.53E-06

At This Location: 250 Meters South

Dataset Name: mispWC-115.
Dataset Date: May 3, 2016 11:25 AM
Wind File: C:\Users\stephen.vigeant\Documents\CAP88\Wind Files\tet
p File: C:\Users\stephen.vigeant\Documents\CAP88\Population Files\mayw

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters South
Lifetime Fatal Cancer Risk: 8.00E-13

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.46E-07	1.63E-06
UB_Wall	2.59E-07	1.72E-06
Bone_Sur	1.58E-05	8.06E-05
Brain	2.55E-07	1.69E-06
Breasts	2.81E-07	1.86E-06
St_Wall	2.58E-07	1.71E-06
SI_Wall	2.54E-07	1.68E-06
ULI_Wall	2.62E-07	1.73E-06
LLI_Wall	2.81E-07	1.85E-06
Kidneys	5.31E-07	3.15E-06
Liver	6.46E-07	3.72E-06
Muscle	2.87E-07	1.91E-06
Ovaries	3.47E-07	2.13E-06
Pancreas	2.43E-07	1.60E-06
R_Marrow	1.01E-06	5.67E-06
Skin	1.61E-06	1.11E-05
Spleen	2.83E-07	1.90E-06
Testes	3.88E-07	2.41E-06
Thymus	2.52E-07	1.67E-06
Thyroid	2.72E-07	1.81E-06
GB_Wall	2.44E-07	1.62E-06
Ht_Wall	2.56E-07	1.69E-06
Uterus	2.52E-07	1.67E-06
ET_Reg	4.78E-06	2.32E-05
Lung_66	1.66E-05	7.95E-05
Effectiv	2.53E-06	1.27E-05

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RADIONUCLIDE EMISSIONS DURING THE YEAR 2015

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	M	1.000	7.1E-11	7.1E-11
Th-234	S	1.000	7.1E-11	7.1E-11
Pa-234m	B	0.000	7.1E-11	7.1E-11
Pa-234	M	1.000	9.2E-14	9.2E-14
U-234	M	1.000	7.6E-11	7.6E-11
Th-230	S	1.000	7.6E-11	7.6E-11
Ra-226	M	1.000	9.4E-11	9.4E-11
Po-218	B	0.000	9.4E-11	9.4E-11
Pb-214	M	1.000	9.4E-11	9.4E-11
Bi-214	M	1.000	9.4E-11	9.4E-11
Po-214	B	0.000	9.4E-11	9.4E-11
Pb-210	M	1.000	9.4E-11	9.4E-11
Bi-210	M	1.000	9.4E-11	9.4E-11
Po-210	B	0.000	9.4E-11	9.4E-11
U-235	M	1.000	3.3E-12	3.3E-12
Th-231	S	1.000	3.3E-12	3.3E-12
Pa-231	M	1.000	3.3E-12	3.3E-12
Ac-227	M	1.000	3.3E-12	3.3E-12
Th-227	S	1.000	3.3E-12	3.3E-12
Fr-223	M	1.000	4.6E-14	4.6E-14
Ra-223	M	1.000	3.3E-12	3.3E-12
Po-215	B	0.000	3.3E-12	3.3E-12
Pb-211	M	1.000	3.3E-12	3.3E-12
Bi-211	B	0.000	3.3E-12	3.3E-12
Tl-207	B	0.000	3.3E-12	3.3E-12
Po-211	B	0.000	9.1E-15	9.1E-15
Th-232	S	1.000	5.6E-10	5.6E-10
Ra-228	M	1.000	5.6E-10	5.6E-10
Ac-228	M	1.000	5.6E-10	5.6E-10
Th-228	S	1.000	5.6E-10	5.6E-10
Ra-224	M	1.000	5.6E-10	5.6E-10
Po-216	B	0.000	5.6E-10	5.6E-10
Pb-212	M	1.000	5.6E-10	5.6E-10
Bi-212	M	1.000	5.6E-10	5.6E-10
Po-212	B	0.000	3.6E-10	3.6E-10
Tl-208	B	0.000	2.0E-10	2.0E-10

SITE INFORMATION

Temperature:	13.100 degrees C
Precipitation:	95.500 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

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SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 238.00

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.0800	0.0000	0.0100
Fraction From Assessment Area:	0.9200	1.0000	0.9900
Fraction Imported:	0.0000	0.0000	0.0000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

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POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	76	228	908	1514	2120	2726	22720
NNW	76	228	908	1514	2120	2726	22720
NW	76	228	908	1514	2120	2726	22720
WNW	76	228	908	1514	2120	2726	20407
W	76	228	908	1514	2120	2726	18094
WSW	76	228	908	1514	2120	2726	18094
SW	76	228	908	1514	2120	2726	18383
SSW	76	228	908	1514	2120	2726	22720
S	76	228	908	1514	2120	2726	22720
SSE	76	228	908	1514	2120	2726	29355
SE	76	228	908	1514	2120	2726	22720
ESE	76	228	908	1514	2120	2726	22720
E	76	228	908	1514	2120	2726	22720
ENE	76	228	908	1514	2120	2726	22720
NE	76	228	908	1514	2120	2726	22720
NNE	76	228	908	1514	2120	2726	22720

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	84434	68188	80216	33880	32143	37228	35855
NNW	90881	113449	43449	29226	35721	42215	46250
NW	84434	89147	120626	143395	54348	28978	36017
WNW	64233	73980	103571	49425	23732	28048	28370
W	72628	95252	54025	67898	54316	46407	34302
WSW	127136	189687	63943	67309	79637	671188	33708
SW	136005	257814	269313	166949	127056	89677	144963
SSW	161027	282282	321140	240032	173772	204331	437015
S	267817	404284	328613	31028	55293	114357	103675
SSE	608746	1103790	1268252	43245	0	0	0
SE	921385	768797	874654	411342	39727	0	0
ESE	948491	548018	315866	346710	316625	117321	58386
E	642213	329351	65099	166023	85633	101201	116771
ENE	95748	86743	90498	68061	62389	73733	85077
NE	74062	65058	116187	147131	182579	143851	162437
NNE	74148	34107	91238	142377	86448	43169	46213

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.46E-07	1.63E-06
UB_Wall	2.59E-07	1.72E-06
Bone_Sur	1.58E-05	8.06E-05
Brain	2.55E-07	1.69E-06
Breasts	2.81E-07	1.86E-06
St_Wall	2.58E-07	1.71E-06
SI_Wall	2.54E-07	1.68E-06
ULI_Wall	2.62E-07	1.73E-06
LLI_Wall	2.81E-07	1.85E-06
Kidneys	5.31E-07	3.15E-06
Liver	6.46E-07	3.72E-06
Muscle	2.87E-07	1.91E-06
Ovaries	3.47E-07	2.13E-06
Pancreas	2.43E-07	1.60E-06
R_Marrow	1.01E-06	5.67E-06
Skin	1.61E-06	1.11E-05
Spleen	2.83E-07	1.90E-06
Testes	3.88E-07	2.41E-06
Thymus	2.52E-07	1.67E-06
Thyroid	2.72E-07	1.81E-06
GB_Wall	2.44E-07	1.62E-06
Ht_Wall	2.56E-07	1.69E-06
Uterus	2.52E-07	1.67E-06
ET_Reg	4.78E-06	2.32E-05
Lung_66	1.66E-05	7.95E-05
Effectiv	2.53E-06	1.27E-05

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	3.20E-09	1.41E-07
INHALATION	2.29E-06	1.09E-05
AIR IMMERSION	2.56E-11	1.06E-10
GROUND SURFACE	2.39E-07	1.65E-06
INTERNAL	2.29E-06	1.10E-05
EXTERNAL	2.39E-07	1.65E-06
TOTAL	2.53E-06	1.27E-05

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
U-238	9.71E-09	4.67E-08
Th-234	2.99E-10	2.02E-09
Pa-234m	3.69E-09	2.55E-08
Pa-234	7.27E-11	5.03E-10
U-234	1.26E-08	6.04E-08
Th-230	6.14E-08	2.94E-07
Ra-226	1.59E-08	8.63E-08
Rn-222	1.62E-11	1.12E-10
Po-218	2.90E-16	2.01E-15
Pb-214	1.07E-08	7.34E-08
At-218	1.08E-15	7.45E-15
Bi-214	6.39E-11	9.56E-11
Rn-218	3.16E-22	3.62E-22
Po-214	1.41E-16	2.05E-16
Tl-210	5.75E-16	1.27E-15
Pb-210	6.05E-09	3.88E-08
Bi-210	1.09E-09	6.67E-09
Hg-206	5.56E-17	3.83E-16
Po-210	1.42E-08	7.08E-08
Tl-206	1.61E-15	1.11E-14
U-235	7.18E-10	3.93E-09
Th-231	2.35E-11	1.62E-10
Pa-231	1.85E-08	8.86E-08
Ac-227	1.41E-08	6.71E-08
Th-227	1.71E-09	8.48E-09
Fr-223	1.66E-12	1.13E-11
Ra-223	1.29E-09	6.54E-09
Rn-219	3.78E-11	2.52E-10
Po-215	7.15E-16	4.90E-15
Pb-211	2.33E-12	1.21E-11
At-219	0.00E+00	0.00E+00
Bi-215	5.71E-22	5.03E-21
Bi-211	7.41E-14	5.03E-13
Tl-207	7.98E-16	1.27E-15
Po-211	1.26E-18	1.88E-18
Th-232	8.35E-07	3.99E-06
Ra-228	8.74E-08	4.92E-07
Ac-228	2.17E-07	1.50E-06
Th-228	1.14E-06	5.41E-06
Ra-224	7.52E-08	3.63E-07
Rn-220	3.37E-11	2.33E-10
Po-216	2.28E-13	1.58E-12
Pb-212	6.20E-09	3.40E-08
Bi-212	7.61E-10	3.64E-09
Po-212	0.00E+00	0.00E+00
Tl-208	2.43E-11	1.21E-10
TOTAL	2.53E-06	1.27E-05

ATTACHMENT A

RADIONUCLIDE SOURCE TERM EMISSIONS CALCULATIONS
FUSRAP MAYWOOD SUPERFUND SITE - MISS
CALENDAR YEAR 2015

IN SITU SOIL WIND EROSION EMISSIONS (AP-42, Chapter 13.2.5, "Industrial Wind Erosion", 11/2006)

INPUT PARAMETERS:				Vegetative Cover/Gravel		Bare Soil/Load-Out Pile	
				TSP	PM-10	TSP	PM-10
Particle Size Multiplier (k)				1	0.5	1	0.5
Number of Disturbances per Period	(Assumption)			4	4	4	4
Surface Area of Soil (m^2)	(Assumption)			7301	7301	7244	7244
Threshold Friction Velocity (m/s)	(Table 13.2.5-2)	Overburden		1.02	1.02	1.02	1.02
Anemometer Height (m)	(Teterboro LCD)			10.0	10.0	10.0	10.0
Roughness Height (m)	(Table 13.2.5-2)	Overburden		0.003	0.003	0.003	0.003
Highest 2-Minute Wind Speed (mph)	(Teterboro LCD)		Week				
January			1	29	29	29	29
			2	22	22	22	22
			3	28	28	28	28
			4	29	29	29	29
February			1	31	31	31	31
			2	26	26	26	26
			3	33	33	33	33
			4	26	26	26	26
March			1	26	26	26	26
			2	29	29	29	29
			3	37	37	37	37
			4	23	23	23	23
			5	23	23	23	23
April			1	32	32	32	32
			2	25	25	25	25
			3	23	23	23	23
			4	35	35	35	35
May			1	22	22	22	22
			2	24	24	24	24
			3	21	21	21	21
			4	23	23	23	23
			5	23	23	23	23
June			1	20	20	20	20
			2	22	22	22	22
			3	26	26	26	26
			4	23	23	23	23
July			1	22	22	22	22
			2	24	24	24	24
			3	22	22	22	22
			4	24	24	24	24
			5	24	24	24	24
August			1	23	23	23	23
			2	21	21	21	21
			3	21	21	21	21
			4	20	20	20	20
			5	20	20	20	20
September			1	26	26	26	26
			2	21	21	21	21

		3	16	16	16	16
		4	22	22	22	22
	October	1	21	21	21	21
		2	22	22	22	22
		3	22	22	22	22
		4	28	28	28	28
	November	1	22	22	22	22
		2	28	28	28	28
		3	24	24	24	24
		4	18	18	18	18
	December	1	23	23	23	23
		2	16	16	16	16
		3	26	26	26	26
		4	24	24	24	24
Friction Velocity (m/s)						
	January	1	0.69	0.69	0.69	0.69
		2	0.52	0.52	0.52	0.52
		3	0.66	0.66	0.66	0.66
		4	0.69	0.69	0.69	0.69
	February	1	0.73	0.73	0.73	0.73
		2	0.62	0.62	0.62	0.62
		3	0.78	0.78	0.78	0.78
		4	0.62	0.62	0.62	0.62
	March	1	0.62	0.62	0.62	0.62
		2	0.69	0.69	0.69	0.69
		3	0.88	0.88	0.88	0.88
		4	0.54	0.54	0.54	0.54
		5	0.54	0.54	0.54	0.54
	April	1	0.76	0.76	0.76	0.76
		2	0.59	0.59	0.59	0.59
		3	0.54	0.54	0.54	0.54
		4	0.83	0.83	0.83	0.83
	May	1	0.52	0.52	0.52	0.52
		2	0.57	0.57	0.57	0.57
		3	0.50	0.50	0.50	0.50
		4	0.54	0.54	0.54	0.54
		5	0.54	0.54	0.54	0.54
	June	1	0.47	0.47	0.47	0.47
		2	0.52	0.52	0.52	0.52
		3	0.62	0.62	0.62	0.62
		4	0.54	0.54	0.54	0.54
	July	1	0.52	0.52	0.52	0.52
		2	0.57	0.57	0.57	0.57
		3	0.52	0.52	0.52	0.52
		4	0.57	0.57	0.57	0.57
		5	0.57	0.57	0.57	0.57
	August	1	0.54	0.54	0.54	0.54
		2	0.50	0.50	0.50	0.50
		3	0.50	0.50	0.50	0.50
		4	0.47	0.47	0.47	0.47
		5	0.47	0.47	0.47	0.47
	September	1	0.62	0.62	0.62	0.62
		2	0.50	0.50	0.50	0.50
		3	0.38	0.38	0.38	0.38
		4	0.52	0.52	0.52	0.52

October	1	0.50	0.50	0.50	0.50
	2	0.52	0.52	0.52	0.52
	3	0.52	0.52	0.52	0.52
	4	0.66	0.66	0.66	0.66
November	1	0.52	0.52	0.52	0.52
	2	0.66	0.66	0.66	0.66
	3	0.57	0.57	0.57	0.57
	4	0.43	0.43	0.43	0.43
December	1	0.54	0.54	0.54	0.54
	2	0.38	0.38	0.38	0.38
	3	0.62	0.62	0.62	0.62
	4	0.57	0.57	0.57	0.57

	Vegetative Cover	Bare Soil
CONTROL EFFICIENCY (%)-	99	0

EROSION POTENTIAL -E (g/m^2):

January	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00
February	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00
March	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00
	5	0.00	0.00	0.00	0.00
April	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00
May	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00
	5	0.00	0.00	0.00	0.00
June	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00
July	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00
	5	0.00	0.00	0.00	0.00
August	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00
	5	0.00	0.00	0.00	0.00
September	1	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00

		3	0.00	0.00	0.00	0.00
		4	0.00	0.00	0.00	0.00
	October	1	0.00	0.00	0.00	0.00
		2	0.00	0.00	0.00	0.00
		3	0.00	0.00	0.00	0.00
		4	0.00	0.00	0.00	0.00
	November	1	0.00	0.00	0.00	0.00
		2	0.00	0.00	0.00	0.00
		3	0.00	0.00	0.00	0.00
		4	0.00	0.00	0.00	0.00
	December	1	0.00	0.00	0.00	0.00
		2	0.00	0.00	0.00	0.00
		3	0.00	0.00	0.00	0.00
		4	0.00	0.00	0.00	0.00

ANNUAL EMISSIONS (grams/year): Vegetative Cover/Gravel Bare Soil/Load-Out Pile

E (TSP) =	0.00	0.00
E (PM-10) =	0.00	0.00

RADIONUCLIDE SOURCE CONCENTRATION

AVERAGE DETECTED ACTIVITY (MEASURED)

INPUT PARAMETERS:

		U238	U234	U235	Ra226	Th232
Activity Concentration (S) - pCi/g	(Vegetative Cover/Gravel)	27.5	N/A	N/A	4.3	24.8
Activity Concentration (S) - pCi/g	(Bare Soil)	1.37	N/A	N/A	1.58	7.63
Isotope Contribution to Total Uranium (P) - %		47.249	50.539	2.212	N/A	N/A

ANNUAL RADIOACTIVITY EMISSION RATES (Ci/yr)

	Vegetative Cover/Gravel	Bare Soil
U238	0.00E+00	0.00E+00
Th234	0.00E+00	0.00E+00
Pa234m	0.00E+00	0.00E+00
Pa234	0.00E+00	0.00E+00
U234	0.00E+00	0.00E+00
Th230	0.00E+00	0.00E+00
Ra226	0.00E+00	0.00E+00
Po218	0.00E+00	0.00E+00
Pb214	0.00E+00	0.00E+00
Bi214	0.00E+00	0.00E+00
Po214	0.00E+00	0.00E+00
Pb210	0.00E+00	0.00E+00
Bi210	0.00E+00	0.00E+00
Po210	0.00E+00	0.00E+00
U235	0.00E+00	0.00E+00
Th231	0.00E+00	0.00E+00
Pa231	0.00E+00	0.00E+00
Ac227	0.00E+00	0.00E+00
Th227	0.00E+00	0.00E+00
Fr-223	0.00E+00	0.00E+00
Ra223	0.00E+00	0.00E+00
Po215	0.00E+00	0.00E+00
Pb211	0.00E+00	0.00E+00
Bi211	0.00E+00	0.00E+00
Po211	0.00E+00	0.00E+00

Tl207	0.00E+00	0.00E+00
Th232	0.00E+00	0.00E+00
Ra228	0.00E+00	0.00E+00
Ac228	0.00E+00	0.00E+00
Th228	0.00E+00	0.00E+00
Ra224	0.00E+00	0.00E+00
Po216	0.00E+00	0.00E+00
Pb212	0.00E+00	0.00E+00
Bi212	0.00E+00	0.00E+00
Po212	0.00E+00	0.00E+00
Tl208	0.00E+00	0.00E+00

MISS SOIL LOAD-OUT EMISSIONS

EQUATION: E = k(0.0032)(U/5)^1.3/(M/2)^1.4 (AP-42, Chapter 13.2.4, "Aggregate Handling and Storage Piles", 11/2006)

INPUT PARAMETERS:

		Load-outs TSP	Load-outs PM-10
Particle Size Multiplier (k)		0.74	0.35
Mean Wind Speed - U (mph)	(Teterboro, LCD)	6.8	6.8
Material Moisture Content - M (%)	(Table 13.2.4-1)	12.0	12.0
Tons of Material Dropped		240,378	240,378

EMISSION FACTOR -E (lb/ton):	Load-outs
E (TSP) =	2.87E-04
E (PM-10) =	1.36E-04

CONTROL EFFICIENCY (%)- 0

ANNUAL EMISSIONS (grams/year):

E (TSP) =	31342.8
E (PM-10) =	14824.3

RADIONUCLIDE SOURCE CONCENTRATIONS

AVERAGE DETECTED ACTIVITY (MEASURED)

INPUT PARAMETERS:

	U238	U234	U235	Ra226	Th232
Activity Concentration (S) - pCi/g	1.37	N/A	N/A	1.58	7.63
Isotope Contribution to Total Uranium (P) - %	47.249	50.539	2.212	N/A	N/A

ANNUAL RADIOACTIVITY EMISSION RATES (Ci/yr)

	Load-outs
U238	2.03E-08
Th234	2.03E-08
Pa234m	2.03E-08
Pa234	2.64E-11
U234	2.17E-08
Th230	2.17E-08
Ra226	2.34E-08
Po218	2.34E-08
Pb214	2.34E-08
Bi214	2.34E-08
Po214	2.34E-08
Pb210	2.34E-08
Bi210	2.34E-08
Po210	2.34E-08

U235	9.51E-10
Th231	9.51E-10
Pa231	9.51E-10
Ac227	9.51E-10
Th227	9.38E-10
Fr-223	1.31E-11
Ra223	9.51E-10
Po215	9.51E-10
Pb211	9.51E-10
Bi211	9.51E-10
Po211	2.60E-12
Tl207	9.48E-10
Th232	1.13E-07
Ra228	1.13E-07
Ac228	1.13E-07
Th228	1.13E-07
Ra224	1.13E-07
Po216	1.13E-07
Pb212	1.13E-07
Bi212	1.13E-07
Po212	7.25E-08
Tl208	4.06E-08

CLUSTER NO. 10A EQUATION: E = k(0.0032)(U/5)^1.3/(M/2)^1.4 (AP-42, Chapter 13.2.4, "Aggregate Handling and Storage Piles", 11/2006)

EXCAVATION EMISSIONS	INPUT PARAMETERS:		Sub-Cluster No. 10A-1		Sub-Cluster No. 10A-2		
			TSP	PM-10	TSP	PM-10	TSP
	Particle Size Multiplier (k)		0.74	0.35	0.74	0.35	0.74
	Mean Wind Speed - U (mph)	(Teterboro, LCD)	6.8	6.8	6.8	6.8	6.8
	Material Moisture Content - M (%)		12.0	12.0	12.0	12.0	12.0
	Tons of Material Dropped		2451	2451	11754	11754	356

	Sub-Cluster No. 10A-1	Sub-Cluster No. 10A-2	Sub-Cluster No. 10A-3
EMISSION FACTOR -E (lb/ton):			
E (TSP) =	2.87E-04	2.87E-04	2.87E-04
E (PM-10) =	1.36E-04	1.36E-04	1.36E-04
CONTROL EFFICIENCY (%)-	0	0	0
ANNUAL EMISSIONS (grams/year):			
E (TSP) =	319.6	1532.6	46.4
E (PM-10) =	151.2	724.9	22.0

RADIONUCLIDE SOURCE CONCENTRATIONS	AVERAGE DETECTED ACTIVITY	(MEASURED)					
	INPUT PARAMETERS:		U238	U234	U235	Ra226	Th232
	Activity Concentration (S) - pCi/g	Cluster No. 10A-1	3.98	N/A	N/A	5.29	31.24
	Activity Concentration (S) - pCi/g	Cluster No. 10A-2	3.98	N/A	N/A	5.29	31.24
	Activity Concentration (S) - pCi/g	Cluster No. 10A-3	3.98	N/A	N/A	5.29	31.24
	Isotope Contribution to Total Uranium (P) - %		47.249	50.539	2.212	N/A	N/A

	Sub-Cluster No. 10A-1	Sub-Cluster No. 10A-2	Sub-Cluster No. 10A-3
ANNUAL RADIOACTIVITY EMISSION RATES (Ci/yr)			

U238	6.02E-10	2.89E-09	8.74E-11
Th234	6.02E-10	2.89E-09	8.74E-11
Pa234m	6.02E-10	2.89E-09	8.74E-11
Pa234	7.82E-13	3.75E-12	1.14E-13
U234	6.43E-10	3.09E-09	9.35E-11
Th230	6.43E-10	3.09E-09	9.35E-11
Ra226	8.00E-10	3.83E-09	1.16E-10
Po218	8.00E-10	3.83E-09	1.16E-10
Pb214	8.00E-10	3.83E-09	1.16E-10
Bi214	8.00E-10	3.83E-09	1.16E-10
Po214	8.00E-10	3.83E-09	1.16E-10
Pb210	8.00E-10	3.83E-09	1.16E-10
Bi210	8.00E-10	3.83E-09	1.16E-10
Po210	8.00E-10	3.83E-09	1.16E-10
U235	2.82E-11	1.35E-10	4.09E-12
Th231	2.82E-11	1.35E-10	4.09E-12
Pa231	2.82E-11	1.35E-10	4.09E-12
Ac227	2.82E-11	1.35E-10	4.09E-12
Th227	2.78E-11	1.33E-10	4.03E-12
Fr-223	3.89E-13	1.86E-12	5.65E-14
Ra223	2.82E-11	1.35E-10	4.09E-12
Po215	2.82E-11	1.35E-10	4.09E-12
Pb211	2.82E-11	1.35E-10	4.09E-12
Bi211	2.82E-11	1.35E-10	4.09E-12
Po211	7.69E-14	3.69E-13	1.12E-14
Tl207	2.81E-11	1.35E-10	4.08E-12
Th232	4.72E-09	2.26E-08	6.86E-10
Ra228	4.72E-09	2.26E-08	6.86E-10
Ac228	4.72E-09	2.26E-08	6.86E-10
Th228	4.72E-09	2.26E-08	6.86E-10
Ra224	4.72E-09	2.26E-08	6.86E-10
Po216	4.72E-09	2.26E-08	6.86E-10
Pb212	4.72E-09	2.26E-08	6.86E-10
Bi212	4.72E-09	2.26E-08	6.86E-10
Po212	3.03E-09	1.45E-08	4.39E-10
Tl208	1.70E-09	8.14E-09	2.46E-10

CLUSTER NO. 12A EQUATION: E = k(0.0032)(U/5)^1.3/(M/2)^1.4 (AP-42, Chapter 13.2.4, "Aggregate Handling and Storage Piles", 11/2006)

EXCAVATION EMISSIONS

INPUT PARAMETERS:		Sub-Cluster No. 12A-1 TSP	Sub-Cluster No. 12A-1 PM-10	Sub-Cluster No. 12A-2 TSP	Sub-Cluster No. 12A-2 PM-10
Particle Size Multiplier (k)		0.74	0.35	0.74	0.35
Mean Wind Speed - U (mph)	(Teterboro, LCD)	6.8	6.8	6.8	6.8
Material Moisture Content - M (%)		12.0	12.0	12.0	12.0
Tons of Material Dropped		411	411	713	713

EMISSION FACTOR -E (lb/ton):	Sub-Cluster No. 12A-1	Sub-Cluster No. 12A-2
E (TSP) =	2.87E-04	2.87E-04
E (PM-10) =	1.36E-04	1.36E-04

CONTROL EFFICIENCY (%)- 0

ANNUAL EMISSIONS (grams/year):

E (TSP) =	53.6	93.0	
E (PM-10) =	25.3	44.0	

RADIONUCLIDE SOURCE CONCENTRATIONS

AVERAGE DETECTED ACTIVITY (MEASURED)

INPUT PARAMETERS:

		U238	U234	U235	Ra226	Th232
Activity Concentration (S) - pCi/g	Cluster No. 12A-1	3.98	N/A	N/A	5.29	31.24
Activity Concentration (S) - pCi/g	Cluster No. 12A-2	3.98	N/A	N/A	5.29	31.24
Isotope Contribution to Total Uranium (P) - %		47.249	50.539	2.212	N/A	N/A

ANNUAL RADIOACTIVITY EMISSION RATES (Ci/yr)

	Sub-Cluster No. 12A-1	Sub-Cluster No. 12A-2
U238	1.01E-10	1.75E-10
Th234	1.01E-10	1.75E-10
Pa234m	1.01E-10	1.75E-10
Pa234	1.31E-13	2.28E-13
U234	1.08E-10	1.87E-10
Th230	1.08E-10	1.87E-10
Ra226	1.34E-10	2.33E-10
Po218	1.34E-10	2.33E-10
Pb214	1.34E-10	2.33E-10
Bi214	1.34E-10	2.33E-10
Po214	1.34E-10	2.33E-10
Pb210	1.34E-10	2.33E-10
Bi210	1.34E-10	2.33E-10
Po210	1.34E-10	2.33E-10
U235	4.72E-12	8.19E-12
Th231	4.72E-12	8.19E-12
Pa231	4.72E-12	8.19E-12
Ac227	4.72E-12	8.19E-12
Th227	4.66E-12	8.08E-12
Fr-223	6.52E-14	1.13E-13
Ra223	4.72E-12	8.19E-12
Po215	4.72E-12	8.19E-12
Pb211	4.72E-12	8.19E-12
Bi211	4.72E-12	8.19E-12
Po211	1.29E-14	2.24E-14
Tl207	4.71E-12	8.17E-12
Th232	7.92E-10	1.37E-09
Ra228	7.92E-10	1.37E-09
Ac228	7.92E-10	1.37E-09
Th228	7.92E-10	1.37E-09
Ra224	7.92E-10	1.37E-09
Po216	7.92E-10	1.37E-09
Pb212	7.92E-10	1.37E-09
Bi212	7.92E-10	1.37E-09
Po212	5.07E-10	8.80E-10
Tl208	2.85E-10	4.94E-10

CLUSTER NO. 12B EXCAVATION EMISSIONS

EQUATION: E = k(0.0032)(U/5)^1.3/(M/2)^1.4 (AP-42, Chapter 13.2.4, "Aggregate Handling and Storage Piles", 11/2006)

INPUT PARAMETERS:

	Sub-Cluster No. 12B-1		Sub-Cluster No. 12B-2	
	TSP	PM-10	TSP	PM-10

Particle Size Multiplier (k)		0.74	0.35	0.74	0.35
Mean Wind Speed - U (mph)	(Teterboro, LCD)	6.8	6.8	6.8	6.8
Material Moisture Content - M (%)		12.0	12.0	12.0	12.0
Tons of Material Dropped		43502	43502	13399	13399

EMISSION FACTOR -E (lb/ton):	Sub-Cluster No. 12B-1	Sub-Cluster No. 12B-2
E (TSP) =	2.87E-04	2.87E-04
E (PM-10) =	1.36E-04	1.36E-04
CONTROL EFFICIENCY (%)-	0	0
ANNUAL EMISSIONS (grams/year):		
E (TSP) =	5672.2	1747.1
E (PM-10) =	2682.8	826.3

RADIONUCLIDE SOURCE CONCENTRATIONS

AVERAGE DETECTED ACTIVITY (MEASURED)

INPUT PARAMETERS:		U238	U234	U235	Ra226	Th232
Activity Concentration (S) - pCi/g	Cluster No. 12B-1	3.98	N/A	N/A	5.29	31.24
Activity Concentration (S) - pCi/g	Cluster No. 12B-2	3.98	N/A	N/A	5.29	31.24
Isotope Contribution to Total Uranium (P) - %		47.249	50.539	2.212	N/A	N/A

ANNUAL RADIOACTIVITY EMISSION RATES (Ci/yr)	Sub-Cluster No. 12B-1	Sub-Cluster No. 12B-2
U238	1.07E-08	3.29E-09
Th234	1.07E-08	3.29E-09
Pa234m	1.07E-08	3.29E-09
Pa234	1.39E-11	4.28E-12
U234	1.14E-08	3.52E-09
Th230	1.14E-08	3.52E-09
Ra226	1.42E-08	4.37E-09
Po218	1.42E-08	4.37E-09
Pb214	1.42E-08	4.37E-09
Bi214	1.42E-08	4.37E-09
Po214	1.42E-08	4.37E-09
Pb210	1.42E-08	4.37E-09
Bi210	1.42E-08	4.37E-09
Po210	1.42E-08	4.37E-09
U235	5.00E-10	1.54E-10
Th231	5.00E-10	1.54E-10
Pa231	5.00E-10	1.54E-10
Ac227	5.00E-10	1.54E-10
Th227	4.93E-10	1.52E-10
Fr-223	6.90E-12	2.12E-12
Ra223	5.00E-10	1.54E-10
Po215	5.00E-10	1.54E-10
Pb211	5.00E-10	1.54E-10
Bi211	5.00E-10	1.54E-10
Po211	1.36E-12	4.20E-13
Tl207	4.99E-10	1.54E-10
Th232	8.38E-08	2.58E-08

Ra228	8.38E-08	2.58E-08	
Ac228	8.38E-08	2.58E-08	
Th228	8.38E-08	2.58E-08	
Ra224	8.38E-08	2.58E-08	
Po216	8.38E-08	2.58E-08	
Pb212	8.38E-08	2.58E-08	
Bi212	8.38E-08	2.58E-08	
Po212	5.37E-08	1.65E-08	
Tl208	3.01E-08	9.28E-09	

61 TRUDY DR, LODI EQUATION: E = k(0.0032)(U/5)^1.3/(M/2)^1.4 (AP-42, Chapter 13.2.4, "Aggregate Handling and Storage Piles", 11/2006)

EXCAVATION

EMISSIONS INPUT PARAMETERS:

		61 Trudy Dr, Lodi TSP	61 Trudy Dr, Lodi PM-10
Particle Size Multiplier (k)		0.74	0.35
Mean Wind Speed - U (mph)	(Teterboro, LCD)	6.8	6.8
Material Moisture Content - M (%)		12.0	12.0
Tons of Material Dropped		2929	2929

EMISSION FACTOR -E (lb/ton): 61 Trudy Dr, Lodi

E (TSP) =	2.87E-04
E (PM-10) =	1.36E-04

CONTROL EFFICIENCY (%)- 0

ANNUAL EMISSIONS (grams/year):

E (TSP) =	381.9
E (PM-10) =	180.6

RADIONUCLIDE SOURCE CONCENTRATIONS AVERAGE DETECTED ACTIVITY (MEASURED)

INPUT PARAMETERS:

	U238	U234	U235	Ra226	Th232
Activity Concentration (S) - pCi/g	3.98	N/A	N/A	5.29	31.24
Isotope Contribution to Total Uranium (P) - %	47.249	50.539	2.212	N/A	N/A

ANNUAL RADIOACTIVITY EMISSION RATES (Ci/yr) 61 Trudy Dr, Lodi

U238	7.19E-10
Th234	7.19E-10
Pa234m	7.19E-10
Pa234	9.35E-13
U234	7.69E-10
Th230	7.69E-10
Ra226	9.56E-10
Po218	9.56E-10
Pb214	9.56E-10
Bi214	9.56E-10
Po214	9.56E-10
Pb210	9.56E-10
Bi210	9.56E-10
Po210	9.56E-10
U235	3.37E-11

Th231	3.37E-11	
Pa231	3.37E-11	
Ac227	3.37E-11	
Th227	3.32E-11	
Fr-223	4.64E-13	
Ra223	3.37E-11	
Po215	3.37E-11	
Pb211	3.37E-11	
Bi211	3.37E-11	
Po211	9.19E-14	
Tl207	3.36E-11	
Th232	5.64E-09	
Ra228	5.64E-09	
Ac228	5.64E-09	
Th228	5.64E-09	
Ra224	5.64E-09	
Po216	5.64E-09	
Pb212	5.64E-09	
Bi212	5.64E-09	
Po212	3.62E-09	
Tl208	2.03E-09	

205 MAIN ST, LODI

EXCAVATION EMISSIONS

EQUATION: E = k(0.0032)(U/5)^1.3/(M/2)^1.4 (AP-42, Chapter 13.2.4, "Aggregate Handling and Storage Piles", 11/2006)

INPUT PARAMETERS:

		305 Main St, Lodi TSP	305 Main St, Lodi PM-10
Particle Size Multiplier (k)		0.74	0.35
Mean Wind Speed - U (mph)	(Teterboro, LCD)	6.8	6.8
Material Moisture Content - M (%)		12.0	12.0
Tons of Material Dropped		4322	4322

EMISSION FACTOR -E (lb/ton): 305 Main St, Lodi

E (TSP) =	2.87E-04
E (PM-10) =	1.36E-04

CONTROL EFFICIENCY (%)- 0

ANNUAL EMISSIONS (grams/year):

E (TSP) =	563.5
E (PM-10) =	266.5

RADIONUCLIDE SOURCE CONCENTRATIONS

AVERAGE DETECTED ACTIVITY (MEASURED)

INPUT PARAMETERS:

	U238	U234	U235	Ra226	Th232
Activity Concentration (S) - pCi/g	3.98	N/A	N/A	5.29	31.24
Isotope Contribution to Total Uranium (P) - %	47.249	50.539	2.212	N/A	N/A

ANNUAL RADIOACTIVITY EMISSION RATES (Ci/yr) 305 Main St, Lodi

U238	1.06E-09
Th234	1.06E-09
Pa234m	1.06E-09

Pa234	1.38E-12
U234	1.13E-09
Th230	1.13E-09
Ra226	1.41E-09
Po218	1.41E-09
Pb214	1.41E-09
Bi214	1.41E-09
Po214	1.41E-09
Pb210	1.41E-09
Bi210	1.41E-09
Po210	1.41E-09
U235	4.97E-11
Th231	4.97E-11
Pa231	4.97E-11
Ac227	4.97E-11
Th227	4.90E-11
Fr-223	6.85E-13
Ra223	4.97E-11
Po215	4.97E-11
Pb211	4.97E-11
Bi211	4.97E-11
Po211	1.36E-13
Tl207	4.97E-11
Th232	8.33E-09
Ra228	8.33E-09
Ac228	8.33E-09
Th228	8.33E-09
Ra224	8.33E-09
Po216	8.33E-09
Pb212	8.33E-09
Bi212	8.33E-09
Po212	5.33E-09
Tl208	2.99E-09

W. CENTRAL AVE, MAYWOOD
EXCAVATION
EMISSIONS

EQUATION: E = k(0.0032)(U/5)^1.3/(M/2)^1.4 (AP-42, Chapter 13.2.4, "Aggregate Handling and Storage Piles", 11/2006)

INPUT PARAMETERS:		WC-1, Maywood TSP	WC-1, Maywood PM-10
Particle Size Multiplier (k)		0.74	0.35
Mean Wind Speed - U (mph)	(Teterboro, LCD)	6.8	6.8
Material Moisture Content - M (%)		12.0	12.0
Tons of Material Dropped		289	289

EMISSION FACTOR -E (lb/ton):	WC-1, Maywood
E (TSP) =	2.87E-04
E (PM-10) =	1.36E-04
CONTROL EFFICIENCY (%)-	0
ANNUAL EMISSIONS (grams/year):	
E (TSP) =	37.7
E (PM-10) =	17.8

RADIONUCLIDE SOURCE CONCENTRATIONS

AVERAGE DETECTED ACTIVITY (MEASURED)

INPUT PARAMETERS:	U238	U234	U235	Ra226	Th232
Activity Concentration (S) - pCi/g	3.98	N/A	N/A	5.29	31.24
Isotope Contribution to Total Uranium (P) - %	47.249	50.539	2.212	N/A	N/A

ANNUAL RADIOACTIVITY EMISSION RATES (Ci/yr)	WC-1, Maywood
U238	7.09E-11
Th234	7.09E-11
Pa234m	7.09E-11
Pa234	9.22E-14
U234	7.59E-11
Th230	7.59E-11
Ra226	9.43E-11
Po218	9.43E-11
Pb214	9.43E-11
Bi214	9.43E-11
Po214	9.43E-11
Pb210	9.43E-11
Bi210	9.43E-11
Po210	9.43E-11
U235	3.32E-12
Th231	3.32E-12
Pa231	3.32E-12
Ac227	3.32E-12
Th227	3.28E-12
Fr-223	4.58E-14
Ra223	3.32E-12
Po215	3.32E-12
Pb211	3.32E-12
Bi211	3.32E-12
Po211	9.07E-15
Tl207	3.31E-12
Th232	5.57E-10
Ra228	5.57E-10
Ac228	5.57E-10
Th228	5.57E-10
Ra224	5.57E-10
Po216	5.57E-10
Pb212	5.57E-10
Bi212	5.57E-10
Po212	3.57E-10
Tl208	2.00E-10

Appendix C
Analytical Data for the Year 2015

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ANALYTICAL DATA FOR THE YEAR 2015

Table C-1A. 2015 Environmental Monitoring Program Summary: Air Monitoring

Table C-1B. 2015 Environmental Monitoring Program Summary: Groundwater Monitoring

Table C-1C. 2015 Environmental Monitoring Program Summary: Surface Water and Sediment Monitoring

Table C-2. 2015 External Gamma Radiation Dose Rates

Table C-3. 2015 Radon Gas Concentrations

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Table C-5. 2015 Surface Water Analytical Results – Radioactive Constituents

Table C-6. 2015 Sediment Analytical Results – Radioactive Constituents

Table C-7. 2015 Depth to Groundwater and Groundwater Elevations for Overburden Monitoring Wells

Table C-8. 2015 Depth to Groundwater and Groundwater Elevations for Bedrock Monitoring Wells

Table C-9. 2015 Vertical Gradient Calculations for Monitoring Well Clusters

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Table C-11. 2015 Groundwater Analytical Results – Non-Radioactive Constituents

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Table C-1A. 2015 Environmental Monitoring Program Summary: Air Monitoring

Air Monitoring																	
Station Identification	Measured Parameter	Number of Analyses or Measurements															
		No. of Sample Locations				Sample Duplicate				Trip Blank				Contingency Sample				Total Analyses per Year
		Calendar Year Quarter				Calendar Year Quarter				Calendar Year Quarter				Calendar Year Quarter				
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
LABORATORY MEASUREMENTS																		
4, 5, 10, 12, 19, 20,	External gamma radiation		15		15						2		2		14		15	63
21, 22, 23, 24, 25,	Radon-222/Radon-220		15		15		1		1						1		1	34
30, 31, 32, 33	Radon-222				6													6

Table C-1B. 2015 Environmental Monitoring Program Summary: Groundwater Monitoring

Groundwater Monitoring																				
Station Identification	Measured Parameter	Number of Analyses or Measurements																		
		No. of Sample Locations				Rinsate Blank				Field Blank				Sample Duplicate				Total Analyses per Year
		Calendar Year Quarter				Calendar Year Quarter				Calendar Year Quarter				Calendar Year Quarter				
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
FIELD MEASUREMENTS																				
B38W01S, B38W02D, B38W03B, B38W14D, B38W14S, B38W15D, B38W15S, B38W17A, B38W17B, B38W18D, B38W24D, B38W24S, MISS01AA, MISS01B, MISS05AR, MISS05BR, MISS07A, MISS07B, MW-24D, MW-24S, MW-25S, MW-25D, MW-28S, MW-28D, MW-42D,	**Groundwater (Chemical/Physical)**																			
	Dissolved oxygen		24												3			27		
	Oxidation/reduction potential		24												3			27		
	Turbidity		24												3			27		
	Temperature		24												3			27		
	Specific conductivity		24												3			27		
	pH		24												3			27		
LABORATORY MEASURMENTS																				
B38W01S e, B38W14S, B38W15S, B38W17A, B38W24S, B38W24S -F, MISS01AA, MISS05AR, MW24S, MW25S, MW28S, B38W02D e, B38W03B, B38W14D, B38W15D, B38W17B, B38W24D, Miss01B, MISS05BR, MISS07B, MW24D, MW25D, MW28D, MW42D	**Groundwater (Radiological)**																			
	Gross Alpha		24				4				1				3			32		
	Gross Beta		24				4				1				3			32		
	Total Radium		24				4				1				3			32		
	Total Thorium		24				4				1				3			32		
	Total Uranium		24				4				1				3			32		
	K-40		0				4				1				0			5		
	Rn-222		23				4				1				3			31		
LABORATORY MEASURMENTS																				
B38W01S, B38W14S, B38W15S, B38W17A, B38W24S, MISS01AA, MISS05AR, MW24S, MW28S, B38W02D, B38W03B, B38W14D, B38W15D, B38W17B, B38W24D, MISS01B, MISS05BR, MISS07B, MW24D, MW28D, MW42D	**Groundwater (Non-Radiological)**																			
	Arsenic, Total		23				4				1				2			30		
	Lithium, Total		23				4				1				2			30		
	Benzene		23				4				1				2			30		

Table C-1C. 2015 Environmental Monitoring Program Summary: Surface Water and Sediment Monitoring

Surface Water and Sediment Monitoring																				
Station Identification	Measured Parameter	Number of Analyses or Measurements																		
		No. of Sample Locations				Rinsate Blank				Trip Blank				Sample Duplicate				Total Analyses per Year
		Calendar Year Quarter				Calendar Year Quarter				Calendar Year Quarter				Calendar Year Quarter				
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
FIELD MEASUREMENTS																				
SWSD001, SWSD002, SWSD003, SWSD004, SWSD008, SWSD010	**Surface Water (Chemical/Physical)**																			
	Dissolved oxygen		6																	6
	Oxidation/reduction potential		9																	9
	Turbidity		9																	9
	Temperature		9																	9
	Specific conductivity		9																	9
	pH		9																	9
LABORATORY MEASURMENTS																				
SEDIMENT																				
SWSD001, SWSD002, SWSD003, SWSD006, SWSD007, SWSD008, SWSD009, SWSD010	**Radiological**																			
	Radium-226		8												1					9
	Thorium-232		8												1					9
	Uranium-238		8												1					9
SURFACE WATER																				
SWSD001, SWSD002, SWSD003, SWSD004, SWSD006, SWSD007, SWSD008, SWSD009, SWSD010	**Radiological**																			
	Gross Alpha		9												1					10
	Gross Beta		9												1					10
	Total Radium		9												1					10
	Total Thorium		9												1					10
	Total Uranium		9												1					10

Table C-2. 2015 External Gamma Radiation Dose Rates

		12/01/14 to 05/06/15 OSLD[a]		12/01/14 to 12/01/15 OSLD[a]	
Property	**Monitoring Location Number[b]**	**Gross Dose[c] (mrem)**	**Corrected (mrem/yr)**	**Gross Dose[c] (mrem)**	**Corrected (mrem/yr)**
MISS	4	44.2	-2.5	92.2	-3.4
		45.3	0.3	95.2	-0.2
MISS	5	42.4	-7.0	88.7	-7.2
		42.5	-6.8	95.2	-0.2
MISS	10	116.5	179.3	287.1	206.1
		116.4	179.1	277.0	195.2
MISS	12	42.5	-6.8	87.1	-8.9
		42.8	-6.0	87.4	-8.6
MISS	20	44.5	-1.8	95.4	0.0
		43.8	-3.5	98.9	3.8
MISS	21	300.5	642.1	835.9	796.0
		319.2	689.2	885.7	849.6
MISS	22	68.9	59.6	154.0	63.0
		68.2	57.9	156.7	65.9
Stepan	23	57.6	31.2	124.9	31.7
		54.4	23.1	119.7	26.1
MISS	24	42.7	-6.3	93.0	-2.6
		44.3	-2.3	93.3	-2.3
MISS	25	40.1	-12.8	80.5	-16.0
		39.6	-14.1	84.6	-11.6
Stepan	30	51.1	14.8	113.9	19.9
		55.2	25.2	107.2	12.7
Stepan	31	63.7	46.5	134.0	41.5
		60.9	39.5	140.7	48.7
NYS&WR	32	38.6	-16.6	82.5	-13.9
		39.5	-14.3	82.2	-14.2
NYS&WR	33	42.1	-7.8	92.4	-3.2
		42.4	-7.0	86.7	-9.4
Post Office (Background)	19	45.0	Avg. Background	96.3	Avg. Background
		45.4	113.7	94.5	102.6

Notes:

[a] OSLD = Optically stimulated luminescence detector. There are two OSLDs per station.

[b] Monitoring locations are shown on Figure D-2. Two readings were collected from each monitoring location because two OSLDs were deployed at each monitoring location.

[c] OSLD readings are corrected for time, fade, and shelter/absorption factor (s/a = 1.075) and, are normalized to one year's exposure (i.e., the reading is multiplied by 365 days and divided by the number of days that it was deployed, and the multiplied by a factor of 1.075). The average corrected background collected from the Post Office (Monitoring Location 19) is also normalized to one year's exposure, and then subtracted from all other Gross Dose readings to ascertain the Corrected readings.

Table C-3
Table C-3. 2015 Radon Gas Concentrations

Monitoring Location [a]		12/1/2014 to 5/6/2015				5/6/2015 to 12/1/2015			
		Radon-220		Radon-222		Radon-220		Radon-222	
		Average Concentration (pCi/L)	Standard Deviation [c] (%)	Average Concentration (pCi/L)	Standard Deviation [c] (%)	Average Concentration (pCi/L)	Standard Deviation [c] (%)	Average Concentration (pCi/L)	Standard Deviation [c] (%)
MISS perimeter	4	0.52 *	10.2	0.2 *		0.73 *	7.3	0.1 *	
	5	0.37 *		0.2 *		0.52 *	8.9	0.1 *	
	10	0.48 *	10.6	0.2 *		1.44 *	6.0	0.1 *	
	12	0.10 *		0.2 *		0.40 *	9.1	0.1 *	
	20	0.23 *		0.2 *		0.45 *	9.0	0.1 *	
	21	2.04 *	6.0	0.2 *		3.80 *	3.9	0.1 *	
Duplicate[b]	21 Dup	1.67 *	6.6	0.2 *		3.66 *	4.0	0.1 *	
	22	3.42 *	4.8	0.2 *		3.81 *	3.9	0.1 *	
	23	0.36 *		0.2 *		0.17 *	10.0	0.1 *	
	24	0.21 *		0.2 *		0.40 *	8.9	0.1 *	
	25	0.40 *		0.2 *		0.38 *	9.6	0.1 *	
	30	1.18 *	8.1	0.2 *		1.09 *	6.5	0.1 *	
	31	0.20 *		0.2 *		0.21 *		0.1 *	
	32	0.04 *		0.2 *		0.25 *		0.1 *	
	33	0.26 *		0.2 *		0.34 *	10.3	0.1 *	
Background	19	0.14 *		0.2 *		0.03 *		0.1 *	

Notes:

(*) The value reported is the Lower Limit of Detection.

[a] Monitoring locations are shown on Figure A-2. All locations are outside any structure.

[b] A quality control duplicate is collected at the same time and location, and is analyzed by the same method in order to evaluate precision in sampling and analysis.

[c] Standard Deviation % is not calculated unless a reported result exceeds the specified Lower Limit of Detection.

Table C-4. 2015 Field Parameter Summary

Sampling Location	Date	pH	Conductance[a] (mS/cm)	ORP (mV)[b]	DO (mg/L)	Turbidity (NTU)[c]	Temp (C)	Discharge (mL/min)[d]
GROUNDWATER								
B38W01S	5/21/2015	6.67	1.489	-177.0	0.45	48.00	11.53	275.00
B38W02D	5/21/2015	7.66	0.529	-116.0	14.92	47.50	11.79	150.00
B38W03B	5/21/2015	6.29	1.275	-121.9	7.40	75.10	13.38	200.00
B38W14D	5/20/2015	6.85	1.087	-169.3	1.08	46.80	12.69	275.00
B38W14S	5/20/2015	6.59	0.588	-143.1	1.44	21.80	16.87	220.00
B38W15D	5/19/2015	7.52	1.519	336.2	0.58	44.40	15.08	225.00
B38W15S	5/19/2015	7.46	1.448	-21.0	4.63	40.70	13.80	200.00
B38W17A	5/19/2015	5.87	0.304	300.4	2.85	31.00	10.85	300.00
B38W17B	5/20/2015	6.68	2.432	-182.5	0.80	11.30	11.99	375.00
B38W18D	Not Sampled *							
B38W24D	5/28/2015	6.51	3.630	20.1	1.96	23.6	14.41	240.00
B38W24S	5/28/2015	6.59	0.942	-76.1	0.96	21.7	13.83	200.00
MISS01AA	5/26/2015	7.17	2.359	179.3	5.19	11.6	17.66	90.00
MISS01B	5/26/2015	7.25	0.922	21.0	2.52	3.6	16.04	55.00 **
MISS05AR	5/27/2015	7.39	1.822	-74.4	1.72	44.1	12.84	200.00
MISS05BR	5/27/2015	6.93	6.68	-24.8	2.57	48.8	14.41	300.00
MISS07A	5/27/2015	7.12	5.306	50.5	4.49	12.1	14.92	N/A
MISS07B	5/26/2015	6.84	3.852	4.1	0.65	49.2	15.31	375.00
MW-24D	6/1/2015	6.24	1.447	-56.5	0.56	31.0	14.27	300.00
MW-24S	6/1/2015	6.02	4.403	62.4	6.79	179.6	16.72	180.00
MW-25S	6/2/2015	7.17	2.290	205.6	4.97	46.3	13.13	190.00
MW-25D	6/2/2015	6.58	2.185	-35.9	0.84	14.6	12.37	230.00
MW-28S	5/28/2015	6.38	2.293	-83.9	0.81	48.3	13.58	200.00
MW-28D	6/4/2014	6.68	2.806	18.2	4.73	11.4	12.44	220.00
MW-42D	6/2/2015	7.56	0.469	-143.9	0.31	29.4	13.21	240.00

Table C-4. 2015 Field Parameter Summary

Sampling Location	Date	pH	Conductance[a] (mS/cm)	ORP (mV)[b]	DO (mg/L)	Turbidity (NTU)[c]	Temp (C)	Discharge (mL/min)[d]
SURFACE WATER								
SWSD001	6/3/2015	7.58	1.000	99.9	8.57	0.2	14.67	e
SWSD002	6/3/2015	7.66	1.090	146.2	6.95	0.1	14.67	e
SWSD003	6/3/2015	7.88	1.005	34.9	6.36	0.1	15.68	e
SWSD004	6/3/2015	7.70	1.060	178.1	7.32	0.1	15.24	e
SWSD006	4/27/2015	7.34	0.805	115.1	NR	1.7	12.48	e
SWSD007	4/27/2015	7.77	0.825	127.9	NR	6.8	13.25	e
SWSD008	6/3/2015	6.39	1.277	113.3	7.51	116.2	13.19	e
SWSD009	4/27/2015	7.33	0.711	423.0	NR	0.9	12.42	e
SWSD010	6/3/2015	7.76	0.891	146.7	7.72	0.2	17.33	e

Notes:

C - degrees Celsius

DO - dissolved oxygen

mg/L - milligrams per liter

[a] Specific conductance, measured in microsiemens/centimeter (µS/cm).

[b] Oxidation/reduction potential (ORP), measured in millivolts (mV).

[c] Turbidity, measured in Nephelometric Turbidity Units (NTU).

[d] Discharge, measured in milliliters per minute (mL/min).

[e] Parameter not applicable.

[*] Not sampled as damaged during remediation - will be abandoned in 2016

[**]Purged using 3x volume method due to partially collapsed open borehole. Reported as total gallons removed.

N/A = well initally bailed, no well recharge.

Table C-5. 2015 Surface Water Analytical Results – Radioactive Constituents

Sampling Location (Sample ID) [SDG Number]	Date Collected	Analyte	Result[a] (pCi/L)	Result[b] (µg/L)	Error[c] (pCi/L)	Qualifier[d]	MDC[e] (pCi/L)
Samples collected in Westerly Brook:							
SWSD001	6/3/2015	Gross Alpha	3.04		± 1.021		1.218
	6/3/2015	Gross Beta	9.29		± 0.958		1.075
	6/3/2015	Ra-226	0.07		± 0.159	U	0.310
	6/3/2015	Ra-228	0.58		± 0.341		0.314
	6/3/2015	Total Radium	0.65		±		
	6/3/2015	Th-228	-0.02		± 0.065	U	0.172
	6/3/2015	Th-230	1.43		± 0.461	J	0.172
	6/3/2015	Th-232	-0.001		± 0.062		0.080
	6/3/2015	Total Thorium	1.41		±		
	6/3/2015	U-234	0.41		± 0.229		0.147
	6/3/2015	U-235	0		± 0.254	U	0.082
	6/3/2015	U-238	0.25		± 0.184		0.174
	6/3/2015	Total Uranium	0.66	0.76	±		
SWSD002	6/3/2015	Gross Alpha	2.55		± 0.983		1.230
	6/3/2015	Gross Beta	10.73		± 1.147		1.378
	6/3/2015	Ra-226	0.05		± 0.153	U	0.325
	6/3/2015	Ra-228	0.72		± 0.415		0.385
	6/3/2015	Total Radium	0.77		±		
	6/3/2015	Th-228	0.08		± 0.124	U	0.208
	6/3/2015	Th-230	0.60		± 0.292	J	0.145
	6/3/2015	Th-232	0.00		± 0.062	U	0.079
	6/3/2015	Total Thorium	0.68		±		
	6/3/2015	U-234	0.518		± 0.255		0.144
	6/3/2015	U-235	0		± 0.062	U	0.144
	6/3/2015	U-238	0.26		± 0.179		0.079
	6/3/2015	Total Uranium	0.80	0.80	±		

Table C-5. 2015 Surface Water Analytical Results – Radioactive Constituents

Sampling Location (Sample ID) [SDG Number]	Date Collected	Analyte	Result[a] (pCi/L)	Result[b] (µg/L)	Error[c] (pCi/L)	Qualifier[d]	MDC[e] (pCi/L)
SWSD003	6/3/2015	Gross Alpha	0.90		± 0.645	U	0.947
	6/3/2015	Gross Beta	3.34		± 0.793		1.139
	6/3/2015	Ra-226	0.11		± 0.161	U	0.261
	6/3/2015	Ra-228	0.20		± 0.319	UJ	0.313
	6/3/2015	Total Radium	0.30		±		
	6/3/2015	Th-228	0.03		± 0.099	U	0.200
	6/3/2015	Th-230	0.81		± 0.323	J	0.153
	6/3/2015	Th-232	-0.009		± 0.055	U	0.128
	6/3/2015	Total Thorium	0.85		±		
	6/3/2015	U-234	0.30		± 0.199		0.171
	6/3/2015	U-235	0		± 0.249	U	0.080
	6/3/2015	U-238	0.17		± 0.146		0.144
	6/3/2015	Total Uranium	0.47	0.50	±		
SWSD004	6/3/2015	Gross Alpha	2.10		± 0.0926		1.222
	6/3/2015	Gross Beta	8.66		± 1.008		1.156
	6/3/2015	Ra-226	0.06		± 0.172	U	0.366
	6/3/2015	Ra-228	0.50		± 0.347	J	0.321
	6/3/2015	Total Radium	0.55		±		
	6/3/2015	Th-228	0.01		± 0.075	U	0.197
	6/3/2015	Th-230	0.91		± 0.386		0.167
	6/3/2015	Th-232	-0.001		± 0.071	U	0.092
	6/3/2015	Total Thorium	0.92		±		
	6/3/2015	U-234	0.60		± 0.281		0.085
	6/3/2015	U-235	0		± 0.266	U	0.085
	6/3/2015	U-238	0.24		± 0.18		0.154
	6/3/2015	Total Uranium	0.84	0.73	±		

Table C-5. 2015 Surface Water Analytical Results – Radioactive Constituents

Sampling Location (Sample ID) [SDG Number]	Date Collected	Analyte	Result[a] (pCi/L)	Result[b] (µg/L)	Error[c] (pCi/L)	Qualifier[d]	MDC[e] (pCi/L)
Samples collected in Lodi Brook:							
SWSD006	4/27/2015	Gross Alpha	2.00		± 1.327		1.313
	4/27/2015	Gross Beta	3.13		± 1.608		2.405
	4/27/2015	Ra-226	-0.01		± 0.102	U	0.300
	4/27/2015	Ra-228	0.43		± 0.281		J-
	4/27/2015	Total Radium	0.41		±		
	4/27/2015	Th-228	0.02		± 0.118	U	0.258
	4/27/2015	Th-230	0.32		± 0.223	J	0.149
	4/27/2015	Th-232	0.00		± 0.064	U	0.082
	4/27/2015	Total Thorium	0.34		±		
	4/27/2015	U-234	0.07		± 0.107	U	0.173
	4/27/2015	U-235	-0.03		± 0.069	U	0.194
	4/27/2015	U-238	0.20		± 0.160		0.146
	4/27/2015	Total Uranium	0.24	0.60	±		
SWSD006f Duplicate	4/27/2015	Gross Alpha	1.18		± 1.132	U	1.590
	4/27/2015	Gross Beta	1.52		± 1.317	U	2.096
	4/27/2015	Ra-226	0.00		± 0.414	U	0.292
	4/27/2015	Ra-228	0.17		± 0.210	UJ	0.212
	4/27/2015	Total Radium	0.17		±		
	4/27/2015	Th-228	0.09		± 0.141	U	0.236
	4/27/2015	Th-230	0.35		± 0.246	J	0.193
	4/27/2015	Th-232	0.03		± 0.070	U	0.090
	4/27/2015	Total Thorium	0.47		±		
	4/27/2015	U-234	0.25		± 0.185		0.175
	4/27/2015	U-235	0.03		± 0.064	U	0.082
	4/27/2015	U-238	0.00		± 0.253	U	0.081
	4/27/2015	Total Uranium	0.28	0.00	±		

Table C-5. 2015 Surface Water Analytical Results – Radioactive Constituents

Sampling Location (Sample ID) [SDG Number]	Date Collected	Analyte	Result[a] (pCi/L)	Result[b] (µg/L)	Error[c] (pCi/L)	Qualifier[d]	MDC[e] (pCi/L)
SWSD007	4/27/2015	Gross Alpha	1.23		± 1.307	U	1.976
	4/27/2015	Gross Beta	1.76		± 1.237	U	1.912
	4/27/2015	Ra-226	0.11		± 0.175	U	0.282
	4/27/2015	Ra-228	0.43		± 0.248	J-	0.234
	4/27/2015	Total Radium	0.54		± 0.304		
	4/27/2015	Th-228	0.01		± 0.078	U	0.206
	4/27/2015	Th-230	0.26		± 0.217	J	0.108
	4/27/2015	Th-232	-0.01		± 0.074	U	0.173
	4/27/2015	Total Thorium	0.26		± 0.242		
	4/27/2015	U-234	0.30		± 0.201		0.089
	4/27/2015	U-235	0.00		± 0.279	U	0.089
	4/27/2015	U-238	0.07		± 0.096	U	0.089
	4/27/2015	Total Uranium	0.36	0.20	± 0.357		
SWSD008	6/3/2015	Gross Alpha	2.19		± 1.090		1.451
	6/3/2015	Gross Beta	5.26		± 1.133		1.571
	6/3/2015	Ra-226	0.56		± 0.347		0.287
	6/3/2015	Ra-228	0.24		± 0.269	UJ	0.259
	6/3/2015	Total Radium	0.81		±		
	6/3/2015	Th-228	0.13		± 0.147	U	0.205
	6/3/2015	Th-230	0.35		± 0.233	U	0.097
	6/3/2015	Th-232	0.03		± 0.067	U	0.085
	6/3/2015	Total Thorium	0.38		±		
	6/3/2015	U-234	0.51		± 0.242		0.133
	6/3/2015	U-235	0.00		± 0.229	U	0.074
	6/3/2015	U-238	0.47		± 0.235		0.157
	6/3/2015	Total Uranium	0.98	1.42	±		

Table C-5. 2015 Surface Water Analytical Results – Radioactive Constituents

Sampling Location (Sample ID) [SDG Number]	Date Collected	Analyte	Result[a] (pCi/L)	Result[b] (µg/L)	Error[c] (pCi/L)	Qualifier[d]	MDC[e] (pCi/L)
SWSD009	4/27/2015	Gross Alpha	1.52		± 1.123		1.367
	4/27/2015	Gross Beta	1.81		± 1.217	U	1.864
	4/27/2015	Ra-226	0.19		± 0.200	U	0.253
	4/27/2015	Ra-228	0.74		± 0.309	J-	0.279
	4/27/2015	Total Radium	0.93		± 0.368		
	4/27/2015	Th-228	-0.001		± 0.068	U	0.191
	4/27/2015	Th-230	0.22		± 0.189	J	0.144
	4/27/2015	Th-232	-0.01		± 0.062	U	0.143
	4/27/2015	Total Thorium	0.21		± 0.210		
	4/27/2015	U-234	0.17		± 0.145		0.156
	4/27/2015	U-235	0.05		± 0.078	U	0.132
	4/27/2015	U-238	0.13		± 0.122		0.072
	4/27/2015	Total Uranium	0.35	0.41	± 0.205		
SWSD010	6/3/2015	Gross Alpha	0.77		± 0.677	U	0.999
	6/3/2015	Gross Beta	2.96		± 0.740		0.956
	6/3/2015	Ra-226	0.10		± 0.149	U	0.240
	6/3/2015	Ra-228	0.29		± 0.300	UJ	0.288
	6/3/2015	Total Radium	0.38		± 0.335		
	6/3/2015	Th-228	0.09		± 0.107	J	0.082
	6/3/2015	Th-230	0.45		± 0.265	J	0.196
	6/3/2015	Th-232	-0.001		± 0.063	U	0.082
	6/3/2015	Total Thorium	0.54		± 0.293		
	6/3/2015	U-234	0.31		± 0.204		0.155
	6/3/2015	U-235	0.03		± 0.067	U	0.086
	6/3/2015	U-238	0.15		± 0.144	U	0.155
	6/3/2015	Total Uranium	0.49	0.45	± 0.259		

Table C-5. 2015 Surface Water Analytical Results – Radioactive Constituents

Sampling Location (Sample ID) [SDG Number]	Date Collected	Analyte	Result[a] (pCi/L)	Result[b] (µg/L)	Error[c] (pCi/L)	Qualifier[d]	MDC[e] (pCi/L)

Notes:

U = The analyte was not detected.
UJ = Analyte was not detected; estimated value reported. Laboratory replicate precision acceptance criteria was not met.
J1 = Reported as an estimated value. The reported result is within the analytical window of the daily blank, the method blank and/or the rinsate blank result.
J2 = Reported as an estimated value. High LCS recovery.
J3 = Reported as an estimated value. The result is greater than the MDA and less than 2 sigma uncertainty.
J4 = Reported as an estimated value. The absolute difference or relative percent difference between replicate pair results (field replicates, lab replicates, or QA split samples) exceeds the control limit for a given analyte.
J5 = Reported as an extimated value. Low matrix density.
J6 = Reported as an extimated value. Low tracer recovery.
J7 = Reported as an estimated value. MS Z score outside of acceptance range.

[a] Unbiased actual values are used for sum regardless of assigned data qualifier.

[b] To calculate the total uranium in µg/L, the U-238 result in pCi/L is divided by 0.33.

[c] This column shows the 2 sigma error (95 percent confidence level) associated with the pCi/L result.

[d] USACE data qualifier flags based on the CDQMP-QAPP.

[e] Minimum Detectable Concentration (MDC)

[f] A quality control duplicate is collected at the same time and location and is analyzed by the same method in order to evaluate precision in

Table C-6. 2015 Sediment Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result[a] (pCi/g)	Error (pCi/g)	Qualifier[b]	MDA[c] (pCi/g)	Cleanup Criteria[d] (pCi/g)
Samples collected in Westerly Brook:							
SWSD001	6/3/2015	Ra-226	0.65	0.055		0.02	5[f]
	6/3/2015	Th-232	0.92	0.141		0.03	5[f]
	6/3/2015	U-238	0.39	0.255	J	0.12	50
SWSD002	6/3/2015	Ra-226	0.57	0.052		0.02	5[f]
	6/3/2015	Th-232	0.53	0.106		0.03	5[f]
	6/3/2015	U-238	0.52	0.229		0.10	50
SWSD003	6/3/2015	Ra-226	0.59	0.054			5[f]
	6/3/2015	Th-232	0.44	0.097		0.03	5[f]
	6/3/2015	U-238	0.52	0.292		0.12	50
Samples collected in Lodi Brook:							
SWSD006	6/3/2015	Ra-226	0.78	0.062		0.02	5[f]
	6/3/2015	Th-232	0.51	0.106		0.03	5[f]
	6/3/2015	U-238	0.54	0.373		0.17	50
SWSD006 [e] Duplicate	6/3/2015	Ra-226	0.88	0.071		0.02	5[f]
	6/3/2015	Th-232	0.63	0.113		0.04	5[f]
	6/3/2015	U-238	0.56	0.302		0.14	50
SWSD007	6/3/2015	Ra-226	0.71	0.06		0.02	5[f]
	6/3/2015	Th-232	0.82	0.13		0.03	5[f]
	6/3/2015	U-238	0.56	0.29		0.14	50
SWSD008	6/3/2015	Ra-226	0.79	0.06		0.02	5[f]
	6/3/2015	Th-232	0.78	0.12		0.03	5[f]
	6/3/2015	U-238	0.87	0.45		0.19	50
SWSD009	6/3/2015	Ra-226	1.02	0.09		0.022	5[f]
	6/3/2015	Th-232	1.73	0.24		0.05	5[f]
	6/3/2015	U-238	0.09	0.42		0.21	50
SWSD010	6/3/2015	Ra-226	0.65	0.06		0.02	5[f]
	6/3/2015	Th-232	0.99	0.13		0.03	5[f]
	6/3/2015	U-238	0.67	0.28		0.13	50

Notes:

U = The analyte was not detected.

J = Reported as an estimated value. The reported result is within the analytical window of the daily blank, the method blank and/or the rinsate blank result.

[a] Results reported with ± radiological error equal to 2 sigma (95% confidence level).

[b] USACE data qualifier flags based on the CDQMP-QAPP.

[c] Minimum Detectable Activity (MDA)

[d] The unrestricted use soil cleanup criteria established by the *Record of Decision for Soils and Building at the FUSRAP Maywood Superfund Site* (USACE 2003) is used as the basis for evaluating analytical results for sediment.

[e] A quality control duplicate is collected at the same time and location and is analyzed by the same method in order to evaluate precision in sampling and analysis.

[f] The ROD soil cleanup criteria for the combined concentration of Ra-226 and Th-232 above background.

Table C-7. 2015 Depth to Groundwater and Groundwater Elevations for Overburden Monitoring Wells

Well	Top of Inner Casing (feet NGVD)	Water Level (feet below TOC)	GW Elevation (feet NGVD)	Measurement Date
B38W01S	56.57	8.14	48.43	5/18/2015
B38W14S	43.89	4.30	39.59	5/18/2015
B38W15S	46.75	5.00	41.75	5/18/2015
B38W17A	53.24	8.73	44.51	5/18/2015
B38W24S	56.94	10.97	45.97	5/18/2015
MISS01AA	62.70	16.56	46.14	5/18/2015
MISS04A	56.85	10.35	46.50	5/18/2015
MISS05AR	55.09	10.42	44.67	5/18/2015
MISS07A	55.60	9.15	46.45	5/18/2015
MW-24S	57.39	12.25	45.14	5/18/2015
MW-25S	58.85	10.66	48.19	5/18/2015
MW-28S	64.87	15.68	49.19	5/18/2015
MW-33S	61.64	14.36	47.28	5/18/2015

Notes:

NGVD - National Geodetic Vertical Datum - 1929

TOC - Top of Casing

Table C-8. 2015 Depth to Groundwater and Groundwater Elevations for Bedrock Monitoring Wells

Well	Top of Inner Casing (feet NGVD)	Water Level (feet below TOC)	GW Elevation (feet NGVD)	Measurement Date
B38W02D	78.04	17.87	60.17	5/18/2015
B38W03B	58.27	10.78	47.49	5/18/2015
B38W04B	65.64	10.83	54.81	5/18/2015
B38W07B	54.96	9.61	45.35	5/18/2015
B38W14D	43.79	2.34	41.45	5/18/2015
B38W15D	47.04	4.30	42.74	5/18/2015
B38W17B	53.28	8.79	44.49	5/18/2015
B38W24D	56.16	10.35	45.81	5/18/2015
MISS01B	61.98	15.72	46.26	5/18/2015
MISS04B	56.96	11.31	45.65	5/18/2015
MISS05BR	54.58	10.05	44.53	5/18/2015
MISS07B	55.77	10.67	45.10	5/18/2015
MW-24D	57.28	11.83	45.45	5/18/2015
MW-25D	58.13	12.20	45.93	5/18/2015
MW-28D	64.50	17.04	47.46	5/18/2015
MW33D	62.00	15.44	46.56	5/18/2015
MW-42D	62.35	12.74	49.61	5/18/2015

Notes:

NGVD - National Geodetic Vertical Datum - 1929

TOC - Top of Casing

Table C-9. 2015 Vertical Gradient Calculations for Monitoring Well Clusters

Well	Well Type	GW Elv. NGVD 5/18/2015
On-Site (MISS/Stepan Company Property) Well Clusters		
MW-24S	Overburden	45.14
MW-24D	Bedrock	45.45
	Hydraulic Head Difference, feet	-0.31
	Gradient Direction	Upward
MW-25S	Overburden	48.19
MW-25D	Bedrock	45.93
	Hydraulic Head Difference, feet	2.26
	Gradient Direction	Downward
MW-28S	Overburden	49.19
MW-28D	Bedrock	47.46
	Hydraulic Head Difference, feet	1.73
	Gradient Direction	Downward
MW-33S	Overburden	47.28
MW-33D	Bedrock	46.56
	Hydraulic Head Difference, feet	0.72
	Gradient Direction	Downward
MISS01AA	Overburden	46.14
MISS01B	Bedrock	46.26
	Hydraulic Head Difference, feet	-0.12
	Gradient Direction	Transitional
MISS04A	Overburden	46.50
MISS04B	Bedrock	45.65
	Hydraulic Head Difference, feet	0.85
	Gradient Direction	Downward

Table C-9. 2015 Vertical Gradient Calculations for Monitoring Well Clusters

Well	Well Type	GW Elv. NGVD 5/18/2015
MISS07A	Overburden	46.45
MISS07B	Bedrock	45.10
	Hydraulic Head Difference, feet	1.35
	Gradient Direction	Downward
B38W24S	Overburden	45.97
B38W24D	Bedrock	45.81
	Hydraulic Head Difference, feet	0.16
	Gradient Direction	Transitional
Off-Site Well Clusters		
B38W14S	Overburden	39.59
B38W14D	Bedrock	41.45
	Hydraulic Head Difference, feet	2.20
	Gradient Direction	Downward
B38W15S	Overburden	41.75
B38W15D	Bedrock	42.74
	Hydraulic Head Difference, feet	-0.99
	Gradient Direction	Upward
B38W17A	Overburden	44.51
B38W17B	Bedrock	44.49
	Hydraulic Head Difference, feet	0.02
	Gradient Direction	Transitional

Notes:

GW Elv. NGVD - Groundwater Elevation National Geodetic Vertical Datum of 1929

Negative Hydraulic Head Difference depicts an upward vertical gradient.

Positive Hydraulic Head Difference depicts a downward vertical gradient.

Transitional Hydraulic Head Difference depicts a vertical gradient between 0.2 and -0.2 foot/foot.

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
Monitoring Wells Completed in Unconsolidated Sediment							
B38W01S [e]	5/19/2015	Gross Alpha	0.40		± 1.245	U	2.079
	5/19/2015	Gross Beta	23.51		± 1.106		0.977
	5/19/2015	Ra-226	0.00		± 0.397	U	0.280
	5/19/2015	Ra-228	0.63		± 0.253	J	0.203
	5/19/2015	Total Radium	0.63		±		
	5/19/2015	Th-228	0.04		± 0.111	U	0.216
	5/19/2015	Th-230	0.13		± 0.145	J	0.125
	5/19/2015	Th-232	0.03		± 0.053	U	0.069
	5/19/2015	Total Thorium	0.20		±		
	5/19/2015	U-234	0.16		± 0.137		0.134
	5/19/2015	U-235	0.03		± 0.058	U	0.075
	5/19/2015	U-238	-0.01		± 0.058	U	0.134
	5/19/2015	Total Uranium	0.18	-0.027	±		
	5/19/2015	K-40 [f]	20.77		±		
	5/19/2015	Rn-222	428.00		± 58.000		31.000
B38W14S	5/20/2015	Gross Alpha	1.89		± 0.873	J	1.087
	5/20/2015	Gross Beta	6.11		± 0.925		1.051
	5/20/2015	Ra-226	0.05		± 0.162	U	0.345
	5/20/2015	Ra-228	0.38		± 0.183	J	0.155
	5/20/2015	Total Radium	0.43		±		
	5/20/2015	Th-228	0.02		± 0.087	U	0.197
	5/20/2015	Th-230	0.24		± 0.188		0.086
	5/20/2015	Th-232	0.02		± 0.059	U	0.136
	5/20/2015	Total Thorium	0.28		±		
	5/20/2015	U-234	0.39		± 0.222		0.082
	5/20/2015	U-235	0.06		± 0.088	U	0.082
	5/20/2015	U-238	0.11		± 0.122	U	0.147
	5/20/2015	Total Uranium	0.56	0.333	±		
	5/20/2015	K-40 [f]	4.65		±		
	5/20/2015	Rn-222	62.00		± 21.000		31.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
B38W15S	5/19/2015	Gross Alpha	2.19		± 1.366	J	2.021
	5/19/2015	Gross Beta	95.32		± 2.910		1.622
	5/19/2015	Ra-226	0.27		± 0.248	U	0.297
	5/19/2015	Ra-228	0.33		± 0.214	J	0.190
	5/19/2015	Total Radium	0.60		±		
	5/19/2015	Th-228	-0.02		± 0.069	U	0.182
	5/19/2015	Th-230	0.37		± 0.240		0.154
	5/19/2015	Th-232	-1.00		± 0.066	U	0.085
	5/19/2015	Total Thorium	-0.66		±		
	5/19/2015	U-234	0.78		± 0.321		0.084
	5/19/2015	U-235	0.00		± 0.262	U	0.084
	5/19/2015	U-238	0.21		± 0.166		0.152
	5/19/2015	Total Uranium	0.98	0.624	±		
	5/19/2015	K-40 [f]	76.40		±		
	5/19/2015	Rn-222	389.00		± 55.000		35.000
B38W17A	5/19/2015	Gross Alpha	2.04		± 0.762	J	0.809
	5/19/2015	Gross Beta	12.71		± 1.204		1.151
	5/19/2015	Ra-226	0.20		± 0.228	U	0.321
	5/19/2015	Ra-228	0.77		± 0.219	J	0.163
	5/19/2015	Total Radium	0.97		±		
	5/19/2015	Th-228	0.03		± 0.099	U	0.211
	5/19/2015	Th-230	0.48		± 0.276		0.160
	5/19/2015	Th-232	0.03		± 0.068	U	0.088
	5/19/2015	Total Thorium	0.54		±		
	5/19/2015	U-234	0.01		± 0.063	U	0.166
	5/19/2015	U-235	0.00		± 0.241	U	0.077
	5/19/2015	U-238	0.02		± 0.060	U	0.139
	5/19/2015	Total Uranium	0.03	0.058	±		
	5/19/2015	K-40 [f]	9.97		±		
	5/19/2015	Rn-222	282.00		± 44.000		36.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
B38W24S	6/1/2015	Gross Alpha	4.57		± 1.606		2.486
	6/1/2015	Gross Beta	25.31		± 1.680		1.756
	6/1/2015	Ra-226	0.33		± 0.241	J	0.230
	6/1/2015	Ra-228	0.90		± 0.310		0.249
	6/1/2015	Total Radium	1.23		±		
	6/1/2015	Th-228	0.15		± 0.145	U	0.167
	6/1/2015	Th-230	0.32		± 0.221		0.168
	6/1/2015	Th-232	0.00		± 0.061	U	0.078
	6/1/2015	Total Thorium	0.47		±		
	6/1/2015	U-234	-0.01		± 0.063	U	0.147
	6/1/2015	U-235	0.03		± 0.064	U	0.082
	6/1/2015	U-238	0.01		± 0.066	U	0.174
	6/1/2015	Total Uranium	0.03	0.030	±		
	6/1/2015	K-40 [f]	21.60				
	6/1/2015	Rn-222	69.00		± 23.000		32.000
B38W24S -F	6/1/2015	Gross Alpha	3.53		± 1.602		2.526
	6/1/2015	Gross Beta	23.01		± 1.583		1.654
	6/1/2015	Ra-226	0.18		± 0.205	UJ	0.289
	6/1/2015	Ra-228	0.86		± 0.251		0.196
	6/1/2015	Total Radium	1.03		±		
	6/1/2015	Th-228	-0.02		± 0.062	U	0.145
	6/1/2015	Th-230	0.16		± 0.168	J	0.144
	6/1/2015	Th-232	0.00		± 0.062	U	0.079
	6/1/2015	Total Thorium	0.14		±		
	6/1/2015	U-234	0.03		± 0.063	U	0.080
	6/1/2015	U-235	0.00		± 0.251	U	0.081
	6/1/2015	U-238	0.02		± 0.062	U	0.145
	6/1/2015	Total Uranium	0.05	0.061	±		
	6/1/2015	K-40 [f]	21.60		±		
	6/1/2015	Rn-222	NA [g]		±		

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
MISS01AA	5/26/2015	Gross Alpha	4.52		± 1.313		1.998
	5/26/2015	Gross Beta	2.54		± 0.739		1.050
	5/26/2015	Ra-226	0.17		± 0.174	J	0.166
	5/26/2015	Ra-228	0.50		± 0.242	J	0.214
	5/26/2015	Total Radium	0.68		±		
	5/26/2015	Th-228	0.28		± 0.201		0.226
	5/26/2015	Th-230	0.14		± 0.153	J	0.131
	5/26/2015	Th-232	0.00		± 0.056	U	0.072
	5/26/2015	Total Thorium	0.42		±		
	5/26/2015	U-234	0.38		± 0.210		0.134
	5/26/2015	U-235	0.11		± 0.112	J	0.074
	5/26/2015	U-238	0.37		± 0.209		0.134
	5/26/2015	Total Uranium	0.86	1.133	±		
	5/26/2015	K-40 [f]	0.83		±		
	5/26/2015	Rn-222	293.00		± 44.000		33.000
MISS05AR	5/27/2015	Gross Alpha	2.88		± 2.067	U	3.297
	5/27/2015	Gross Beta	8.32		± 1.158		1.625
	5/27/2015	Ra-226	0.12		± 0.170	U	0.265
	5/27/2015	Ra-228	0.71		± 0.335	J	0.306
	5/27/2015	Total Radium	0.83		±		
	5/27/2015	Th-228	0.17		± 0.162	U	0.186
	5/27/2015	Th-230	0.42		± 0.265		0.209
	5/27/2015	Th-232	0.06		± 0.093	U	0.087
	5/27/2015	Total Thorium	0.65		±		
	5/27/2015	U-234	0.46		± 0.244		0.173
	5/27/2015	U-235	0.02		± 0.063	U	0.146
	5/27/2015	U-238	0.45		± 0.235		0.080
	5/27/2015	Total Uranium	0.92	1.348	±		
	5/27/2015	K-40 [f]	14.10		±		
	5/27/2015	Rn-222	450.00		± 60.000		32.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
MW24S	5/28/2015	Gross Alpha	1.44		± 0.701	J	0.8989
	5/28/2015	Gross Beta	19.00		± 1.177		1.042
	5/28/2015	Ra-226	0.14		± 0.192	U	0.309
	5/28/2015	Ra-228	0.41		± 0.260		0.240
	5/28/2015	Total Radium	0.54		±		
	5/28/2015	Th-228	0.07		± 0.122	U	0.217
	5/28/2015	Th-230	0.30		± 0.238		0.217
	5/28/2015	Th-232	0.02		± 0.070	U	0.163
	5/28/2015	Total Thorium	0.39		±		
	5/28/2015	U-234	0.10		± 0.127	U	0.179
	5/28/2015	U-235	0.02		± 0.065	U	0.151
	5/28/2015	U-238	0.03		± 0.065	U	0.083
	5/28/2015	Total Uranium	0.15	0.094	±		
	5/28/2015	K-40 [f]	19.10		±		
	5/28/2015	Rn-222	156.00		± 29.000		30.000
MW25S	6/2/2015	Gross Alpha	3.59		± 1.224		1.889
	6/2/2015	Gross Beta	10.91		± 1.192		1.539
	6/2/2015	Ra-226	0.32		± 0.247	J	0.262
	6/2/2015	Ra-228	0.98		± 0.318		0.264
	6/2/2015	Total Radium	1.30		±		
	6/2/2015	Th-228	0.06		± 0.105	U	0.187
	6/2/2015	Th-230	0.17		± 0.177	U	0.187
	6/2/2015	Th-232	-0.01		± 0.060	U	0.141
	6/2/2015	Total Thorium	0.22		±		
	6/2/2015	U-234	0.40		± 0.224		0.144
	6/2/2015	U-235	0.03		± 0.062	U	0.080
	6/2/2015	U-238	0.44		± 0.232		0.079
	6/2/2015	Total Uranium	0.87	1.330	±		
	6/2/2015	K-40 [f]	9.14		±		
	6/2/2015	Rn-222	162.00		± 30.000		31.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
MW28S	5/28/2015	Gross Alpha	4.78		± 1.510		2.305
	5/28/2015	Gross Beta	24.83		± 1.618		1.838
	5/28/2015	Ra-226	0.20		± 0.202	U	0.261
	5/28/2015	Ra-228	0.74		± 0.346		0.304
	5/28/2015	Total Radium	0.94		±		
	5/28/2015	Th-228	0.19		± 0.161		0.172
	5/28/2015	Th-230	0.23		± 0.191		0.146
	5/28/2015	Th-232	0.24		± 0.171		0.080
	5/28/2015	Total Thorium	0.65		±		
	5/28/2015	U-234	0.50		± 0.253		0.168
	5/28/2015	U-235	0.15		± 0.132		0.079
	5/28/2015	U-238	0.54		± 0.259		0.142
	5/28/2015	Total Uranium	1.19	1.636	±		
	5/28/2015	K-40 [f]	19.90		±		
	5/28/2015	Rn-222	367.00		± 51.000		30.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
Monitoring Wells Completed in Bedrock							
B38W02D [e]	5/21/2015	Gross Alpha	2.65		± 0.868	J	0.843
	5/21/2015	Gross Beta	1.22		± 0.623		0.945
	5/21/2015	Ra-226	0.28		± 0.252	U	0.303
	5/21/2015	Ra-228	1.53		± 0.321	J	0.232
	5/21/2015	Total Radium	1.81		±		
	5/21/2015	Th-228	0.03		± 0.091	U	0.194
	5/21/2015	Th-230	0.14		± 0.160	U	0.147
	5/21/2015	Th-232	0.03		± 0.063	U	0.081
	5/21/2015	Total Thorium	0.20		±		
	5/21/2015	U-234	0.42		± 0.241		0.161
	5/21/2015	U-235	0.02		± 0.069	U	0.161
	5/21/2015	U-238	0.03		± 0.069	U	0.089
	5/21/2015	Total Uranium	0.47	0.100	±		
	5/21/2015	K-40 [f]	1.00		±		
	5/21/2015	Rn-222	267.00		± 41.000		31.000
B38W03B	5/21/2015	Gross Alpha	2.00		± 1.142	J	1.605
	5/21/2015	Gross Beta	6.12		± 1.166		1.609
	5/21/2015	Ra-226	-0.05		± 0.129	U	0.402
	5/21/2015	Ra-228	1.33		± 0.306		0.213
	5/21/2015	Total Radium	1.28		±		
	5/21/2015	Th-228	-0.02		± 0.085	U	0.260
	5/21/2015	Th-230	0.21		± 0.210	U	0.222
	5/21/2015	Th-232	0.00		± 0.072	U	0.092
	5/21/2015	Total Thorium	0.19		±		
	5/21/2015	U-234	0.24		± 0.191		0.192
	5/21/2015	U-235	0.02		± 0.070	U	0.162
	5/21/2015	U-238	0.07		± 0.096	U	0.089
	5/21/2015	Total Uranium	0.33	0.200	±		
	5/21/2015	K-40 [f]	7.64		±		
	5/21/2015	Rn-222	1,150.00		± 140.000		30.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
B38W14D	5/20/2015	Gross Alpha	1.95		± 1.112	J	1.563
	5/20/2015	Gross Beta	3.52		± 1.017		1.506
	5/20/2015	Ra-226	0.00		± 0.450	U	0.317
	5/20/2015	Ra-228	0.51		± 0.222	J	0.182
	5/20/2015	Total Radium	0.51		±		
	5/20/2015	Th-228	-0.05		± 0.078	U	0.251
	5/20/2015	Th-230	0.13		± 0.151	U	0.139
	5/20/2015	Th-232	0.05		± 0.082	U	0.138
	5/20/2015	Total Thorium	0.12		±		
	5/20/2015	U-234	1.01		± 0.352		0.161
	5/20/2015	U-235	0.00		± 0.235	U	0.075
	5/20/2015	U-238	0.39		± 0.211		0.075
	5/20/2015	Total Uranium	1.40	1.176	±		
	5/20/2015	K-40 [f]	2.99		±		
	5/20/2015	Rn-222	1,010.00		± 120.000		30.000
B38W15D	5/19/2015	Gross Alpha	7.43		± 1.707	J	1.521
	5/19/2015	Gross Beta	30.24		± 1.838		1.648
	5/19/2015	Ra-226	0.05		± 0.122	U	0.237
	5/19/2015	Ra-228	0.59		± 0.297	J	0.258
	5/19/2015	Total Radium	0.65		±		
	5/19/2015	Th-228	-0.07		± 0.078	U	0.246
	5/19/2015	Th-230	0.07		± 0.131	U	0.142
	5/19/2015	Th-232	0.00		± 0.061	U	0.078
	5/19/2015	Total Thorium	0.00		±		
	5/19/2015	U-234	3.11		± 0.659		0.132
	5/19/2015	U-235	0.08		± 0.096	J	0.073
	5/19/2015	U-238	1.84		± 0.483		0.132
	5/19/2015	Total Uranium	5.04	5.588	±		
	5/19/2015	K-40 [f]	28.20		±		
	5/19/2015	Rn-222	1,170.00		± 140.000		30.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
B38W17B	5/20/2015	Gross Alpha	7.33		± 1.543		2.203
	5/20/2015	Gross Beta	84.79		± 2.478		1.724
	5/20/2015	Ra-226	0.12		± 0.154	U	0.214
	5/20/2015	Ra-228	1.33		± 0.313	J	0.228
	5/20/2015	Total Radium	1.44		±		
	5/20/2015	Th-228	0.01		± 0.062	U	0.164
	5/20/2015	Th-230	0.35		± 0.224		0.139
	5/20/2015	Th-232	0.00		± 0.059	U	0.076
	5/20/2015	Total Thorium	0.36		±		
	5/20/2015	U-234	0.03		± 0.068	U	0.087
	5/20/2015	U-235	0.00		± 0.273	U	0.088
	5/20/2015	U-238	0.02		± 0.068	U	0.158
	5/20/2015	Total Uranium	0.05	0.064	±		
	5/20/2015	K-40 [f]	74.80		±		
	5/20/2015	Rn-222	330.00		± 47.000		32.000
B38W24D	6/1/2015	Gross Alpha	8.47		± 1.329		0.942
	6/1/2015	Gross Beta	18.84		± 1.224		1.133
	6/1/2015	Ra-226	0.31		± 0.245	J	0.248
	6/1/2015	Ra-228	0.55		± 0.252		0.217
	6/1/2015	Total Radium	0.86		±		
	6/1/2015	Th-228	0.60		± 0.285		0.206
	6/1/2015	Th-230	0.16		± 0.166	J	0.143
	6/1/2015	Th-232	0.03		± 0.061	J	0.143
	6/1/2015	Total Thorium	0.79		±		
	6/1/2015	U-234	0.02		± 0.059	U	0.136
	6/1/2015	U-235	-0.01		± 0.059	U	0.137
	6/1/2015	U-238	0.00		± 0.234	U	0.075
	6/1/2015	Total Uranium	0.01	0.000	±		
	6/1/2015	K-40 [f]	16.60		±		
	6/1/2015	Rn-222	940.00		± 110.000		30.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
Miss01B	5/26/2015	Gross Alpha	4.01		± 1.342	J	1.192
	5/26/2015	Gross Beta	16.55		± 1.539		1.346
	5/26/2015	Ra-226	0.00		± 0.506	U	0.313
	5/26/2015	Ra-228	0.54		± 0.221	J	0.184
	5/26/2015	Total Radium	0.54		±		
	5/26/2015	Th-228	0.04		± 0.086	U	0.167
	5/26/2015	Th-230	0.25		± 0.194		0.142
	5/26/2015	Th-232	-0.02		± 0.064		0.167
	5/26/2015	Total Thorium	0.26		±		
	5/26/2015	U-234	0.88		± 0.350		0.156
	5/26/2015	U-235	-0.01		± 0.067	U	0.157
	5/26/2015	U-238	0.38		± 0.225		0.086
	5/26/2015	Total Uranium	1.25	1.158	±		
	5/26/2015	K-40 [f]	19.90		±		
	5/26/2015	Rn-222	199.00		± 34.000		32.000
MISS05BR	5/27/2015	Gross Alpha	7.63		± 2.199		3.205
	5/27/2015	Gross Beta	923.06		± 14.710		5.5.15
	5/27/2015	Ra-226	0.40		± 0.281		0.319
	5/27/2015	Ra-228	0.88		± 0.327	J	0.279
	5/27/2015	Total Radium	1.28		±		
	5/27/2015	Th-228	0.12		± 0.132	U	0.166
	5/27/2015	Th-230	0.58		± 0.285		0.166
	5/27/2015	Th-232	0.00		± 0.060	U	0.077
	5/27/2015	Total Thorium	0.70		±		
	5/27/2015	U-234	0.10		± 0.123	U	0.173
	5/27/2015	U-235	0.00		± 0.253	U	0.081
	5/27/2015	U-238	0.09		± 0.105	J	0.105
	5/27/2015	Total Uranium	0.19	0.270	±		
	5/27/2015	K-40 [f]	914.00		±		
	5/27/2015	Rn-222	88.00		± 23.000		30.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
MISS05BR-DUP	5/27/2015	Gross Alpha	4.46		±		3.148
	5/27/2015	Gross Beta	1,040.30		± 15.987		7.027
	5/27/2015	Ra-226	0.31		± 0.227		0.217
	5/27/2015	Ra-228	0.71		± 0.365	J	0.333
	5/27/2015	Total Radium	1.03		±		
	5/27/2015	Th-228	0.12		± 0.140	U	0.196
	5/27/2015	Th-230	0.56		± 0.286		0.148
	5/27/2015	Th-232	0.00		± 0.063	U	0.081
	5/27/2015	Total Thorium	0.68		±		
	5/27/2015	U-234	0.14		± 0.133	U	0.144
	5/27/2015	U-235	0.00		± 0.248	U	0.080
	5/27/2015	U-238	-0.01		± 0.062	U	0.144
	5/27/2015	Total Uranium	0.13	-0.030	±		
	5/27/2015	K-40 [f]	914.00		±		
	5/27/2015	Rn-222	147.00		± 29.000		31.000
MISS07B	5/26/2015	Gross Alpha	3.18		± 1.690		2.693
	5/26/2015	Gross Beta	20.40		± 2.411		3.278
	5/26/2015	Ra-226	0.03		± 0.086	U	0.199
	5/26/2015	Ra-228	0.81		± 0.248	J	0.197
	5/26/2015	Total Radium	0.84		±		
	5/26/2015	Th-228	0.19		± 0.162		0.180
	5/26/2015	Th-230	0.40		± 0.235		0.137
	5/26/2015	Th-232	0.00		± 0.058	U	0.075
	5/26/2015	Total Thorium	0.59		±		
	5/26/2015	U-234	3.03		± 0.716		0.193
	5/26/2015	U-235	0.17		± 0.152		0.090
	5/26/2015	U-238	1.31		± 0.443		0.162
	5/26/2015	Total Uranium	4.51	3.979	±		
	5/26/2015	K-40 [f]	24.90		±		
	5/26/2015	Rn-222	900.00		± 110.000		30.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
MW24D	5/28/2015	Gross Alpha	18.88		± 1.585		1.861
	5/28/2015	Gross Beta	6.88		± 1.101		1.486
	5/28/2015	Ra-226	0.16		± 0.186	U	0.261
	5/28/2015	Ra-228	0.40		± 0.285		0.266
	5/28/2015	Total Radium	0.56		±		
	5/28/2015	Th-228	0.17		± 0.209	U	0.321
	5/28/2015	Th-230	0.24		± 0.211		0.170
	5/28/2015	Th-232	0.00		± 0.073	U	0.030
	5/28/2015	Total Thorium	0.41		±		
	5/28/2015	U-234	8.56		± 1.379		0.160
	5/28/2015	U-235	0.29		± 0.200		0.088
	5/28/2015	U-238	5.66		± 1.039		0.088
	5/28/2015	Total Uranium	14.51	17.142	±		
	5/28/2015	K-40 [f]	5.15		±		
	5/28/2015	Rn-222	1,350.00		± 160.000		30.000
MW25D	6/2/2015	Gross Alpha	1.82		± 1.219	U	1.964
	6/2/2015	Gross Beta	111.39		± 2.788		1.633
	6/2/2015	Ra-226	0.01		± 0.170	UJ	0.385
	6/2/2015	Ra-228	0.78		± 0.270		0.223
	6/2/2015	Total Radium	0.79		±		
	6/2/2015	Th-228	0.00		± 0.118	U	0.273
	6/2/2015	Th-230	0.31		± 0.217		0.145
	6/2/2015	Th-232	0.00		± 0.062	U	0.079
	6/2/2015	Total Thorium	0.31		±		
	6/2/2015	U-234	0.18		± 0.156		0.154
	6/2/2015	U-235	-0.01		± 0.660	U	0.154
	6/2/2015	U-238	0.03		± 0.066	U	0.085
	6/2/2015	Total Uranium	0.20	0.094	±		
	6/2/2015	K-40 [f]	99.70		±		
	6/2/2015	Rn-222	511.00		± 66.000		31.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
MW28D	6/4/2015	Gross Alpha	1.74		± 1.841	U	3.017
	6/4/2015	Gross Beta	88.88		± 2.472		1.465
	6/4/2015	Ra-226	0.15		± 0.180	U	0.254
	6/4/2015	Ra-228	0.76		± 0.407	J	0.367
	6/4/2015	Total Radium	0.91		±		
	6/4/2015	Th-228	-0.02		± 0.063	U	0.191
	6/4/2015	Th-230	0.45		± 0.238		0.146
	6/4/2015	Th-232	0.02		± 0.053	U	0.123
	6/4/2015	Total Thorium	0.45		±		
	6/4/2015	U-234	0.20		± 0.156		0.156
	6/4/2015	U-235	0.00		± 0.228	U	0.073
	6/4/2015	U-238	0.10		± 0.110	U	0.132
	6/4/2015	Total Uranium	0.30	0.300	±		
	6/4/2015	K-40 [f]	73.10		±		
	6/4/2015	Rn-222	940.00		± 120.000		30.000
MW28D-DUP	6/4/2015	Gross Alpha	2.99		± 1.758		2.815
	6/4/2015	Gross Beta	79.82		± 2.277		1.368
	6/4/2015	Ra-226	0.05		± 0.144	U	0.307
	6/4/2015	Ra-228	0.15		± 0.296	UJ	0.294
	6/4/2015	Total Radium	0.20		±		
	6/4/2015	Th-228	0.03		± 0.092	U	0.197
	6/4/2015	Th-230	0.57		± 0.295		0.197
	6/4/2015	Th-232	-0.01		± 0.064	U	0.148
	6/4/2015	Total Thorium	0.59		±		
	6/4/2015	U-234	0.18		± 0.160		0.158
	6/4/2015	U-235	0.03		± 0.068	U	0.087
	6/4/2015	U-238	0.10		± 0.114	J	0.087
	6/4/2015	Total Uranium	0.31	0.291	±		
	6/4/2015	K-40 [f]	71.40		±		
	6/4/2015	Rn-222	950.00		± 120.000		30.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)
MW42D	6/2/2015	Gross Alpha	2.46		± 0.855		0.833
	6/2/2015	Gross Beta	2.46		± 0.677		0.901
	6/2/2015	Ra-226	0.12		± 0.156	UJ	0.217
	6/2/2015	Ra-228	0.74		± 0.321		0.277
	6/2/2015	Total Radium	0.86		±		
	6/2/2015	Th-228	0.09		± 0.158	U	0.280
	6/2/2015	Th-230	0.19		± 0.204	U	0.233
	6/2/2015	Th-232	0.03		± 0.069	U	0.089
	6/2/2015	Total Thorium	0.31		±		
	6/2/2015	U-234	0.20		± 0.173	U	0.209
	6/2/2015	U-235	0.02		± 0.062	U	0.145
	6/2/2015	U-238	0.17		± 0.147		0.144
	6/2/2015	Total Uranium	0.38	0.506	±		
	6/2/2015	K-40 [f]	1.16		±		
	6/2/2015	Rn-222	783.00		± 97.000		31.000
MW42D-DUP	6/2/2015	Gross Alpha	2.60		± 0.860		0.806
	6/2/2015	Gross Beta	2.20		± 0.687		0.954
	6/2/2015	Ra-226	0.17		± 0.223	UJ	0.223
	6/2/2015	Ra-228	0.33		± 0.310		0.301
	6/2/2015	Total Radium	0.51		±		
	6/2/2015	Th-228	0.02		± 0.064	U	0.149
	6/2/2015	Th-230	0.14		± 0.163	U	0.150
	6/2/2015	Th-232	-0.02		± 0.067	U	0.176
	6/2/2015	Total Thorium	0.00		±		
	6/2/2015	U-234	0.44		± 0.243		0.156
	6/2/2015	U-235	-0.01		± 0.067	U	0.156
	6/2/2015	U-238	0.14		± 0.146	U	0.184
	6/2/2015	Total Uranium	0.56	0.418	±		
	6/2/2015	K-40 [f]	1.08		±		
	6/2/2015	Rn-222	810.00		± 100.000		30.000

Table C-10. 2015 Groundwater Analytical Results – Radioactive Constituents

Sampling Location	Date Collected	Analyte	Result (pCi/L)	Result [a] (µg/L)	Error [b] (pCi/L)	Data [c] Qualifier	MDC [d] (pCi/L)

Notes:

U = The analyte was not detected.

J = Reported as an estimated value. If a sample was reanalyzed, the reanalyzed results are reported, not the original results. If a lab replicate (LREP) sample pair was analyzed, only the original sample results are reported. However, if the LREP is qualified J, then the original sample is also qualified J.

+B = Blank analytes above control limits

M3 = Result did not meet the targeted MDC but the reported activity was greater than the achieved MDC

[a] To calculate the total uranium in µg/L, the U-238 result in pCi/L is divided by 0.3365.

[b] This column shows the 2 sigma error (95 percent confidence level) associated with the pCi/L result.

[c] USACE data qualifier flags based on the UFP-QAPP;

[d] Minimum Detectable Concentration (MDC).

[e] Monitoring wells B38W01S and B38W02D are the background locations that are completed in the overburden and bedrock

[f] K-40 concentrations are based on non-radiological, total potassium measurements which are then each multiplied by two factors: the fraction of K-40 in total potassium and the specific activity of K-40, to obtain K-40 results in picoCuries per liter (pCi/L). This approach was used because the off-site laboratory was unable to meet requested minimum detectable concentrations for this isotope.

Table C-11. 2015 Groundwater Analytical Results – Non-Radioactive Constituents

Sampling Location		Date Collected	Analyte	Result (ug/L)	Data [a] Qualifier	ROD Cleanup Criteria (ug/L)
Monitoring Wells Completed in Unconsolidated Sediment						
B38W01S	B38W01S	5/21/2015	Arsenic, Total	2.00	U	3
	B38W01S	5/21/2015	Benzene	1.00	U	1
	B38W01S	5/21/2015	Lithium, Total	850.00		730
B38W14S	B38W14S	5/20/015	Arsenic, Total	1.50		3
	B38W14S	5/20/015	Benzene	1.00	U	1
	B38W14S	5/20/015	Lithium, Total	35.00	J	730
B38W15S	B38W15S	5/19/2015	Arsenic, Total	2.80		3
	B38W15S	5/19/2015	Benzene	1.00	U	1
	B38W15S	5/19/2015	Lithium, Total	1,500.00	J+	730
B38W17A	B38W17A	5/19/2015	Arsenic, Total	2.00	U	3
	B38W17A	5/19/2015	Benzene	1.00	U	1
	B38W17A	5/19/2015	Lithium, Total	170.00	J+	730
B38W24S	B38W24S	6/1/2015	Arsenic, Total	0.93	J+	3
	B38W24S	6/1/2015	Benzene	1.00	U	1
	B38W24S	6/1/2015	Lithium, Total	56.00		730
MISS01AA	MISS01AA	5/26/2015	Arsenic, Total	1.80		3
	MISS01AA	5/26/2015	Benzene	1.00	U	1
	MISS01AA	5/26/2015	Lithium, Total	240.00		730
MISS05AR	MISS05AR	5/27/2015	Arsenic, Total	3.20		3
	MISS05AR	5/27/2015	Benzene	1.00	U	1
	MISS05AR	5/27/2015	Lithium, Total	1,300.00		730
MW24S	MW24S	5/28/2015	Arsenic, Total	8.10	J-	3
	MW24S	5/28/2015	Benzene	1.00	U	1
	MW24S	5/28/2015	Lithium, Total	260.00		730
MW25S	MW25S	6/2/2015	Arsenic, Total	0.83	J	3
	MW25S	6/2/2015	Benzene	1	U	1
	MW25S	6/2/2015	Lithium, Total	5.9	J	730
MW28S	MW28S	5/28/2015	Arsenic, Total	6.10	J-	3
	MW28S	5/28/2015	Benzene	1.00	U	1
	MW28S	5/28/2015	Lithium, Total	2,100.00		730

Table C-11. 2015 Groundwater Analytical Results – Non-Radioactive Constituents

Sampling Location		Date Collected	Analyte	Result (ug/L)	Data [a] Qualifier	ROD Cleanup Criteria (ug/L)
Monitoring Wells Completed in Bedrock						
B38W02D	B38W02D	5/2/2015	Arsenic, Total	2.00	U	3
	B38W02D	5/2/2015	Benzene	1.00	U	1
	B38W02D	5/2/2015	Lithium, Total	12.00		730
B38W03B	B38W03B	5/21/2015	Arsenic, Total	2.00	U	3
	B38W03B	5/21/2015	Benzene	1.00	U	1
	B38W03B	5/21/2015	Lithium, Total	36.00		730
B38W14D	B38W14D	5/20/2015	Arsenic, Total	1.40		3
	B38W14D	5/20/2015	Benzene	1.00	U	1
	B38W14D	5/20/2015	Lithium, Total	27.00	J	730
B38W15D	B38W15D	5/19/2015	Arsenic, Total	6.70		3
	B38W15D	5/19/2015	Benzene	1.00	U	1
	B38W15D	5/19/2015	Lithium, Total	1,800.00	J	730
B38W17B	B38W17B	5/20/2015	Arsenic, Total	1.00	U	3
	B38W17B	5/20/2015	Benzene	0.96		1
	B38W17B	5/20/2015	Lithium, Total	240.00		730
B38W24D	B38W24D	6/1/2015	Arsenic, Total	1.40	J-	3
	B38W24D	6/1/2015	Benzene	1.00	U	1
	B38W24D	6/1/2015	Lithium, Total	110.00		730
MISS01B	MISS01B	5/26/2015	Arsenic, Total	0.98		3
	MISS01B	5/26/2015	Benzene	1.00	U	1
	MISS01B	5/26/2015	Lithium, Total	87.00		730
MISS05BR	MISS05BR	5/27/2015	Arsenic, Total	3.20		3
	MISS05BR	5/27/2015	Benzene	1,000.00	J	1
	MISS05BR	5/27/2015	Lithium, Total	5,500.00		730
MISS07B	MISS07B	5/26/2015	Arsenic, Total	72.00		3
	MISS07B	5/26/2015	Benzene	1.00	U	1
	MISS07B	5/26/2015	Lithium, Total	4,200.00		730
MW24D	MW24D	5/28/2015	Arsenic, Total	2.00	UJ	3
	MW24D	5/28/2015	Benzene	1.20		1
	MW24D	5/28/2015	Lithium, Total	2,400.00		730
MW25D	MW25D	6/2/2015	Arsenic, Total	0.63	J	3
	MW25D	6/2/2015	Benzene	1	U	1
	MW25D	6/2/2015	Lithium, Total	1,100.00	V	730

Table C-11. 2015 Groundwater Analytical Results – Non-Radioactive Constituents

Sampling Location		Date Collected	Analyte	Result (ug/L)	Data [a] Qualifier	ROD Cleanup Criteria (ug/L)
MW28D	MW28D	6/4/2015	Arsenic, Total	2.00	U	3
	MW28D	6/4/2015	Benzene	1.00	U	1
	MW28D	6/4/2015	Lithium, Total	4,100.00		730
MW28D (DUP)	MW28D (DUP)	6/4/2015	Arsenic, Total	2.00	U	3
	MW28D (DUP)	6/4/2015	Benzene	1.00	U	1
	MW28D (DUP)	6/4/2015	Lithium, Total	4,000.00		730
MW42D	MW42D	6/2/2015	Arsenic, Total	0.78		3
	MW42D	6/2/2015	Benzene	1.00	U	1
	MW42D	6/2/2015	Lithium, Total	6.00	J	730
MW42D (DUP)	MW42D (DUP)	6/2/2015	Arsenic, Total	0.81		3
	MW42D (DUP)	6/2/2015	Benzene	1.00	U	1
	MW42D (DUP)	6/2/2015	Lithium, Total	5.20	J	730

Notes:

U = The analyte was not detected.

J = Reported as an estimated value. If a sample was reanalyzed, the reanalyzed results are reported, not the original results. If a a USACE data qualifier flags based on the CDQMP-QAPP;

Monitoring wells B38W01S and B38W02D are the background locations that are completed in the overburden and bedrock

Appendix D
Changes to the Environmental Monitoring Program

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CHANGES TO THE ENVIRONMENTAL MONITORING PROGRAM

In 2001, the sediment and surface water sampling program was expanded to include more sample locations downstream of both Westerly and Lodi brooks to identify if a pattern of contaminant migration downstream from the FMSS exists.

In 2005, changes were made to the groundwater sampling program. These changes were due to ongoing remedial activities. Monitoring wells MISS06A, B38W25D, and B38W25S were abandoned in accordance with NJDEP requirements. Monitoring wells MW-26D, MW26S, and B38W03B were substituted for these wells. Monitoring wells MISS03A and MISS03B were also abandoned per NJDEP requirements. These two wells were not included within the sampling network but were used to determine groundwater depth and flow. In addition, monitoring well B38W12A was abandoned per NJDEP requirements and new well B38W12AR was installed. This well was not sampled, but was only used to determine groundwater depth and flow.

In 2007, sampling at surface water and sediment locations SWSD011 through SWSD015 was suspended. These locations lie along the lower Lodi Brook in the Borough of Lodi. The rationale for suspending the sampling was based on 6 years of non-detect sample results and the completion of remedial work at the properties within the drainage area of the lower Lodi Brook.

In 2008, sampling at surface water and sediment location SWSD005 was terminated due to the NJ Department of Transportation's widening of NJ Route 17. New southbound shoulders and on-ramps were constructed over this location. The open swale at this location was replaced with storm water piping.

In 2009, quarterly groundwater level measurements were suspended because groundwater flow patterns were well understood based on more than 10 years of quarterly monitoring data. A single round of measurements was performed prior to initiating groundwater sampling.

In 2010, monitoring wells MW-26S and MW-26D were abandoned in accordance with NJDEP requirements. These wells were abandoned due to their proximity to MISS load out operations. The MISS load out area was expanded to accommodate the increased volume of contaminated soil that was planned to be transported off-site. These wells could not be adequately protected; therefore, the decision was made to abandon them. Bedrock monitoring well MW-33D was substituted for bedrock monitoring well MW-26D. This well is in close proximity to monitoring well MW-26D. A suitable overburden well was not available to replace overburden monitoring well MW-26S.

In 2011, monitoring wells MW-3S, MW-3D, and MW-20D were sampled to support the remediation effort planned for the New York, Susquehanna and Western Railroad property. These three wells lie on the south side of the New York, Susquehanna and Western Railroad tracks. Remediation of this property continued in 2011.

Prior to the 2012 sampling event, the following monitoring wells were abandoned to support remediation of the MISS and New York Susquehanna & Western Railroad properties: B38W19S, B38W19D, MISS02A, MISS02B, MISS05A, and MISS05B. Following remediation, several new monitoring wells were installed and sampled. Monitoring wells MISS05AR and MISS05BR were installed between former monitoring well clusters MISS05A/MISS05B and B38W19S/B38W19D, and monitoring well MW-33S was installed adjacent to MW-33D. In addition, monitoring wells MW-24S and MW-24D were sampled to provide additional characterization on the southern portion of the MISS.

Prior to the 2013 sampling event, the following monitoring wells were abandoned to support remediation of the MISS and/or New York Susquehanna & Western Railroad properties; and construction of the new loadout pad and railroad spur: MW-3S, MW-3D, and MW-20D. Monitoring wells MW-25D, MW-28S, and MW-28D were sampled to provide additional characterization on the southern portion of the MISS. In addition to the normal groundwater constituents analyzed, additional samples were collected for K-40 and Rn-222 analysis.

For the 2014 sampling event, USACE requested that the non-radiological constituents listed in the Groundwater ROD be added to the monitoring program. Those constituents are lithium, arsenic, and benzene.

For 2015 Monitoring well MISS 07a was dry and could not be sampled. Monitoring well B38W18D was not sampled as it was damaged during the Phase 18 remediation, and the location was inaccessible as it was in the center of an active remediation. Nearby well MW-42D was sampled in 2015 as a temporary replacement well for B38W18D. Monitoring well MW-25S (which was damaged in 2014 and not sampled for that event) was repaired in April 2015 and sampled in May 2015. An above ground section of the PVC riser pipe was replaced due to damage from freezing.

Appendix E
Historical Results

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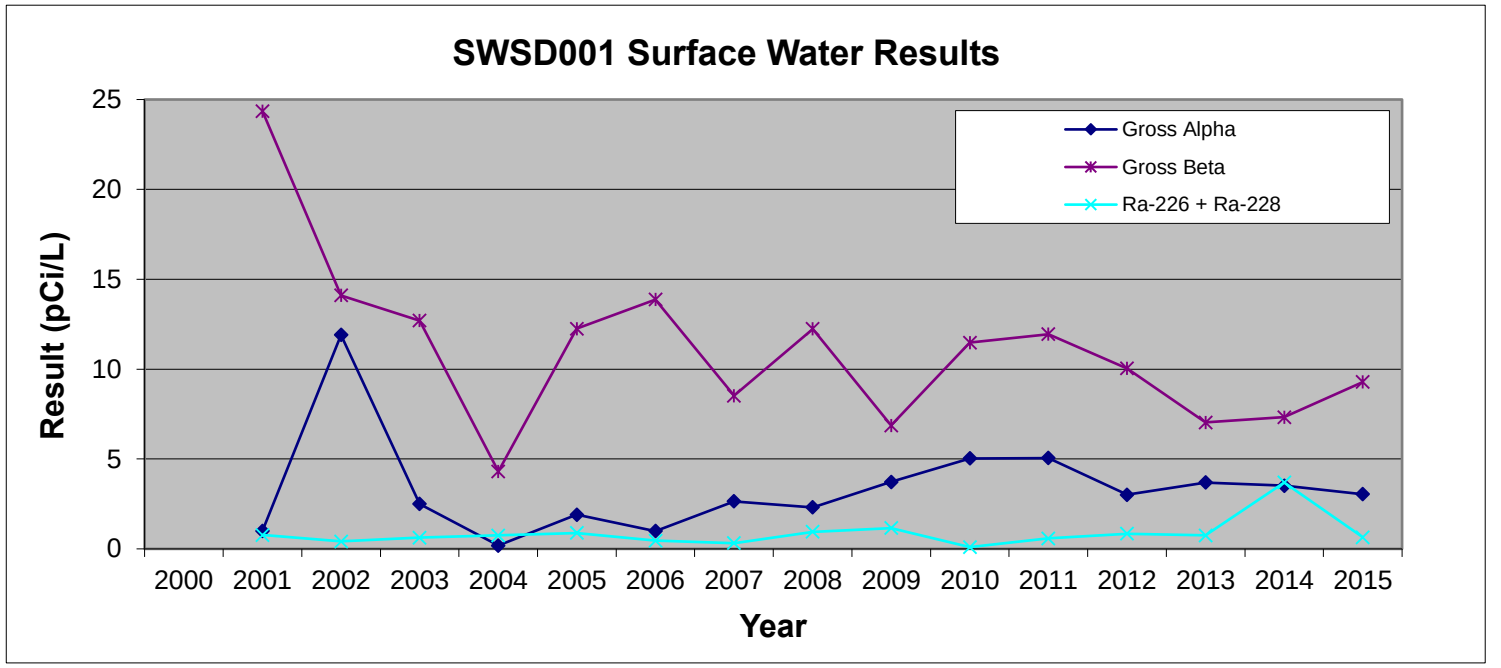
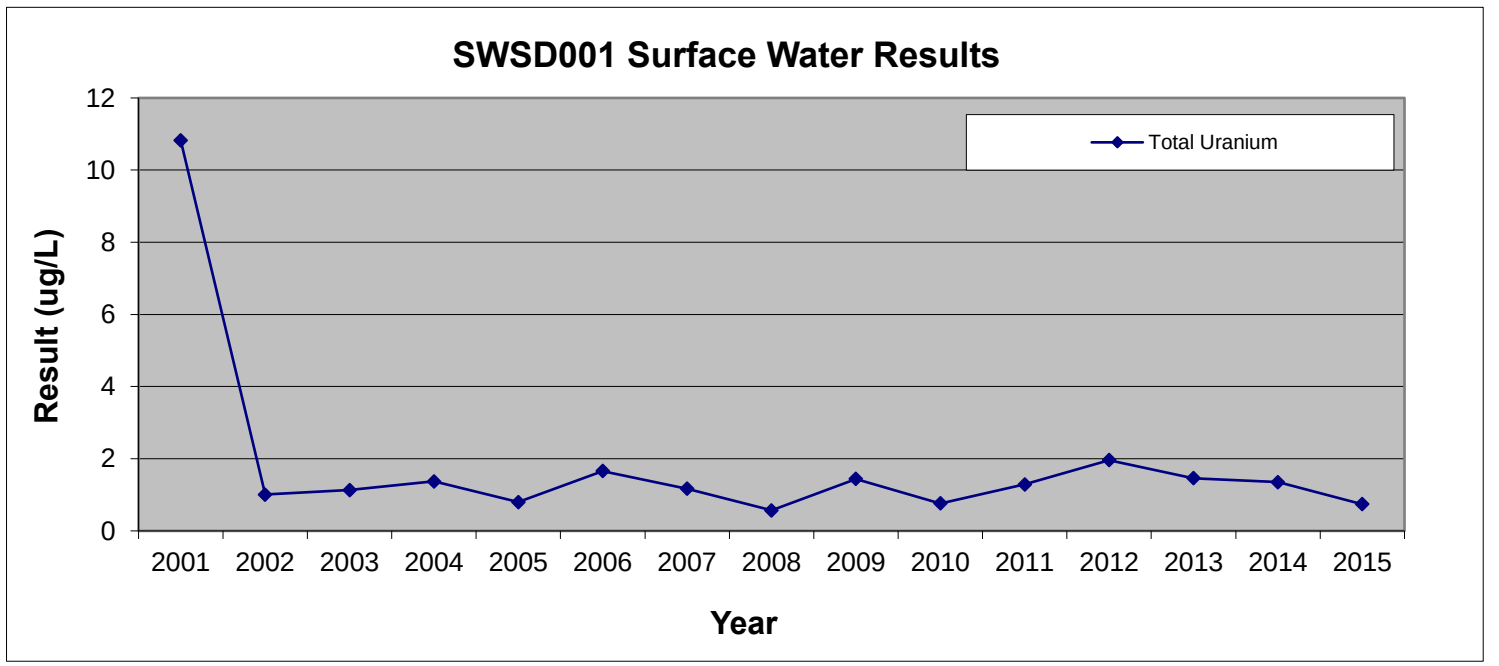
HISTORICAL RESULTS

Figure E-1. Historical Results For Radiological Parameters at SWSD001
Figure E-1. (Continued) Historical Results For Radiological Parameters at SWSD001 (Continued)
Figure E-2. Historical Results For Radiological Parameters at SWSD002
Figure E-2. (Continued) Historical Results For Radiological Parameters at SWSD002 (Continued)
Figure E-3. Historical Results For Radiological Parameters at SWSD003
Figure E-3. (Continued) Historical Results For Radiological Parameters at SWSD003 (Continued)
Figure E-4. Historical Results For Radiological Parameters at SWSD004
Figure E-5. Historical Results For Radiological Parameters at SWSD006
Figure E-5. (Continued) Historical Results For Radiological Parameters at SWSD006 (Continued)
Figure E-6. Historical Results For Radiological Parameters at SWSD007
Figure E-6. (Continued) Historical Results For Radiological Parameters at SWSD007 (Continued)
Figure E-7. Historical Results For Radiological Parameters at SWSD008
Figure E-7. (Continued) Historical Results For Radiological Parameters at SWSD008 (Continued)
Figure E-8. Historical Results For Radiological Parameters at SWSD009
Figure E-8. (Continued) Historical Results For Radiological Parameters at SWSD009 (Continued)
Figure E-9. Historical Results For Radiological Parameters at SWSD010
Figure E-9. (Continued) Historical Results For Radiological Parameters at SWSD010 (Continued)
Figure E-10. Historical Results For Radiological Parameters at B38W01S
Figure E-11. Historical Results For Radiological Parameters at B38W14S
Figure E-12. Historical Results For Radiological Parameters at B38W15S
Figure E-13. Historical Results For Radiological Parameters at B38W17A
Figure E-14. Historical Results For Radiological Parameters at B38W24S
Figure E-15. Historical Results For Radiological Parameters at MISS01AA
Figure E-16. Historical Results For Radiological Parameters at MISS05AR
Figure E-17. Historical Results For Radiological Parameters at MISS07A
Figure E-18. Historical Results For Radiological Parameters at MW-24S
Figure E-19. Historical Results For Radiological Parameters at MW-25S
Figure E-20. Historical Results For Radiological Parameters at MW-28S
Figure E-21. Historical Results For Radiological Parameters at B38W02D
Figure E-22. Historical Results For Radiological Parameters at B38W03B
Figure E-23. Historical Results For Radiological Parameters at B38W14D
Figure E-24. Historical Results For Radiological Parameters at B38W15D
Figure E-25. Historical Results For Radiological Parameters at B38W17B

Figure E-26. Historical Results For Radiological Parameters at B38W18D
Figure E-27. Historical Results For Radiological Parameters at B38W24D
Figure E-28. Historical Results For Radiological Parameters at MISS01B
Figure E-29. Historical Results For Radiological Parameters at MISS05BR
Figure E-30. Historical Results For Radiological Parameters at MISS07B
Figure E-31. Historical Results For Radiological Parameters at MW-24D
Figure E-32. Historical Results For Radiological Parameters at MW-25D
Figure E-33. Historical Results For Radiological Parameters at MW-28D
Figure E-34. Historical Results For Radiological Parameters at MW-42D



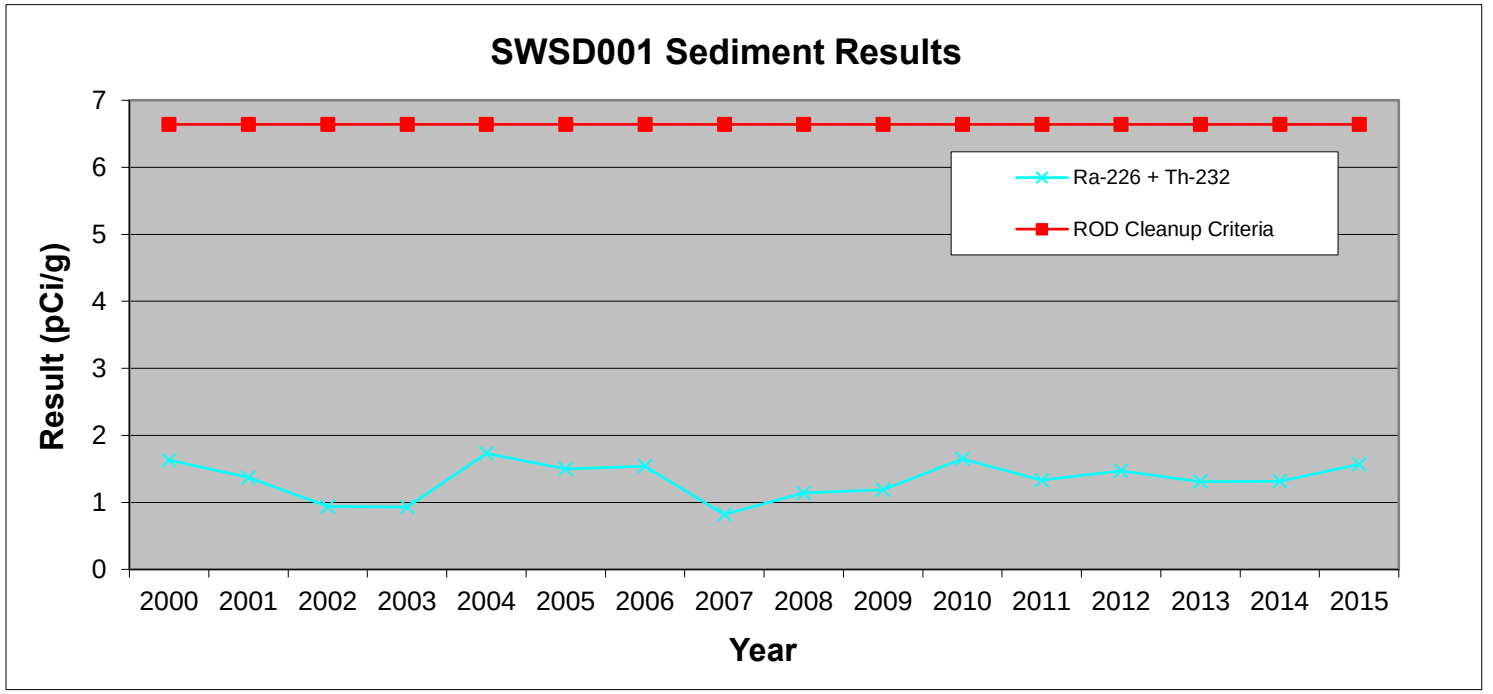
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001	1.00	24.35	0.23	0.54	0.77
2002	11.90	14.10		0.42	0.42
2003	2.50	12.70	0.19	0.44	0.63
2004	0.19	4.31	0.15	0.60	0.75
2005	1.90	12.25	0.14	0.75	0.89
2006	0.99	13.87	0.07	0.39	0.46
2007	2.65	8.52	0.05	0.27	0.32
2008	2.31	12.24	0.16	0.79	0.95
2009	3.73	6.87	0.33	0.83	1.16
2010	5.03	11.48	0.03	0.07	0.10
2011	5.05	11.95	0.07	0.51	0.58
2012	3.01	10.04	0.11	0.73	0.84
2013	3.69	7.03	0.00	0.75	0.75
2014	3.51	7.33	0.03	3.66	3.69
2015	3.04	9.29	0.07	0.58	0.65



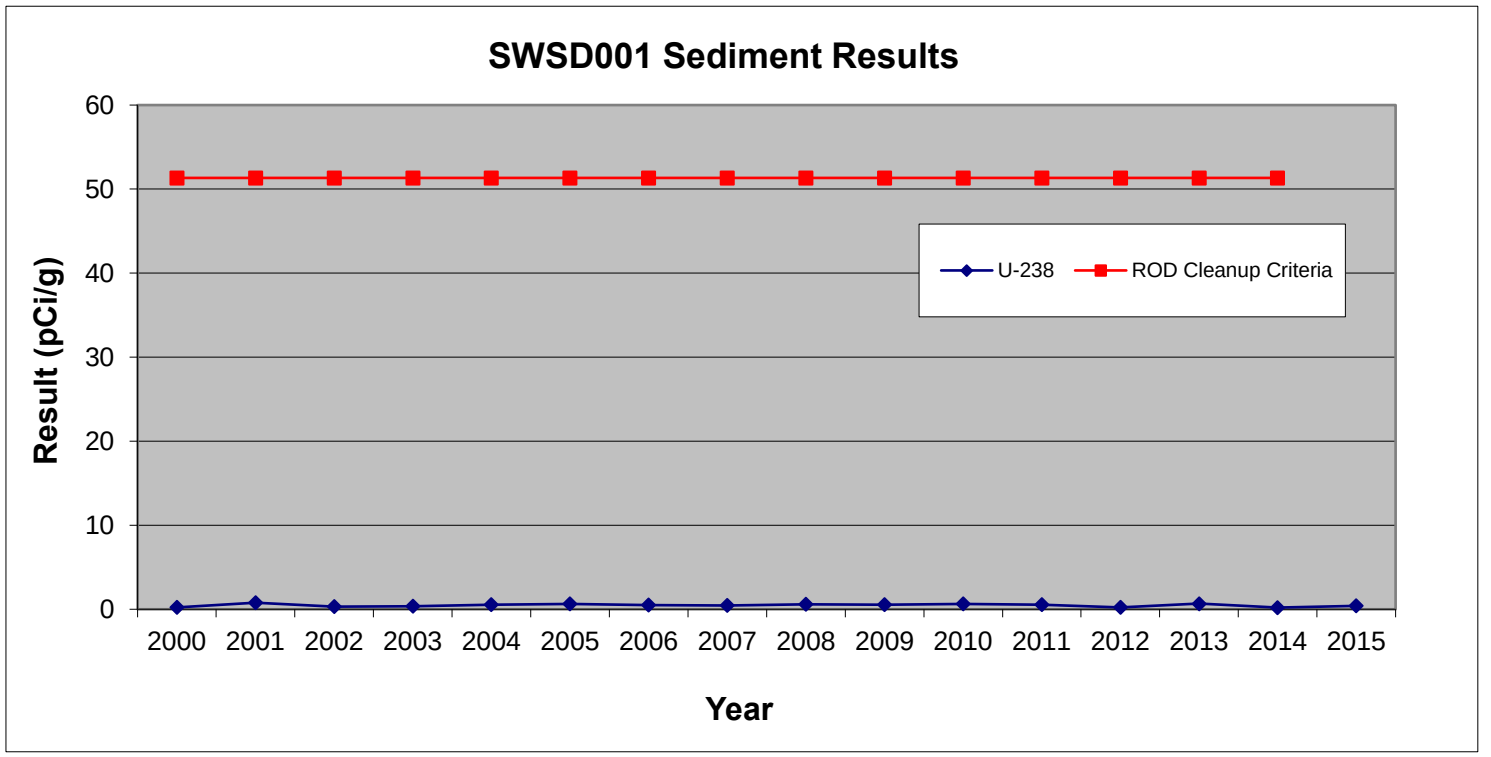
Year	Total Uranium
2000	1.19
2001	10.82
2002	1.01
2003	1.13
2004	1.37
2005	0.80
2006	1.66
2007	1.17
2008	0.57
2009	1.44
2010	0.76
2011	1.29
2012	1.96
2013	1.46
2014	1.35
2015	0.74

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-1
Historical Results For Radiological Parameters at SWSD001



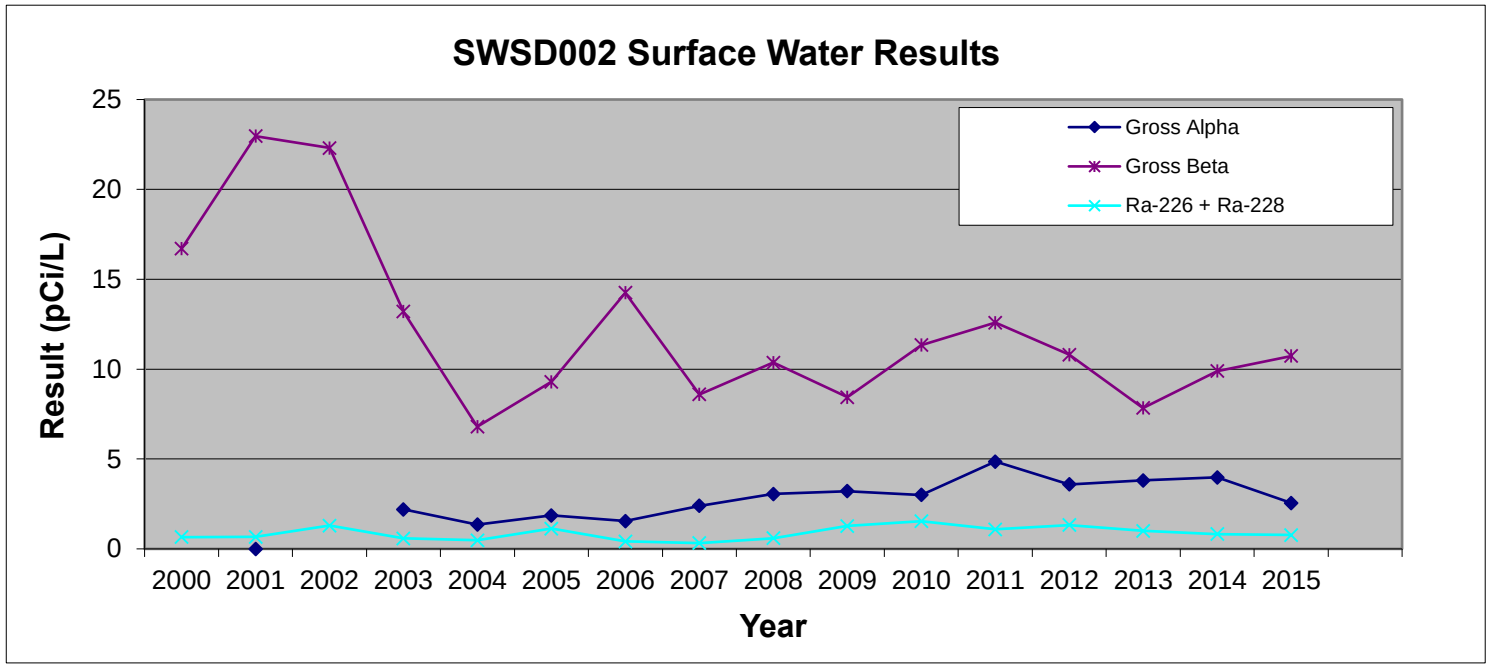
Year	Ra-226	Th-232	Ra-226 + Th-232	ROD Cleanup Criteria
2000	0.98	0.65	1.63	6.64
2001	0.91	0.46	1.37	6.64
2002	0.55	0.39	0.94	6.64
2003	0.57	0.36	0.93	6.64
2004	0.77	0.96	1.73	6.64
2005	0.76	0.74	1.50	6.64
2006	0.70	0.84	1.54	6.64
2007	0.39	0.43	0.82	6.64
2008	0.58	0.56	1.14	6.64
2009	0.58	0.61	1.19	6.64
2010	0.73	0.92	1.65	6.64
2011	0.62	0.71	1.33	6.64
2012	0.66	0.81	1.47	6.64
2013	0.53	0.78	1.31	6.64
2014	0.63	0.69	1.32	6.64
2015	0.65	0.92	1.57	6.64



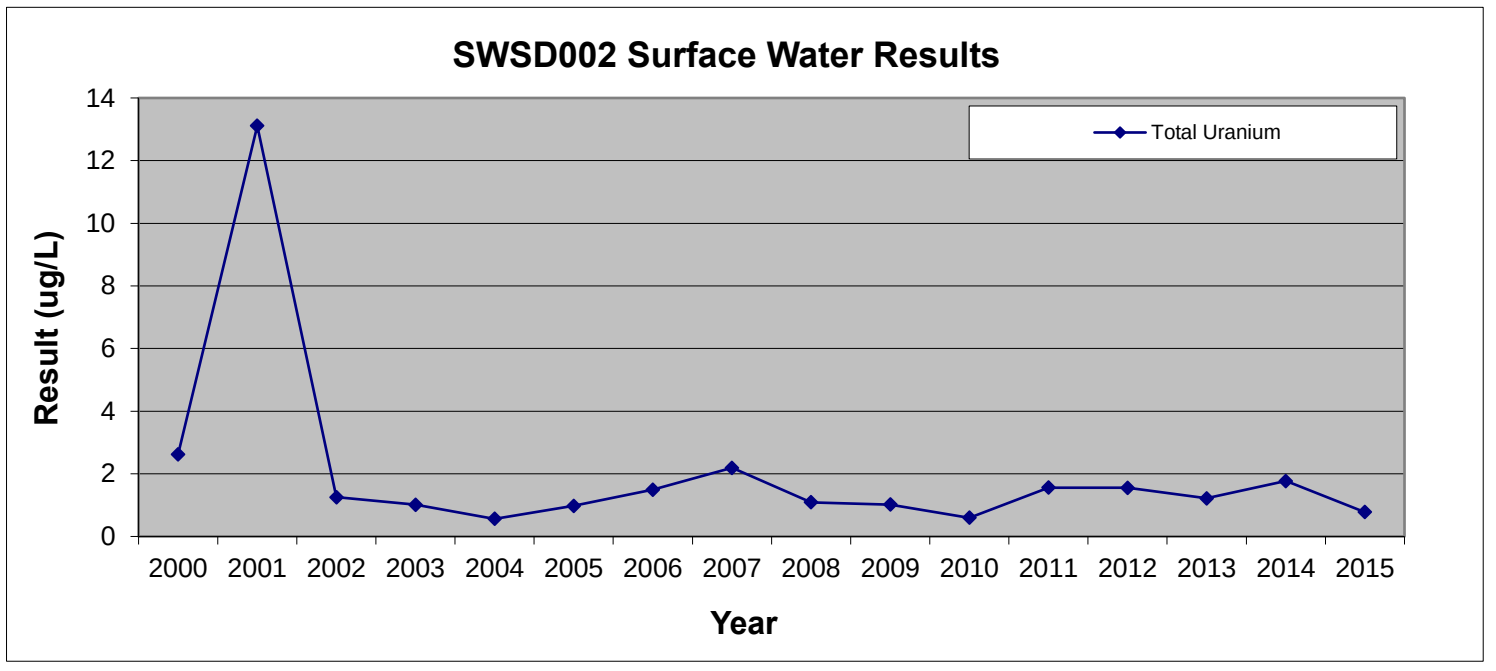
Year	U-238	ROD Cleanup Criteria
2000	0.24	51.33
2001	0.78	51.33
2002	0.33	51.33
2003	0.36	51.33
2004	0.56	51.33
2005	0.63	51.33
2006	0.50	51.33
2007	0.44	51.33
2008	0.60	51.33
2009	0.56	51.33
2010	0.63	51.33
2011	0.54	51.33
2012	0.23	51.33
2013	0.66	51.33
2014	0.20	51.33
2015	0.39	51.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
b) The ROD unrestricted use soil cleanup criteria for the combination of Ra-226 and Th-232 is 5 pCi/g above background. Background is approximately 1.64 pCi/g.
c) The ROD unrestricted use soil cleanup criteria for U-238 is 50 pCi/g above background. Background is approximately 1.33 pCi/g.

Figure E-1 (Continued)
Historical Results For Radiological Parameters at SWSD001 (Continued)



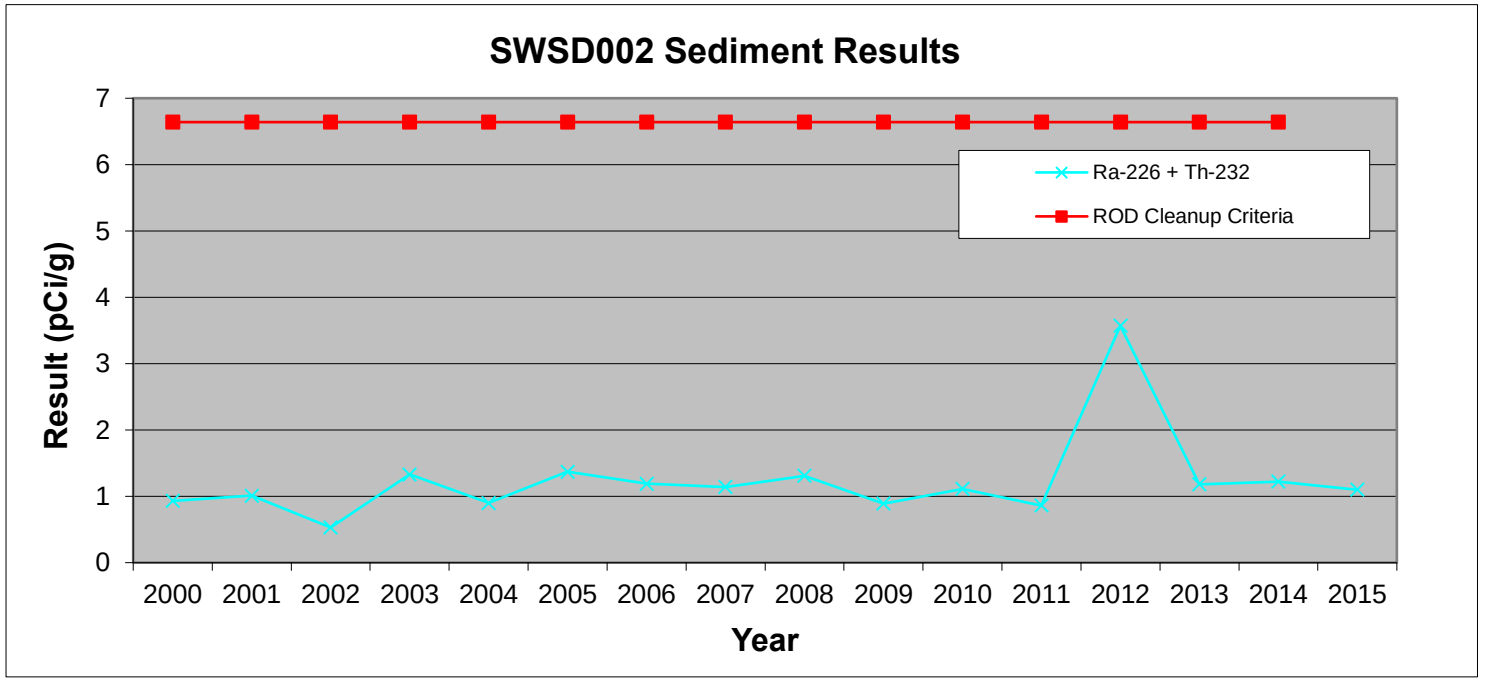
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000		16.70		0.66	0.66
2001	0.00	22.96	0.13	0.54	0.67
2002		22.30	0.19	1.10	1.29
2003	2.20	13.20	0.17	0.41	0.58
2004	1.35	6.80	0.18	0.30	0.48
2005	1.86	9.30	0.22	0.91	1.13
2006	1.55	14.25	0.07	0.34	0.41
2007	2.39	8.59	0.21	0.11	0.32
2008	3.06	10.36	0.14	0.45	0.59
2009	3.21	8.44	0.26	1.01	1.27
2010	3.00	11.34	0.11	1.43	1.54
2011	4.86	12.58	0.23	0.86	1.09
2012	3.59	10.80	0.12	1.21	1.33
2013	3.81	7.84	0.08	0.92	1.00
2014	3.98	9.90	0.06	0.77	0.82
2015	2.55	10.73	0.05	0.72	0.77



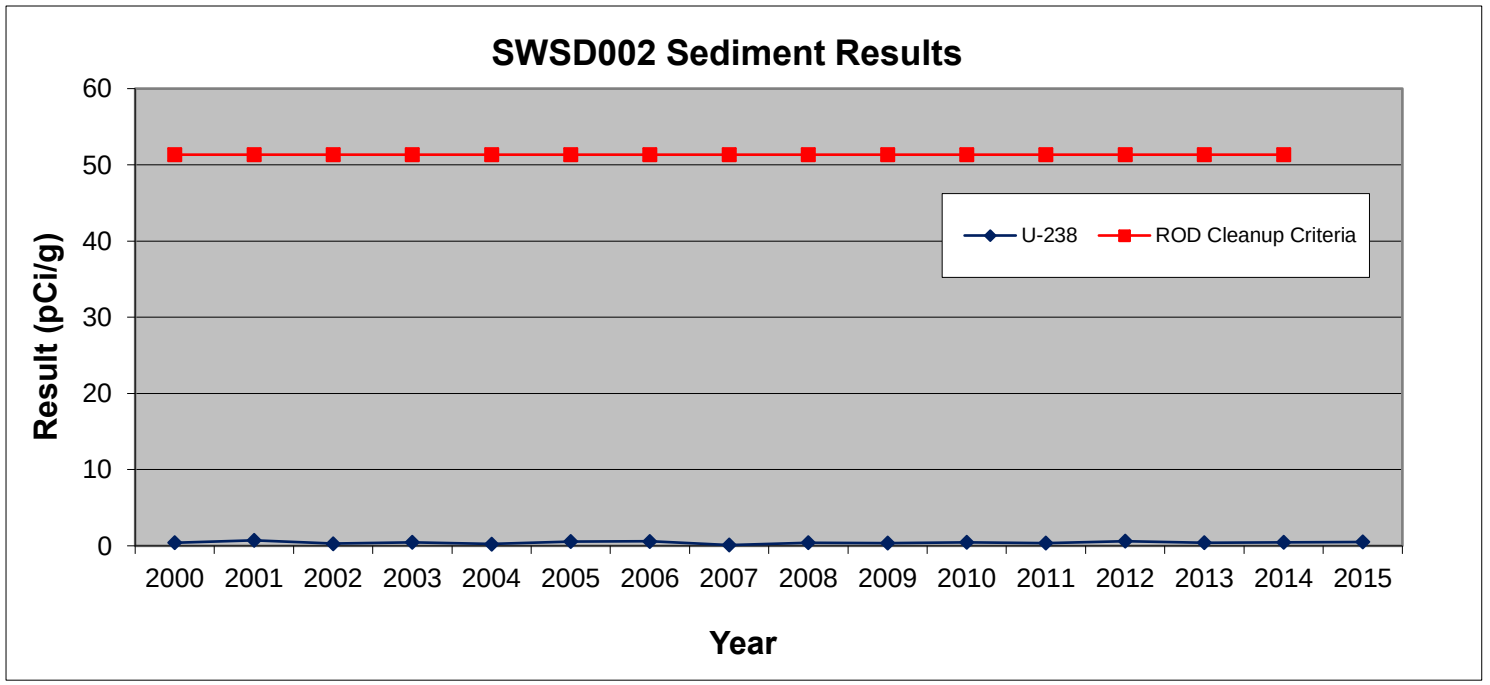
Year	Total Uranium
2000	2.62
2001	13.11
2002	1.25
2003	1.01
2004	0.56
2005	0.98
2006	1.49
2007	2.19
2008	1.09
2009	1.02
2010	0.6
2011	1.56
2012	1.55
2013	1.22
2014	1.77
2015	0.78

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-2
Historical Results For Radiological Parameters at SWSD002



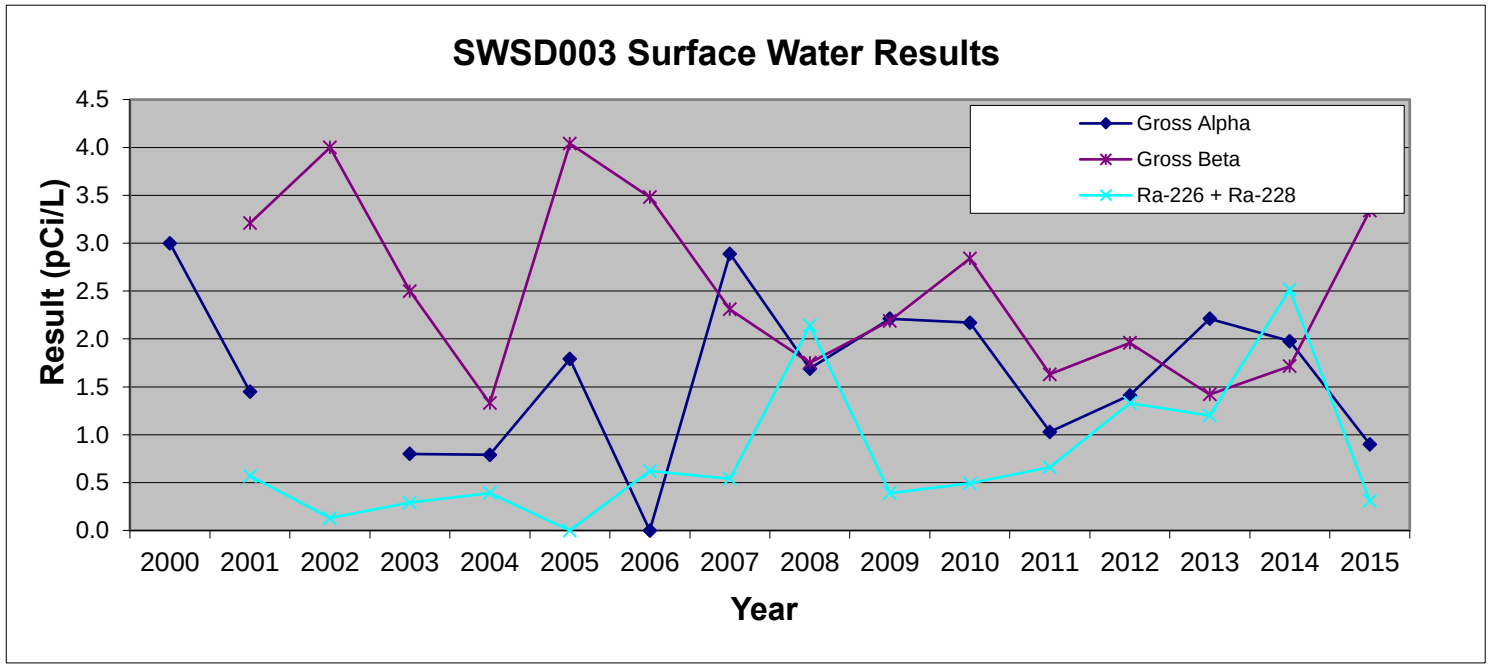
Year	Ra-226	Th-232	Ra-226 + Th-232	ROD Cleanup Criteria
2000	0.58	0.35	0.93	6.64
2001	0.66	0.35	1.01	6.64
2002	0.18	0.35	0.53	6.64
2003	0.89	0.44	1.33	6.64
2004	0.47	0.43	0.90	6.64
2005	0.70	0.67	1.37	6.64
2006	0.58	0.61	1.19	6.64
2007	0.61	0.53	1.14	6.64
2008	0.66	0.65	1.31	6.64
2009	0.40	0.49	0.89	6.64
2010	0.52	0.59	1.11	6.64
2011	0.45	0.41	0.86	6.64
2012	2.87	0.70	3.57	6.64
2013	0.57	0.61	1.18	6.64
2014	0.61	0.62	1.22	6.64
2015	0.57	0.53	1.10	6.64



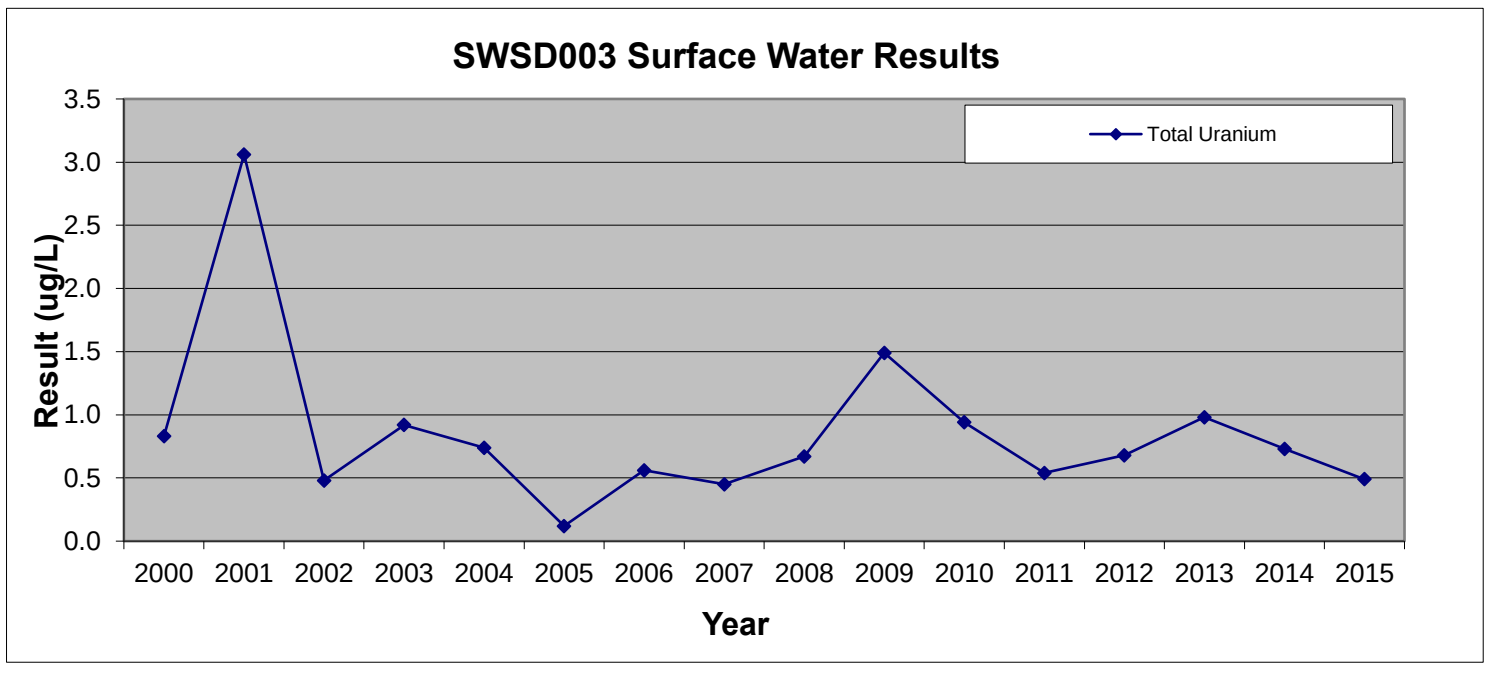
Year	U-238	ROD Cleanup Criteria
2000	0.42	51.33
2001	0.72	51.33
2002	0.28	51.33
2003	0.45	51.33
2004	0.23	51.33
2005	0.56	51.33
2006	0.58	51.33
2007	0.10	51.33
2008	0.40	51.33
2009	0.36	51.33
2010	0.45	51.33
2011	0.36	51.33
2012	0.61	51.33
2013	0.42	51.33
2014	0.45	51.33
2015	0.52	51.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
b) The ROD unrestricted use soil cleanup criteria for the combination of Ra-226 and Th-232 is 5 pCi/g above background. Background is approximately 1.64 pCi/g.
c) The ROD unrestricted use soil cleanup criteria for U-238 is 50 pCi/g above background. Background is approximately 1.33 pCi/g.

Figure E-2 (Continued)
Historical Results For Radiological Parameters at SWSD002 (Continued)



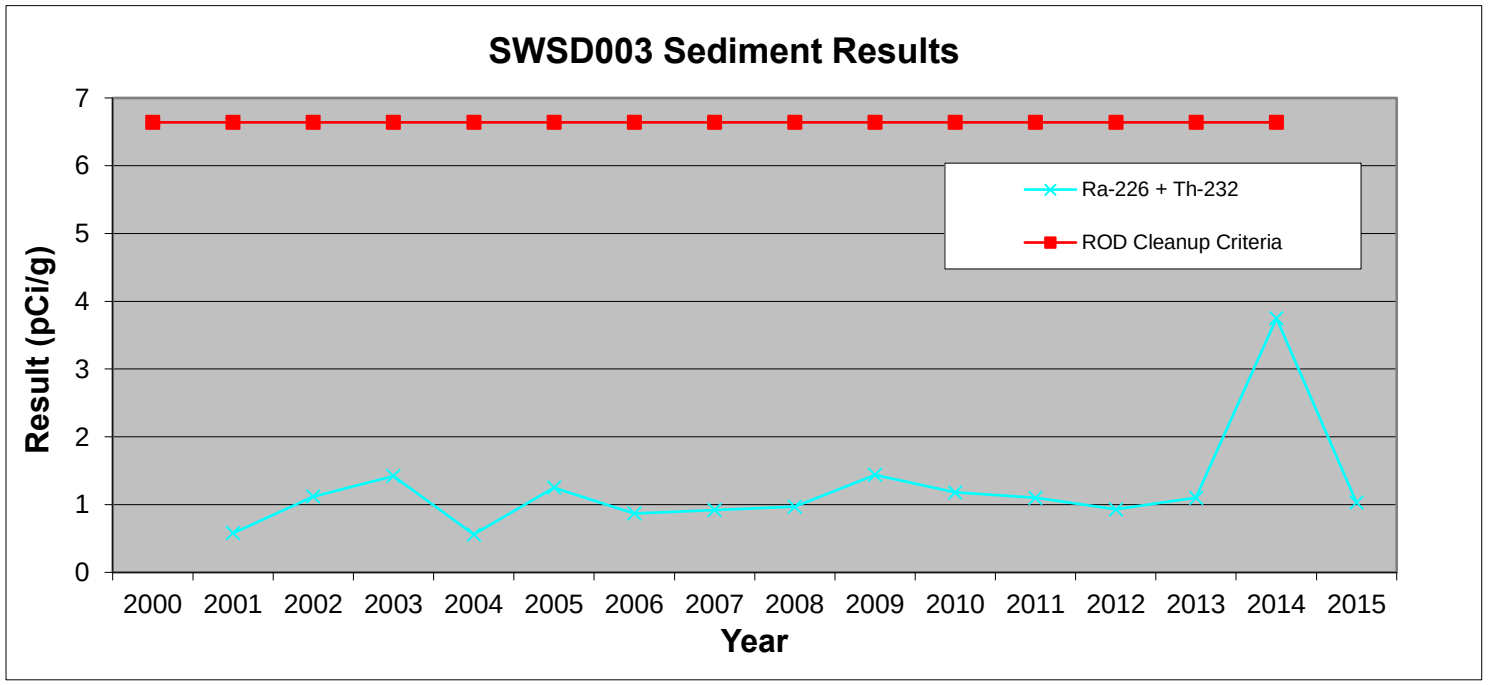
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	3.00				
2001	1.45	3.21	0.21	0.36	0.57
2002		4.00	0.13		0.13
2003	0.80	2.50	0.04	0.25	0.29
2004	0.79	1.33	0.21	0.18	0.39
2005	1.79	4.04	0.00	0.00	0.00
2006	0.00	3.48	0.04	0.58	0.62
2007	2.89	2.31	0.05	0.49	0.54
2008	1.69	1.75	0.02	2.12	2.14
2009	2.21	2.19	0.08	0.31	0.39
2010	2.17	2.84	0.23	0.26	0.49
2011	1.03	1.63	0.23	0.43	0.66
2012	1.41	1.96	0.00	1.33	1.33
2013	2.21	1.42	0.05	1.15	1.20
2014	1.98	1.72	0.39	2.126	2.515
2015	0.90	3.34	0.11	0.2	0.31



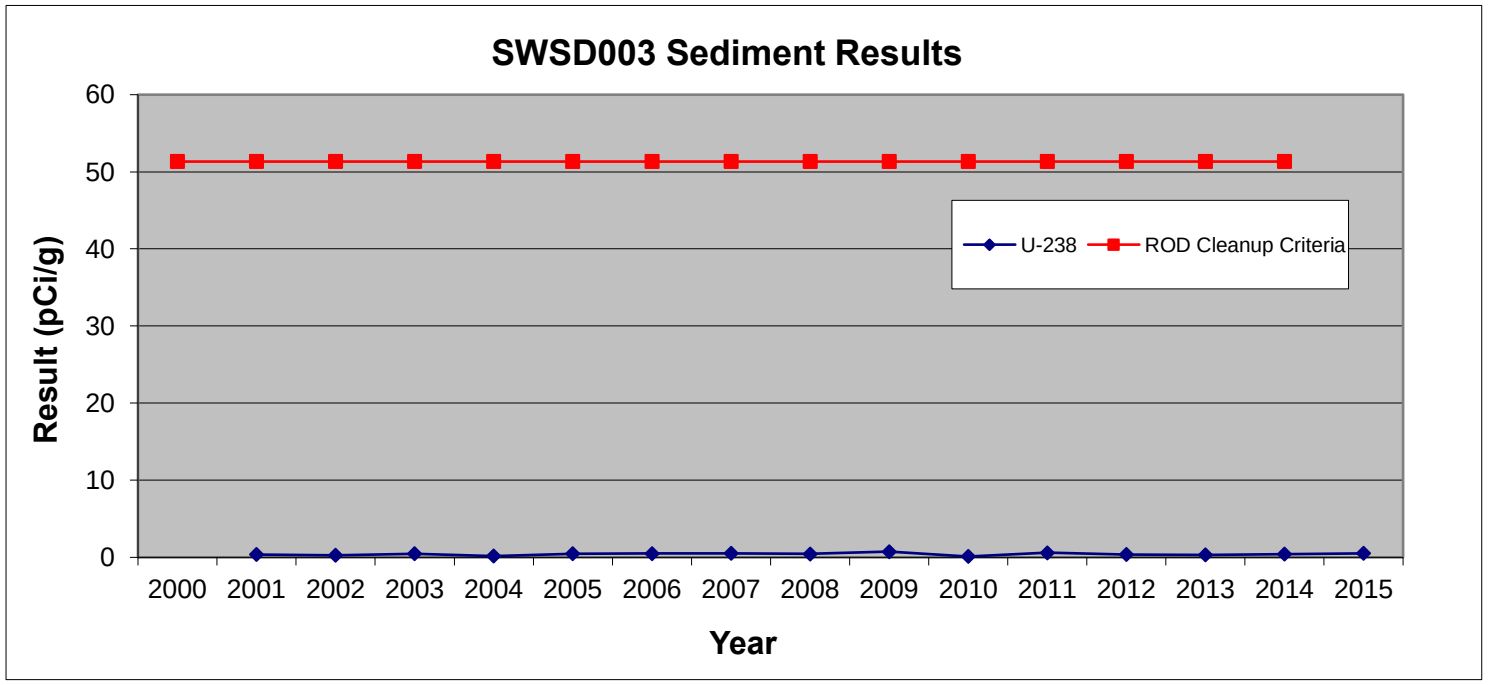
Year	Total Uranium
2000	0.83
2001	3.06
2002	0.48
2003	0.92
2004	0.74
2005	0.12
2006	0.56
2007	0.45
2008	0.67
2009	1.49
2010	0.94
2011	0.54
2012	0.68
2013	0.98
2014	0.73
2015	0.49

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-3
Historical Results For Radiological Parameters at SWSD003



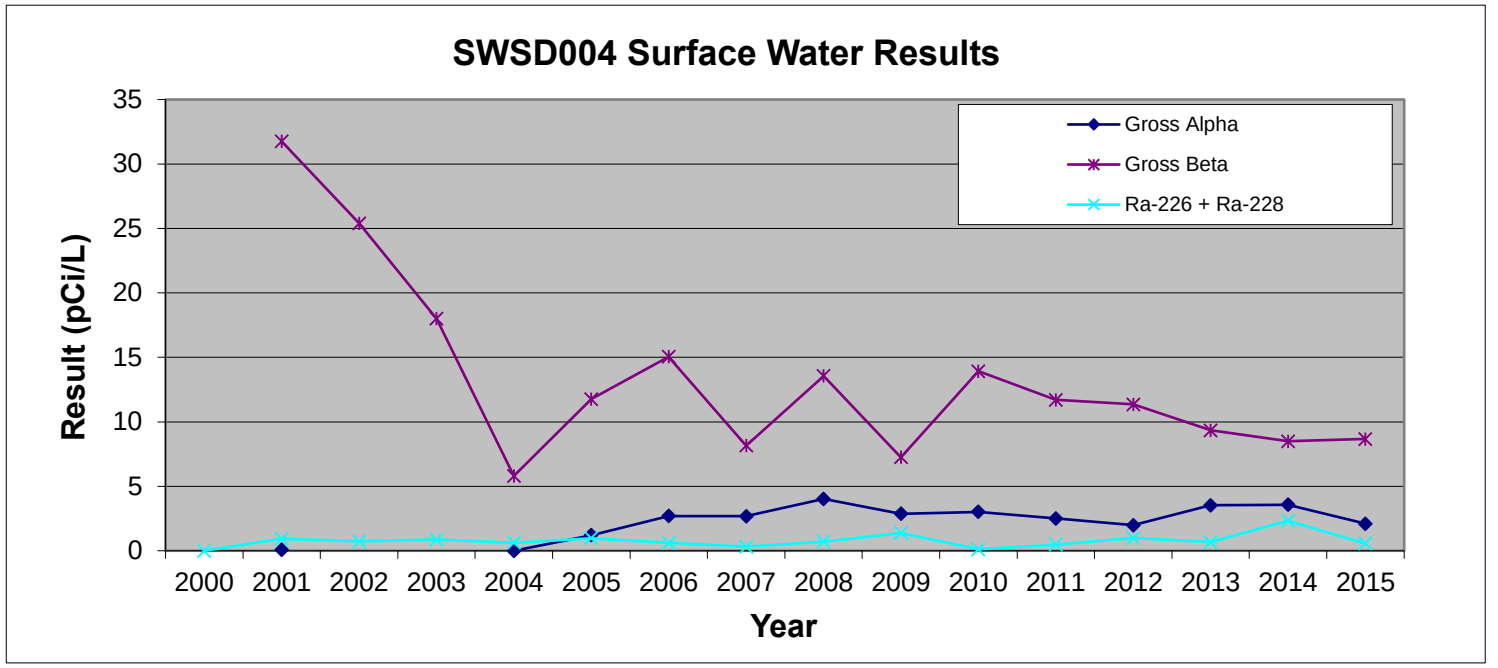
Year	Ra-226	Th-232	Ra-226 + Th-232	ROD Cleanup Criteria
2000				6.64
2001	0.24	0.34	0.58	6.64
2002	0.51	0.61	1.12	6.64
2003	1.02	0.40	1.42	6.64
2004	0.29	0.27	0.56	6.64
2005	0.78	0.47	1.25	6.64
2006	0.52	0.35	0.87	6.64
2007	0.51	0.41	0.92	6.64
2008	0.53	0.44	0.97	6.64
2009	0.85	0.59	1.44	6.64
2010	0.57	0.61	1.18	6.64
2011	0.61	0.49	1.10	6.64
2012	0.52	0.41	0.93	6.64
2013	0.61	0.49	1.10	6.64
2014	3.09	0.66	3.75	6.64
2015	0.59	0.44	1.03	6.64



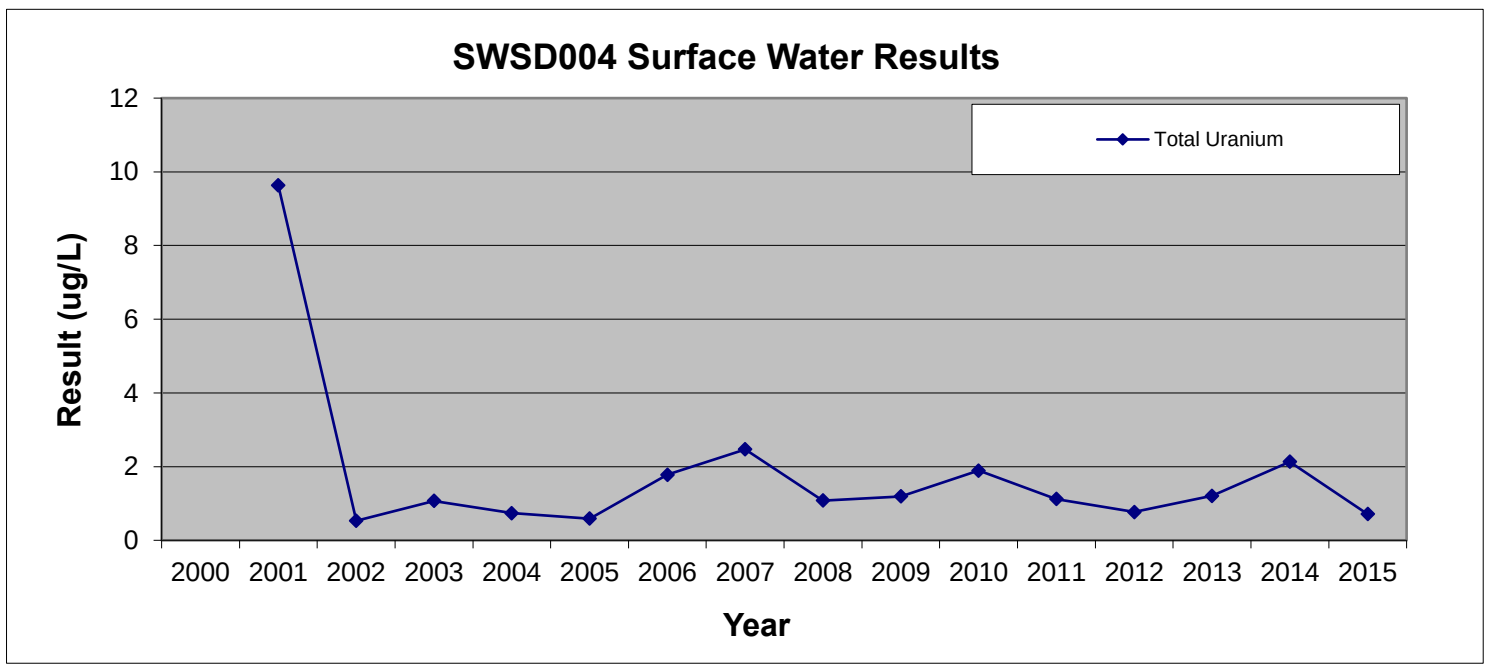
Year	U-238	ROD Cleanup Criteria
2000		51.33
2001	0.38	51.33
2002	0.27	51.33
2003	0.46	51.33
2004	0.17	51.33
2005	0.48	51.33
2006	0.50	51.33
2007	0.54	51.33
2008	0.45	51.33
2009	0.75	51.33
2010	0.11	51.33
2011	0.6	51.33
2012	0.39	51.33
2013	0.33	51.33
2014	0.44	51.33
2015	0.52	51.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
b) The ROD unrestricted use soil cleanup criteria for the combination of Ra-226 and Th-232 is 5 pCi/g above background. Background is approximately 1.64 pCi/g.
c) The ROD unrestricted use soil cleanup criteria for U-238 is 50 pCi/g above background. Background is approximately 1.33 pCi/g.

Figure E-3 (Continued)
Historical Results For Radiological Parameters at SWSD003 (Continued)



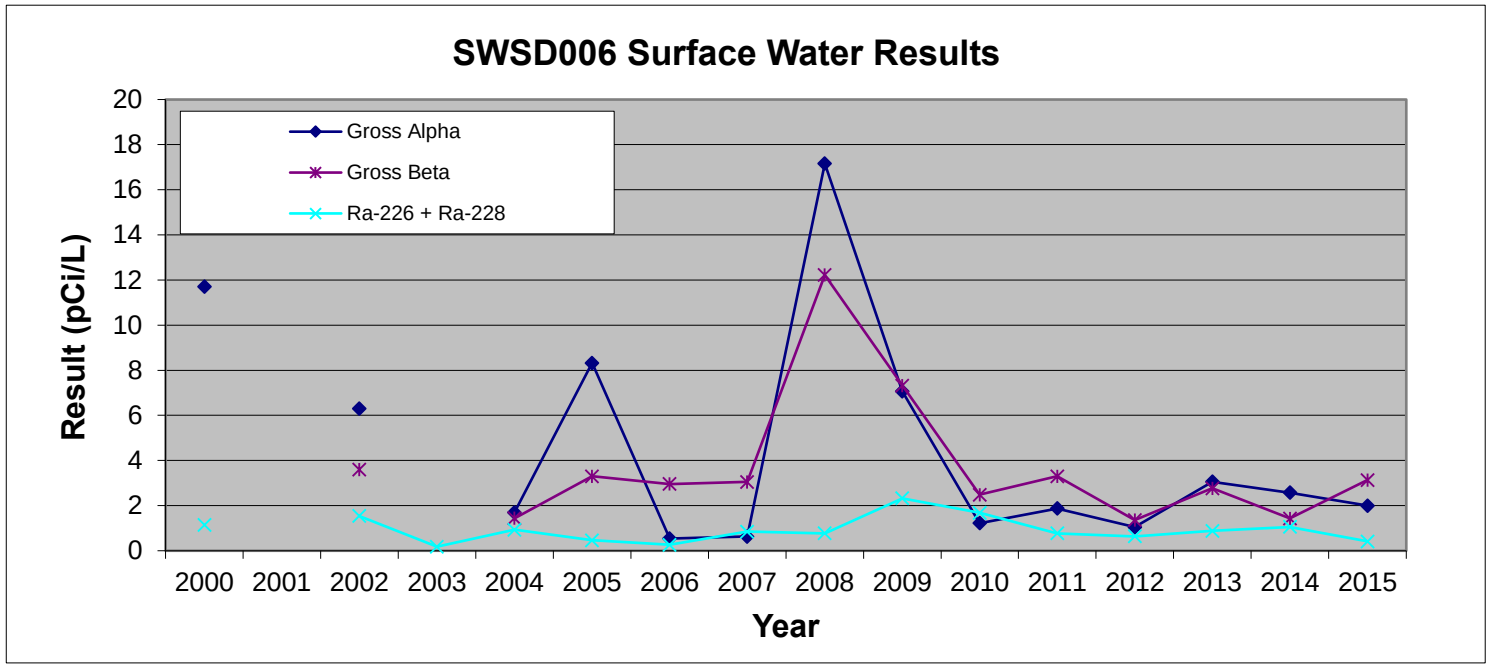
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					0.00
2001	0.08	31.75	0.65	0.27	0.92
2002		25.40	0.18	0.54	0.72
2003		18.00	0.22	0.65	0.87
2004	0.00	5.80	0.17	0.45	0.62
2005	1.21	11.76	0.16	0.81	0.97
2006	2.69	15.05	0.16	0.44	0.60
2007	2.68	8.15	0.07	0.24	0.31
2008	4.02	13.56	0.11	0.60	0.71
2009	2.87	7.25	0.20	1.18	1.38
2010	3.02	13.92	0.11	0.00	0.11
2011	2.50	11.70	0.04	0.43	0.47
2012	1.98	11.36	0.16	0.83	0.99
2013	3.53	9.33	0.12	0.54	0.66
2014	3.57	8.49	0.27	2.059	2.327
2015	2.10	8.66	0.06	0.50	0.56



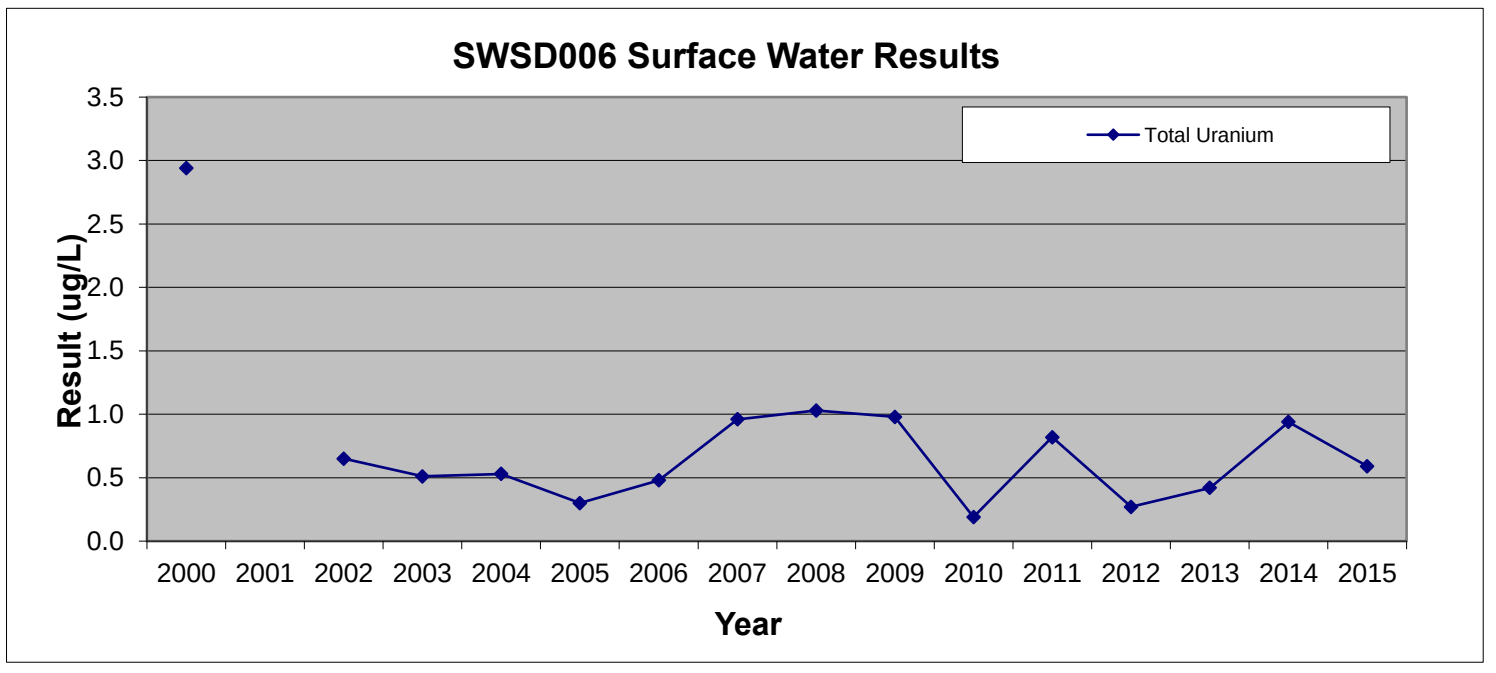
Year	Total Uranium
2000	
2001	9.63
2002	0.53
2003	1.07
2004	0.74
2005	0.59
2006	1.78
2007	2.47
2008	1.08
2009	1.19
2010	1.89
2011	1.12
2012	0.77
2013	1.21
2014	2.13
2015	0.71

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-4
Historical Results For Radiological Parameters at SWSD004



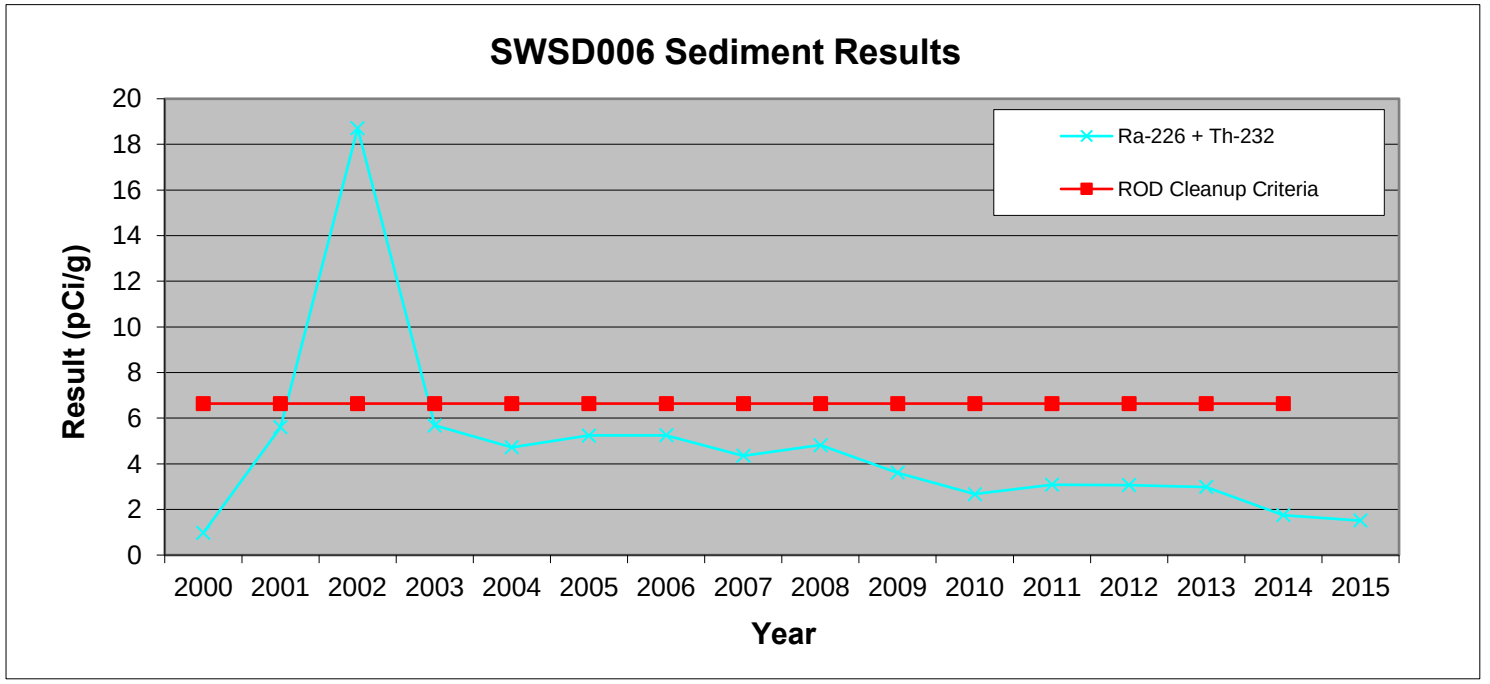
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	11.70			1.14	1.14
2001					
2002	6.30	3.60	0.38	1.16	1.54
2003			0.18		0.18
2004	1.70	1.44	0.38	0.55	0.93
2005	8.32	3.30	0.04	0.42	0.46
2006	0.54	2.96	0.10	0.16	0.26
2007	0.63	3.05	0.17	0.68	0.85
2008	17.16	12.22	0.22	0.55	0.77
2009	7.06	7.32	0.23	2.09	2.32
2010	1.22	2.48	0.10	1.58	1.68
2011	1.87	3.30	0.00	0.77	0.77
2012	1.05	1.36	0.06	0.58	0.64
2013	3.06	2.77	0.33	0.55	0.88
2014	2.57	1.43	0.04	1.02	1.06
2015	2.00	3.13	-0.01	0.43	0.416



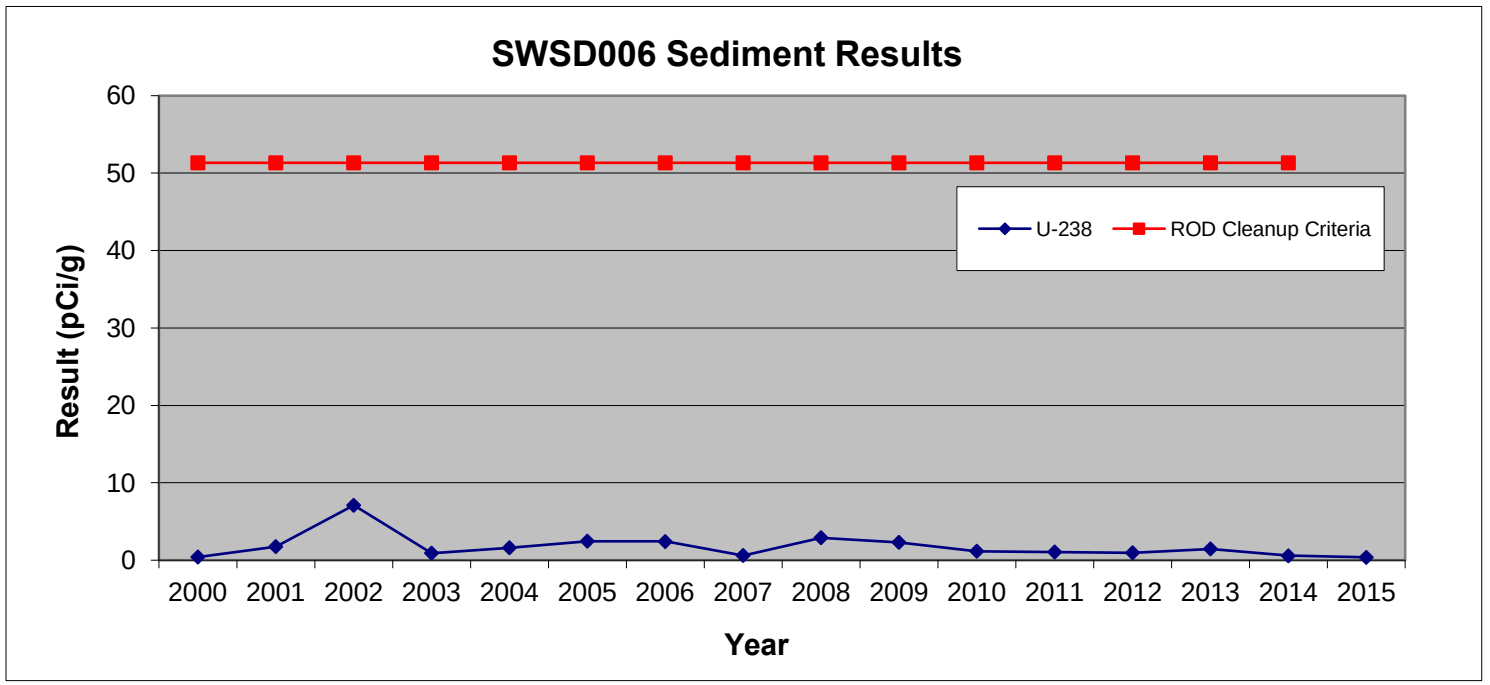
Year	Total Uranium
2000	2.94
2001	
2002	0.65
2003	0.51
2004	0.53
2005	0.30
2006	0.48
2007	0.96
2008	1.03
2009	0.98
2010	0.19
2011	0.82
2012	0.27
2013	0.42
2014	0.94
2015	0.59

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-5
Historical Results For Radiological Parameters at SWSD006



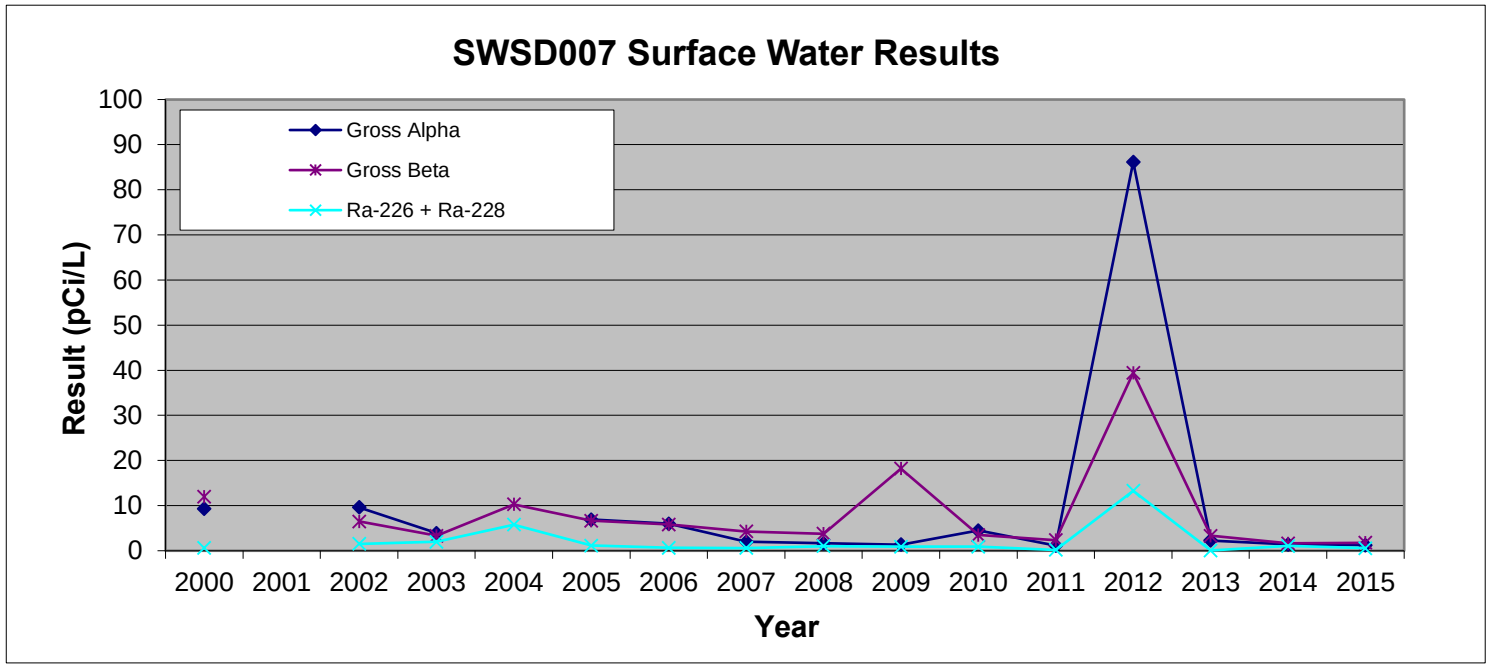
Year	Ra-226	Th-232	Ra-226 + Th-232	ROD Cleanup Criteria
2000	0.64	0.33	0.97	6.64
2001	1.41	4.19	5.60	6.64
2002	3.51	15.20	18.71	6.64
2003	2.54	3.14	5.68	6.64
2004	2.27	2.45	4.72	6.64
2005	1.85	3.39	5.24	6.64
2006	1.65	3.60	5.25	6.64
2007	1.38	2.97	4.35	6.64
2008	1.33	3.49	4.82	6.64
2009	1.30	2.31	3.61	6.64
2010	1.10	1.57	2.67	6.64
2011	1.08	2.01	3.09	6.64
2012	0.96	2.11	3.07	6.64
2013	0.79	2.19	2.98	6.64
2014	1.10	0.65	1.75	6.64
2015	0.88	0.63	1.51	6.64



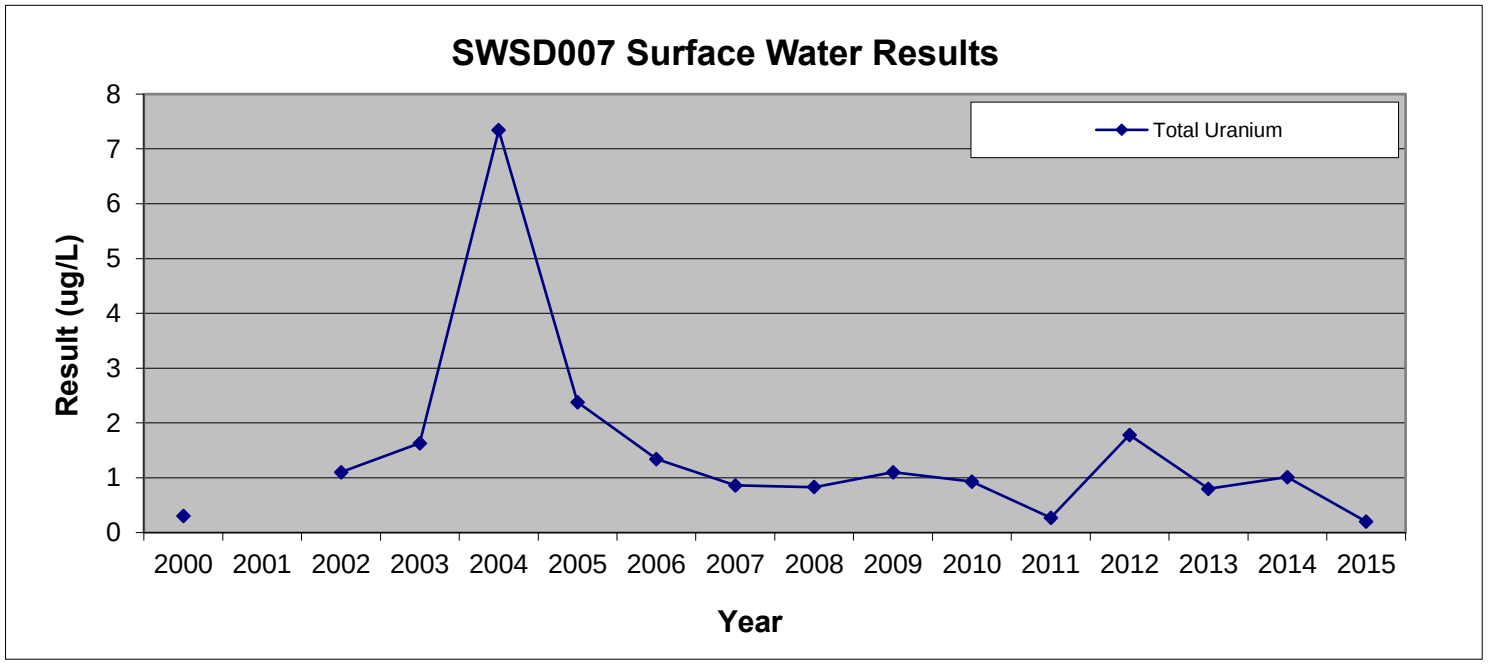
Year	U-238	ROD Cleanup Criteria
2000	0.40	51.33
2001	1.77	51.33
2002	7.10	51.33
2003	0.89	51.33
2004	1.61	51.33
2005	2.45	51.33
2006	2.42	51.33
2007	0.60	51.33
2008	2.88	51.33
2009	2.31	51.33
2010	1.14	51.33
2011	1.05	51.33
2012	0.94	51.33
2013	1.47	51.33
2014	0.58	51.33
2015	0.373	51.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
b) The ROD unrestricted use soil cleanup criteria for the combination of Ra-226 and Th-232 is 5 pCi/g above background. Background is approximately 1.64 pCi/g.
c) The ROD unrestricted use soil cleanup criteria for U-238 is 50 pCi/g above background. Background is approximately 1.33 pCi/g.

Figure E-5 (Continued)
Historical Results For Radiological Parameters at SWSD006 (Continued)



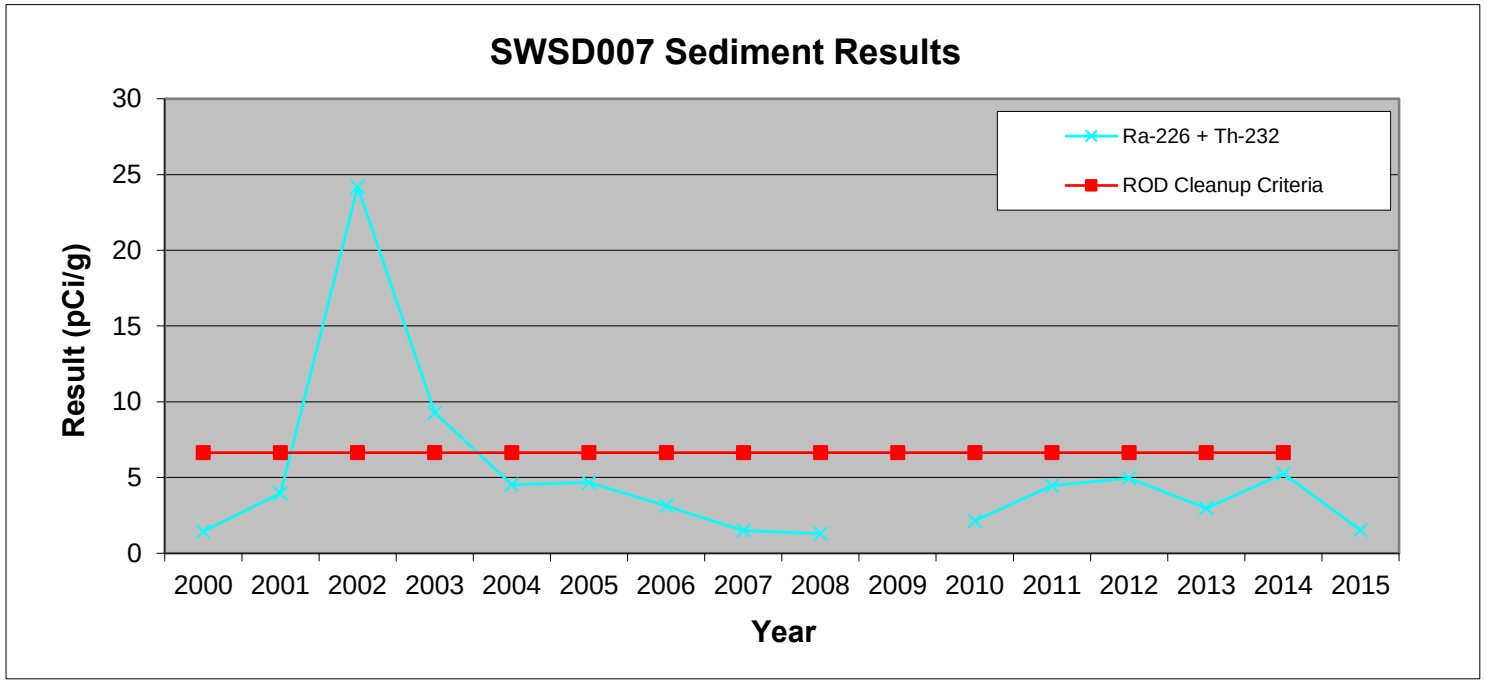
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	9.30	12.00		0.60	0.60
2001					
2002	9.60	6.50	0.32	1.21	1.53
2003	3.90	3.30	0.20	1.79	1.99
2004		10.30	1.17	4.59	5.76
2005	6.92	6.66	0.31	0.85	1.16
2006	5.99	5.81	0.22	0.42	0.64
2007	1.99	4.27	0.02	0.58	0.60
2008	1.65	3.77	0.02	1.00	1.02
2009	1.36	18.20	0.20	0.69	0.89
2010	4.50	3.47	0.30	0.6	0.90
2011	1.14	2.34	0.06	0.12	0.18
2012	86.15	39.43	3.37	9.9	13.27
2013	2.28	3.33	0.06	0.00	0.06
2014	1.39	1.65	0.29	0.782	1.07
2015	1.23	1.76	0.11	0.43	0.54



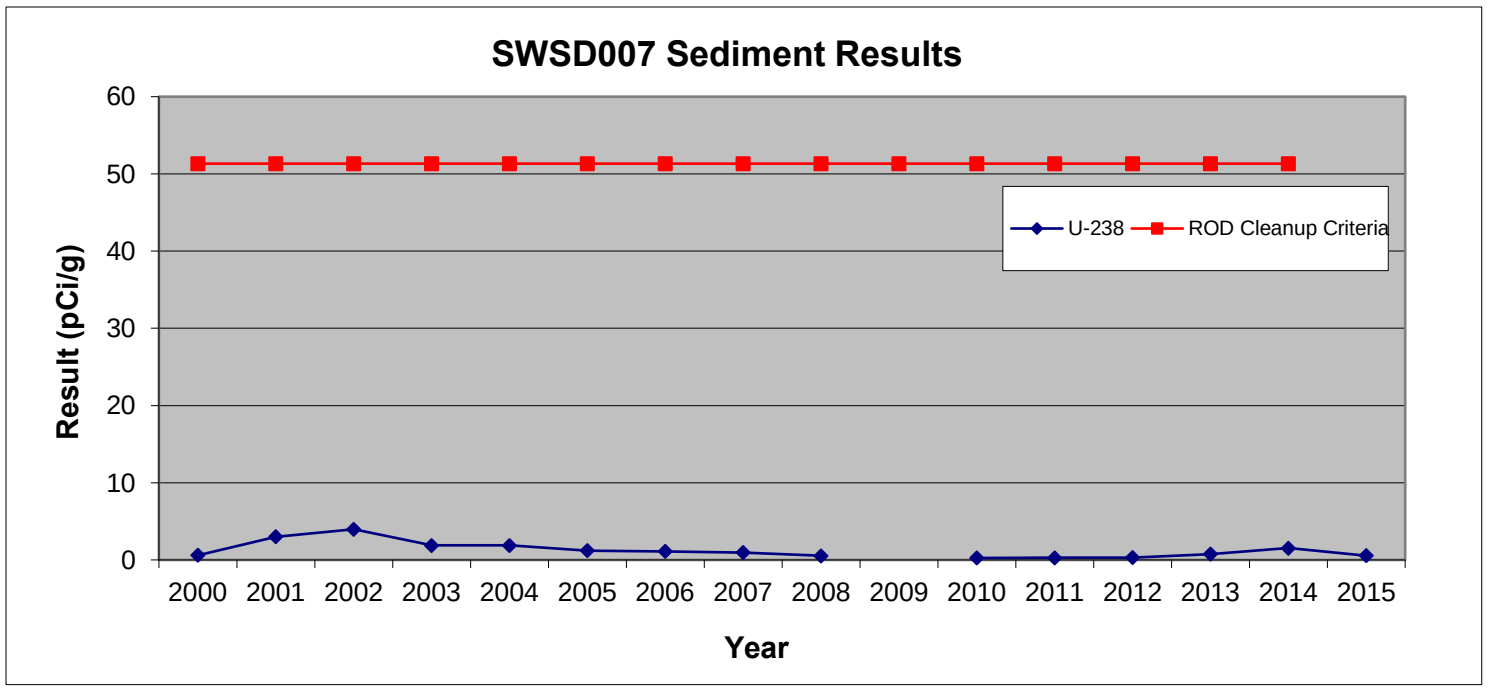
Year	Total Uranium
2000	0.30
2001	
2002	1.10
2003	1.63
2004	7.34
2005	2.38
2006	1.34
2007	0.86
2008	0.83
2009	1.10
2010	0.93
2011	0.27
2012	1.78
2013	0.80
2014	1.01
2015	0.2

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-6
Historical Results For Radiological Parameters at SWSD007



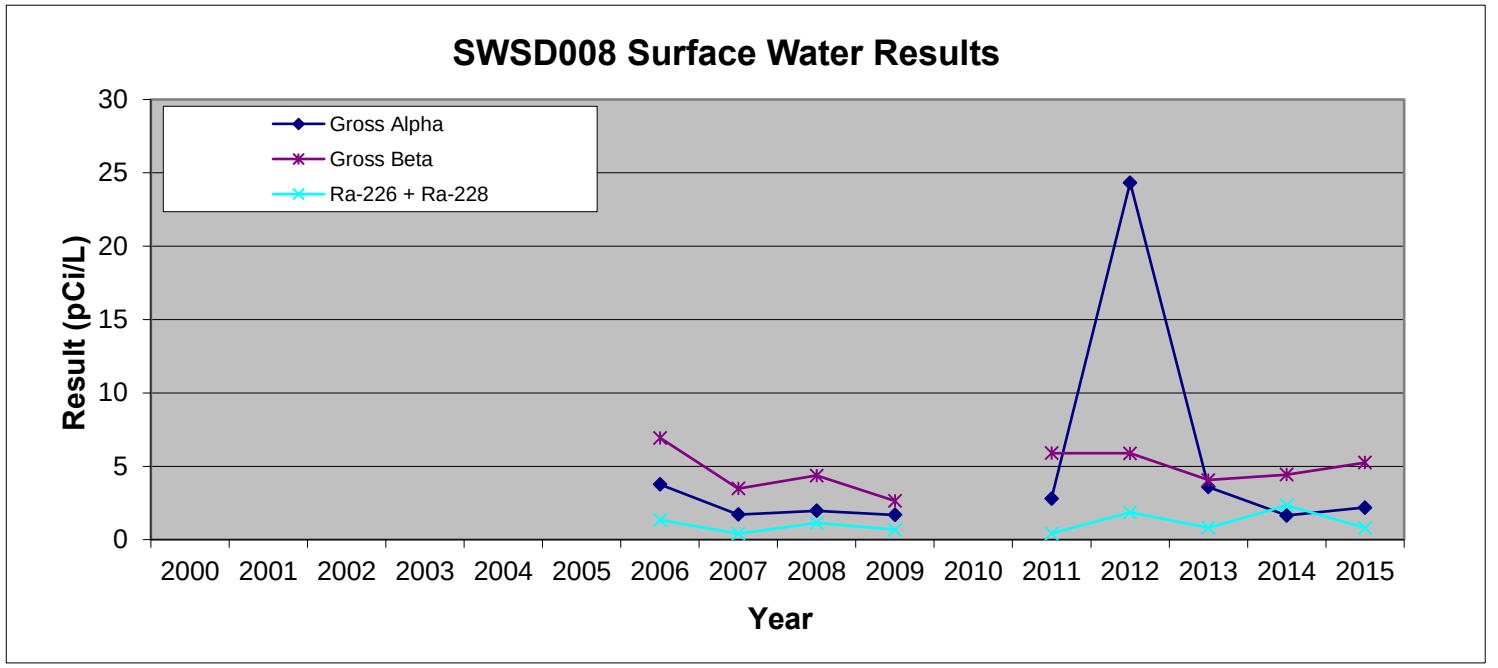
Year	Ra-226	Th-232	Ra-226 + Th-232	ROD Cleanup Criteria
2000		1.43	1.43	6.64
2001	0.89	3.06	3.95	6.64
2002	6.58	17.60	24.18	6.64
2003	3.77	5.50	9.27	6.64
2004	0.91	3.62	4.53	6.64
2005	1.44	3.23	4.67	6.64
2006	0.98	2.15	3.13	6.64
2007	0.68	0.82	1.50	6.64
2008	0.62	0.67	1.29	6.64
2009				6.64
2010	0.88	1.24	2.12	6.64
2011	1.63	2.83	4.46	6.64
2012	1.6	3.36	4.96	6.64
2013	0.79	2.19	2.98	6.64
2014	3.815	1.44	5.25	6.64
2015	0.71	0.82	1.53	6.64



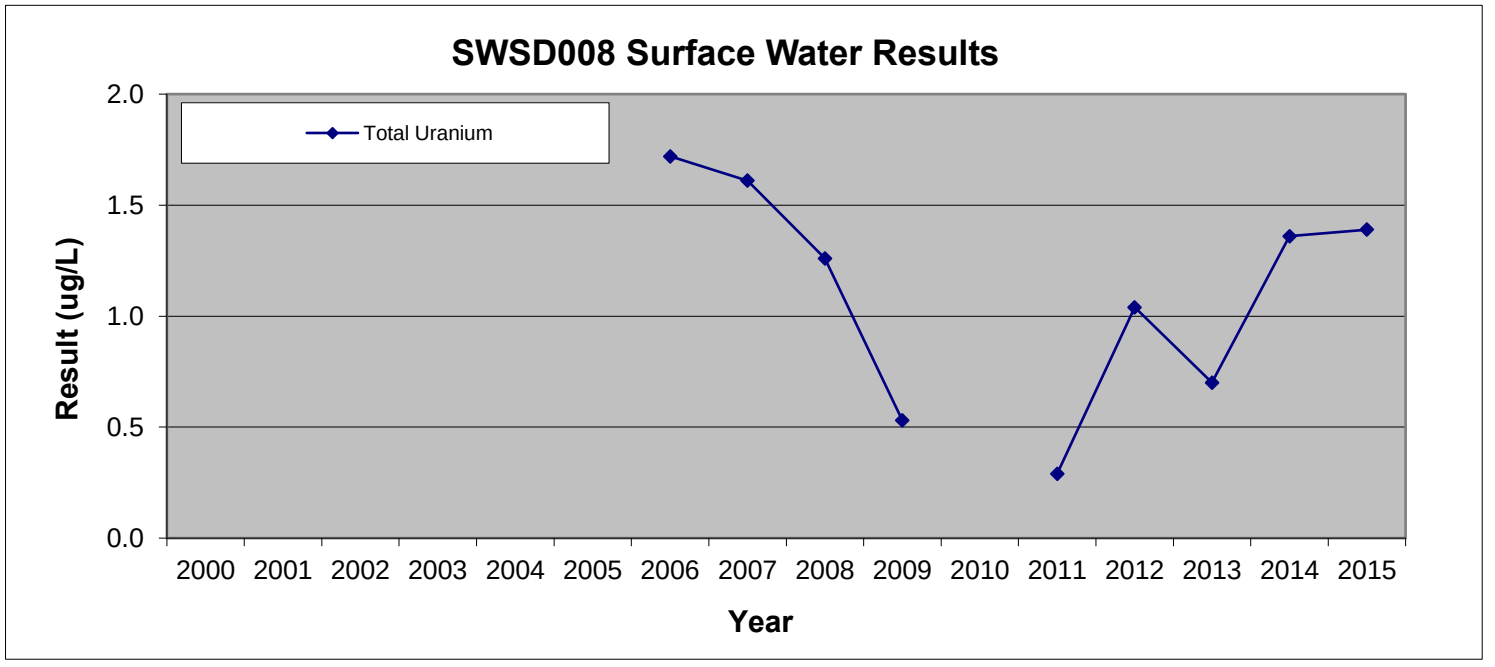
Year	U-238	ROD Cleanup Criteria
2000	0.62	51.33
2001	3.01	51.33
2002	3.97	51.33
2003	1.87	51.33
2004	1.87	51.33
2005	1.22	51.33
2006	1.11	51.33
2007	0.94	51.33
2008	0.53	51.33
2009		51.33
2010	0.25	51.33
2011	0.28	51.33
2012	0.32	51.33
2013	0.74	51.33
2014	1.53	51.33
2015	0.56	51.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
b) The ROD unrestricted use soil cleanup criteria for the combination of Ra-226 and Th-232 is 5 pCi/g above background. Background is approximately 1.64 pCi/g.
c) The ROD unrestricted use soil cleanup criteria for U-238 is 50 pCi/g above background. Background is approximately 1.33 pCi/g.

Figure E-6 (Continued)
Historical Results For Radiological Parameters at SWSD007 (Continued)



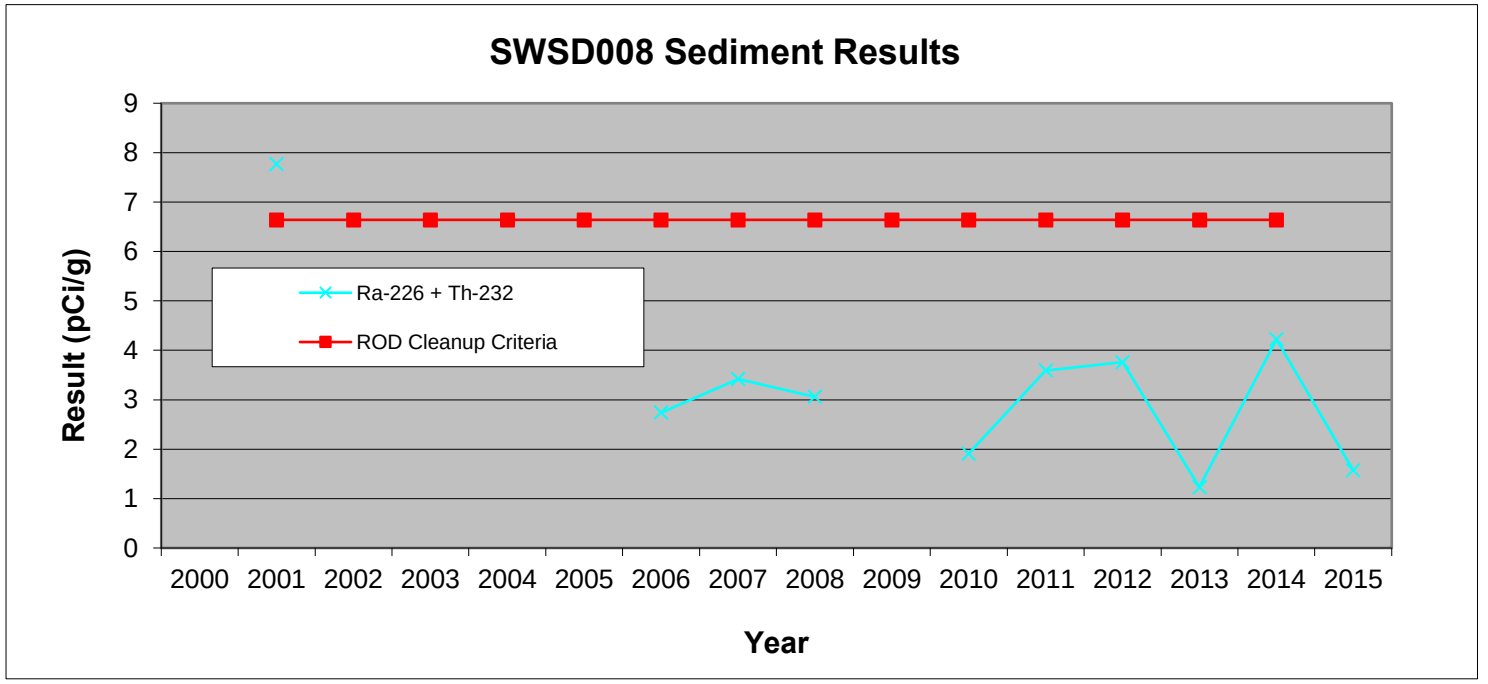
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006	3.77	6.94	0.54	0.80	1.34
2007	1.71	3.48	0.16	0.24	0.40
2008	1.97	4.37	0.09	1.04	1.13
2009	1.69	2.64	0.09	0.58	0.67
2010					
2011	2.81	5.90	0.00	0.42	0.42
2012	24.34	5.89	0.26	1.6	1.86
2013	3.59	4.06	0.09	0.72	0.81
2014	1.65	4.43	0.12	2.213	2.335
2015	2.19	5.26	0.56	0.24	0.8



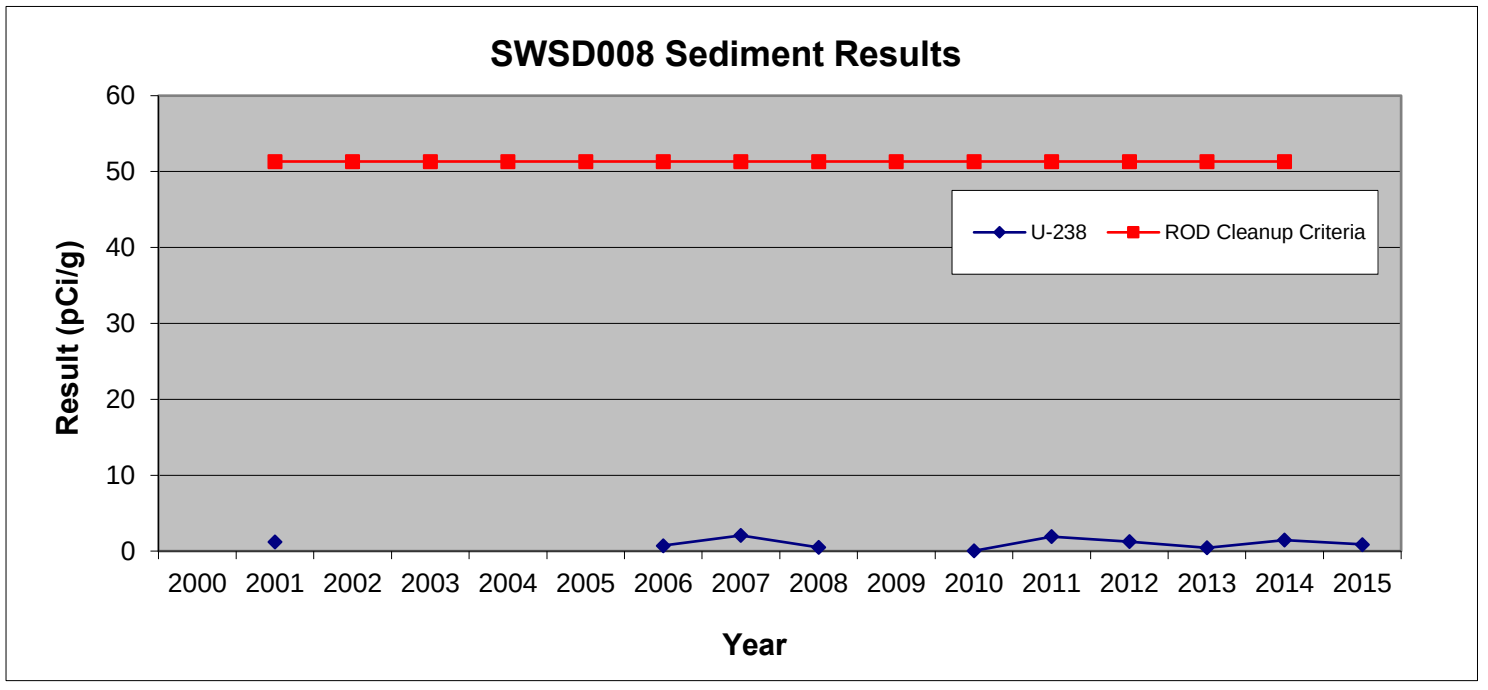
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	1.72
2007	1.61
2008	1.26
2009	0.53
2010	
2011	0.29
2012	1.04
2013	0.70
2014	1.36
2015	1.39

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-7
Historical Results For Radiological Parameters at SWSD008



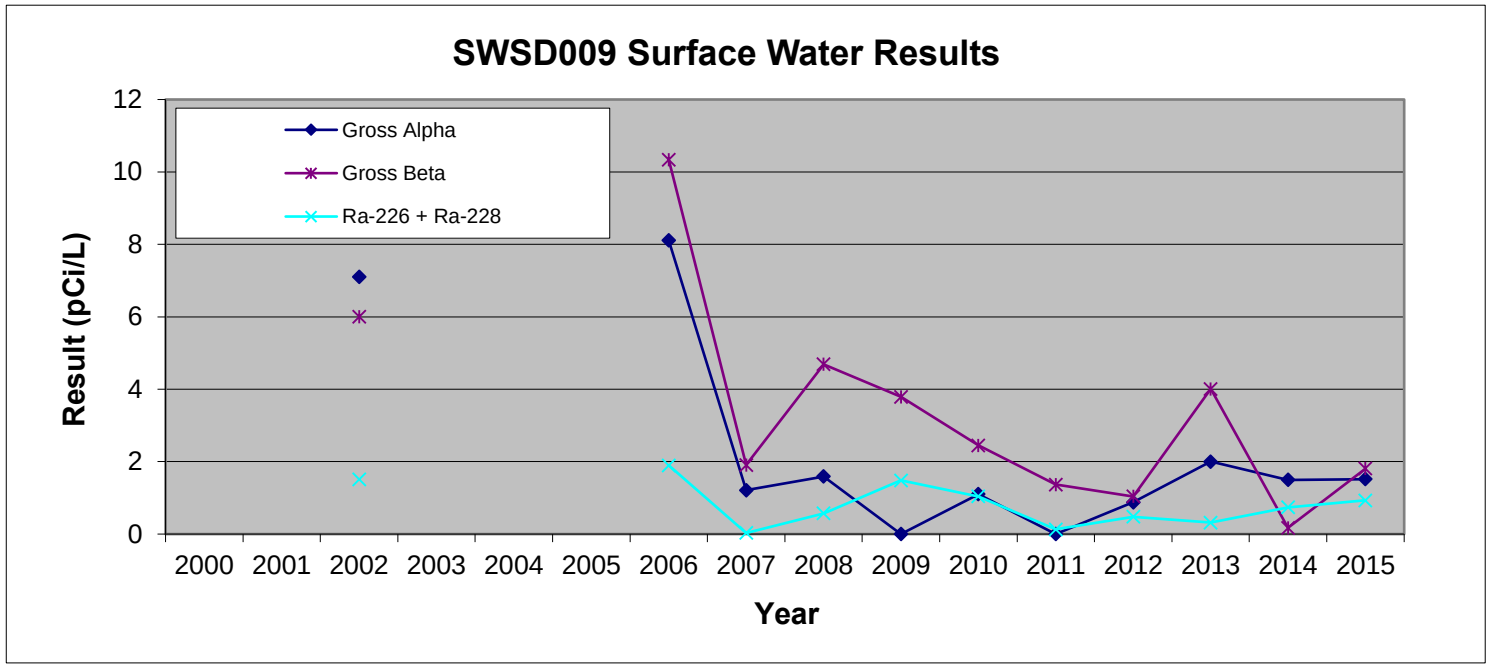
Year	Ra-226	Th-232	Ra-226 + Th-232	ROD Cleanup Criteria
2000				
2001	1.96	5.81	7.77	6.64
2002				6.64
2003				6.64
2004				6.64
2005				6.64
2006	0.96	1.78	2.74	6.64
2007	1.17	2.25	3.42	6.64
2008	1.07	1.99	3.06	6.64
2009				6.64
2010	0.75	1.16	1.91	6.64
2011	1.45	2.14	3.59	6.64
2012	1.25	2.51	3.76	6.64
2013	0.54	0.69	1.23	6.64
2014	1.54	2.68	4.22	6.64
2015	0.79	0.78	1.57	6.64



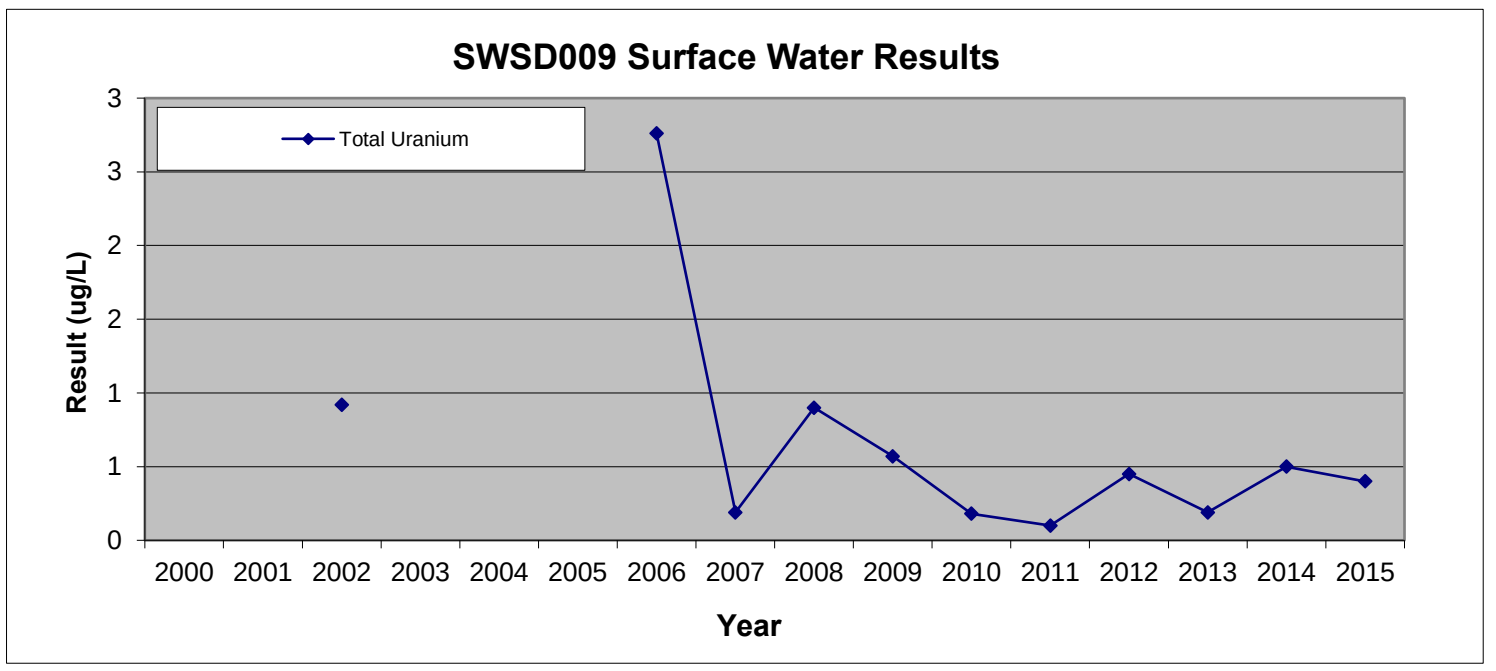
Year	U-238	ROD Cleanup Criteria
2000		
2001	1.20	51.33
2002		51.33
2003		51.33
2004		51.33
2005		51.33
2006	0.71	51.33
2007	2.06	51.33
2008	0.50	51.33
2009		51.33
2010	0.03	51.33
2011	1.92	51.33
2012	1.24	51.33
2013	0.45	51.33
2014	1.43	51.33
2015	0.87	51.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
b) The ROD unrestricted use soil cleanup criteria for the combination of Ra-226 and Th-232 is 5 pCi/g above background. Background is approximately 1.64 pCi/g.
c) The ROD unrestricted use soil cleanup criteria for U-238 is 50 pCi/g above background. Background is approximately 1.33 pCi/g.

Figure E-7 (Continued)
Historical Results For Radiological Parameters at SWSD008 (Continued)



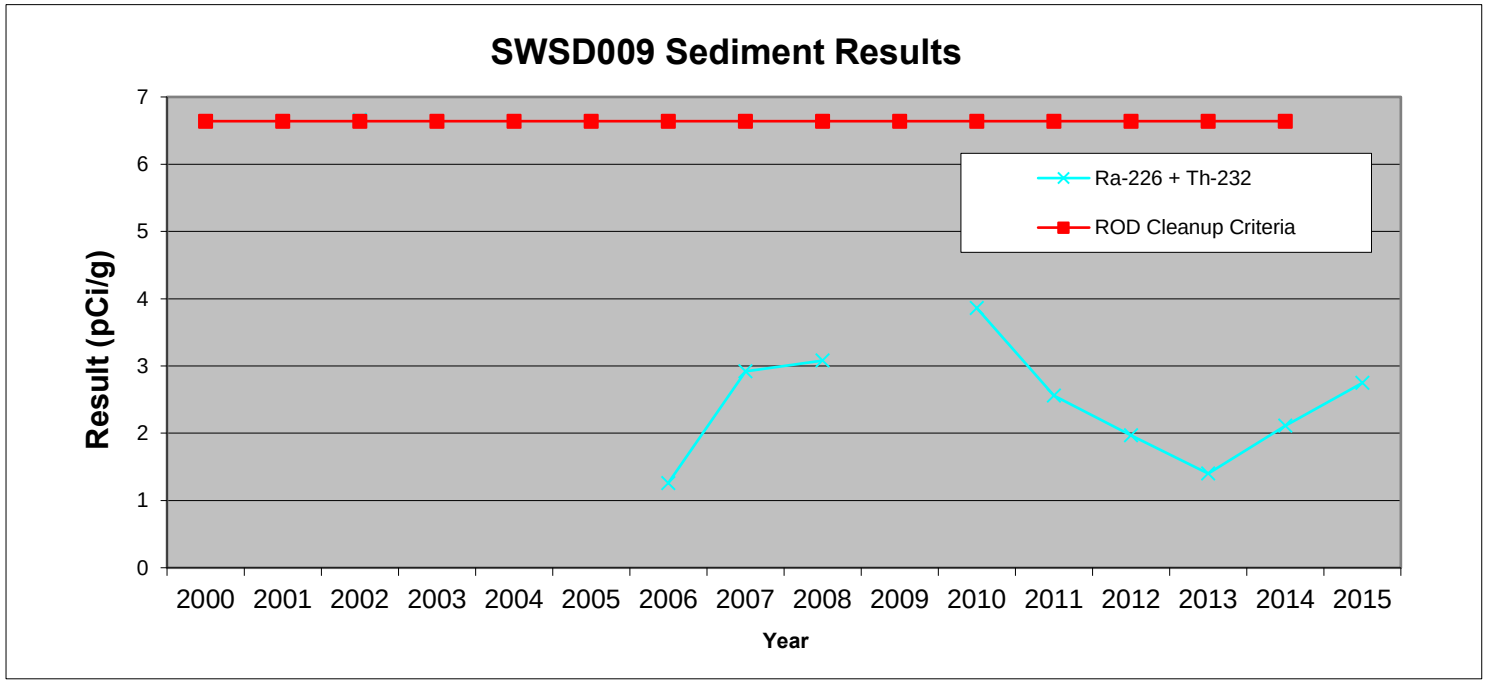
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002	7.10	6.00	0.25	1.26	1.51
2003					
2004					
2005					
2006	8.11	10.34	0.74	1.16	1.90
2007	1.21	1.91	0.03	0.00	0.03
2008	1.59	4.69	0.06	0.51	0.57
2009	0.00	3.79	0.09	1.39	1.48
2010	1.10	2.45	0.02	1.02	1.04
2011	0.00	1.37	0.06	0.07	0.13
2012	0.88	1.04	0.08	0.4	0.48
2013	2.00	4.01	0.00	0.32	0.32
2014	1.50	0.17	0.04	0.69	0.74
2015	1.52	1.81	0.19	0.74	0.93



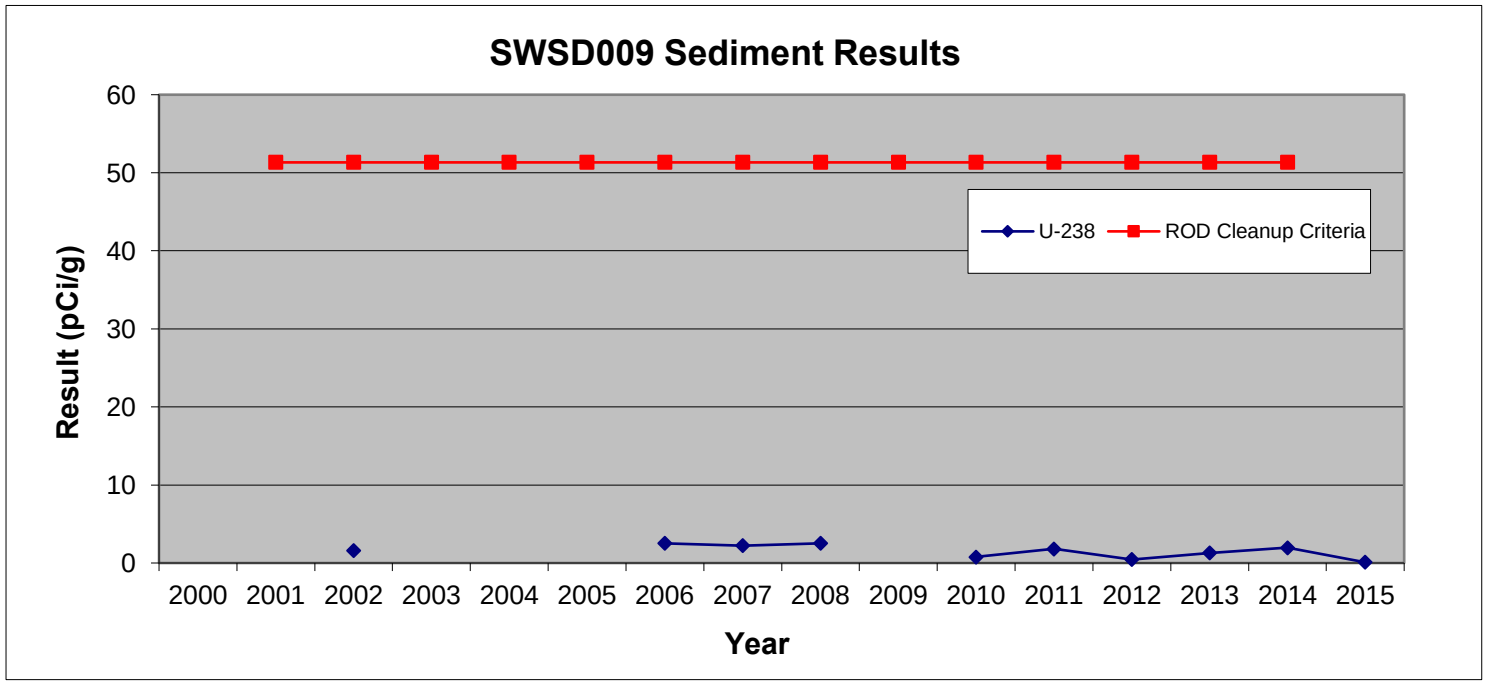
Year	Total Uranium
2000	
2001	
2002	0.92
2003	
2004	
2005	
2006	2.76
2007	0.19
2008	0.9
2009	0.57
2010	0.18
2011	0.10
2012	0.45
2013	0.19
2014	0.50
2015	0.4

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-8
Historical Results For Radiological Parameters at SWSD009



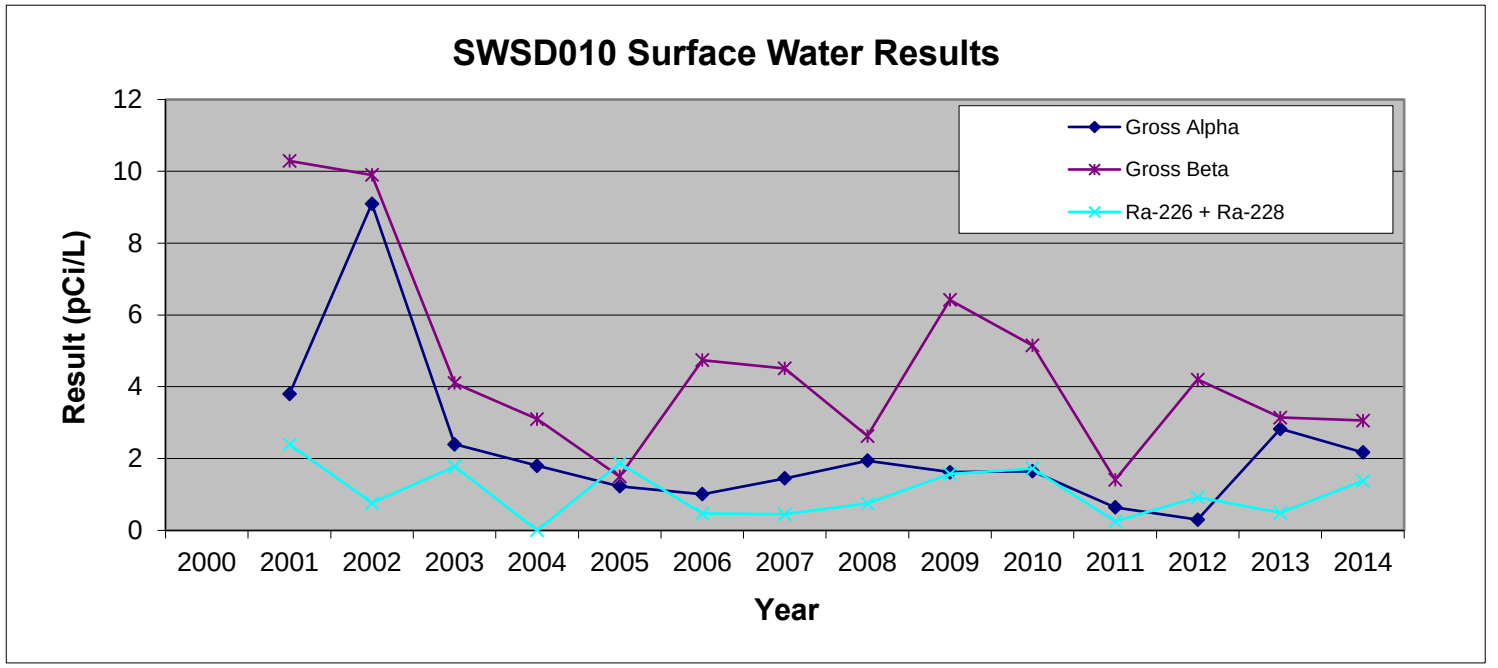
Year	Ra-226	Th-232	Ra-226 + Th-232	ROD Cleanup Criteria
2000				6.64
2001				6.64
2002	1.16	5.50	6.66	6.64
2003				6.64
2004				6.64
2005				6.64
2006	0.49	0.77	1.26	6.64
2007	1.12	1.80	2.92	6.64
2008	1.58	1.50	3.08	6.64
2009				6.64
2010	0.83	3.03	3.86	6.64
2011	0.97	1.59	2.56	6.64
2012	0.82	1.15	1.97	6.64
2013	0.52	0.88	1.40	6.64
2014	1.11	1.00	2.11	6.64
2015	1.02	1.73	2.75	6.64



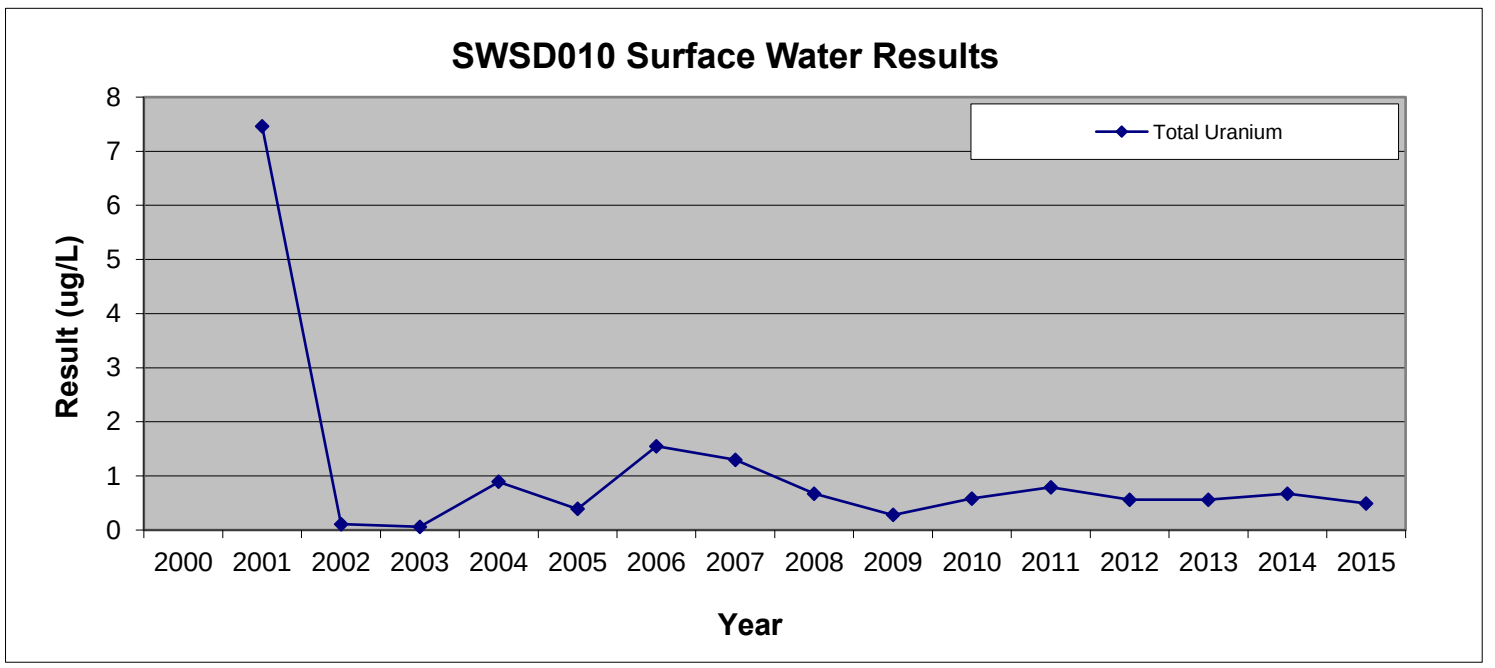
Year	U-238	ROD Cleanup Criteria
2000		
2001		51.33
2002	1.60	51.33
2003		51.33
2004		51.33
2005		51.33
2006	2.51	51.33
2007	2.21	51.33
2008	2.52	51.33
2009		51.33
2010	0.77	51.33
2011	1.80	51.33
2012	0.43	51.33
2013	1.30	51.33
2014	1.95	51.33
2015	0.09	51.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
b) The ROD unrestricted use soil cleanup criteria for the combination of Ra-226 and Th-232 is 5 pCi/g above background. Background is approximately 1.64 pCi/g.

Figure E-8 (Continued)
Historical Results For Radiological Parameters at SWSD009 (Continued)



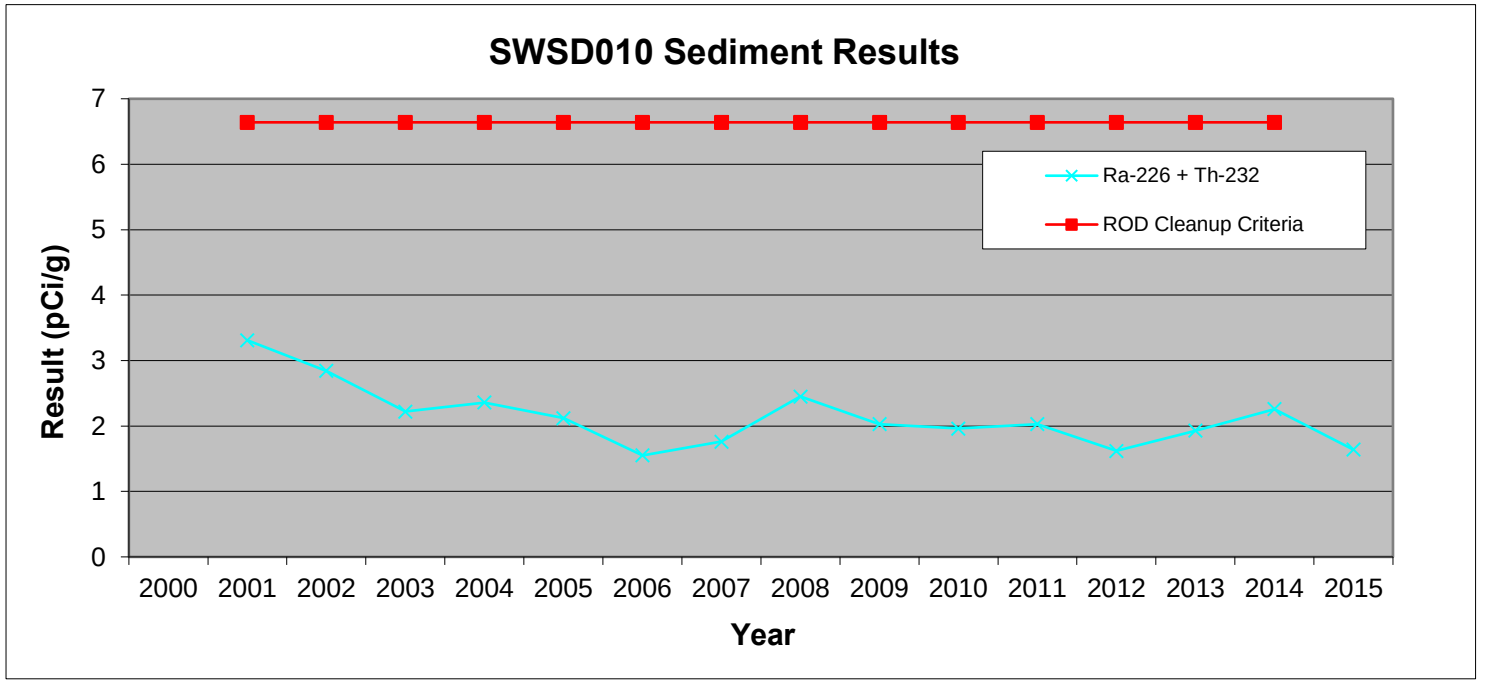
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001	3.80	10.29	1.05	1.35	2.40
2002	9.10	9.90		0.76	0.76
2003	2.40	4.10	0.20	1.58	1.78
2004	1.80	3.10	0.00		0.00
2005	1.23	1.50	0.05	1.82	1.87
2006	1.01	4.74	0.00	0.47	0.47
2007	1.45	4.51	0.04	0.41	0.45
2008	1.94	2.63	0.02	0.73	0.75
2009	1.62	6.42	0.00	1.57	1.57
2010	1.65	5.15	0.00	1.72	1.72
2011	0.64	1.41	0.06	0.19	0.25
2012	0.30	4.20	0.05	0.87	0.92
2013	2.83	3.14	0.14	0.35	0.49
2014	2.17	3.06	0.36	1.025	1.38
2015	0.77	2.96	0.10	0.29	0.39



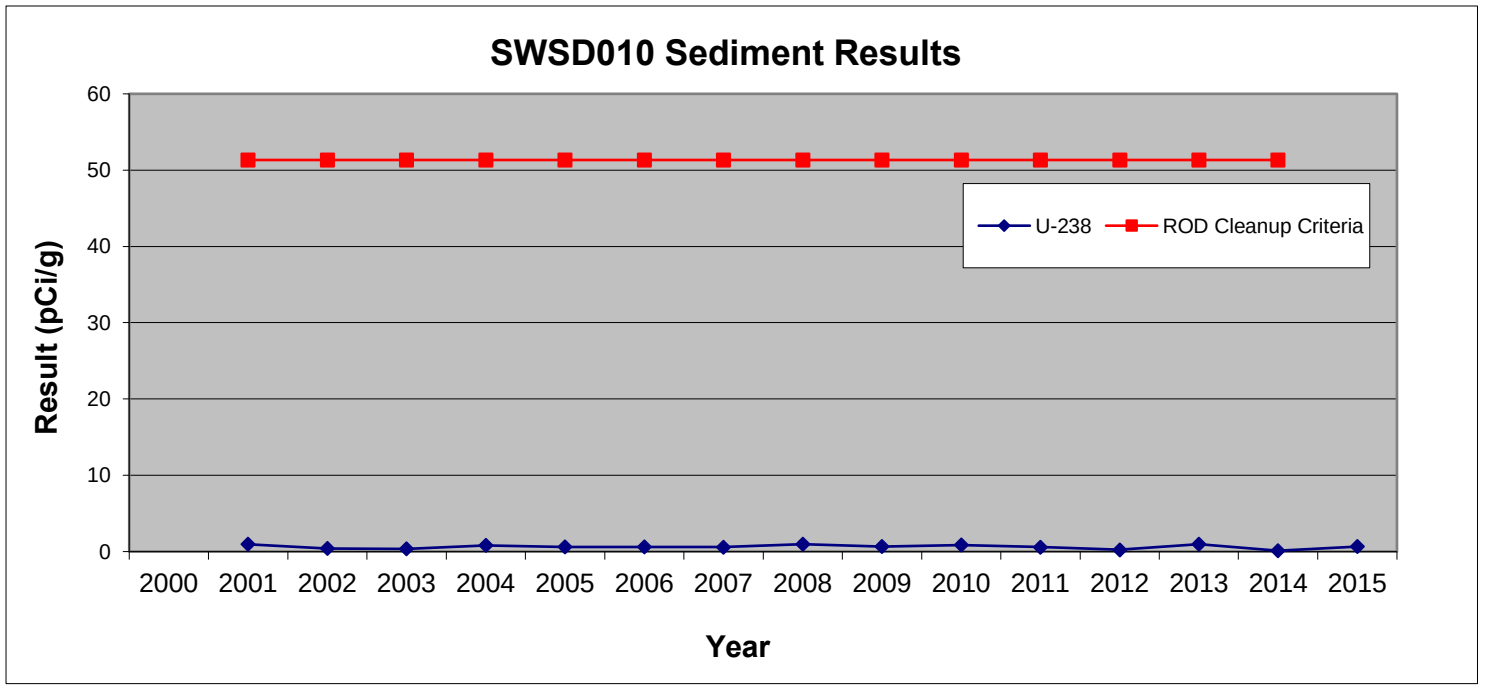
Year	Total Uranium
2000	
2001	7.46
2002	0.11
2003	0.06
2004	0.89
2005	0.39
2006	1.55
2007	1.30
2008	0.67
2009	0.28
2010	0.58
2011	0.79
2012	0.56
2013	0.56
2014	0.67
2015	0.49

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-9
Historical Results For Radiological Parameters at SWSD010



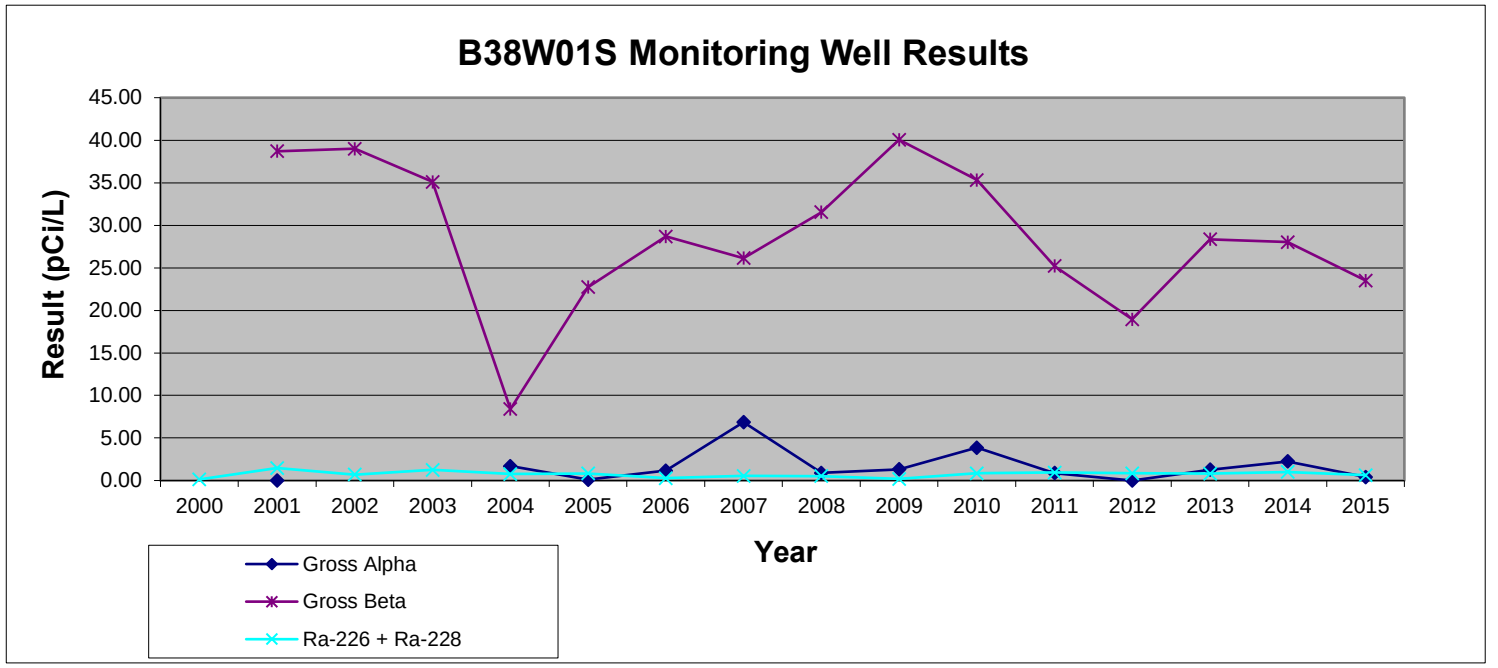
Year	Ra-226	Th-232	Ra-226 + Th-232	ROD Cleanup Criteria
2000				
2001	0.62	2.69	3.31	6.64
2002	0.88	1.96	2.84	6.64
2003	0.94	1.28	2.22	6.64
2004	0.00	2.36	2.36	6.64
2005	1.03	1.09	2.12	6.64
2006	0.55	1.00	1.55	6.64
2007	0.86	0.90	1.76	6.64
2008	1.20	1.25	2.45	6.64
2009	0.70	1.33	2.03	6.64
2010	0.86	1.10	1.96	6.64
2011	0.79	1.24	2.03	6.64
2012	0.65	0.97	1.62	6.64
2013	0.82	1.11	1.93	6.64
2014	0.75	1.51	2.26	6.64
2015	0.65	0.99	1.64	6.64



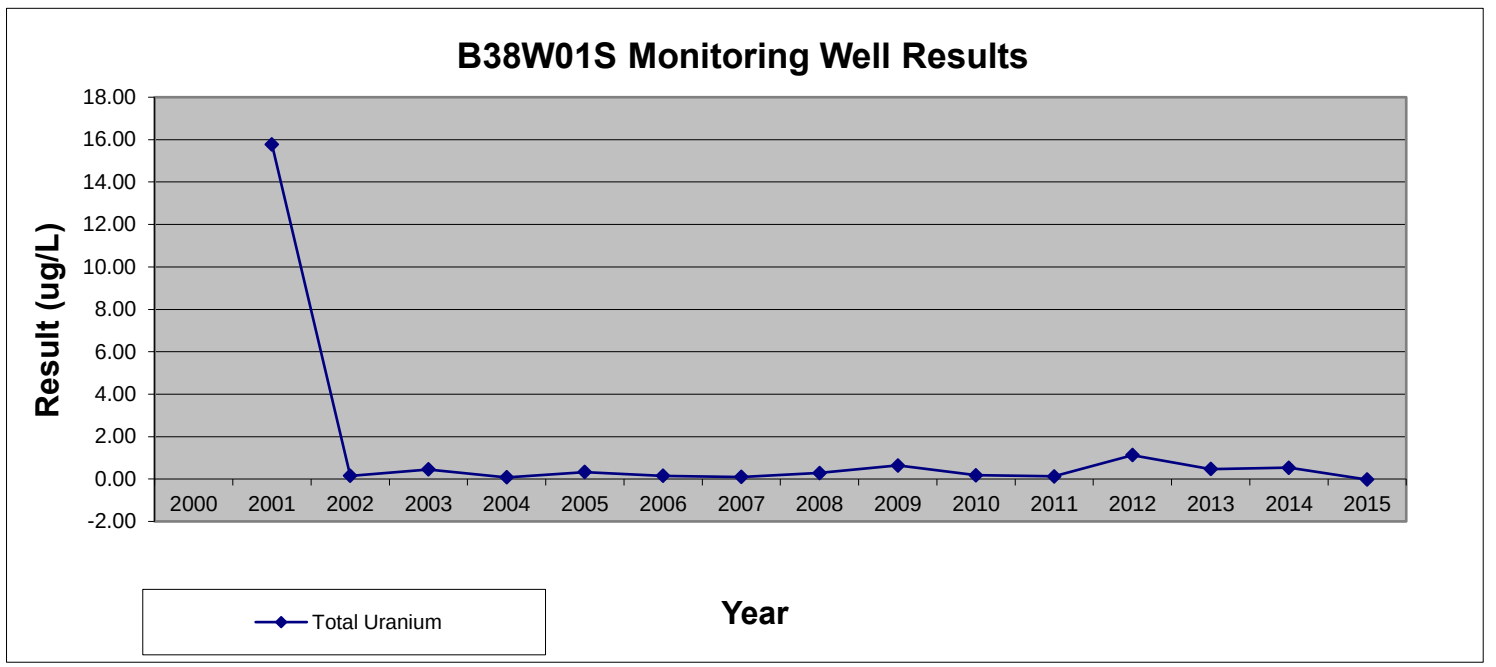
Year	U-238	ROD Cleanup Criteria
2000		
2001	0.96	51.33
2002	0.39	51.33
2003	0.35	51.33
2004	0.80	51.33
2005	0.60	51.33
2006	0.60	51.33
2007	0.59	51.33
2008	0.97	51.33
2009	0.67	51.33
2010	0.87	51.33
2011	0.58	51.33
2012	0.23	51.33
2013	0.97	51.33
2014	0.12	51.33
2015	0.67	51.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
b) The ROD unrestricted use soil cleanup criteria for the combination of Ra-226 and Th-232 is 5 pCi/g above background. Background is approximately 1.64 pCi/g.
c) The ROD unrestricted use soil cleanup criteria for U-238 is 50 pCi/g above background. Background is approximately 1.33 pCi/g.

Figure E-9 (Continued)
Historical Results For Radiological Parameters at SWSD010 (Continued)



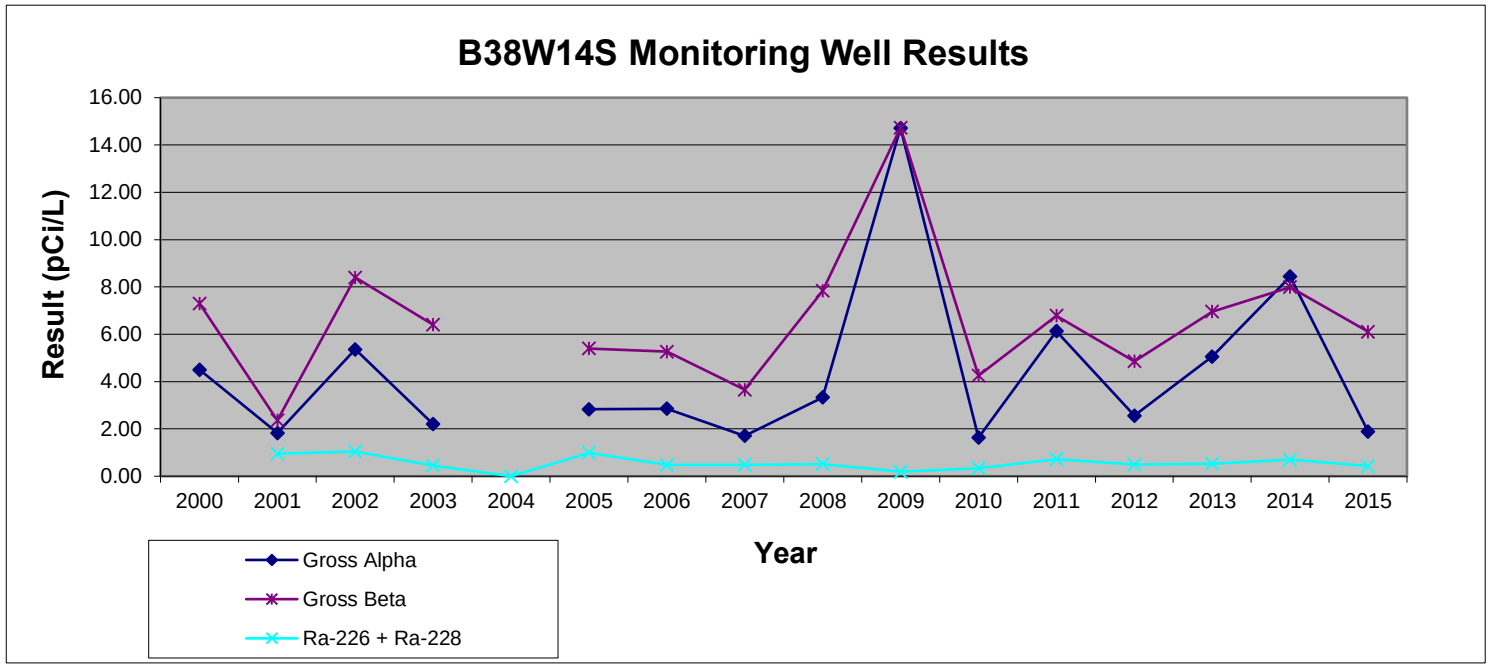
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000			0.13	0.00	0.13
2001	0.00	38.70	0.28	1.19	1.47
2002		39.00	0.17	0.52	0.69
2003		35.10	0.18	1.08	1.26
2004	1.70	8.40	0.27	0.50	0.77
2005	0.11	22.74	0.06	0.77	0.83
2006	1.17	28.69	0.02	0.26	0.28
2007	6.86	26.15	0.14	0.39	0.53
2008	0.90	31.55	0.00	0.52	0.52
2009	1.31	40.06	0.18	0.00	0.18
2010	3.86	35.32	0.16	0.69	0.85
2011	0.87	25.22	0.28	0.67	0.95
2012	0.00	18.94	0.03	0.81	0.84
2013	1.27	28.36	0.00	0.80	0.8
2014	2.24	28.02	0.12	0.89	1.01
2015	0.40	23.51	0.00	0.63	0.63



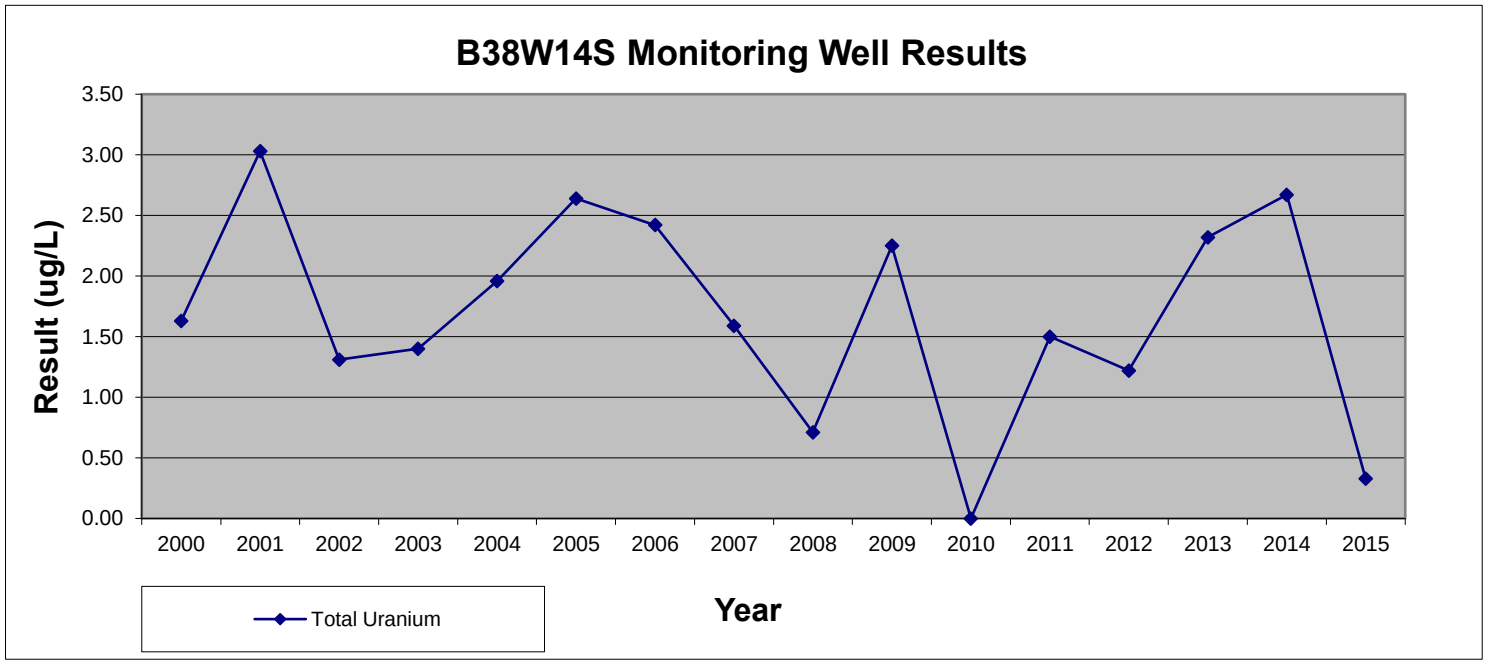
Year	Total Uranium
2000	
2001	15.78
2002	0.15
2003	0.45
2004	0.08
2005	0.33
2006	0.15
2007	0.10
2008	0.29
2009	0.64
2010	0.18
2011	0.12
2012	1.13
2013	0.47
2014	0.5322
2015	-0.027

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-10
Historical Results For Radiological Parameters at B38W01S



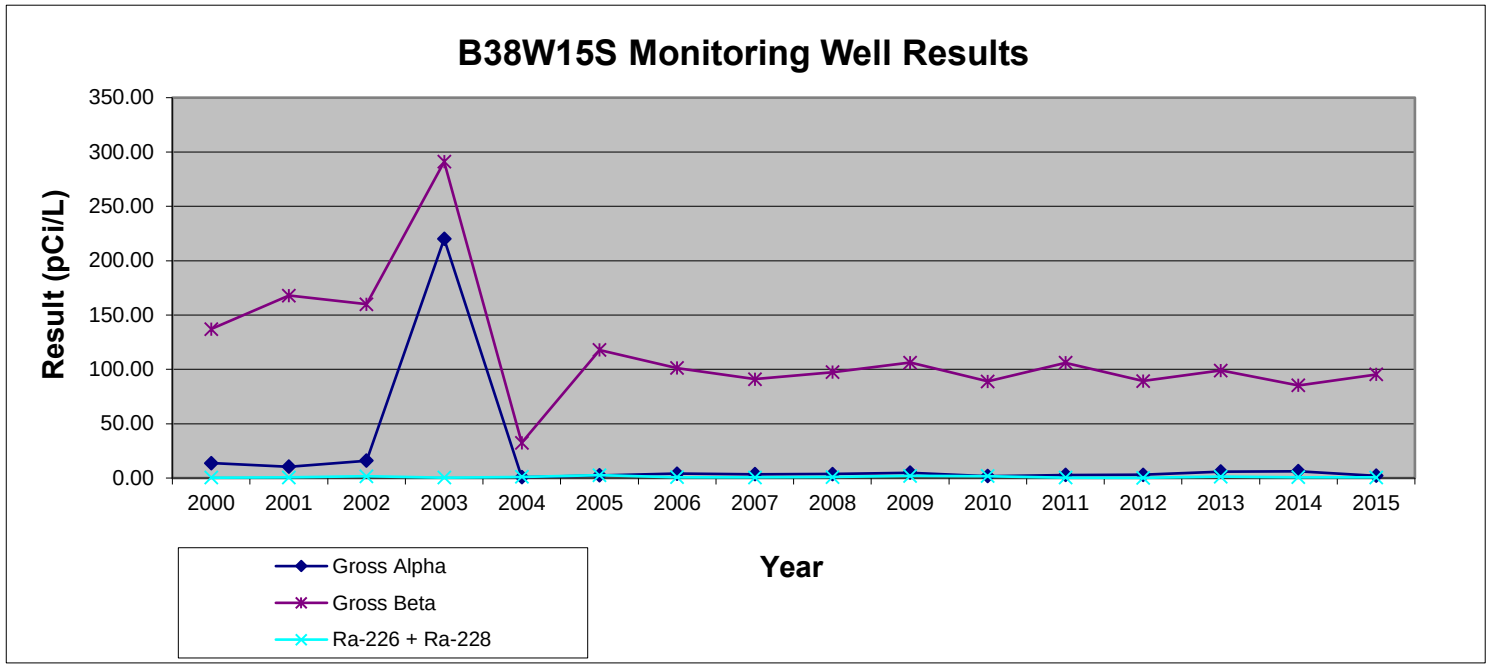
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	4.50	7.30			
2001	1.83	2.36		0.95	0.95
2002	5.36	8.40	1.04		1.04
2003	2.20	6.40		0.45	0.45
2004					0.00
2005	2.83	5.40	0.04	0.95	0.99
2006	2.85	5.26	0.20	0.27	0.47
2007	1.71	3.66	0.07	0.41	0.48
2008	3.33	7.83	0.00	0.51	0.51
2009	14.72	14.73	0.13	0.06	0.19
2010	1.63	4.25	0.03	0.31	0.34
2011	6.13	6.78	0.17	0.55	0.72
2012	2.56	4.86	0.12	0.37	0.49
2013	5.06	6.96	0.11	0.42	0.53
2014	8.44	8.00	0.35	0.35	0.70
2015	1.89	6.11	0.05	0.38	0.43



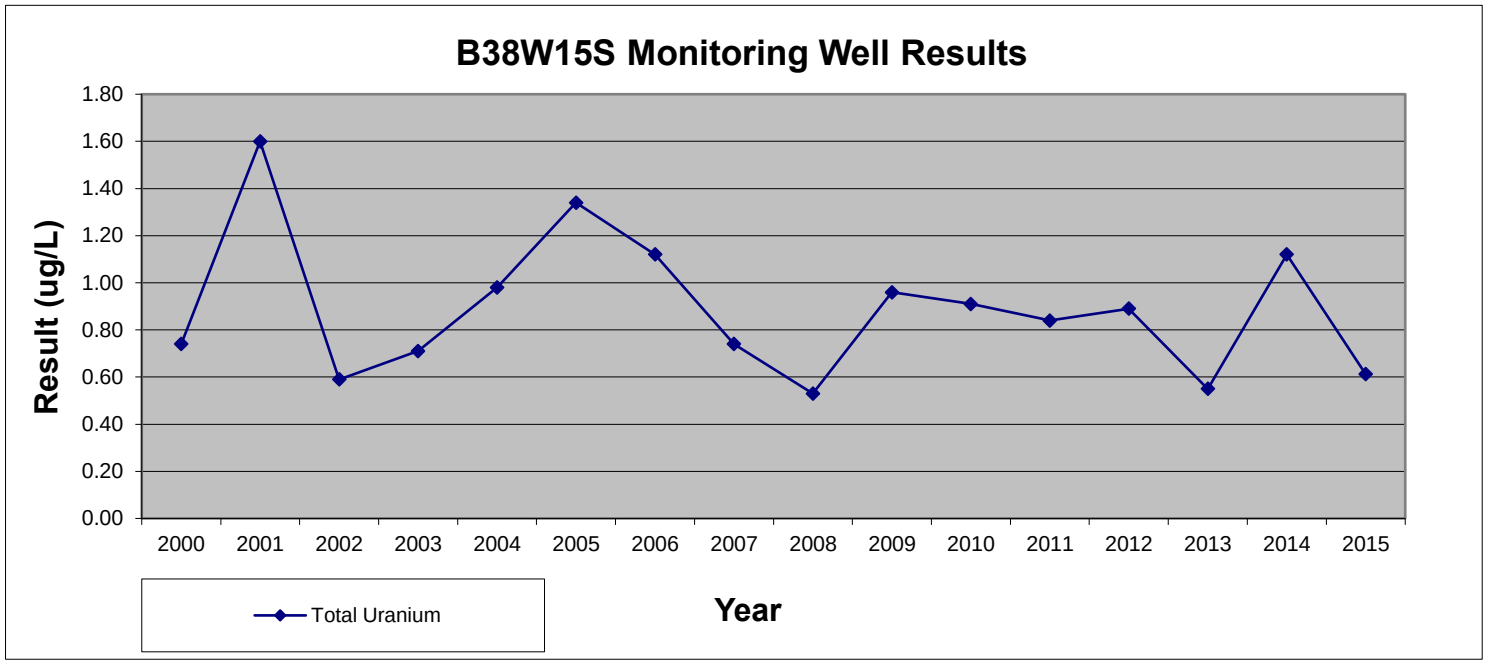
Year	Total Uranium
2000	1.63
2001	3.03
2002	1.31
2003	1.40
2004	1.96
2005	2.64
2006	2.42
2007	1.59
2008	0.71
2009	2.25
2010	0.00
2011	1.50
2012	1.22
2013	2.32
2014	2.67
2015	0.33

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-11
Historical Results For Radiological Parameters at B38W14S



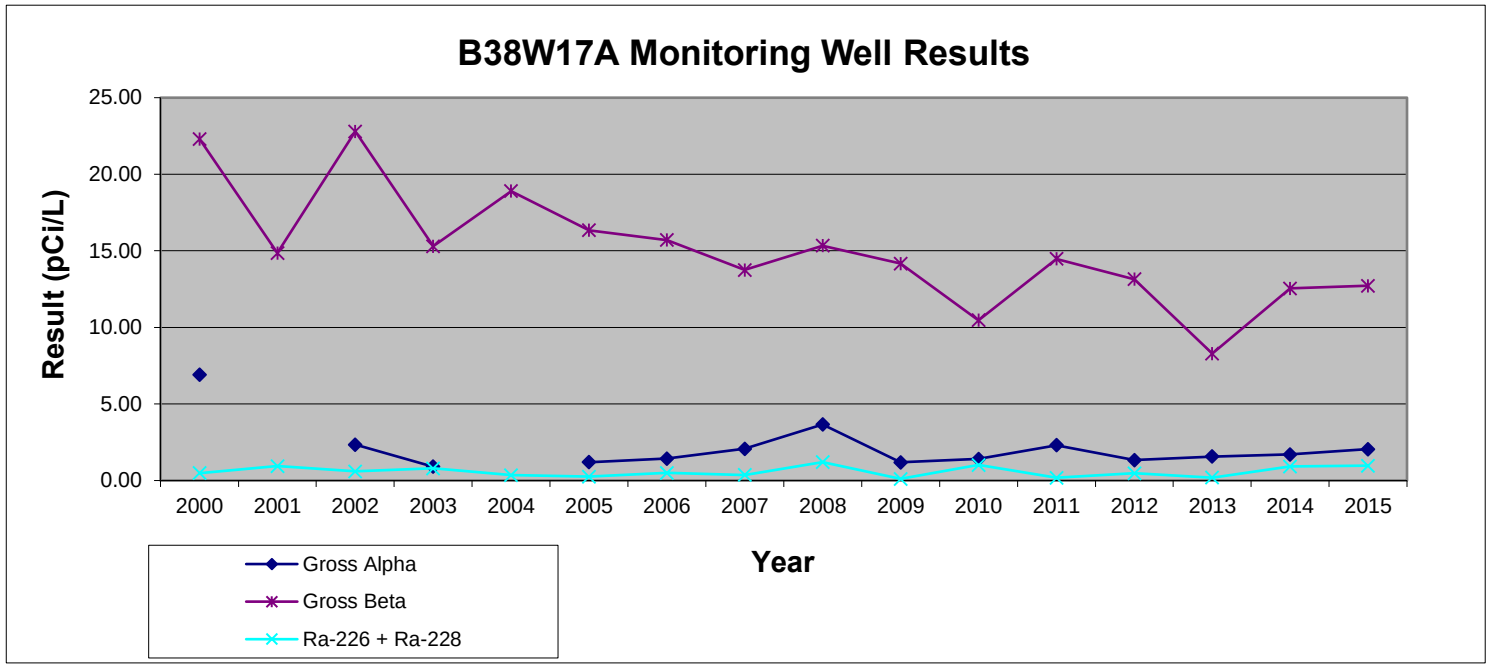
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	13.80	137.00	0.34		0.34
2001	10.43	167.87	0.15	0.44	0.59
2002	15.94	160.00		1.55	1.55
2003	220.00	291.00	0.12	0.35	0.47
2004	0.80	32.50	0.23	0.90	1.13
2005	2.53	117.82	0.32	2.36	2.68
2006	4.10	101.23	0.20	0.56	0.76
2007	3.52	91.07	0.12	0.54	0.66
2008	3.70	97.43	0.10	0.85	0.95
2009	4.94	106.33	0.11	1.82	1.93
2010	1.78	88.97	0.17	1.68	1.85
2011	2.82	106.00	0.12	0.22	0.34
2012	3.04	89.28	0.07	0.16	0.23
2013	5.93	98.89	0.04	1.32	1.36
2014	6.29	85.23	0.09	0.63	0.72
2015	2.19	95.32	0.27	0.33	0.60



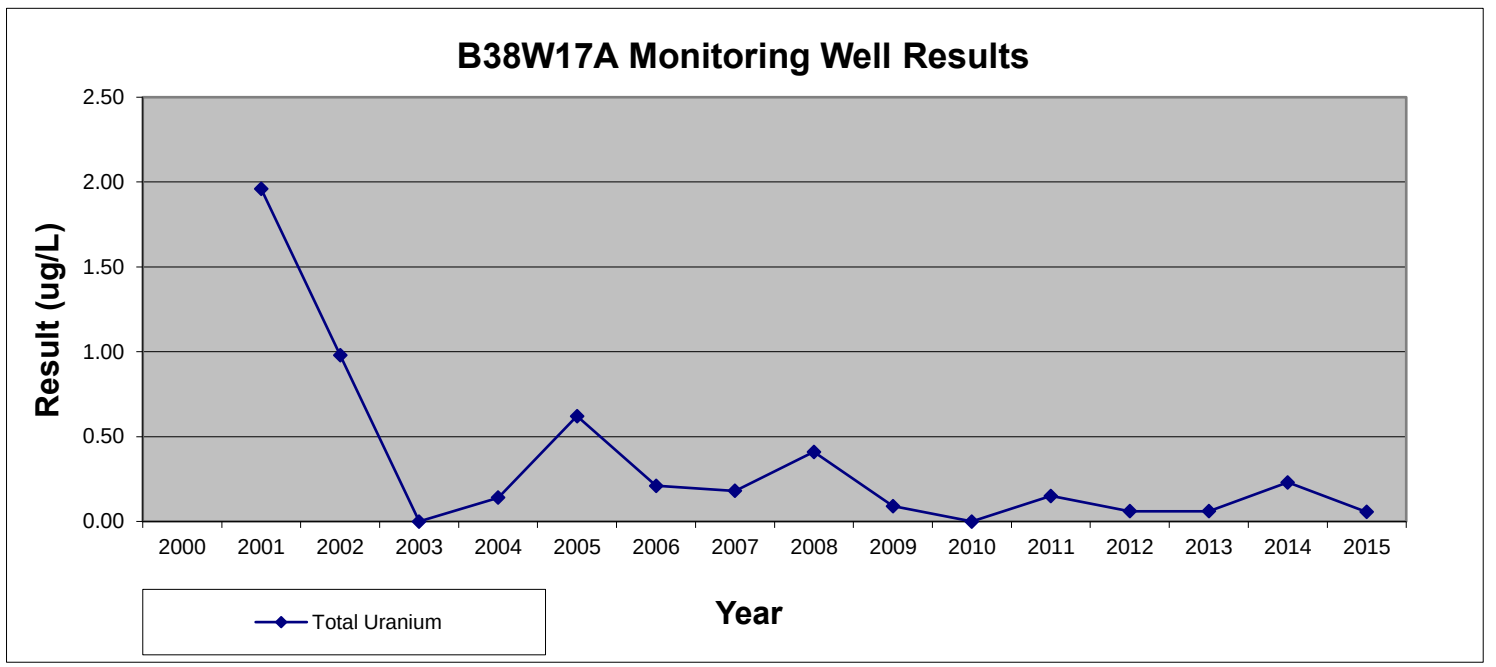
Year	Total Uranium
2000	0.74
2001	1.60
2002	0.59
2003	0.71
2004	0.98
2005	1.34
2006	1.12
2007	0.74
2008	0.53
2009	0.96
2010	0.91
2011	0.84
2012	0.89
2013	0.55
2014	1.12
2015	0.612

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-12
Historical Results For Radiological Parameters at B38W15S



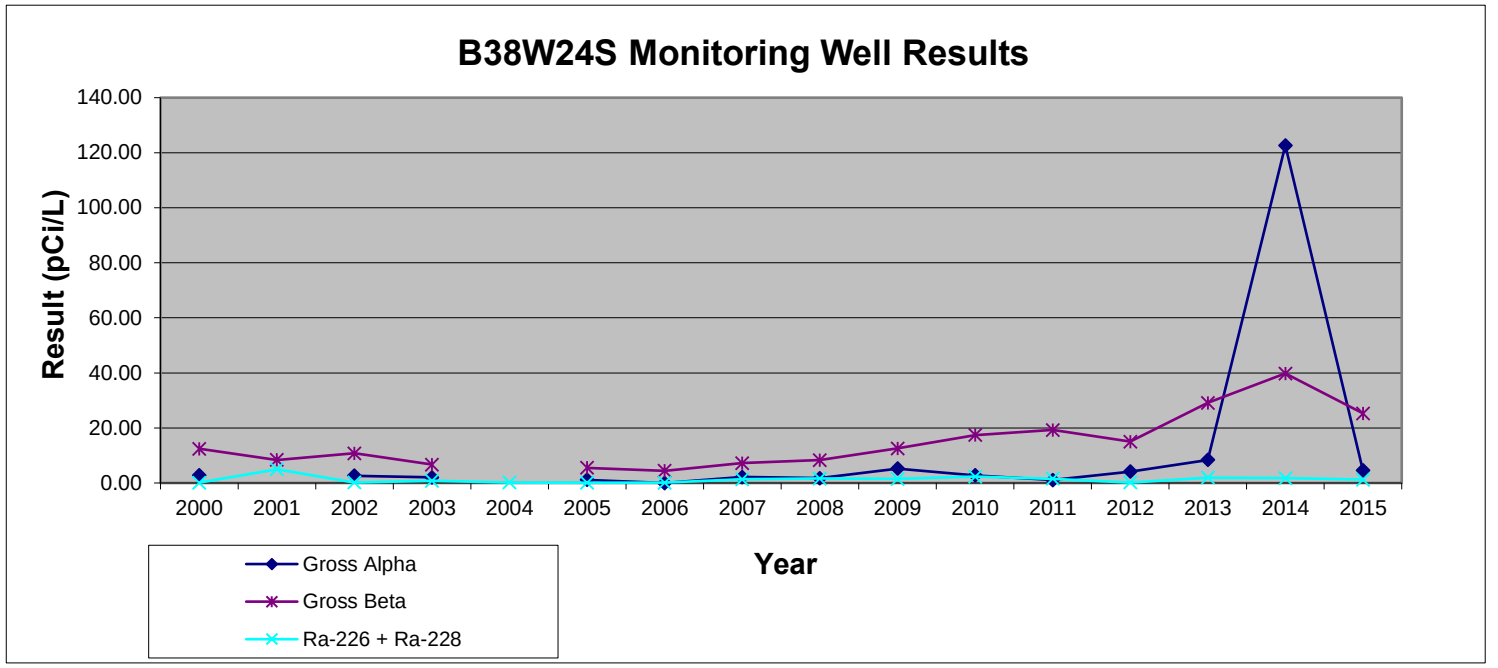
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	6.90	22.30	0.48		0.48
2001		14.85	0.24	0.70	0.94
2002	2.34	22.80	0.14	0.46	0.60
2003	0.90	15.30	0.13	0.66	0.79
2004		18.90	0.01	0.34	0.35
2005	1.20	16.34	0.06	0.19	0.25
2006	1.43	15.70	0.18	0.32	0.50
2007	2.07	13.75	0.21	0.15	0.36
2008	3.66	15.34	0.12	1.08	1.2
2009	1.19	14.17	0.06	0.05	0.11
2010	1.41	10.47	0.24	0.78	1.02
2011	2.30	14.47	0.18	0	0.18
2012	1.34	13.15	0.03	0.44	0.47
2013	1.57	8.29	0.00	0.19	0.19
2014	1.70	12.55	-0.04	0.96	0.92
2015	2.04	12.71	0.20	0.77	0.97



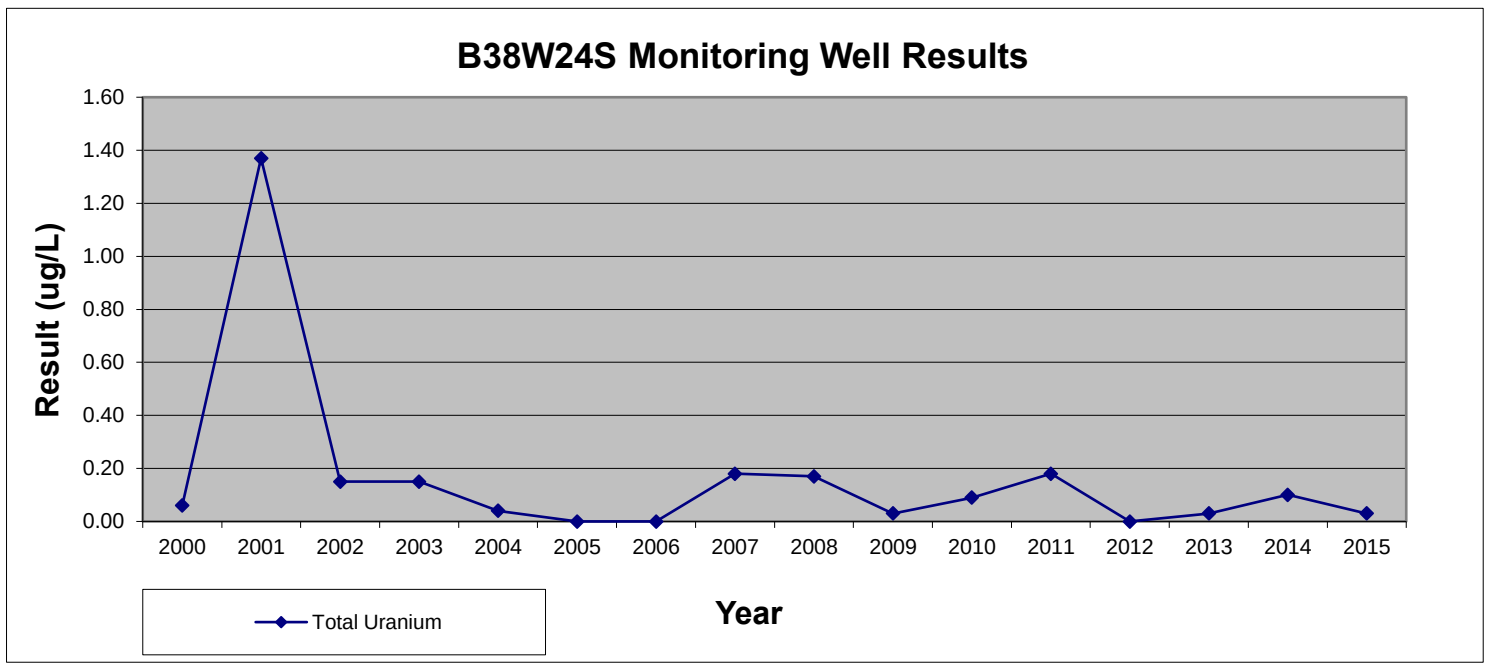
Year	Total Uranium
2000	
2001	1.96
2002	0.98
2003	0.00
2004	0.14
2005	0.62
2006	0.21
2007	0.18
2008	0.41
2009	0.09
2010	0.00
2011	0.15
2012	0.06
2013	0.06
2014	0.23
2015	0.056

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-13
Historical Results For Radiological Parameters at B38W17A



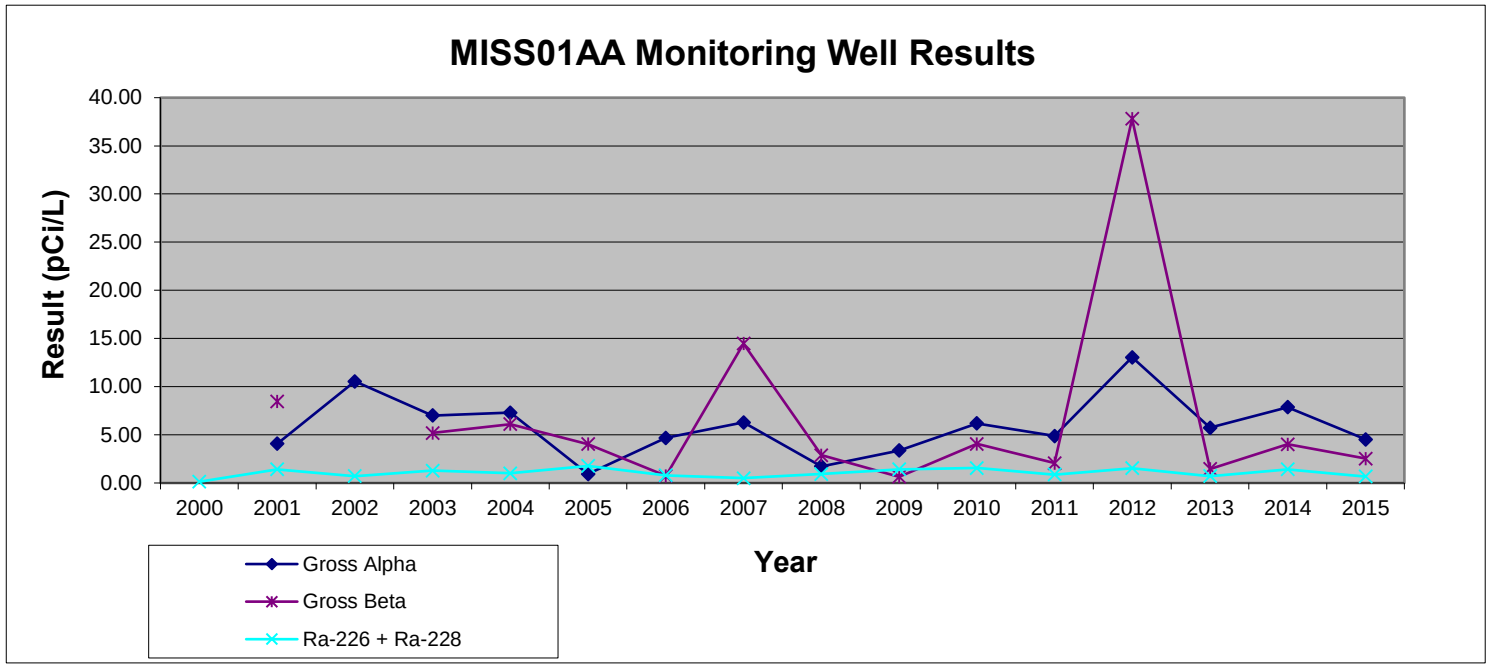
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	2.80	12.40	0.10		0.10
2001		8.37	0.29	4.68	4.97
2002	2.65	10.80	0.15		0.15
2003	2.00	6.70	0.14	0.64	0.78
2004			0.15		0.15
2005	1.16	5.50	0.09	0.00	0.09
2006	0.00	4.41	0.08	0.06	0.14
2007	2.15	7.24	0.51	0.86	1.37
2008	1.72	8.31	0.17	1.44	1.61
2009	5.25	12.56	0.47	0.99	1.46
2010	2.75	17.41	0.30	2.00	2.3
2011	1.05	19.27	0.50	1.07	1.57
2012	4.17	15.02	0.13	0.06	0.19
2013	8.36	29.10	0.66	1.29	1.95
2014	122.68	39.80	0.18	1.577	1.752
2015	4.57	25.31	0.33	0.90	1.23



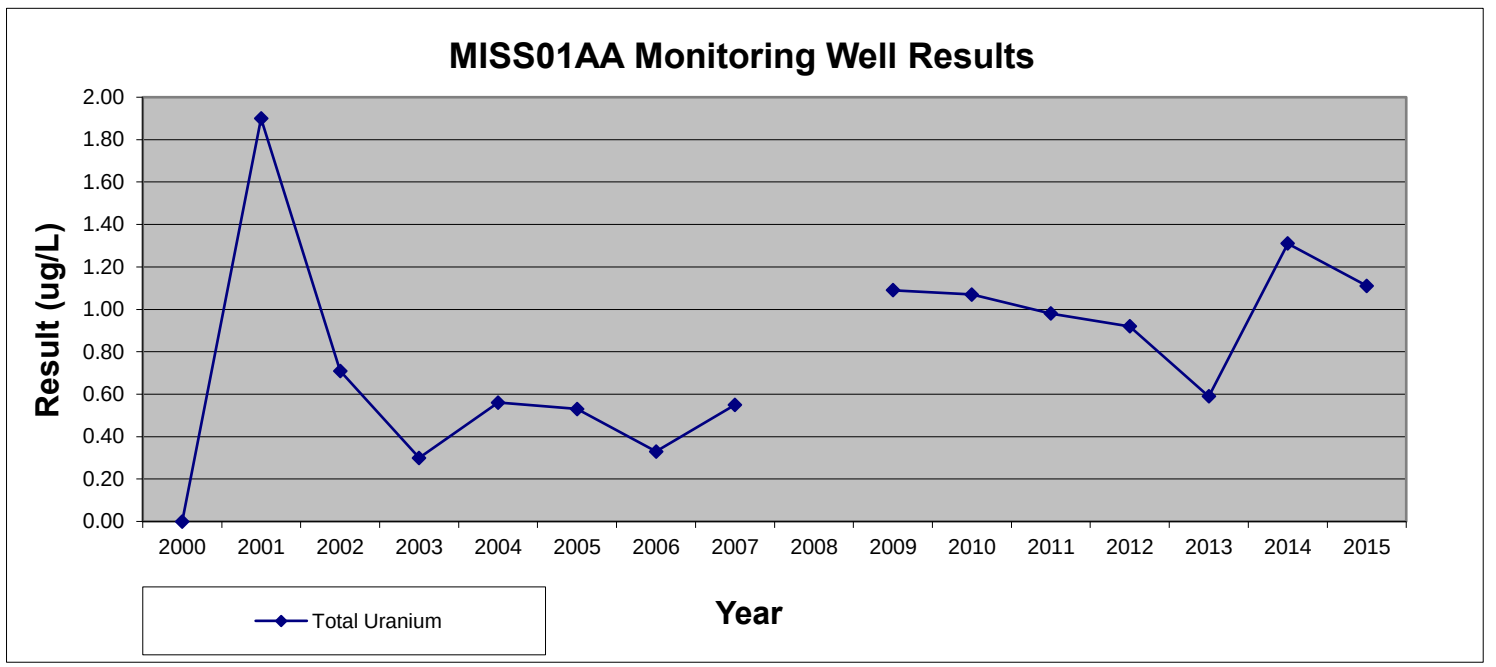
Year	Total Uranium
2000	0.06
2001	1.37
2002	0.15
2003	0.15
2004	0.04
2005	0.00
2006	0.00
2007	0.18
2008	0.17
2009	0.03
2010	0.09
2011	0.18
2012	0.00
2013	0.03
2014	0.10
2015	0.03

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-14
Historical Results For Radiological Parameters at B38W24S



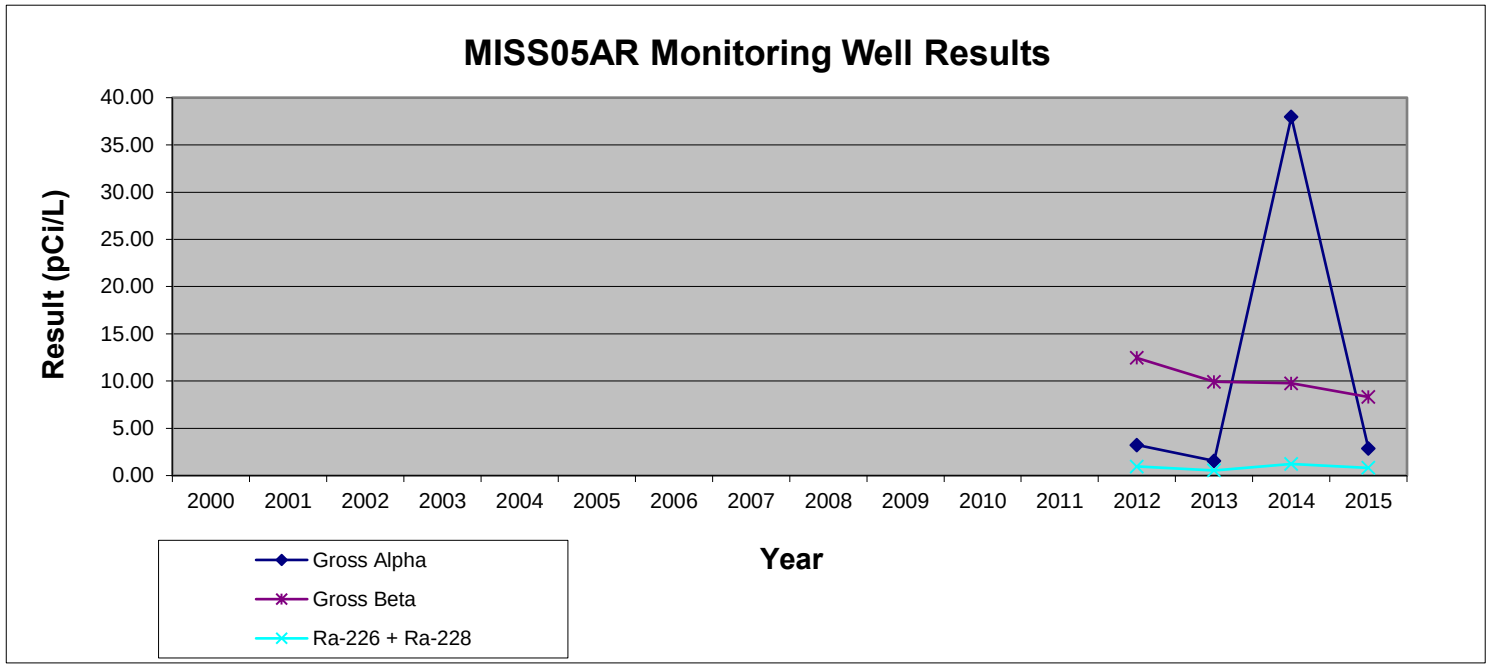
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000			0.13		0.13
2001	4.07	8.47	0.35	1.06	1.41
2002	10.55		0.16	0.55	0.71
2003	7.00	5.20	0.30	0.98	1.28
2004	7.30	6.10	0.23	0.77	1.00
2005	0.94	4.03	0.15	1.62	1.77
2006	4.69	0.74	0.06	0.73	0.79
2007	6.29	14.48	0.03	0.46	0.49
2008	1.73	2.89	0.00	0.94	0.94
2009	3.38	0.64	0.09	1.33	1.42
2010	6.19	4.06	0.23	1.33	1.56
2011	4.87	2.06	0.24	0.63	0.87
2012	13.05	37.81	0.12	1.42	1.54
2013	5.74	1.46	0.00	0.72	0.72
2014	7.87	4.03	0.07	1.35	1.42
2015	4.52	2.54	0.17	0.50	0.67



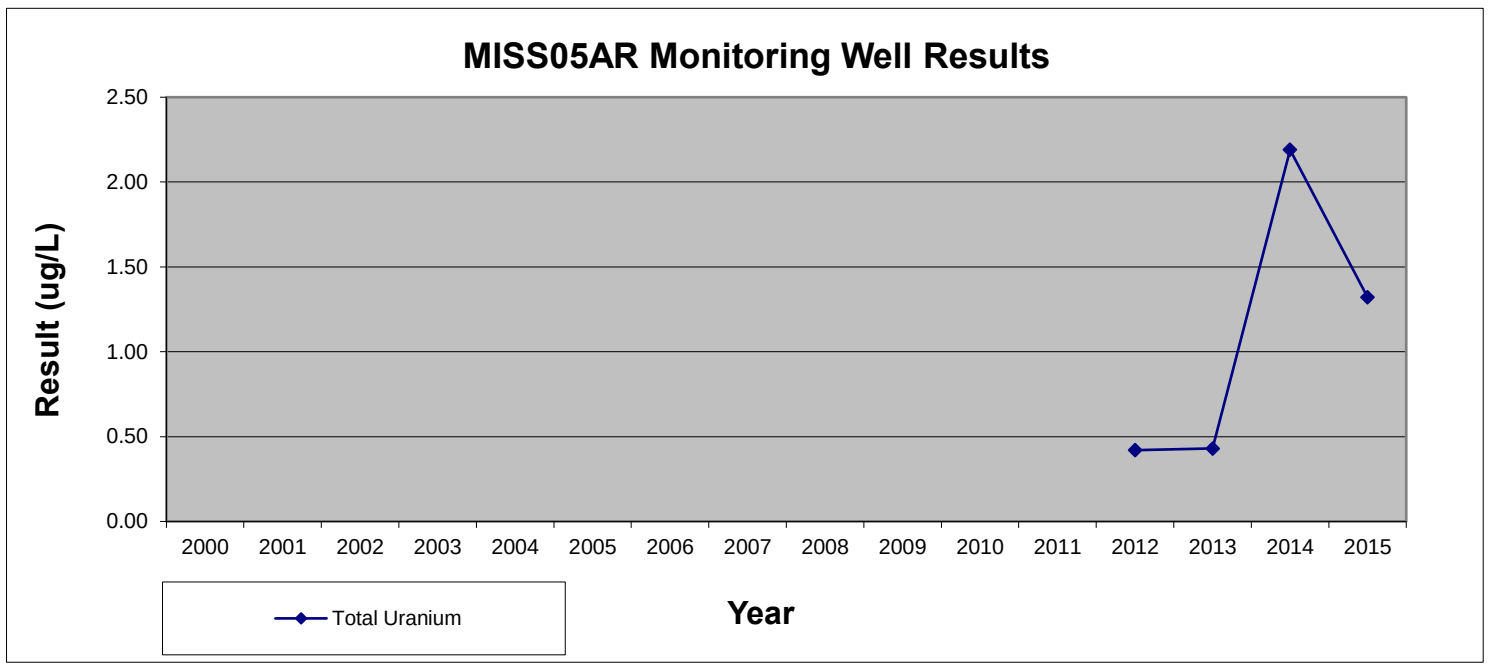
Year	Total Uranium
2000	0.00
2001	1.90
2002	0.71
2003	0.30
2004	0.56
2005	0.53
2006	0.33
2007	0.55
2008	
2009	1.09
2010	1.07
2011	0.98
2012	0.92
2013	0.59
2014	1.31
2015	1.111

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-15
Historical Results For Radiological Parameters at MISS01AA



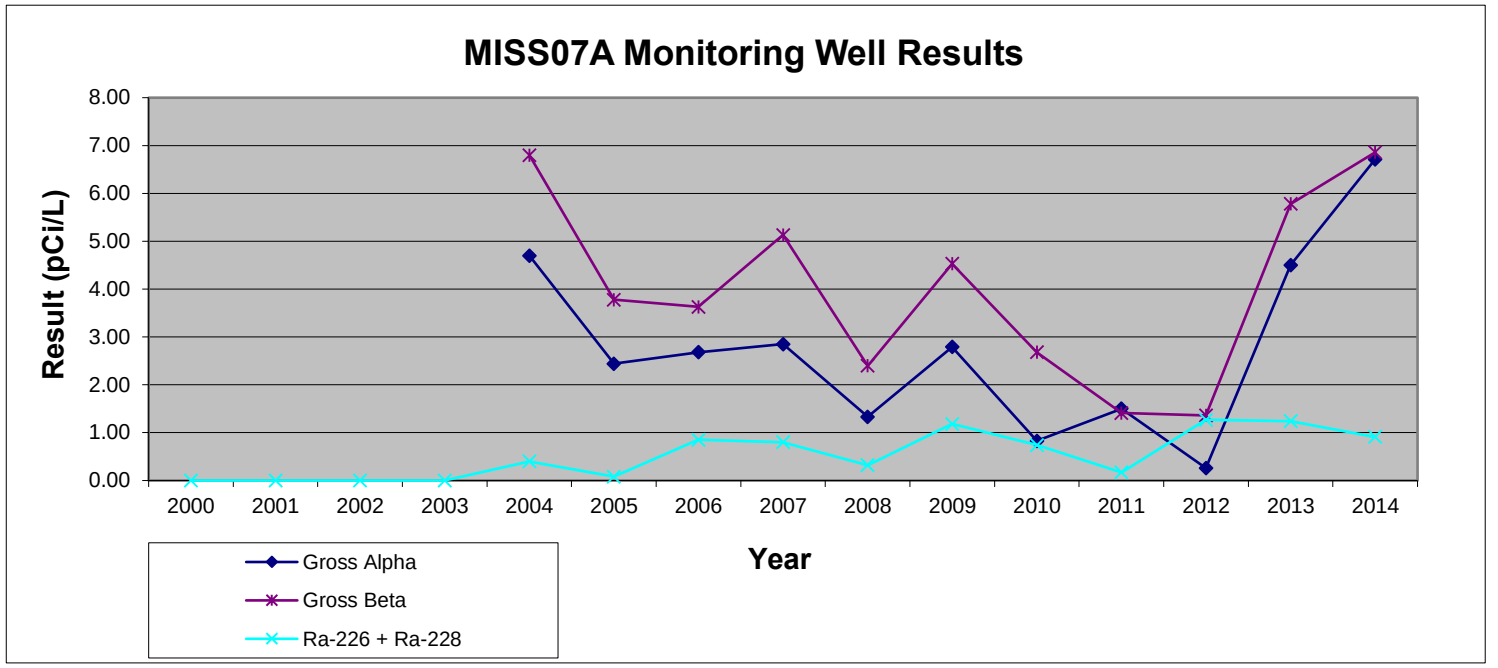
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012	3.23	12.45	0.00	0.96	0.96
2013	1.56	9.92	0.19	0.35	0.54
2014	37.96	9.78	0.11	1.12	1.23
2015	2.88	8.32	0.12	0.71	0.83



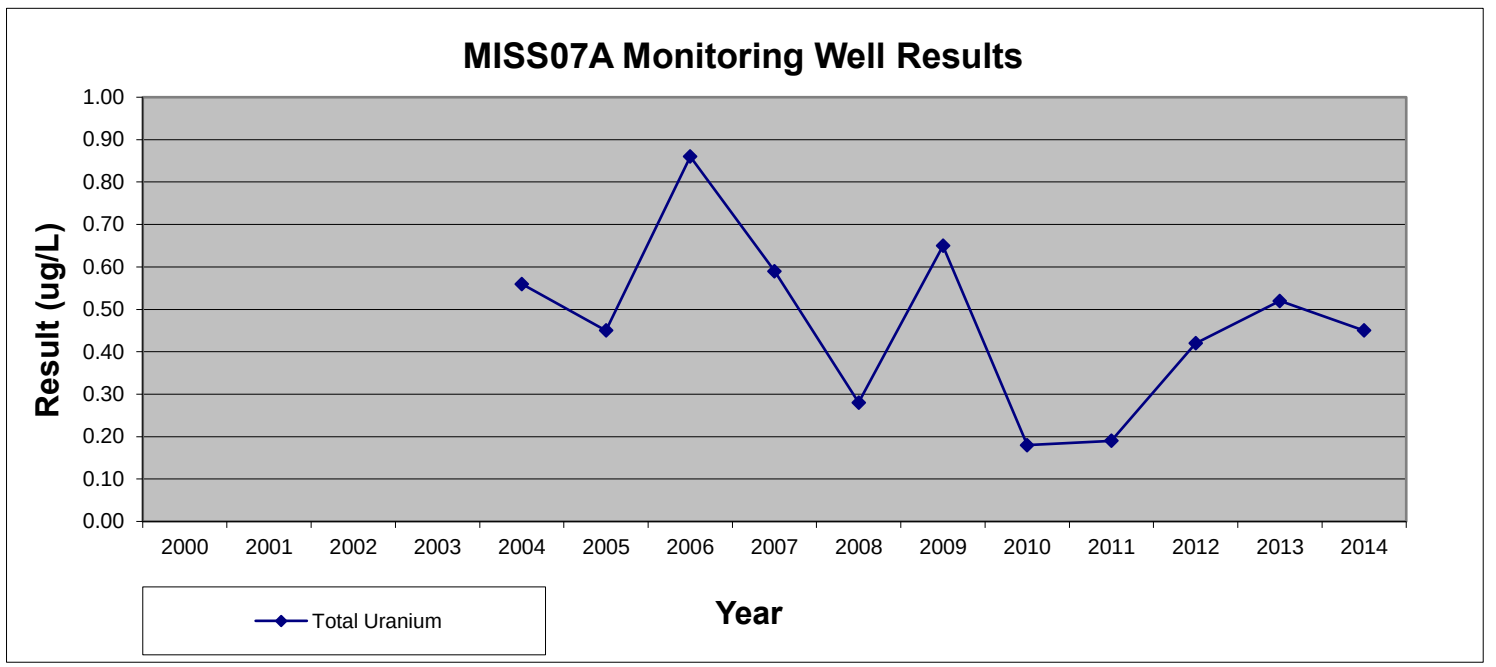
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	0.42
2013	0.43
2014	2.19
2015	1.322

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-16
Historical Results For Radiological Parameters at MISS05AR



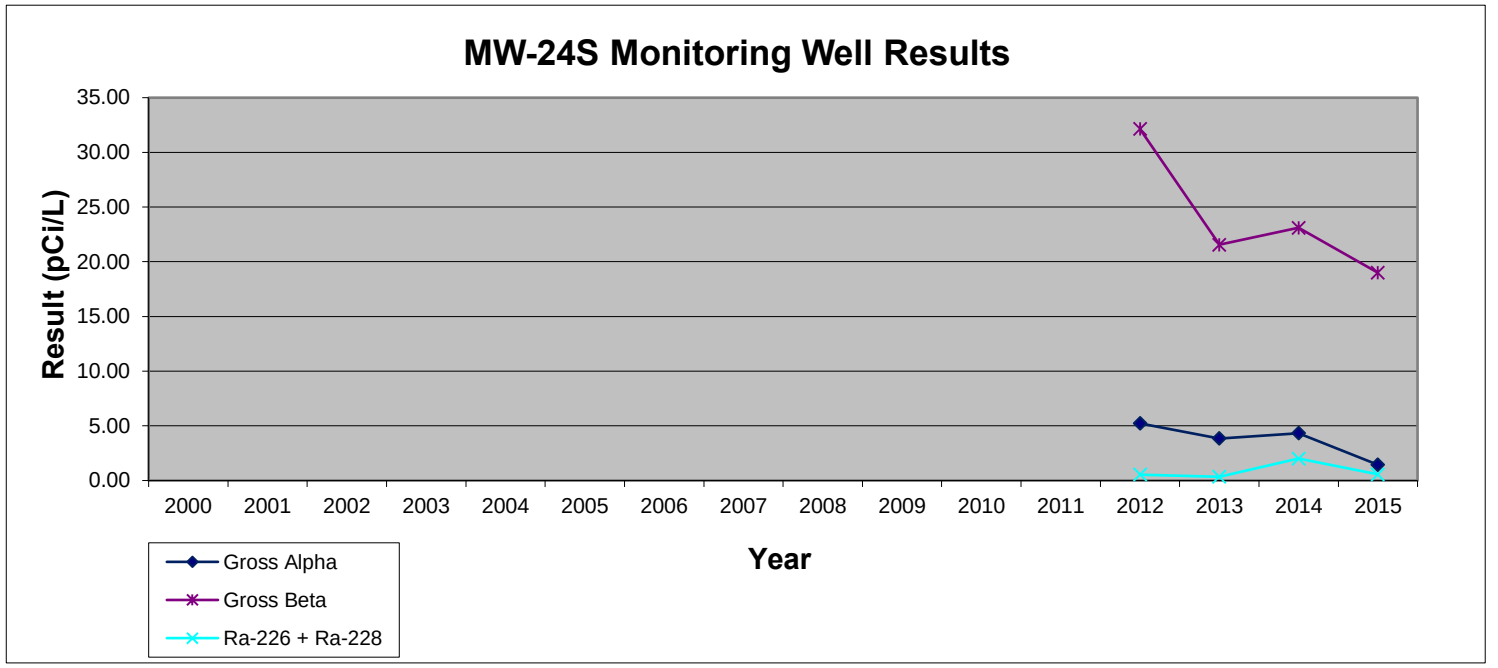
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					0.00
2001					0.00
2002					0.00
2003					0.00
2004	4.70	6.80	0.15	0.25	0.40
2005	2.44	3.78	0.08		0.08
2006	2.68	3.63	0.26	0.59	0.85
2007	2.85	5.13	0.35	0.45	0.80
2008	1.33	2.40	0.01	0.31	0.32
2009	2.79	4.53	0.05	1.13	1.18
2010	0.83	2.68	0.00	0.74	0.74
2011	1.50	1.41	0.16	0.01	0.17
2012	0.26	1.36	0.05	1.22	1.27
2013	4.50	5.78	0.27	0.97	1.24
2014	6.71	6.86	0.14	0.78	0.91
2015*					



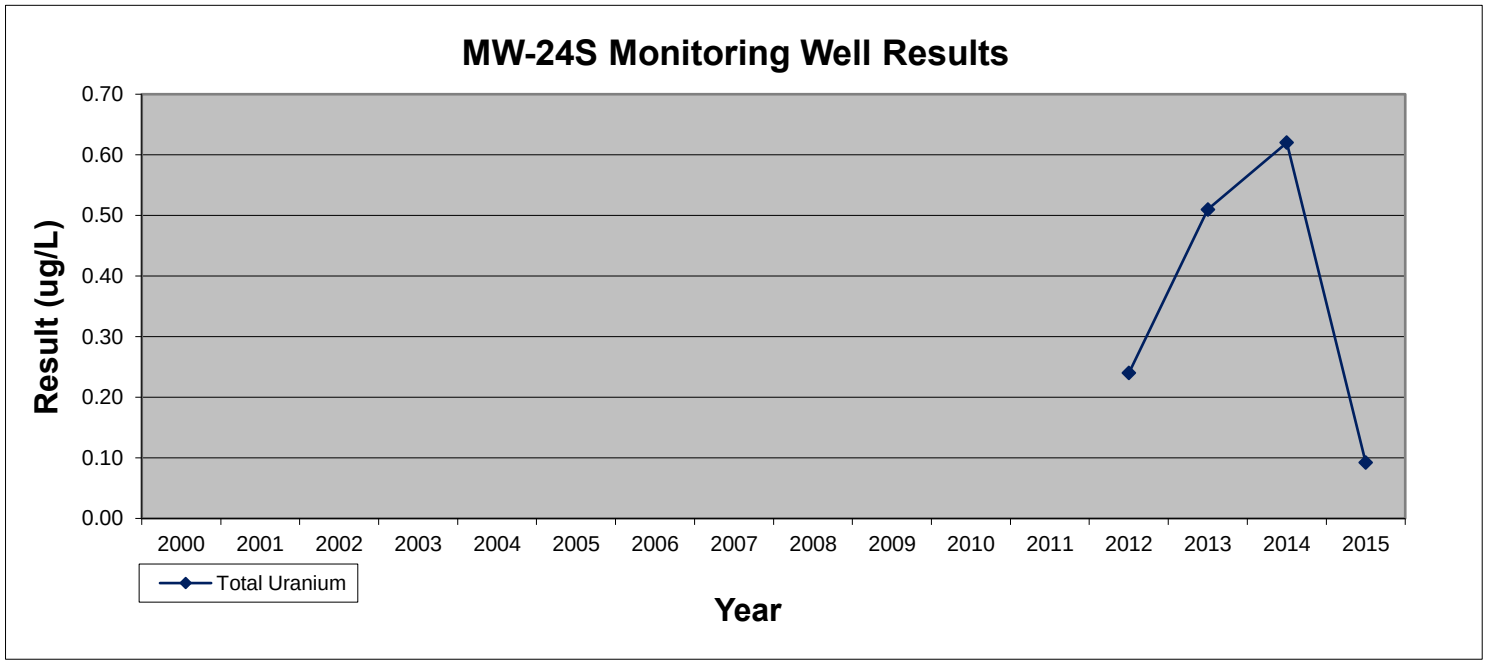
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	0.56
2005	0.45
2006	0.86
2007	0.59
2008	0.28
2009	0.65
2010	0.18
2011	0.19
2012	0.42
2013	0.52
2014	0.45
2015*	

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
* Monitoring Well MISS07A was dry - not sampled in 2015

Figure E-17
Historical Results For Radiological Parameters at MISS07A



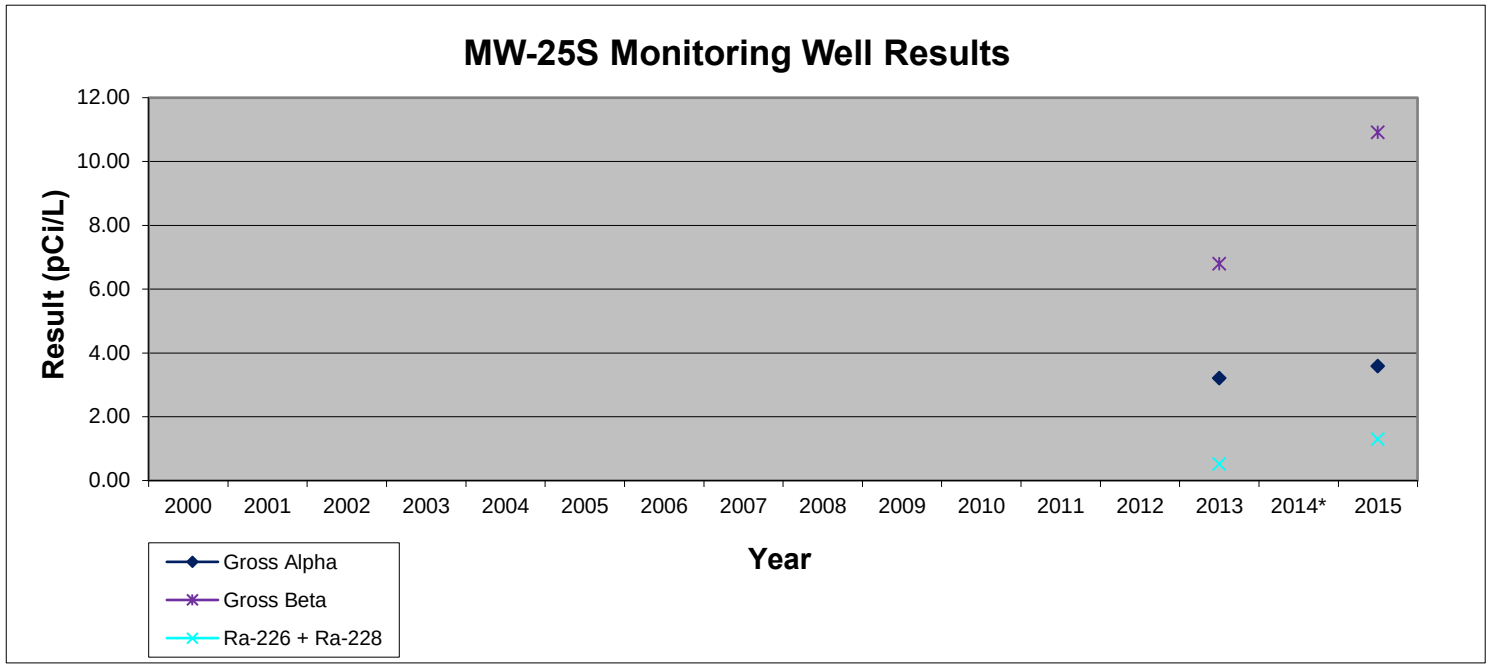
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012	5.22	32.13	0.23	0.31	0.54
2013	3.85	21.55	0.04	0.3	0.34
2014	4.33	23.10	0.30	1.71	2.01
2015	1.44	19.00	0.14	0.41	0.55



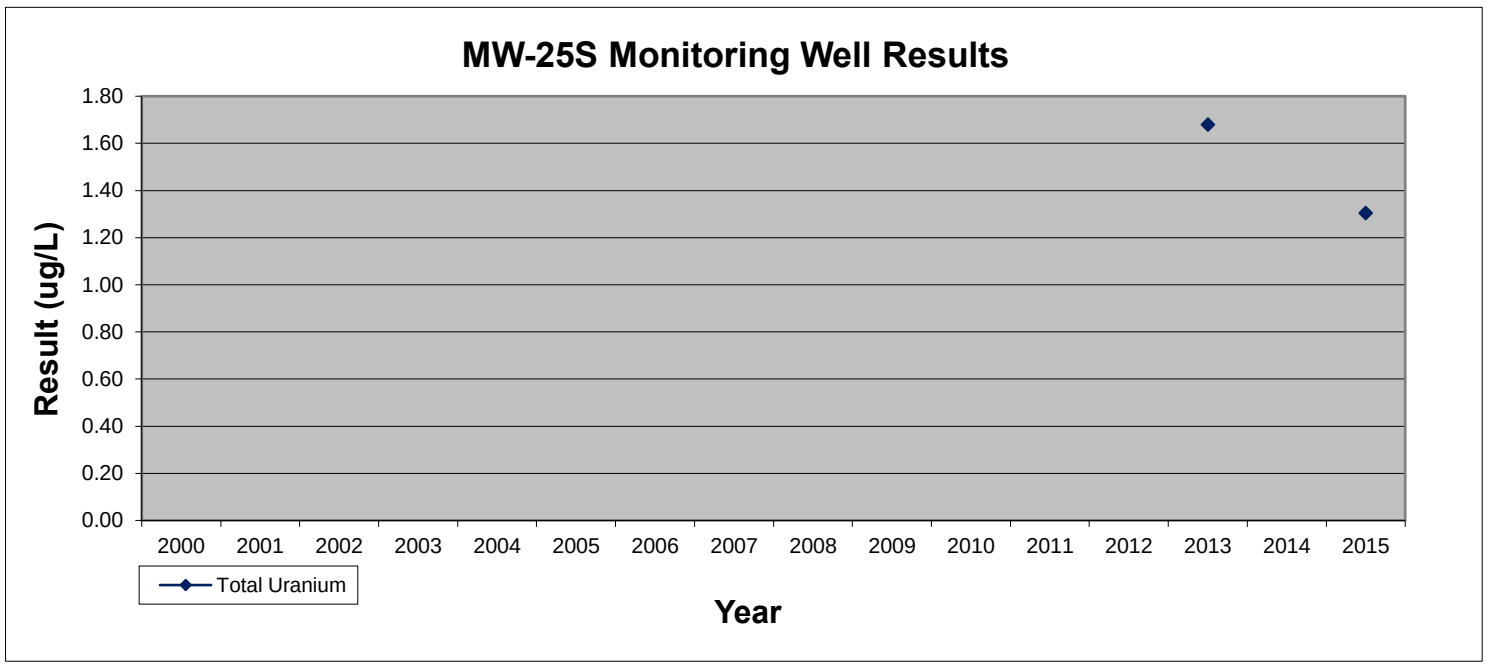
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	0.24
2013	0.51
2014	0.62
2015	0.092

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-18
Historical Results For Radiological Parameters at MW-24S



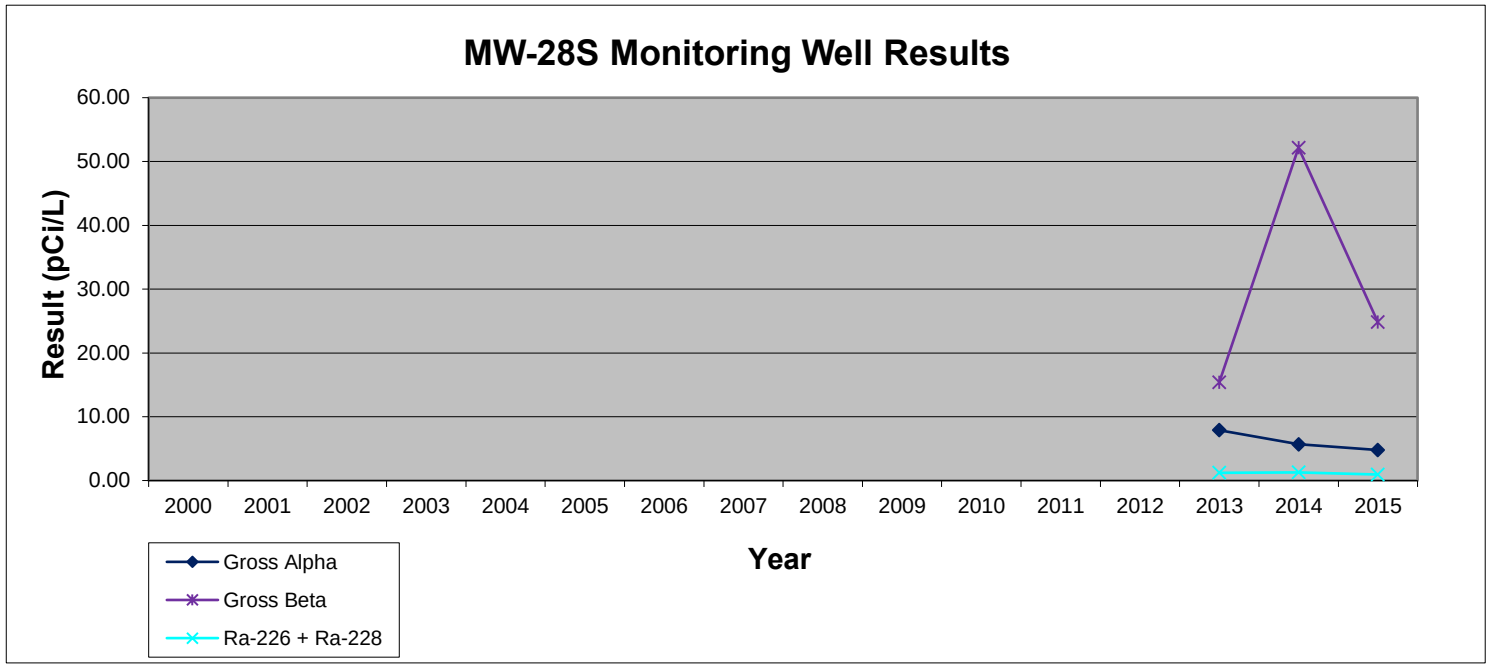
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013	3.21	6.80	0.11	0.41	0.52
2014*					
2015	3.59	10.91	0.32	0.98	1.30



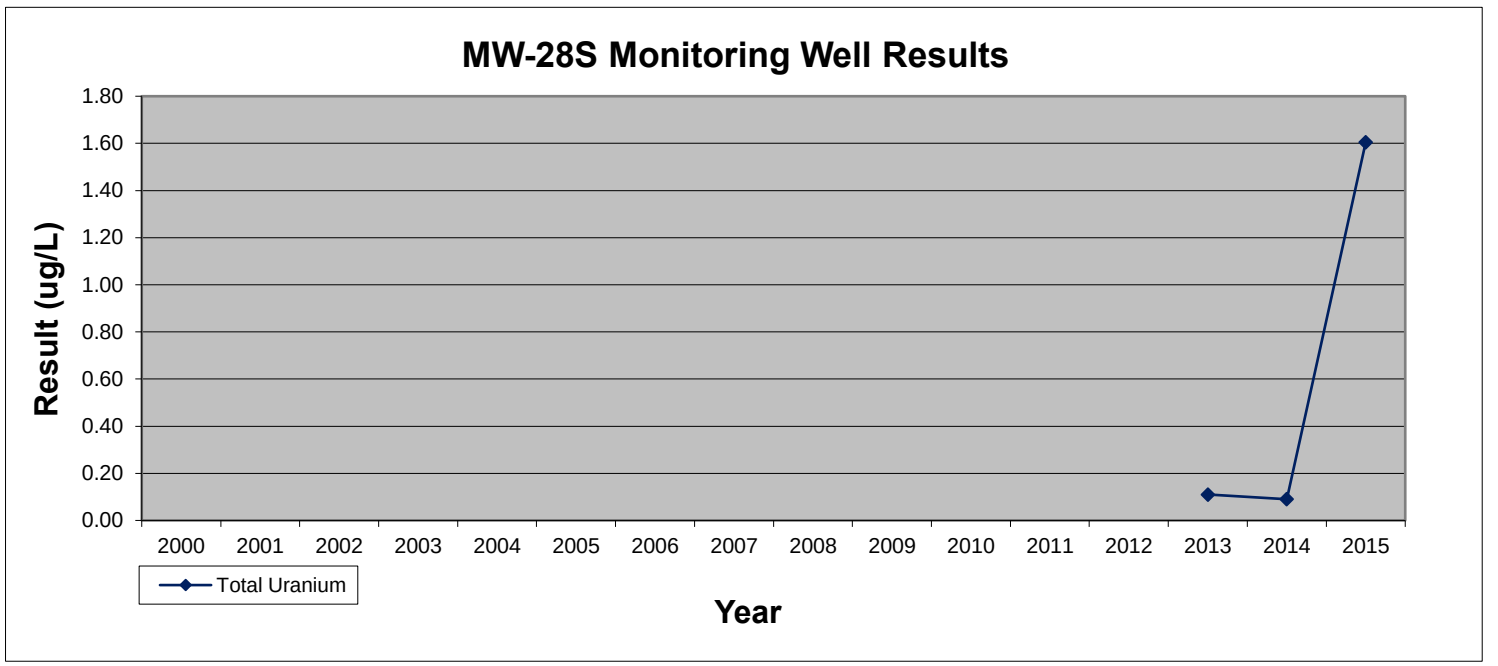
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	1.68
2014	
2015	1.305

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
* MW25S was inaccessible due to damage and not sampled in 2014

Figure E-19
Historical Results For Radiological Parameters at MW-25S



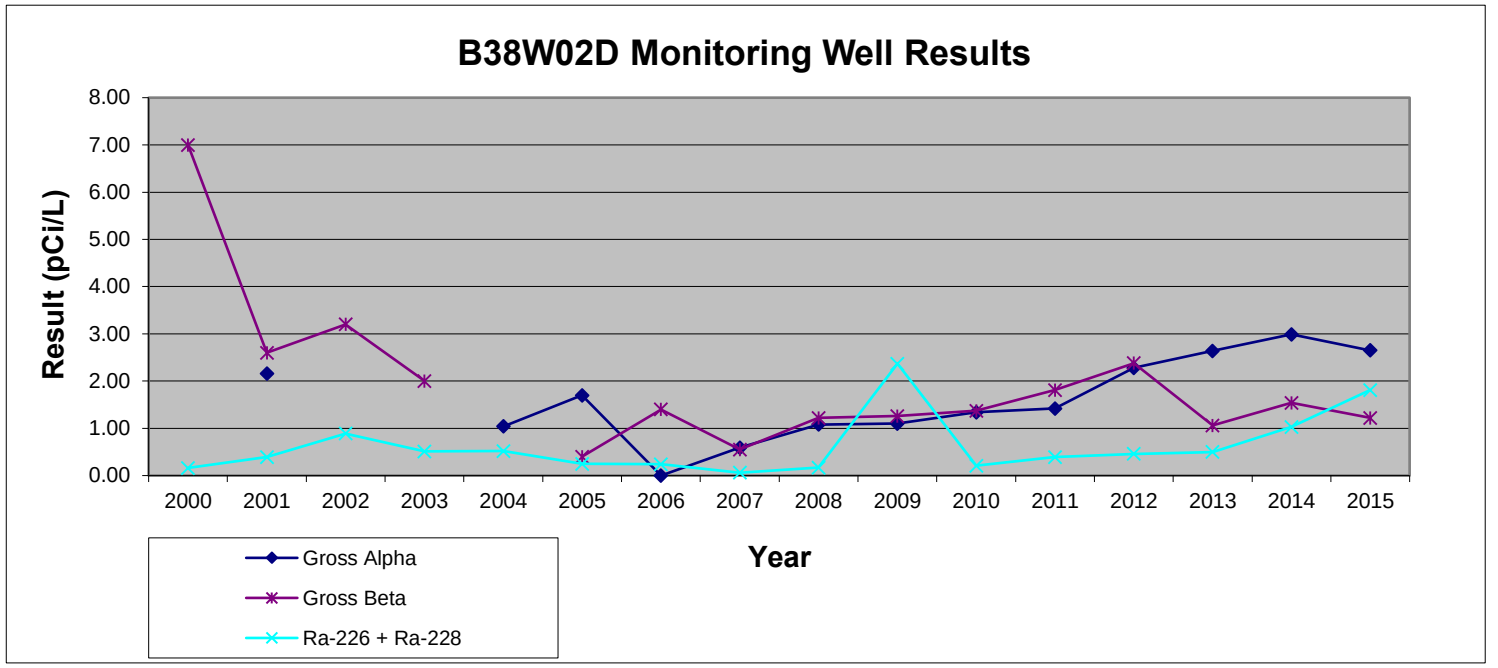
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013	7.88	15.39	0.32	0.91	1.23
2014	5.68	52.17	0.12	1.15	1.27
2015	4.78	24.83	0.20	0.74	0.94



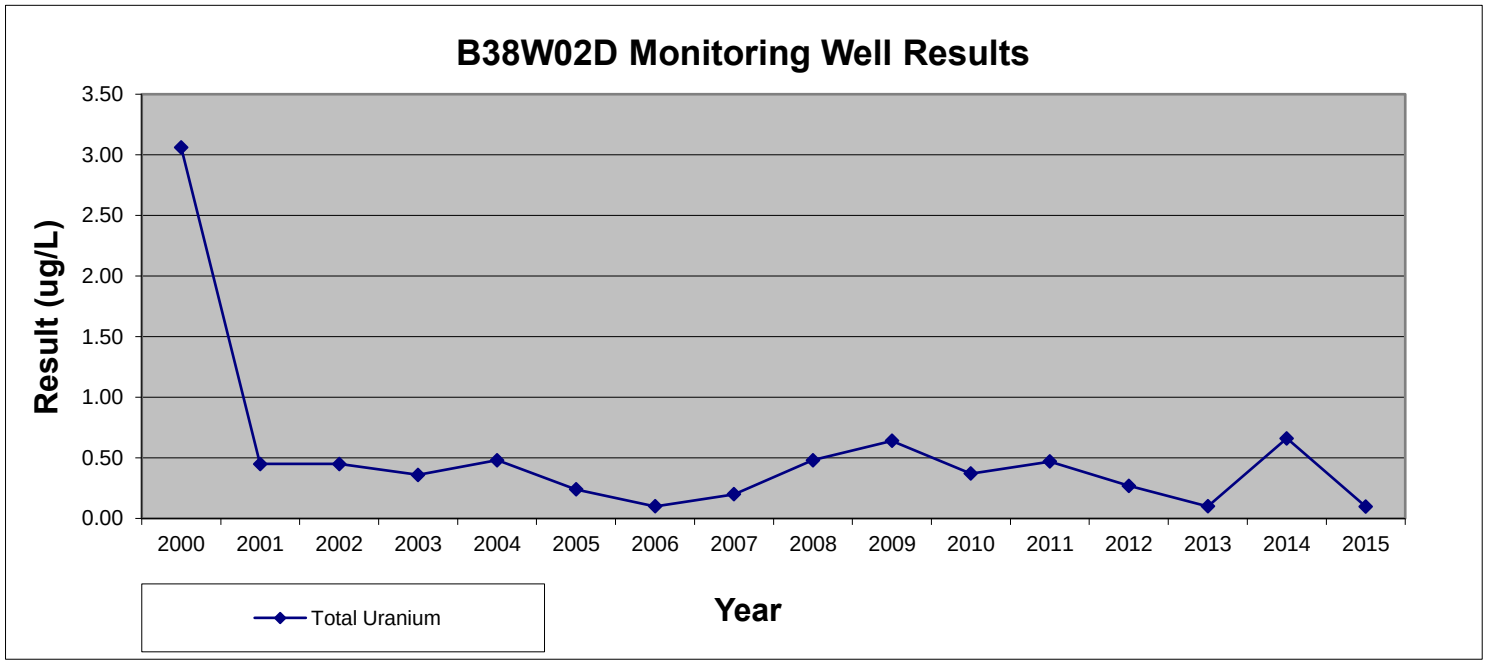
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	0.11
2014	0.09
2015	1.605

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-20
Historical Results For Radiological Parameters at MW-28S



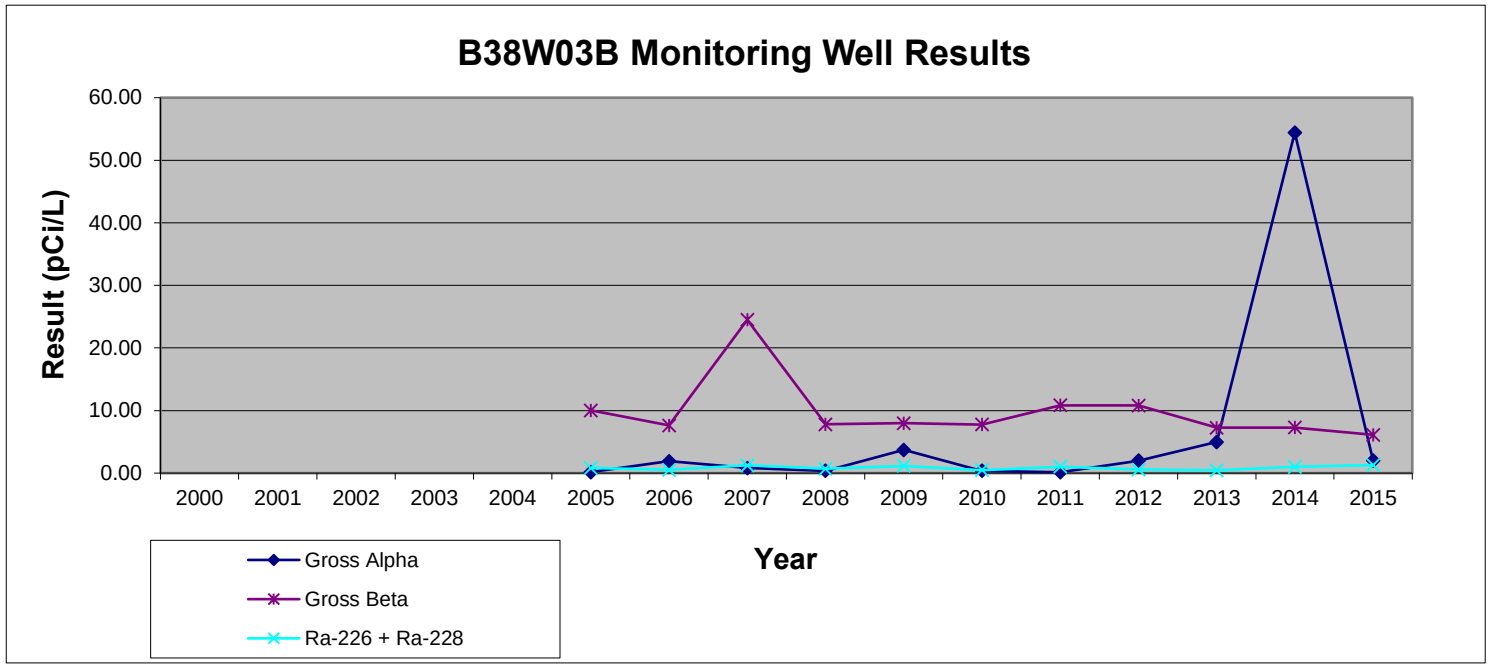
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000		7.00	0.16		0.16
2001	2.16	2.60	0.33	0.06	0.39
2002		3.20	0.26	0.63	0.89
2003		2.00	0.51		0.51
2004	1.04		0.20	0.32	0.52
2005	1.70	0.40	0.09	0.16	0.25
2006	0.00	1.40	0.15	0.09	0.24
2007	0.59	0.55	0.06	0.00	0.06
2008	1.08	1.22	0.06	0.11	0.17
2009	1.10	1.26	0.29	2.08	2.37
2010	1.34	1.37	0.07	0.14	0.21
2011	1.42	1.81	0.10	0.29	0.39
2012	2.28	2.38	0.18	0.28	0.46
2013	2.64	1.06	0.21	0.29	0.50
2014	2.99	1.54	0.18	0.85	1.03
2015	2.65	1.22	0.28	1.53	1.81



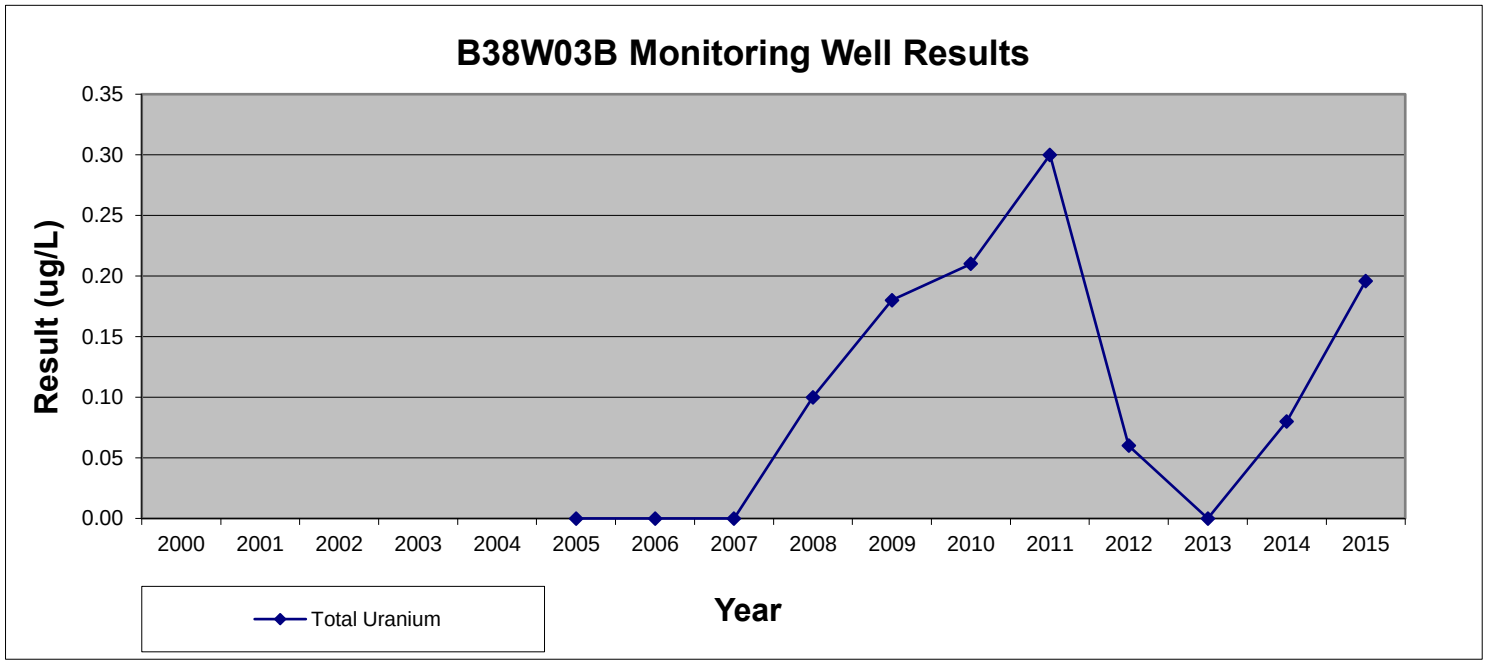
Year	Total Uranium
2000	3.06
2001	0.45
2002	0.45
2003	0.36
2004	0.48
2005	0.24
2006	0.10
2007	0.20
2008	0.48
2009	0.64
2010	0.37
2011	0.47
2012	0.27
2013	0.10
2014	0.66
2015	0.098

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-21
Historical Results For Radiological Parameters at B38W02D



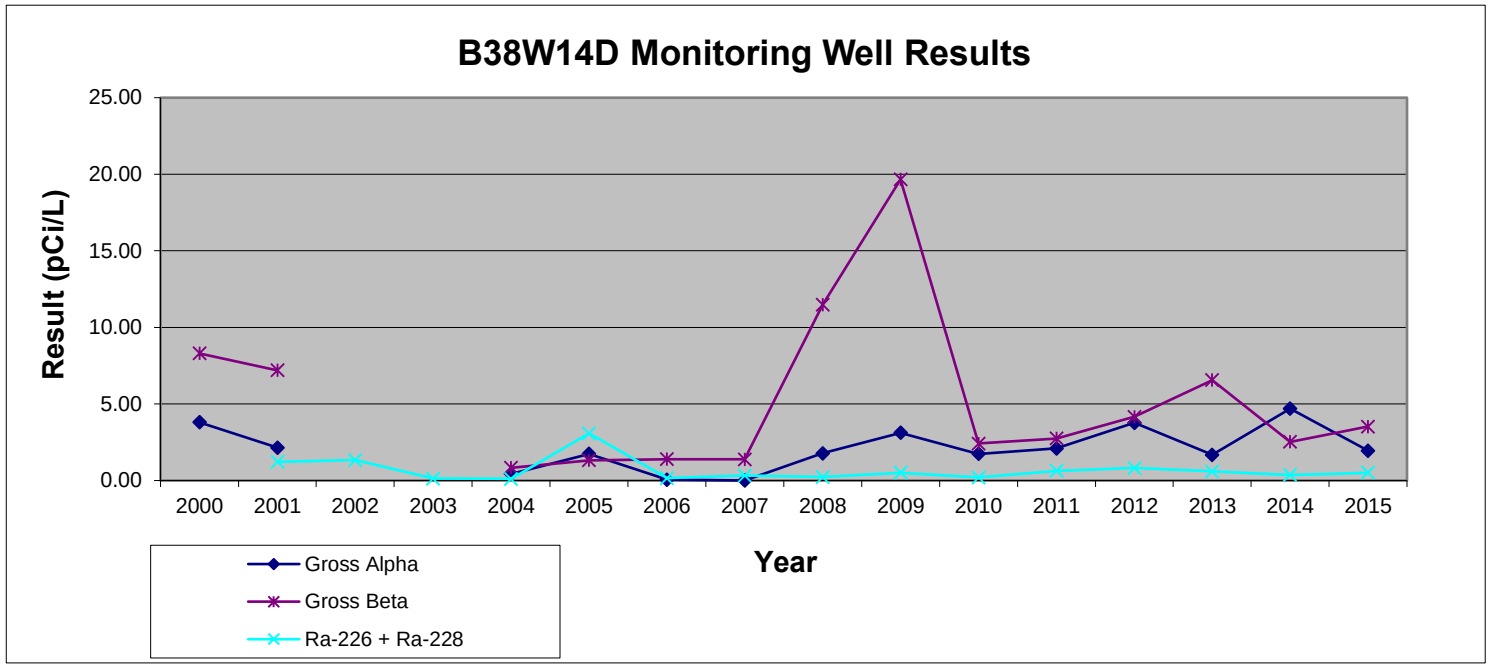
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005	0.15	10.02	0.04	0.77	0.81
2006	1.90	7.61	0.16	0.35	0.51
2007	0.80	24.49	0.14	1.09	1.23
2008	0.36	7.81	0.25	0.43	0.68
2009	3.70	7.96	0.18	0.97	1.15
2010	0.36	7.76	0.23	0.26	0.49
2011	0.14	10.84	0.17	0.86	1.03
2012	1.99	10.81	0.07	0.52	0.59
2013	4.96	7.24	0.00	0.44	0.44
2014	54.42	7.28	0.08	0.92	1.00
2015	2.00	6.12	-0.05	1.33	1.28



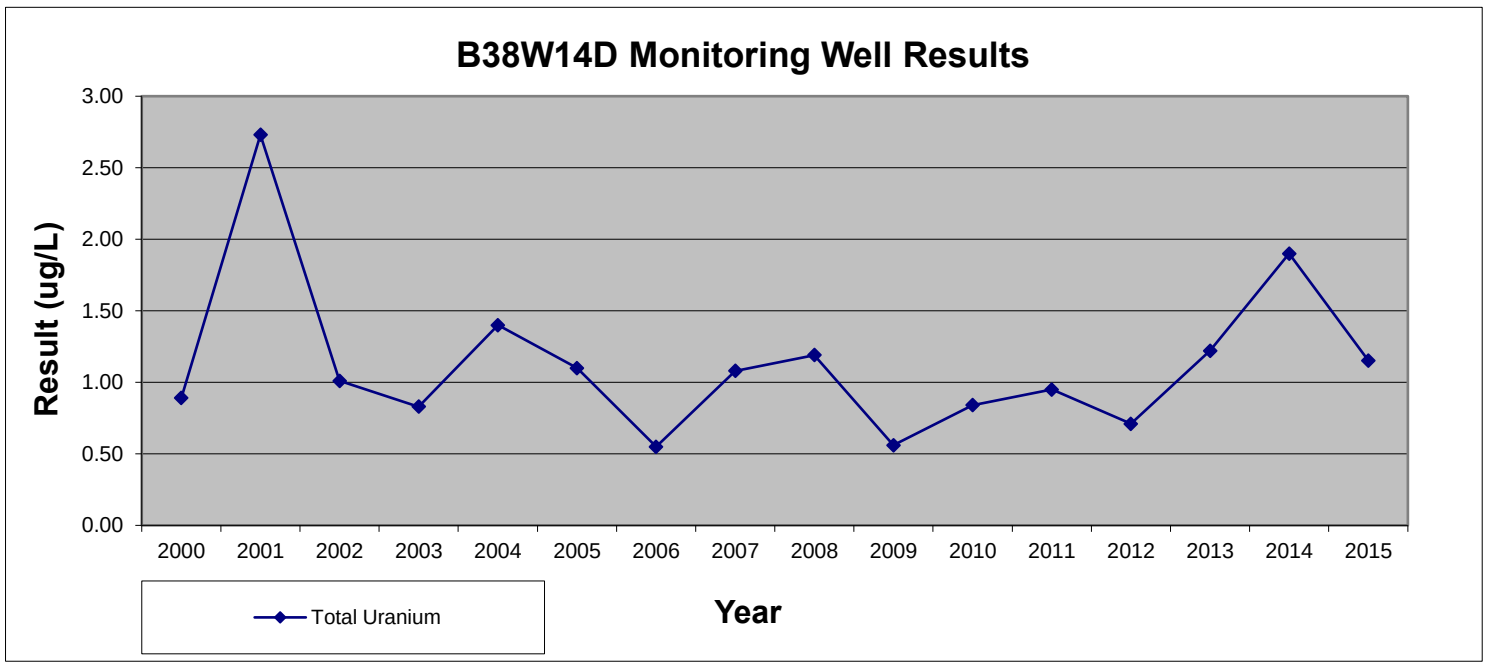
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	0.00
2006	0.00
2007	0.00
2008	0.10
2009	0.18
2010	0.21
2011	0.3
2012	0.06
2013	0.00
2014	0.08
2015	0.196

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-22
Historical Results For Radiological Parameters at B38W03B



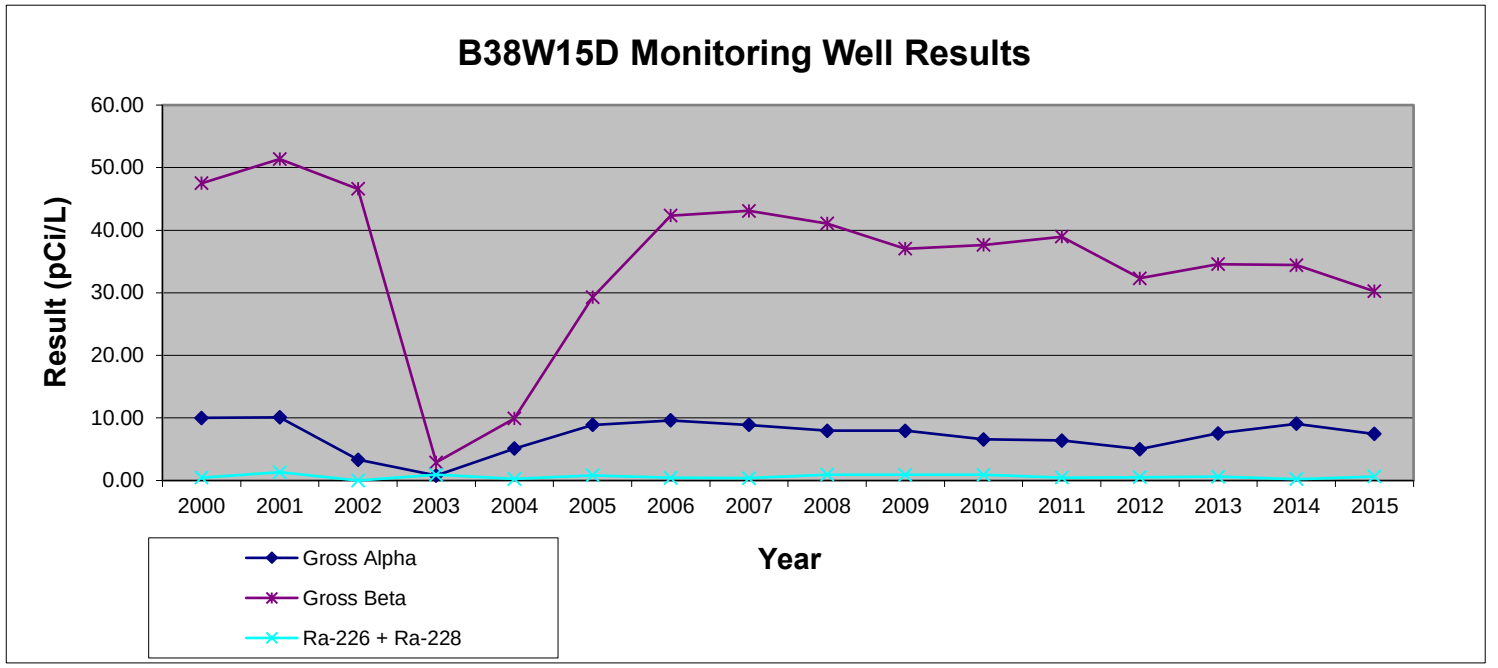
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	3.80	8.30			
2001	2.14	7.20	0.42	0.80	1.22
2002			1.34		1.34
2003			0.13		0.13
2004	0.44	0.83	0.11		0.11
2005	1.74	1.32	0.03	3.05	3.08
2006	0.06	1.39	0.08	0.07	0.15
2007	0.00	1.38	0.18	0.15	0.33
2008	1.78	11.48	0.09	0.14	0.23
2009	3.12	19.66	0.09	0.42	0.51
2010	1.74	2.41	0.20	0	0.20
2011	2.10	2.75	0.08	0.55	0.63
2012	3.77	4.16	0.13	0.69	0.82
2013	1.68	6.56	0.08	0.51	0.59
2014	4.69	2.53	0.07	0.29	0.36
2015	1.95	3.52	0.00	0.51	0.51



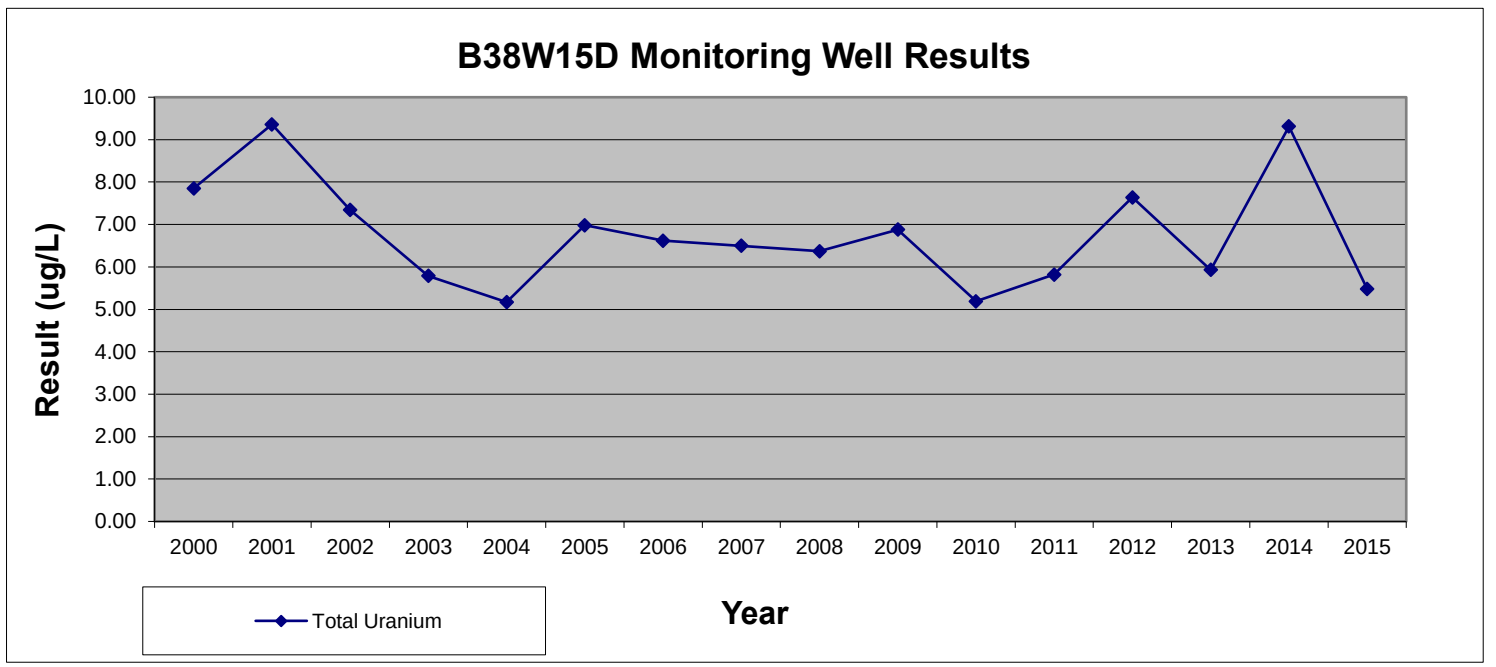
Year	Total Uranium
2000	0.89
2001	2.73
2002	1.01
2003	0.83
2004	1.40
2005	1.10
2006	0.55
2007	1.08
2008	1.19
2009	0.56
2010	0.84
2011	0.95
2012	0.71
2013	1.22
2014	1.90
2015	1.15

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-23
Historical Results For Radiological Parameters at B38W14D



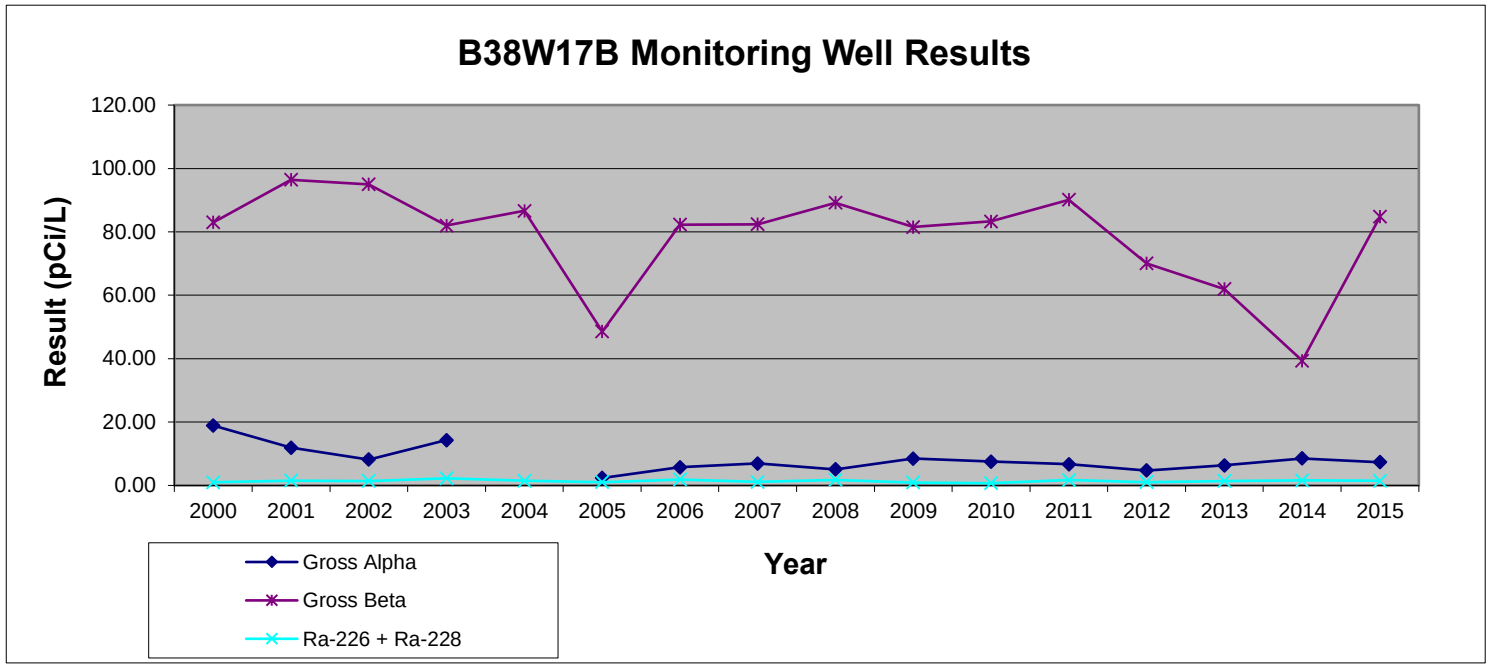
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	10.00	47.50	0.30	0.15	0.45
2001	10.09	51.37	0.17	1.16	1.33
2002	3.31	46.60			0.00
2003	0.80	2.90	0.18	0.73	0.91
2004	5.10	9.90	0.26		0.26
2005	8.89	29.29	0.15	0.68	0.83
2006	9.60	42.34	0.02	0.40	0.42
2007	8.89	43.09	0.09	0.27	0.36
2008	7.96	41.08	0.12	0.82	0.94
2009	7.95	37.05	0.00	0.90	0.90
2010	6.58	37.66	0.14	0.76	0.90
2011	6.40	38.97	0.15	0.30	0.45
2012	4.99	32.31	0.12	0.40	0.52
2013	7.53	34.58	0.00	0.60	0.60
2014	9.08	34.42	0.00	0.23	0.23
2015	7.43	30.24	0.05	0.59	0.64



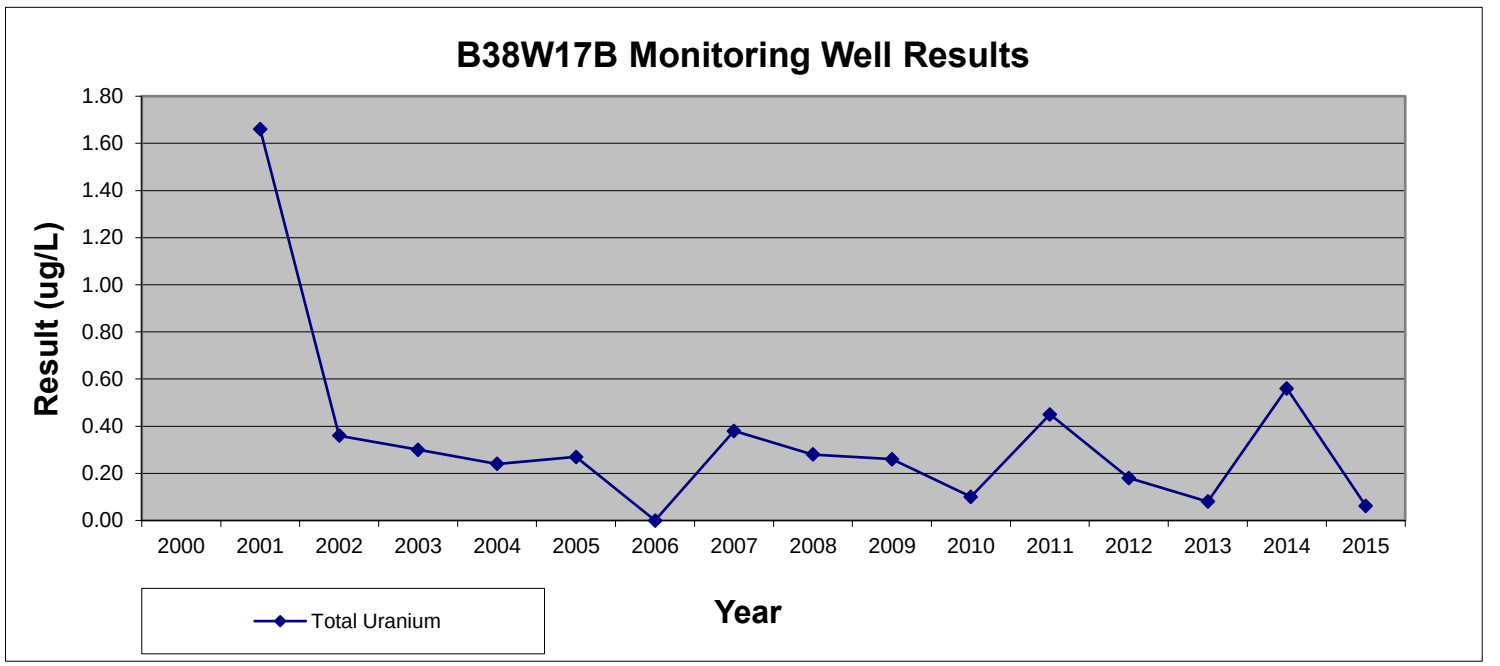
Year	Total Uranium
2000	7.85
2001	9.36
2002	7.34
2003	5.79
2004	5.17
2005	6.98
2006	6.62
2007	6.50
2008	6.37
2009	6.88
2010	5.19
2011	5.82
2012	7.64
2013	5.93
2014	9.31
2015	5.48

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-24
Historical Results For Radiological Parameters at B38W15D



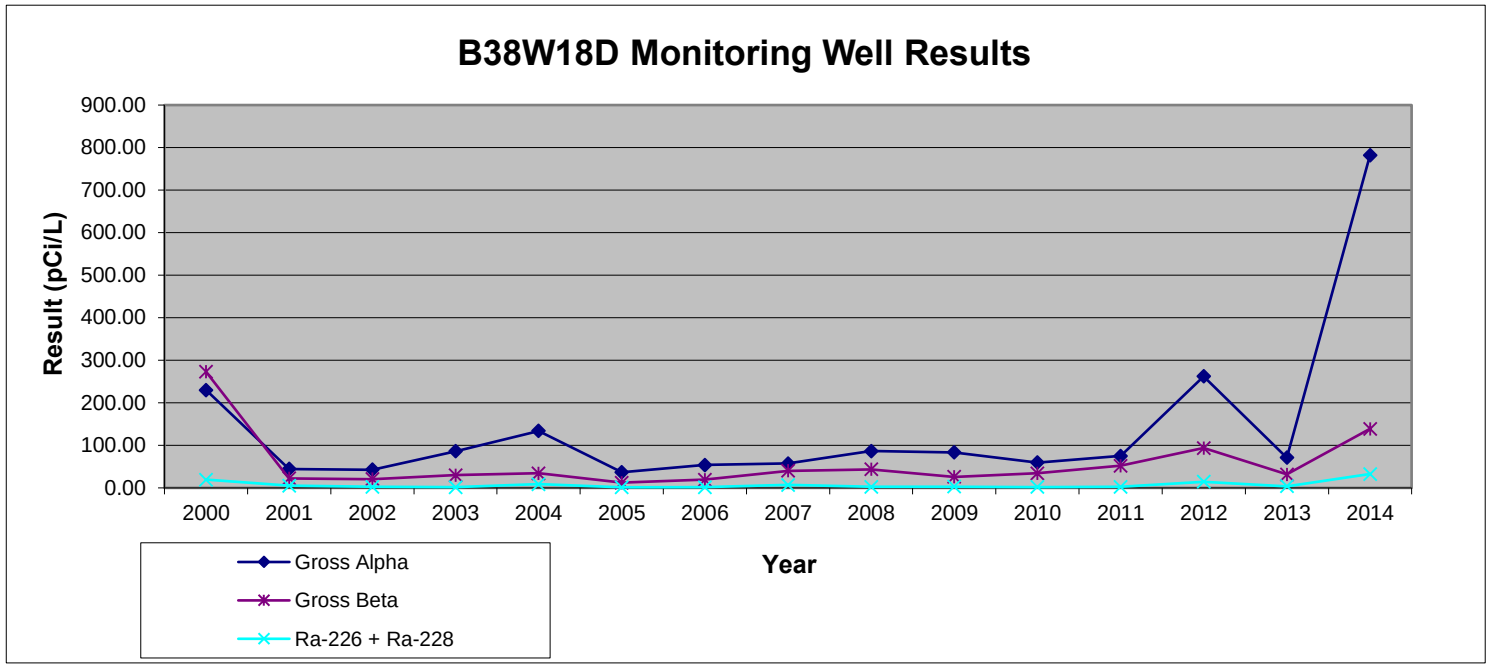
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	18.90	83.00		0.97	0.97
2001	11.90	96.42	0.62	0.89	1.51
2002	8.15	95.00	0.36	1.03	1.39
2003	14.30	82.00	0.45	1.79	2.24
2004		86.60	0.27	1.17	1.44
2005	2.35	48.54	0.46	0.59	1.05
2006	5.74	82.31	0.64	1.26	1.90
2007	6.92	82.41	0.35	0.73	1.08
2008	5.10	89.16	0.35	1.39	1.74
2009	8.49	81.51	0.28	0.63	0.91
2010	7.50	83.32	0.19	0.51	0.70
2011	6.67	90.12	0.18	1.49	1.67
2012	4.71	70.03	0.28	0.79	1.07
2013	6.35	61.99	0.45	0.95	1.40
2014	8.54	39.36	0.21	1.38	1.59
2015	7.33	84.79	0.12	1.33	1.45



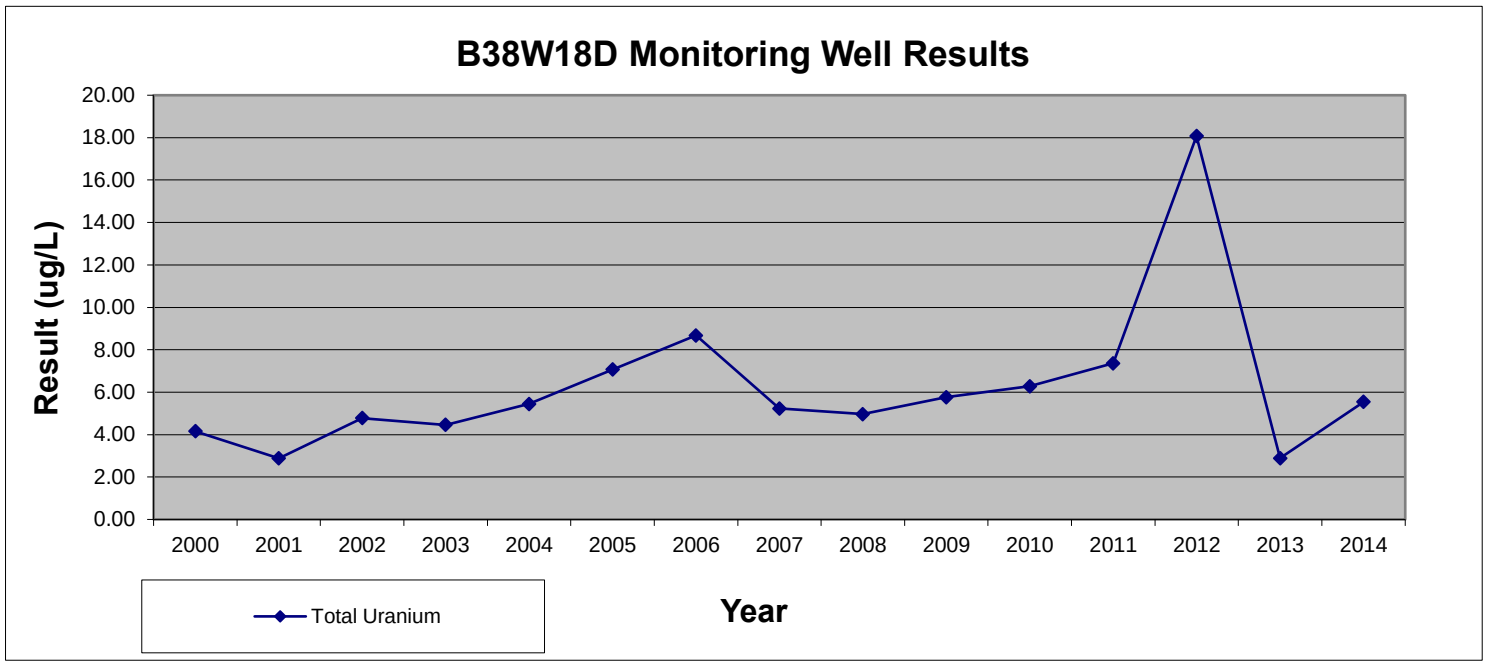
Year	Total Uranium
2000	
2001	1.66
2002	0.36
2003	0.30
2004	0.24
2005	0.27
2006	0.00
2007	0.38
2008	0.28
2009	0.26
2010	0.10
2011	0.45
2012	0.18
2013	0.08
2014	0.56
2015	0.062

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-25
Historical Results For Radiological Parameters at B38W17B



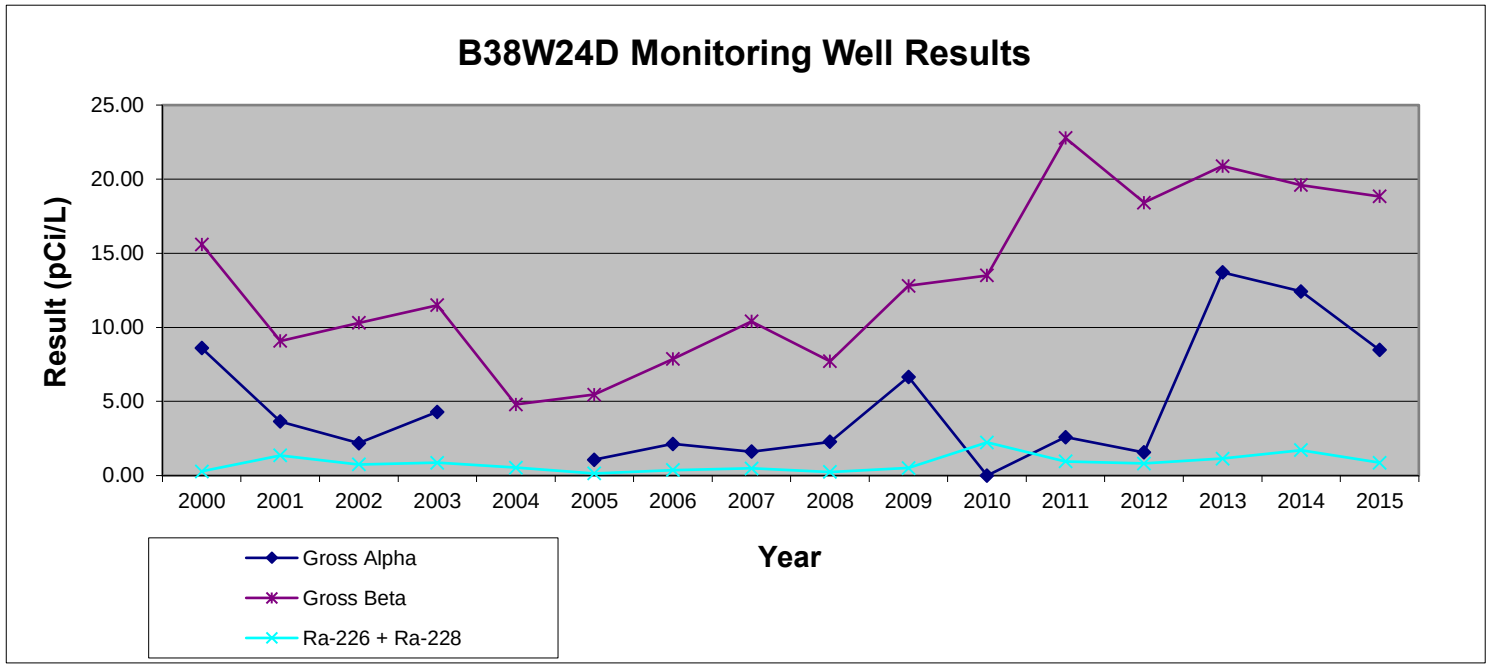
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	230.00	273.00	2.87	16.53	19.40
2001	44.65	22.35	0.48	4.46	4.94
2002	42.98	20.70	0.86	1.83	2.69
2003	86.00	30.00	0.61	0.81	1.42
2004	134.00	34.60	3.35	5.25	8.60
2005	36.79	12.43	0.28	1.11	1.39
2006	54.08	19.24	0.19	1.61	1.80
2007	57.16	40.07	0.25	6.59	6.84
2008	86.55	43.59	0.17	2.53	2.70
2009	83.63	26.14	0.47	2.52	2.99
2010	59.52	34.32	0.44	1.53	1.97
2011	74.89	52.15	0.60	1.73	2.33
2012	262.22	93.61	2.29	12.36	14.65
2013	71.09	31.51	0.47	3.35	3.82
2014	782.44	138.64	2.81	29.89	32.70
2015*					



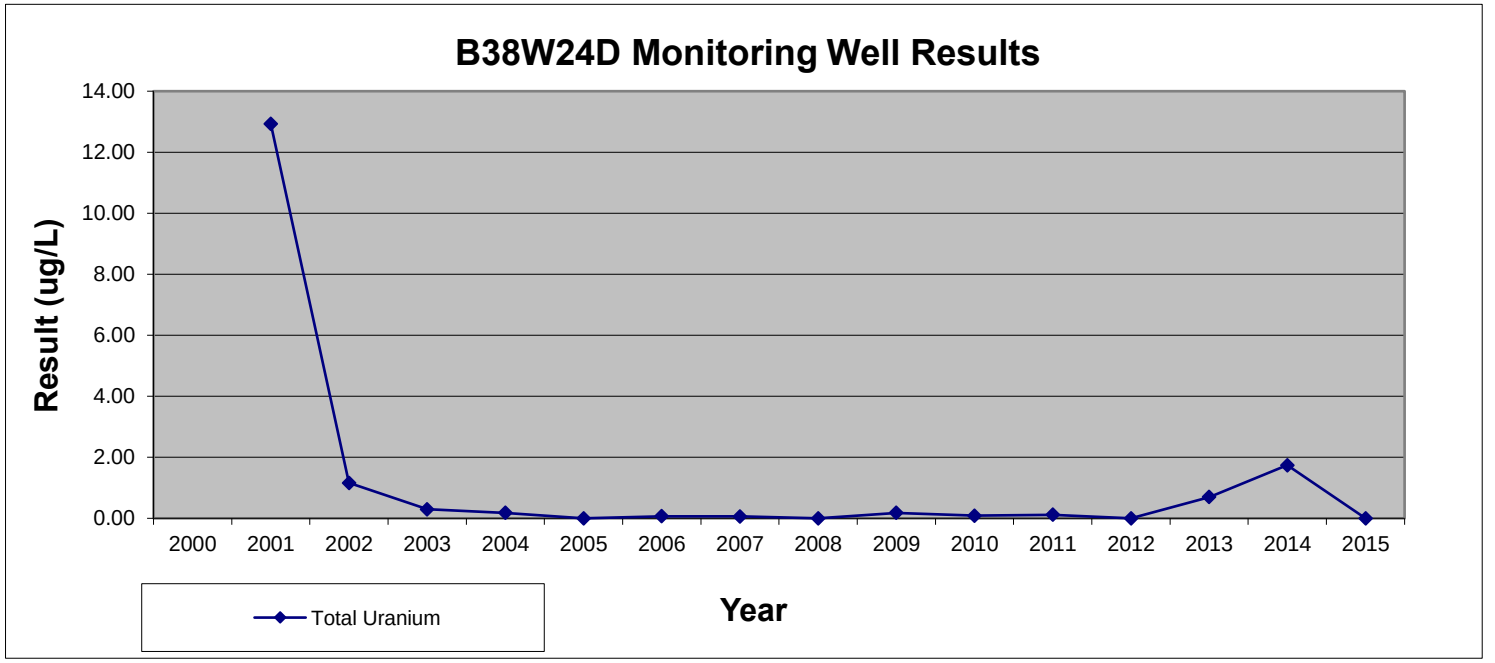
Year	Total Uranium
2000	4.16
2001	2.88
2002	4.78
2003	4.46
2004	5.44
2005	7.07
2006	8.67
2007	5.23
2008	4.97
2009	5.76
2010	6.28
2011	7.36
2012	18.07
2013	2.89
2014	5.54
2015*	

NOTES:
a) For years where duplicate samples were collected, the highest result was used.
* B38W18D was not accessible due to damage, was not sampled in 2015

Figure E-26
Historical Results For Radiological Parameters at B38W18D



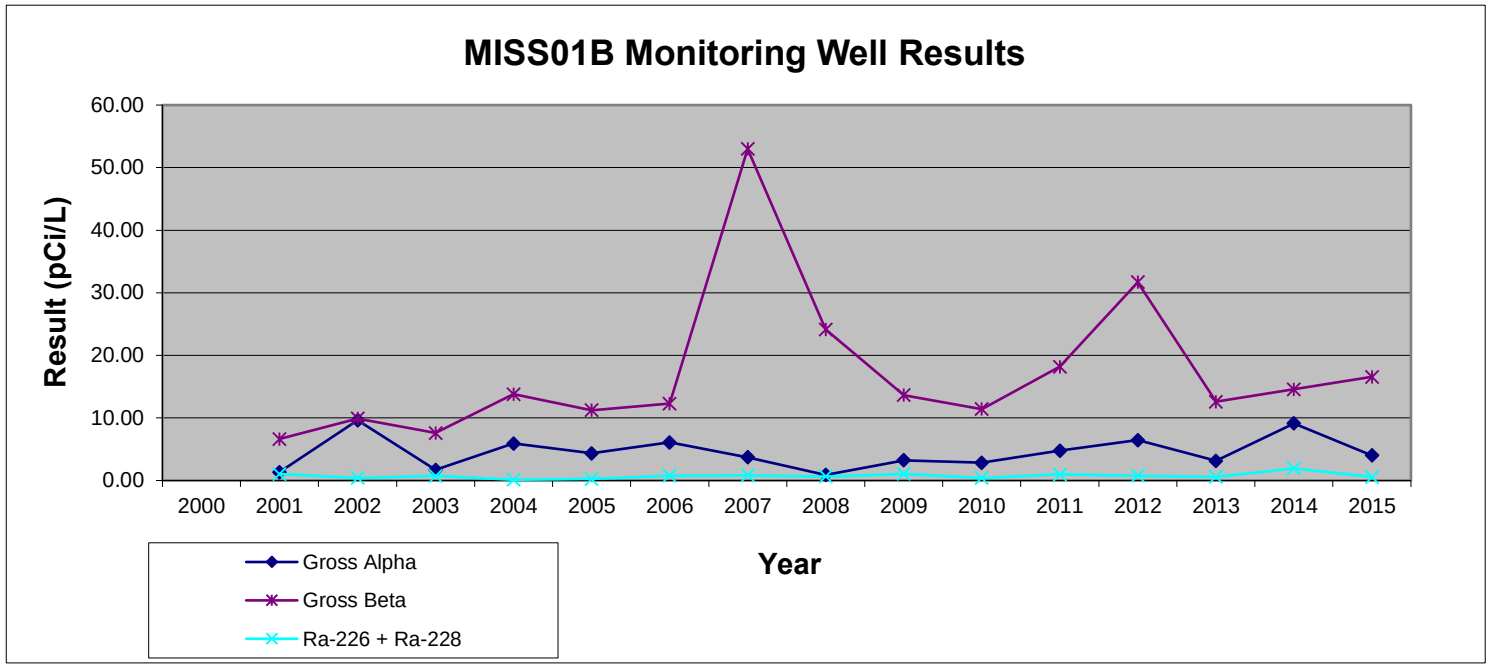
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	8.60	15.60	0.28		0.28
2001	3.65	9.08	0.14	1.22	1.36
2002	2.19	10.30		0.75	0.75
2003	4.30	11.50	0.36	0.51	0.87
2004		4.80	0.14	0.39	0.53
2005	1.07	5.46	0.09	0.05	0.14
2006	2.13	7.86	0.13	0.24	0.37
2007	1.61	10.40	0.16	0.32	0.48
2008	2.27	7.71	0.23	0.01	0.24
2009	6.66	12.80	0.07	0.44	0.51
2010	0.00	13.50	0.17	2.07	2.24
2011	2.59	22.78	0.35	0.6	0.95
2012	1.57	18.42	0.16	0.65	0.81
2013	13.71	20.89	0.35	0.8	1.15
2014	12.42	19.60	0.23	1.48	1.71
2015	8.47	18.84	0.31	0.55	0.86



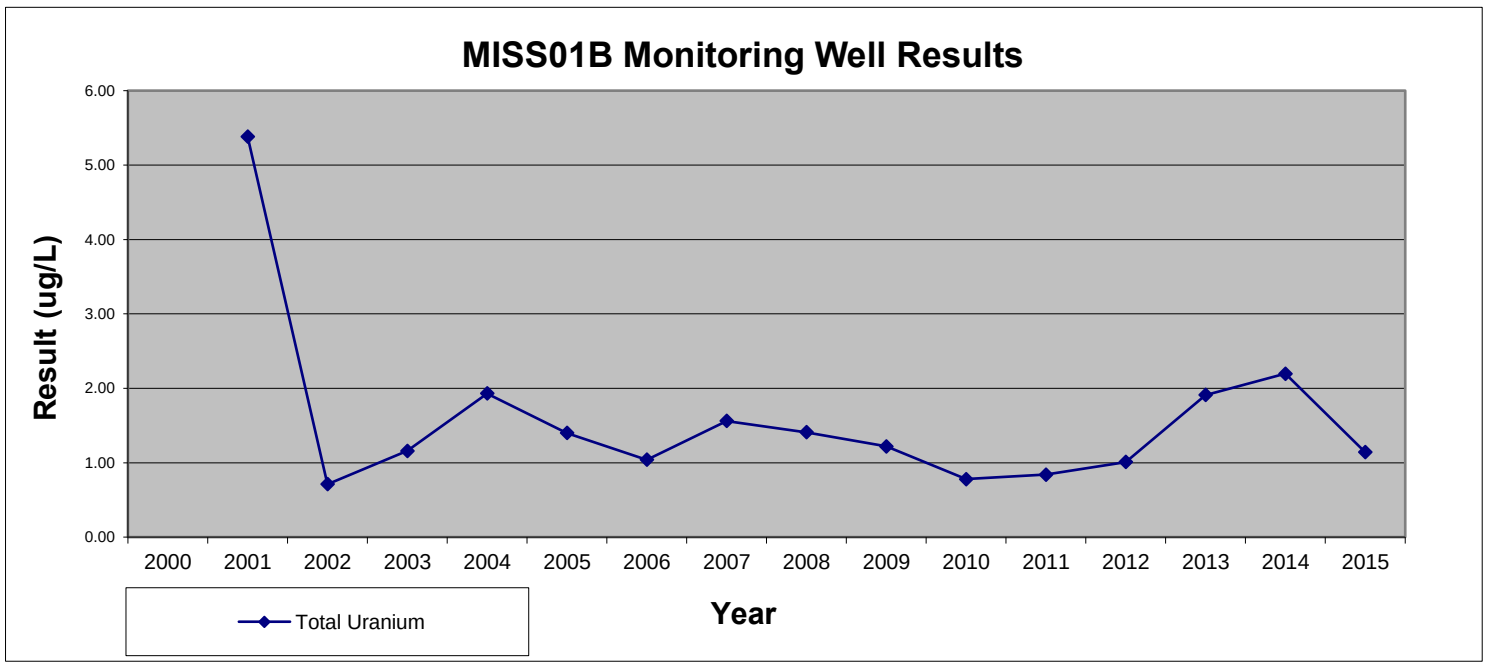
Year	Total Uranium
2000	
2001	12.93
2002	1.16
2003	0.30
2004	0.18
2005	0.00
2006	0.07
2007	0.06
2008	0.00
2009	0.18
2010	0.09
2011	0.12
2012	0.00
2013	0.70
2014	1.74
2015	0.00

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-27
Historical Results For Radiological Parameters at B38W24D



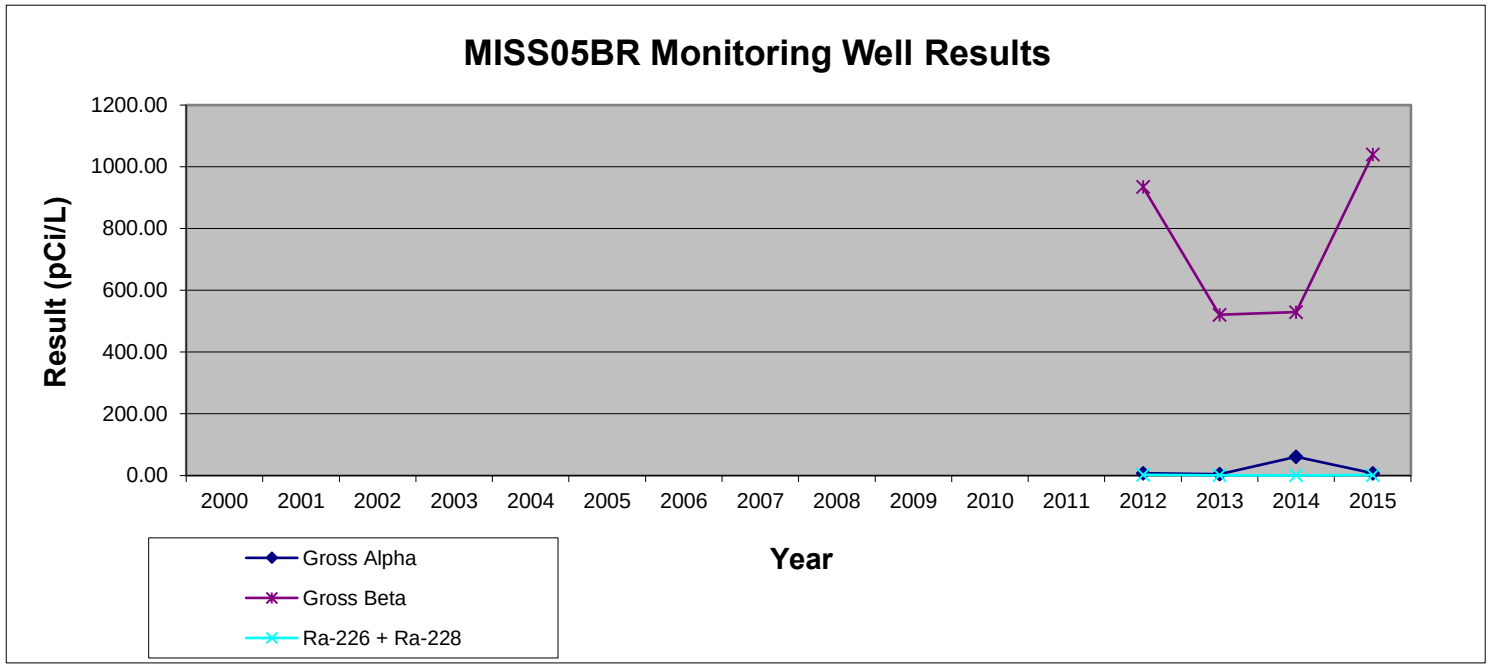
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001	1.34	6.64		1.02	1.02
2002	9.63	9.90		0.40	0.40
2003	1.70	7.60	0.22	0.52	0.74
2004	5.90	13.80	0.12		0.12
2005	4.34	11.22	0.01	0.23	0.24
2006	6.09	12.30	0.01	0.75	0.76
2007	3.70	52.99	0.20	0.63	0.83
2008	0.89	24.14		0.65	0.65
2009	3.24	13.63	0.12	0.95	1.07
2010	2.84	11.40	0.36	0.04	0.40
2011	4.75	18.17	0.30	0.67	0.97
2012	6.46	31.68	0.04	0.72	0.76
2013	3.13	12.60	0.04	0.53	0.57
2014	9.14	14.58	0.21	1.73	1.94
2015	4.01	16.55	0.00	0.54	0.54



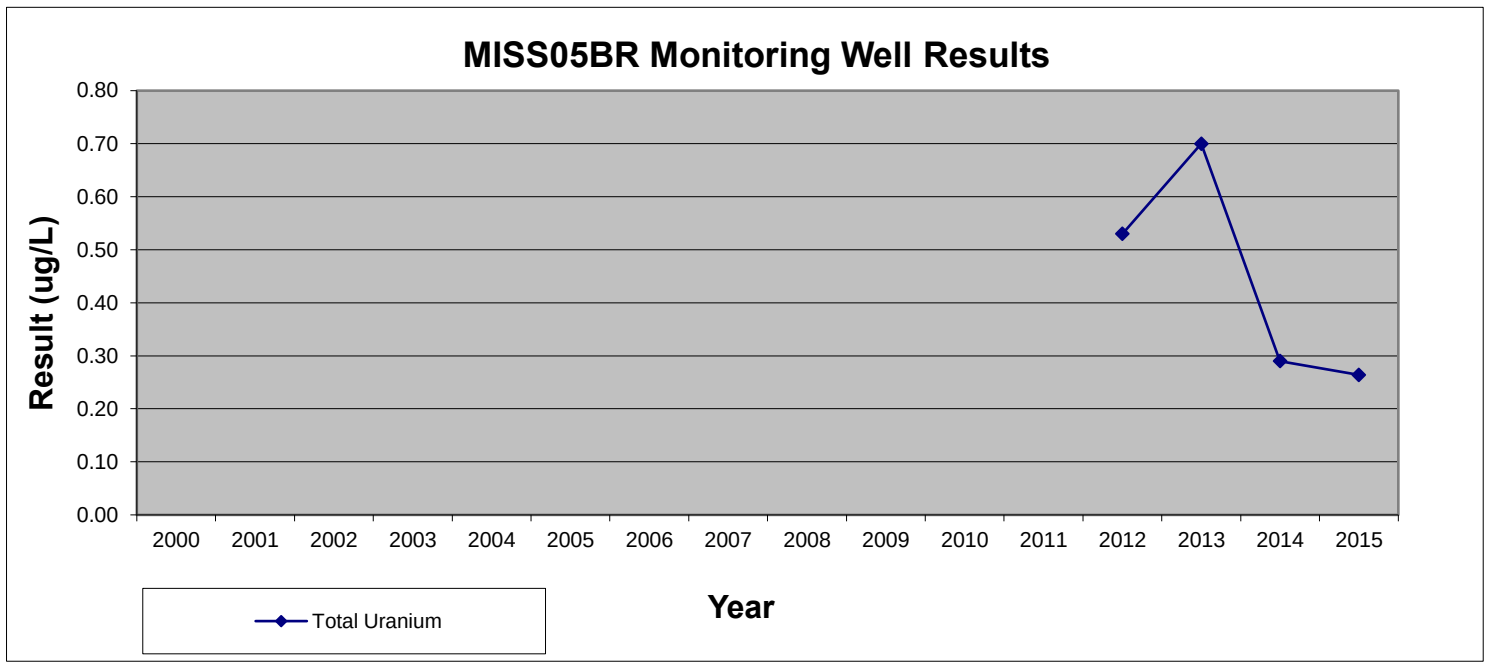
Year	Total Uranium
2000	
2001	5.38
2002	0.71
2003	1.16
2004	1.93
2005	1.40
2006	1.04
2007	1.56
2008	1.41
2009	1.22
2010	0.78
2011	0.84
2012	1.01
2013	1.91
2014	2.20
2015	1.14

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-28
Historical Results For Radiological Parameters at MISS01B



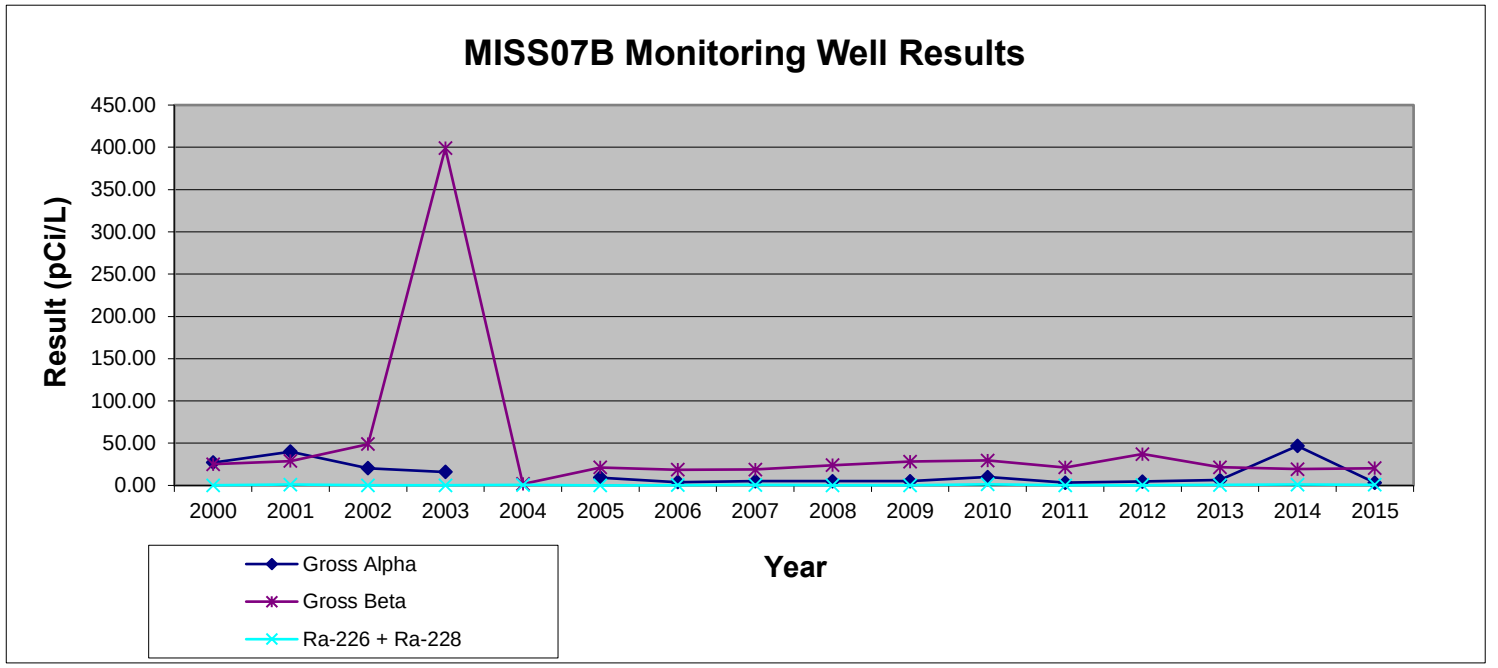
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012	7.27	934.61	0.44	2.04	2.48
2013	4.33	520.91	0.50	0.22	0.72
2014	60.89	529.40	0.13	0.6	0.73
2015	7.63	1040.00	0.40	0.88	1.28



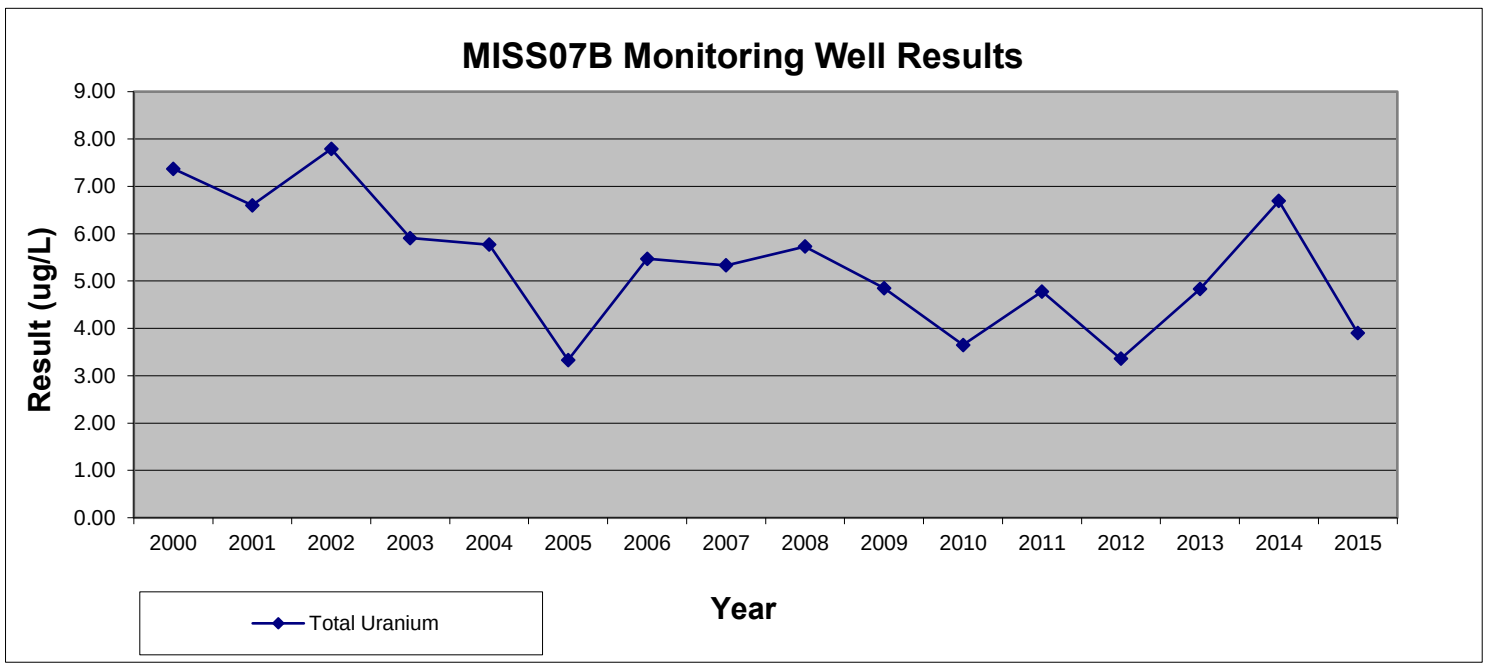
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	0.53
2013	0.70
2014	0.29
2015	0.26

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-29
Historical Results For Radiological Parameters at MISS05BR



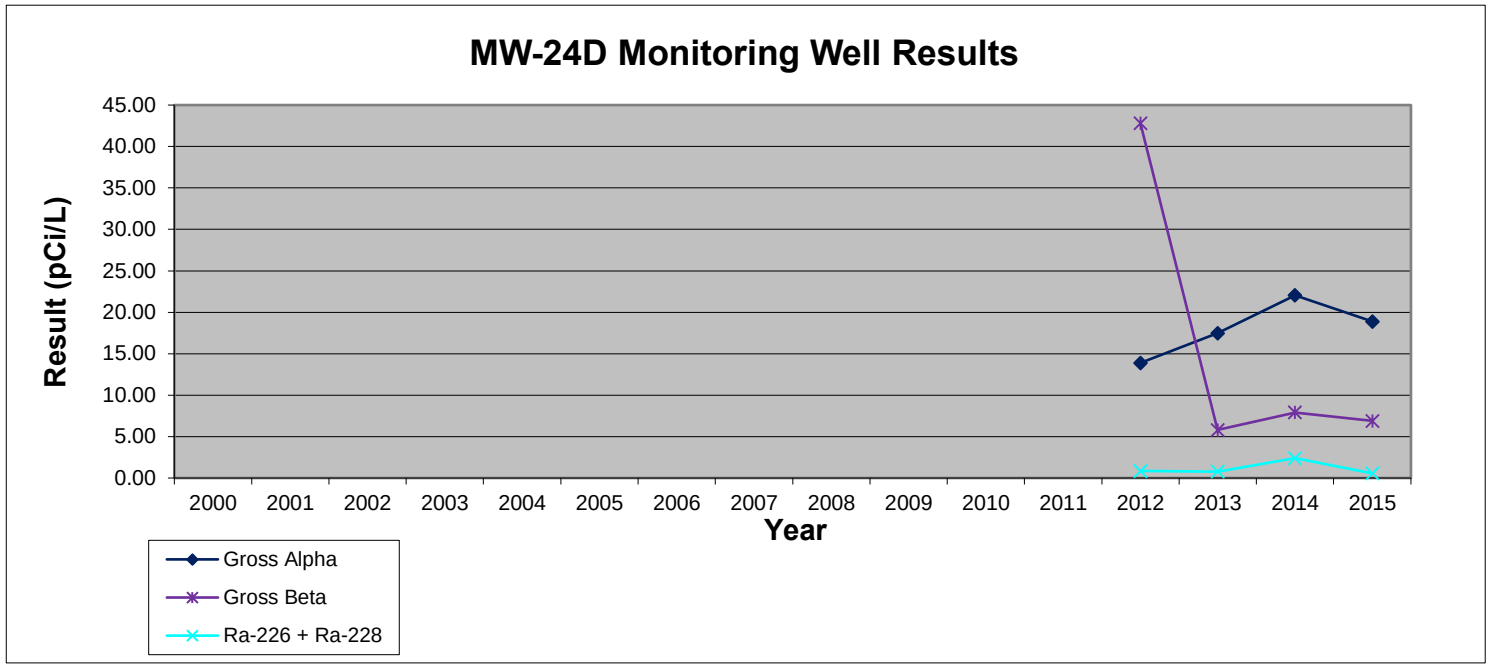
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000	27.00	25.00	0.10		0.10
2001	40.00	28.87	0.18	0.77	0.95
2002	20.43	49.00	0.10		0.10
2003	16.00	399.00	0.20		0.20
2004		1.70	0.18	0.37	0.55
2005	9.29	21.24	0.00	0.00	0.00
2006	4.00	18.54	0.03	0.35	0.38
2007	4.93	18.94	0.04	0.45	0.49
2008	5.16	23.87	0.04	0.03	0.08
2009	5.00	28.18	0.22	0.33	0.08
2010	9.99	29.54	0.00	1.32	1.32
2011	3.24	21.26	0.07	0	0.07
2012	4.66	37.23	0.00	0.32	0.32
2013	6.44	21.54	0.09	0.53	0.62
2014	46.78	19.20	0.08	0.884	0.96
2015	3.18	20.40	0.03	0.81	0.84



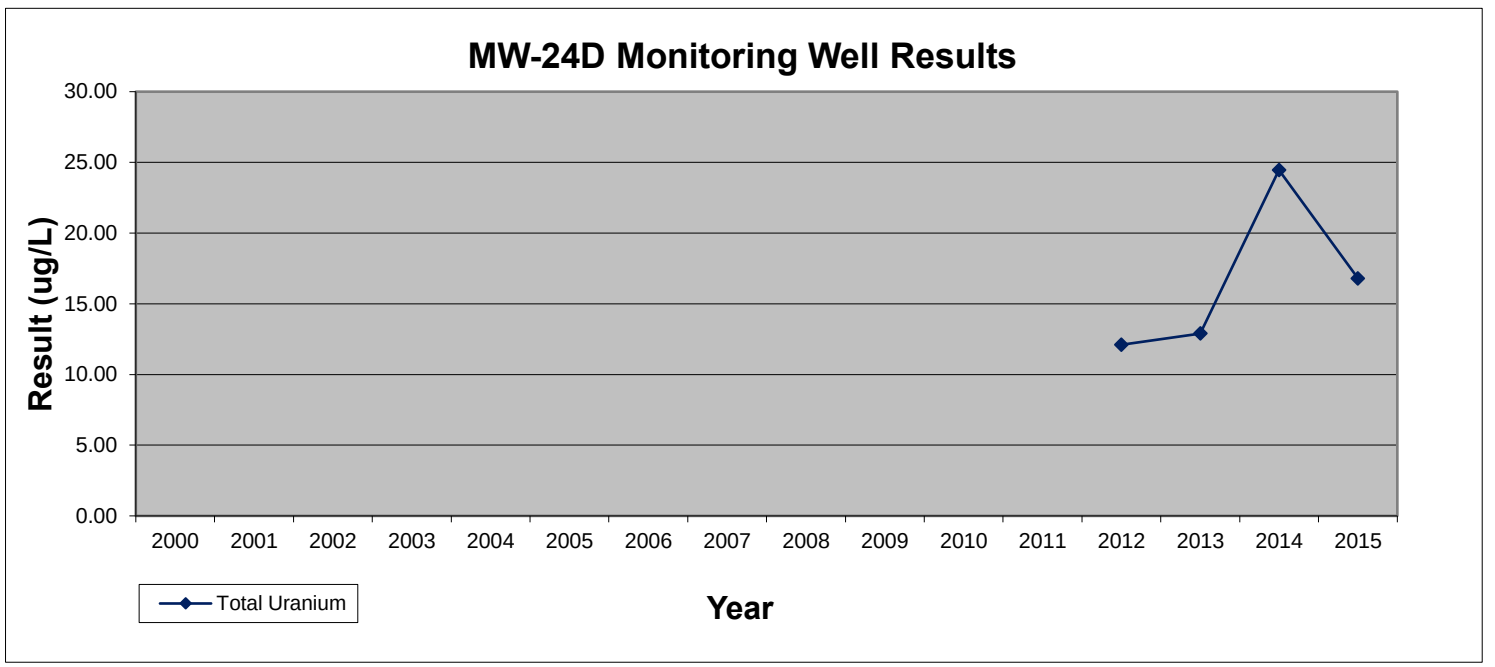
Year	Total Uranium
2000	7.37
2001	6.60
2002	7.79
2003	5.91
2004	5.77
2005	3.33
2006	5.47
2007	5.33
2008	5.73
2009	4.85
2010	3.65
2011	4.78
2012	3.36
2013	4.83
2014	6.69
2015	3.9

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-30
Historical Results For Radiological Parameters at MISS07B



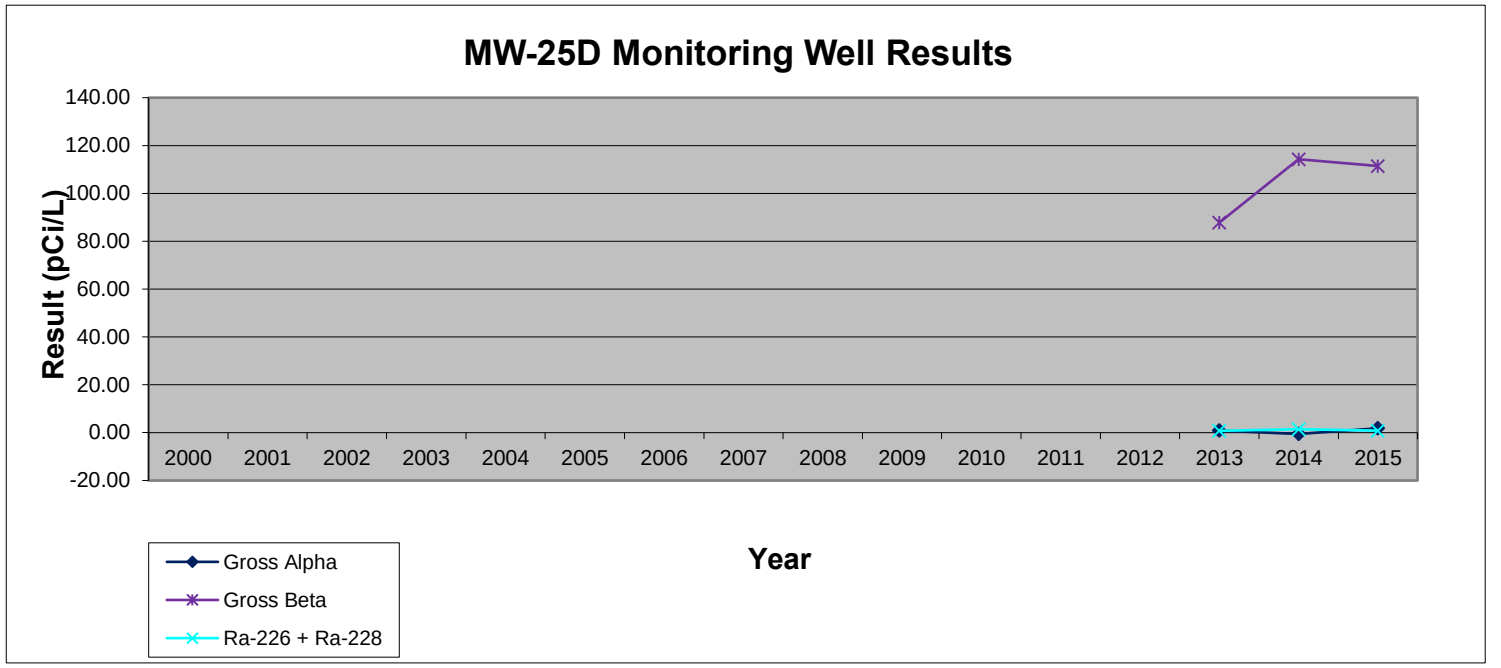
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012	13.89	42.79	0.32	0.53	0.85
2013	17.46	5.81	0.21	0.57	0.78
2014	22.04	7.91	0.07	2.33	2.40
2015	18.88	6.88	0.16	0.4	0.56



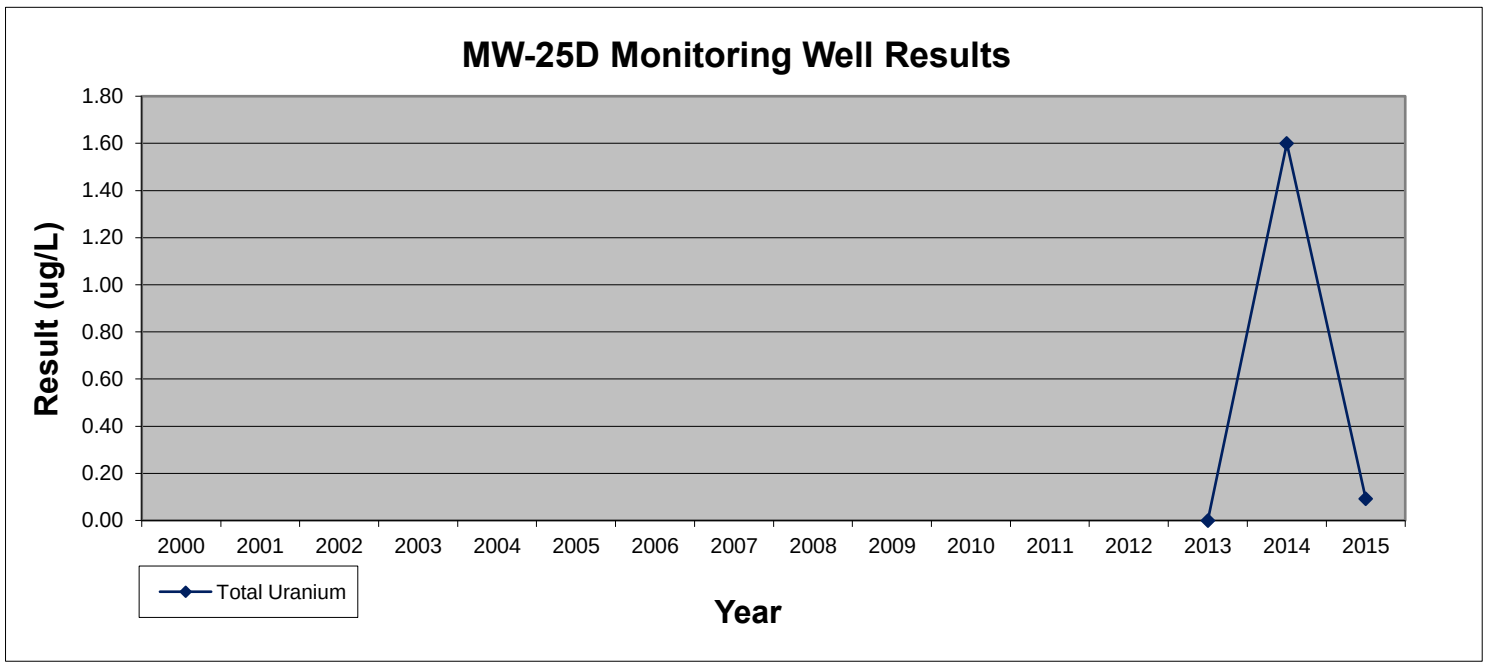
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	12.10
2013	12.90
2014	24.46
2015	16.80

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-31
Historical Results For Radiological Parameters at MW-24D



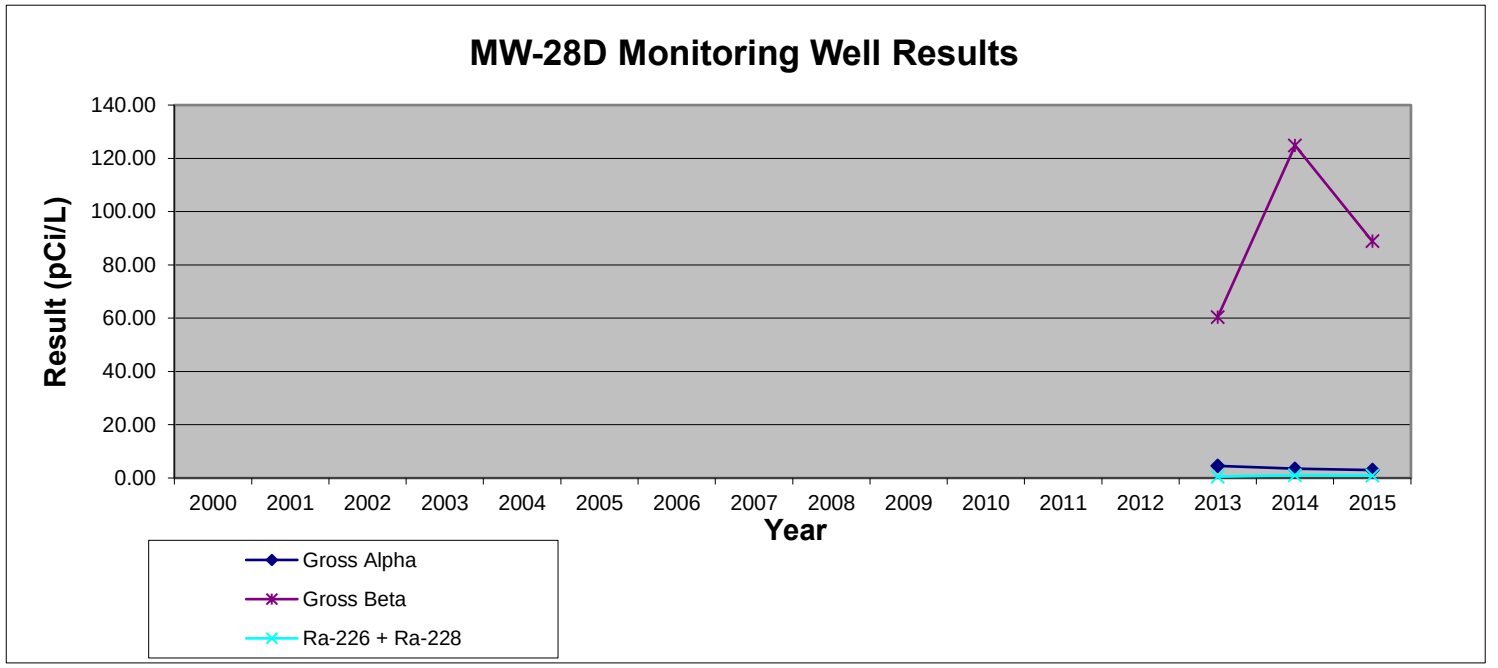
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013	0.92	87.77	0.01	0.76	0.77
2014	-0.55	114.27	0.21	1.23	1.44
2015	1.82	111.40	0.01	0.78	0.79



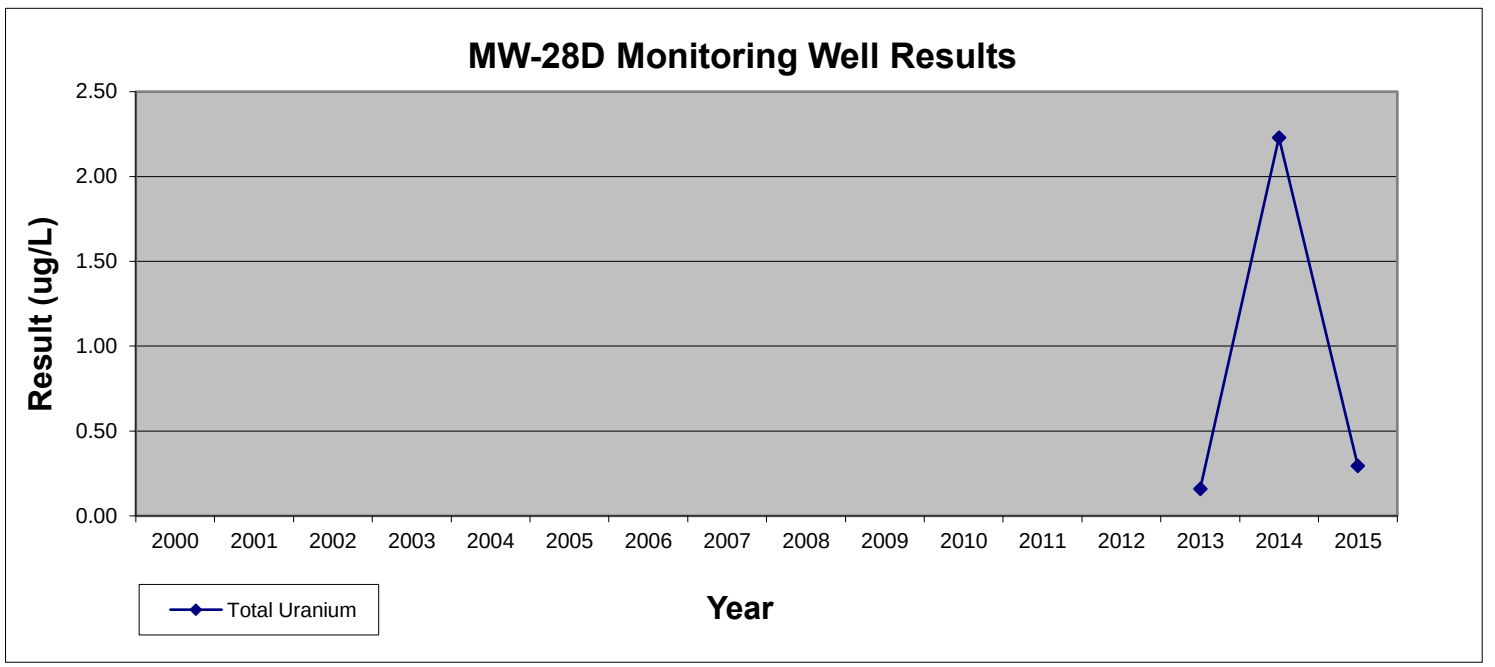
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	0.00
2014	1.60
2015	0.092

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-32
Historical Results For Radiological Parameters at MW-25D



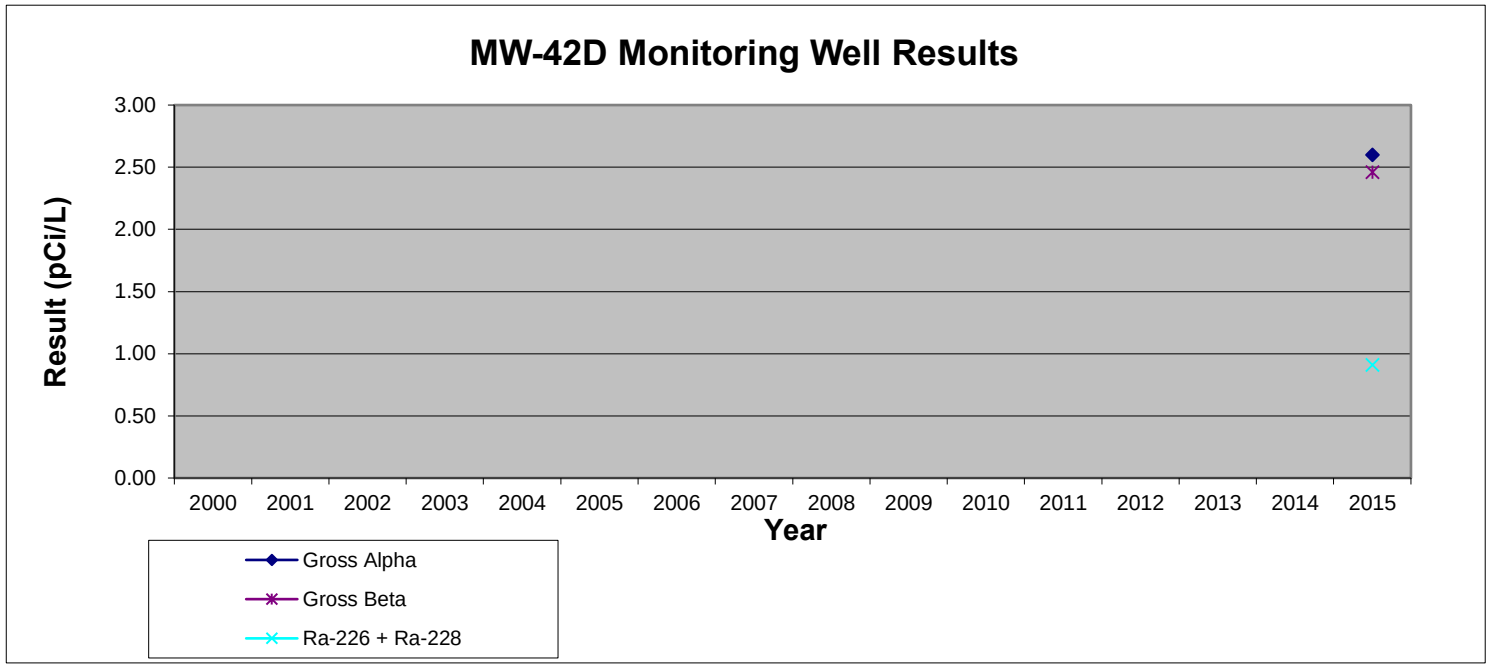
Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013	4.56	60.41	0.01	0.51	0.52
2014	3.48	124.82	0.04	1.05	1.09
2015	2.99	88.88	0.15	0.76	0.91



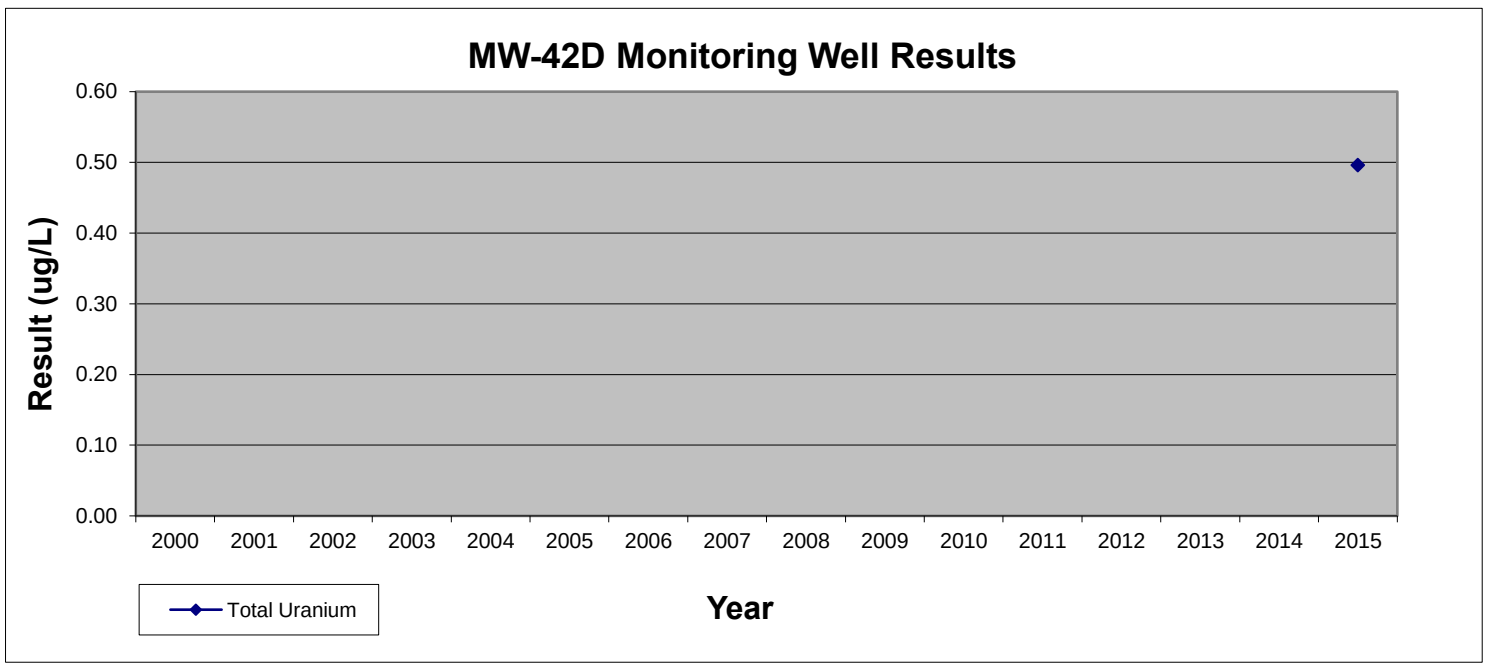
Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	0.16
2014	2.23
2015	0.294

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-33
Historical Results For Radiological Parameters at MW-28D



Year	Gross Alpha	Gross Beta	Ra-226	Ra-228	Ra-226 + Ra-228
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015	2.60	2.46	0.17	0.74	0.91



Year	Total Uranium
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	0.496

NOTES:
a) For years where duplicate samples were collected, the highest result was used.

Figure E-34
Historical Results For Radiological Parameters at MW-42D

Appendix F
Quality Control Summary Report for the Year 2015

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QUALITY CONTROL SUMMARY REPORT FOR THE ANNUAL ENVIRONMENTAL MONITORING REPORT, 2015

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

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

Prepared for

Department of the Army
U.S. Army Engineer
New York District
26 Federal Plaza
New York, New York 10278

Department of the Army
U.S. Army Engineer
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700 Federal Building
Kansas City, Missouri 64106

Prepared by

CABRERA SERVICES
RADIOLOGICAL• ENVIRONMENTAL• REMEDIATION

100 West Hunter Avenue
Maywood, New Jersey 07607

August 2016
Revision 0

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August 2016
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Dr. Brian Tucker
Chemical Quality Control Coordinator

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ABBREVIATIONS AND ACRONYMS

μ	method uncertainty
σ	sigma
%	percent
μg/L	micrograms per liter
ANSI	American National Standards Institute
aq	aqueous
As	arsenic
ASTM	American Society of Testing Materials International
Ba-133	barium 133
Cabrera	Cabrera Services Inc.
CCB	continuing calibration blank
CCC	calibration check compound
COC	chain-of-custody
CRDL	Contract Required Detection Limit
%D	percent difference
DOE	U.S. Department of Energy
EB	equipment blank
Eh	oxidation/reduction potential
EPA	U.S. Environmental Protection Agency
FB	field blank
FMSS	FUSRAP Maywood Superfund Site
FREP	field replicate
FUSRAP	Formerly Utilized Sites Remedial Action Program
g	gram
GA	Gross Alpha
GB	Gross Beta
GFPC	gas-flow proportional counting
HNO_3	nitric acid
ICP-MS	Inductively-coupled plasma mass spectrometer
J	estimated value
K	potassium
keV	kiloelectron volt
L	liter
LCS	laboratory control sample
Li	lithium
LREP	laboratory replicate
MDA	minimum detectable concentration
MDL	minimum detectable limit
MISS	Maywood Interim Storage Site
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
NJ	New Jersey
NJDEP	New Jersey Department of Environmental Protection
pCi	picocurie
pCi/g	picocuries per gram
pCi/L	picocuries per liter
$pCi/m^2/s$	picocuries per square meter per second
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCSR	Quality Control Summary Report
R	rejected
Ra	radium
Ra-226	radium 226
Ra-228	radium 228
RL	reporting limit
Rn	radon
Rn-222	radon 222
ROD	Record of Decision
RPD	relative percent difference
SDG	sample delivery group
SPCC	system performance check compound
SOP	Standard Operating Procedure
STF	Sample Tracking Form
Th	thorium
Th-228	thorium 228
Th-229	thorium 229
Th-230	thorium 230
Th-232	thorium 232
Th-234	thorium 234
U	non-detected (undetected)
U	uranium
U-232	uranium 232
U-234	uranium 234
U-235	uranium 235
U-238	uranium 238
$U_{(tot)}$	total uranium
UFML	USACE FUSRAP Maywood Laboratory

ABBREVIATIONS AND ACRONYMS (CONTINUED)

UJ	non-detected estimated
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

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1.0 INTRODUCTION

Cabrera Services Inc. (Cabrera) conducted environmental monitoring of the groundwater, surface water, and sediment for year 2015 during May and June of 2015.

This *Quality Control Summary Report (QCSR) for the Annual Environmental Monitoring Report, 2015* addresses data collected from analysis of groundwater, surface water, and sediment samples collected between May 18, 2015 and June 4, 2015.

The groundwater and surface water samples were tested for radium 226 (Ra-226), radium 228 (Ra-228), thorium 228 (Th-228), thorium 230 (Th-230), thorium 232 (Th-232), uranium 234 (U-234), uranium 235 (U-235), uranium 238 (U-238), gross alpha, and gross beta. Groundwater samples were also tested for benzene, lithium (Li), arsenic (As), potassium (K) and radon 222 (Rn-222). The sediment samples were tested for Ra-226, Th-232, and U-238.

This QCSR will only discuss deviations in quality control (QC) criteria for these Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS) parameters. A project QCSR will be prepared at the conclusion of the project. This QCSR for the 2015 Environmental Monitoring Program will support preparation of the project QCSR.

The QCSR for the 2015 Environmental Monitoring Program is organized into seven sections as follows:

- Section 1.0, Introduction;
- Section 2.0, Data Collection;
- Section 3.0, Data Analysis and Validation;
- Section 4.0, Data Summaries;
- Section 5.0, Analytical And Quality Assurance / Quality Control Problems Encountered At Laboratories;
- Section 6.0, Discussion; and,
- Section 7.0, References.

2.0 DATA COLLECTION

Environmental monitoring data collection procedures were evaluated for any deviations or modifications that may have occurred in the areas of sample handling and custody, equipment calibration and maintenance, and analytical methods. Within this report, the terms batch, package, and Sample Delivery Group (SDG) are synonymous. An SDG is a data report that contains the various test results of one or more sample batches plus associated QC data such as calibrations, blank spike and matrix spike (MS) results, blanks, etc.

There were no sample collection anomalies during the 2015 sampling effort.

2.1 SAMPLE HANDLING AND CUSTODY

Custody seals were not provided on samples provided to the on-site laboratory since they were hand-delivered to the laboratory on the sampling date. The on-site laboratory does not generate condition upon receipt forms. All on-site laboratory chain-of-custodies (COCs) were properly signed and dated. All water samples for radiological analysis were preserved with nitric acid. All COCs indicate that aqueous (aq) sample pH values were less than 2 except as follows:

2.1.1 Data Package 15G-0150, -0153, etc.

All sample pH values were not < 2 at sample receipt. The COC notes that 10 mLs of nitric acid (HNO_3) were added to Samples 12B-026001 and 12B-026047 and that 20 mLs of HNO3 was added to Sample 12B-026000.

2.1.2 Data Package 15G-0158, -0161, etc.

Sample 10A-026052 was field filtered.

2.1.3 Data Package 15G-0105 and -0107

The COC noted that additional HNO_3 was added to samples 09A-085016 and 09A-095017 to adjust the pH to < 2.

2.2 LABORATORY DATA PACKAGE ANOMALIES

The following off-site laboratory data package anomalies are noted:

2.2.1 Data Package 1505470

One volatile organic compound (VOC) sample vial for 12B-025995 was received with a pH>2. The sample pH was adjusted by the laboratory to <2 with nitric acid upon receipt.

2.2.2 Data Package 1505503

One more bottle than indicated by the COC was received for Samples 12B-026000, 12B-026047, and 12B-026001. Several samples were received with wet or torn labels, but all IDs were readable. Also for elements, Sample 12B-026000 was received at a pH >2. The laboratory adjusted the pH to <2 with HNO_3.

2.2.3 Data Package 1505503

VOC samples 12B-026000, 12B-026000RR1(reanalysis), 12B-026000MS (matrix spike), and 12B-026000MSD (matrix spike duplicate) had pH values >2 when analyzed. Samples were analyzed within 7 days of sample receipt. No results are qualified based upon sample pH values. Samples 12B-026000MS, 12B-026000MSD, 12B-026000RR1(reanalysis), 12B-026047 and 12B-026032 had head space less than the size of a pea. Based upon the presence of headspace the benzene results for 12B-026000RR and 12B-026047 are qualified as estimated (J) and the benzene results for 12B-026001 and 12B-026032 are qualified as non-detected estimated (UJ).

2.2.4 Data Package 15060214

Sample 10A-026052 was filtered in the field and is labeled as dissolved. This sample is the dissolved fraction of Sample 10A-026005.

2.3 EQUIPMENT CALIBRATION AND MAINTENANCE

2.3.1 Field Instrument Measurement and Calibration

Field measurements were made for dissolved oxygen, oxidation/reduction potential (Eh), turbidity, temperature, specific conductivity, and pH in the 23 groundwater and nine surface water samples. There were no discrepancies observed in the area of field equipment calibration and measurement for the 2015 Environmental Monitoring Program.

2.3.2 On-site Laboratory – Radiological Analyses

For radiological analyses conducted at the on-site laboratory, all criteria were met for initial and continuing instrument calibrations.

2.3.3 Off-site Laboratory – Chemical Analyses

For elements, the laboratory did provide initial calibration data for the inductively-coupled plasma mass spectrometer (ICP-MS) analyses. Initial calibration verification results were submitted. All acceptance criteria were between 90-110% for all analyses. All ICP-MS bracketing continuing calibration results supplied by the laboratory also met acceptance criteria for elemental analyses.

Also for elements, the laboratory analyzed an elements standard at or near 2X the laboratory's reporting limit (Contract Required Detection Limit [CRDL] standard). The CRDL recoveries are not all between 70-130% for various packages as noted below:

Data Package 1505326

The potassium closing CRDL standard recovery is 64%. The potassium standard concentration is 50 micrograms per liter (µg/L). The potassium reporting limit is 1,000 µg/L following a 10X dilution. Using professional judgment the potassium results for 12B-026028 and 12B-026030 are qualified by the data validator as non-detected estimated (UJ).

Data Packages 1505370 and 1505392

The lithium closing CRDL standard recovery is 132%. The lithium standard concentration is 1.0 µg/L. The lithium reporting limit is 10.0 µg /L following a 10X dilution. Using professional judgment the lithium results for 20A-025959, 20A-025960, 20A-025987, 19A-025988 and 19A-025989 are qualified as estimated (J+) by the data validator due to CRDL recovery. Reported results may be biased high.

Data Package 1505415

The potassium closing CRDL standard recovery is 62%. The potassium standard concentration is 50.0 µg/L. The potassium reporting limit is 1,000 µg/L following a 10X dilution. Using professional judgment no potassium results are qualified by the data validator based upon the low biased CRDL standard recovery.

Data Packages 1505470 and 1505503

The potassium closing CRDL standard recovery is 144%. The potassium standard concentration is 50.0 µg/L. The potassium reporting limit is 1,000 µg/L after a 10X dilution. Using professional judgment the potassium results for 12B-025996, 12B-025997 and 12B-026032 EB (equipment blank) are qualified as estimated (J+) by the data validator due to CRDL recovery. Reported results may be biased high. The potassium result for 12B-026032 is ultimately qualified as non-detected (U) at the reporting limit (RL) based upon method blank results.

Data Packages 1505521 and 1506014

The arsenic opening CRDL standard recovery is 69%. The arsenic standard concentration is 0.2 µg/L. The arsenic reporting limit is 2 µg/L following a 10X dilution. Using professional judgment the arsenic results for Samples 12B-026003, 12B-026002, 10A-026005 and 10A-026006 are qualified as estimated low (J-) by the data validator and the arsenic results for Samples 12B-026004, 12B-026033 and 10A-026052 are qualified as UJ due to CRDL recovery. Reported results may be biased low. All CRDL recoveries were out for the closing CRDL. The standard recoveries were arsenic 9,670%, lithium 4,033%, and potassium 557,909%. The internal standard recoveries for this CRDL were 0%. Because continuing calibration standard results were acceptable, no results are qualified based upon the closing CRDL.

For VOC benzene analysis, all system performance check compound (SPCC) and calibration check compound (CCC) results are within the method acceptance criteria for both initial and continuing calibrations. In addition, all %RSD values for initial calibration response factors and percent difference (%D) values between the continuing calibration response factor and the initial calibration mean response factor are less than 20%.

Data Package 1505503

The initial benzene result for 12B-026000 is rejected (R) since the result exceeds the highest initial calibration standard. The sample was reanalyzed at a 50X dilution and the result fell within the concentration range of the calibration.

2.4 ANALYTICAL METHODS

Two laboratories were employed for radiological analysis and one was employed for both chemical and radiological analysis.

2.4.1 Radiological Analysis

U.S. Army Corps of Engineers (USACE) FUSRAP Maywood Laboratory (UFML)
100 West Hunter Avenue
Maywood, NJ 07607

Test America
13715 Rider Trail North
Earth City, MO 63045

2.4.2 Chemical and Radiological Analysis

ALS Environmental
225 Commerce Drive
Fort Collins, CO 80524

UFML, the Maywood project's on-site laboratory operated by Cabrera Services Inc. analyzed all groundwater and surface water samples using alpha spectroscopy and gas-flow proportional counting (GFPC). UFML analyzed sediment samples using gamma spectroscopy. They analyzed the groundwater and surface water samples using U.S. Environmental Protection Agency (EPA) Method 903.0 modified for Ra-226, EPA Method 904.0 for Ra-228, isotopic uranium by SM-7500-U and isotopic thorium by HASL-300 using alpha spectroscopy, gross alpha/gross beta by EPA Method 900.0 modified (for low total solids samples), and gross alpha by GFPC, SM 7100C (for high total solids samples).

Sediment samples were analyzed for lead 214 (Ra-226), actinium 228 (Th-232), and thorium 234 (Th-234) (U-238) by employing the following methodologies:

- *ASTM (American Society of Testing Materials International) C1402-04: Standard for High-Resolution Gamma-Ray Spectrometry for Soil Samples* (ASTM 2009)
- *ANSI (American National Standards Institute) N42.14-99; Calibration and Use of Germanium Spectrometers for the Measurement of Gamma-Ray Emissions Rates of Radionuclides* (ANSI 1999)
- *EPA 600 4-80-032: Prescribed Procedures for Measurement of Radioactivity in Drinking Water, Method 901.1, Gamma Emitting Radionuclide* (EPA 1980)
- *HASL-300, 28th Ed., Feb. 1997, US DOE (U.S. Department of Energy) Environmental Measurements Laboratory, Method Ga-01-R, Gamma Radioassay* (DOE 1997)

The first off-site radiological laboratory, Test America in St. Louis, Missouri, analyzed USACE Quality Assurance (QA) split samples for the same radiological parameters analyzed by UFML. The QA split sample collection frequency is at least 5%.

The second off-site radiological laboratory, ALS Environmental in Fort Collins, CO analyzed groundwater samples for Rn-222. The samples were analyzed for Rn-222 by SM 7500-Rn B.

ALS Environmental also analyzed groundwater samples for the chemical parameters benzene, arsenic, lithium and potassium. ALS analyzed samples for arsenic, lithium and potassium using ICP/MS method SW-846 6020, and for benzene using SW-846 method 8260B with a 25 mL purge.

2.5 MODIFICATIONS TO THE WORK PLAN

There were no modifications to the radiation measurement techniques or analytical methods described in the *General Environmental Protection Plan* (USACE 2013) and *Uniform Federal Projects – Quality Assurance Project Plan* (USACE, 2015).

3.0 DATA ANALYSIS AND VALIDATION

Kestrel Environmental Technologies, Inc. performed data evaluation of the radiological and chemical data. They evaluated 100% of the on-site laboratory sample results and all of the ALS off-site laboratory sample results. Radiological data were evaluated using the USACE's *Radionuclide Data Quality Evaluation Guidance* (USACE 2009), and chemical data were validated using EPA Region II Standard Operating Procedures (SOP). In those instances where professional judgment was used by the data validator, the Maywood project's Chemical Quality Control Coordinator concurs with the data qualifications performed.

4.0 DATA SUMMARIES

Data summaries for the on-site laboratories' radiological and chemical data are presented in the *Annual Environmental Monitoring Report, 2015* (USACE 2016).

5.0 ANALYTICAL AND QUALITY ASSURANCE / QUALITY CONTROL PROBLEMS ENCOUNTERED AT LABORATORIES

Included in the 27 groundwater, six surface water, and nine sediment samples were three groundwater field duplicates and one field duplicate each for surface water and sediments. Two groundwater split samples, one surface water split sample, and one sediment split sample were also collected. Six rinsate blanks, two smear (wipe), and two field blank (FB) samples were also collected. The frequency of split sample collection (8.3% for groundwater, 12.5% for sediment, and 16.7% for surface water) met the required minimum frequency of 5% for this project (percentage based on total number of non-QC field samples).

All samples were analyzed for radiological and chemical parameters. The groundwater and surface water radiological samples were analyzed for Ra-226, Ra-228, Th-228, Th-230, and Th-232, U-234, U-235, and U-238, gross alpha and gross beta at the on-site laboratory and analyzed for arsenic, lithium, potassium, benzene and Rn-222 at the ALS off-site laboratory. The sediment radiological samples were analyzed by gamma spectroscopy for Ra-226, Th-232, and U-238 at the on-site laboratory. All of the results from testing of these samples were validated. The validator noted the following general findings as discussed in Sections 5.1 through 5.13. A summary of the data qualifications is presented as follows.

5.1 SUMMARY OF DATA QUALIFICATIONS

5.1.1 Data Qualifier Definitions

Data Qualifier	Definition
U	A normal, non-detected (< critical value (for radiological results) or < minimum detectable limit (MDL) (for chemical results)) result
J	An uncertain or estimated result
R	A rejected result: the problems (quantitative or qualitative) are severe; rejected data may still be usable depending upon the intended use of the data and the reason for data rejection
R	A rejected result: the problems (quantitative or qualitative) are severe; rejected data may still be usable depending upon the intended use of the data and the reason for data rejection
UJ	A non-detect result that has an uncertain minimum detectable activity (MDA) value (for radiological results) or MDL value (for chemical results)

5.1.2 Qualification Reasons

Qualify a result rejected (R) for one of the following reasons:

No samples were qualified rejected.

Qualify the following results non-detect (U) for one of the following reasons:

- Due to low CRDL recovery, the potassium result for 12B-026032.
- Due to potassium detected in method blanks, the potassium results in field Samples 12B-026032, 12B-025995.

Qualify the following results UJ for one of the following reasons:

- Based upon the presence of headspace less than the size of a pea, the benzene results for 12B-026001 and 12B-026032.
- Due to low CRDL recovery, the potassium results for 12B-026028 and -030, and the arsenic results for Samples 12B-026004, 12B-026033 and 10A-026052.
- Due to negative method blank results, the Gross Alpha (GA) results for 12B-026010 and -008, and the As result for 12B-026004.
- Due to low matrix spike Z scores, the GA results in Samples 12B-026030, -031 and -032.
- Due to low laboratory control sample (LCS) percent recoveries, the Ra-228 results in Samples 22A-085023, 12B-026030, 20A-025960LREP (laboratory replicate), 12B-026032, 23A-026016, 22A-026018, 22A-026019 and 12B-026049, and the Ra-226 results for 12B-026033, 10A-026052, 12B-026010, 12B-026012, 12b-026050 and 10A-026005 LREP.
- Due to the differences in QA split results for Ra-226 in Sample 20A-025990, the UFML Ra-226 result for 20A-025990 is qualified estimated non-detect, UJ.

Qualify a result estimated (J) for one of the following reasons:

- The reported result is within the analytical window of the daily blank, the method blank, the field blank and/or the rinsate blank result.
- High LCS recovery.

- The result is greater than the MDA and less than the 2 sigma uncertainty.
- The absolute difference or relative percent difference between replicate pair results (field replicates, lab replicates, or QA split samples) exceeds the control limit for a given analyte.
- Low matrix density.
- Serial dilution result exceeding the 10% difference criterion.
- Headspace in one or more VOC vials.
- Holding time exceedance.

Reasons for Qualifying Sample Analyte Results Estimated J

Reason	Sample Numbers	Analyte(s)
1	22A-085001, 22A-085001 LREP, 22A-085002, 22A-085024, 22A-085023, 12B-085022, 09A-085016, 12B-085022 and 09A-085017 DISS, 12B-026028, 12B-026030, 20A-025959, 20A-025987, 19A-025988, 20A-025990, 12A-025991, 20A-025960 LREP, 12B-026000, 12B-026000 LREP, 12B-026047, 12B-026032, 12B-026002, 12B-026003, 12B-026004, 12B-025995, 12B-025996, 12B-025997, 12B-026001, 10A-026005, 10A-026006, 12B-026033, 10A-026052, 12B-026010, 23A-026014, 23A-026015, 23A-026016, 23A-026017, 22A-026018, 22A-026019, 12B-026008, 12B-026049, 10A-026006 LREP, 23A-026015 LREP, 22A-026018 LREP,	Th-230
1	22A-085001, 22A-085001 LREP, 22A-085002, 22A-085024, 22A-085023, 12B-085022, 09A-085016, 12B-085022 and 09A-085017 DISS, 12B-026028, 12B-026030, 20A-025959, 20A-025987, 19A-025988, 20A-025990, 12A-025991, 20A-025960 LREP, 12B-026000, 12B-026000 LREP, 12B-026047, 12B-026032, 12B-026002, 12B-026003, 12B-026004, 12B-025995, 12B-025996, 12B-025997, 12B-026001, 10A-026005, 10A-026006, 12B-026033, 10A-026052, 12B-026010, 23A-026014, 23A-026015, 23A-026016, 23A-026017, 22A-026018, 22A-026019, 12B-026008, 12B-026049, 10A-026006 LREP, 23A-026015 LREP, 22A-026018 LREP,	Th-230
1	22A-085001, 22A-085001 LREP, 22A-085002, 20A-025990, 12A-025991, 12A-025992, 10A-025993, 12B-026031, 12A-025992 LREP, 12B-085022, 12B-026028, 20A-025959, 19A-025988, 12B-025995, 12B-025996, 12B-026001, 12B-026047 and 12B-026000 LREP, 10A-026006 and 12B-026050	Ra-228
1	20A-025959, 20A-025987, 19A-025988, 19A-025989 and 10A-025993	Gross Alpha
1	12A-025991, 10A-025993, 12B-026010, 12B-026008 and 12B-026049	U-234
1	23A-026020	Th-234
4	12B-026000, 12B-026000 LREP, 12B-026047, 12B-026047 LREP, 09A-085017 DISS and 09A-085017 DISS LREP	Gross Beta
4	12B-025996, 20A-025960	Rn-222
6	20A-025960	Lithium
6	20A-025960	POTASSIUM
7	12B-026000RR and 12B-026047	BENZENE

5.2 BLANK ANALYSES

In accordance with USACE Radiological Data Evaluation Guidance, if a method blank result is within ±3μ, where μ is the required method uncertainty, the blank result is within control limits. However, the validator may still choose to qualify a sample result using the following rationale: if the lower one sigma (σ) activity of the sample result (sample result – one sigma) is less than the upper one sigma activity of the blank (blank result + one sigma), then the result is qualified estimated J.

For daily blanks, a result is acceptable if it falls within the control limits of the mean ±3σ. Similar to the method blanks, the validator may still choose to qualify sample results if it is thought that they may be impacted by the blank result. Daily blanks were analyzed on each day that analyses were performed for gamma spectroscopy analyses and gross alpha/gross beta analyses. For alpha spectroscopy, there is no daily blank; only a preparation (or method) blank is analyzed. All daily blank results were within the mean ±3σ criterion for gamma spectroscopy analyses and gross alpha/gross beta analyses. All acceptance criteria were also met for all weekly backgrounds. Some results for the radionuclides of concern were qualified due to preparation (method) blank contamination, or using professional judgment, as described below.

5.2.1 On-site Laboratory – Radiological Analyses

Data Package 15G-0105, -0107, etc.

Positive aqueous method blank results are summarized below.

Radionuclide	STF [a]	Lab ID [b]	Concentration (pCi/L) [c]	2 sigma uncertainty (pCi/L) [c]	MDA [d] (pCi/L)
Th-230	15-5006	15-04176	0.629	0.228	0.084
Ra-228	15-2007	15-04416	0.293	0.241	0.236

Notes:
a. STF = Sample Tracking Form
b. Lab ID = Laboratory Identifier
c. pCi/L = picocuries per liter
d. MDA = minimum detectable activity

Based upon the Th-230 method blank results, the Th-230 results for 22A-085001, 22A-085001 LREP, 22A-085002, 22A-085024, 22A-085023, 12B-085022, 09A-085016 and 09A-085017 DISS are qualified as estimated (J).

Based upon the Ra-228 method blank results, the Ra-228 results for 22A-085001, 22A-085001 LREP, 22A-085002, and 12B-085022 are qualified as estimated (J).

Field Blank 12B-085022 was collected with samples collected on 04/27/2015. Positive field blank results are summarized below.

Radionuclide	STF [a]	Lab ID [b]	Concentration (pCi/L) [c]	2 sigma uncertainty (pCi/L) [c]	MDA [d] (pCi/L)
Ra-228	15-2007	15-04068	0.472	0.284	0.272
Th-230	15-5006	15-04068	0.275	0.222	0.190

Notes:
a. STF = Sample Tracking Form
b. Lab ID = Laboratory Identifier
c. pCi/L = picocuries per liter
d. MDA = minimum detectable activity

The Th-230 and Ra-228 results for 12B-085022 are qualified as estimated (J) based upon the method blank results. Therefore, no field sample results are qualified based upon field blank 12B-085022 results.

Data Package 15G-0130, -0134, etc.

Positive aqueous method blank results are summarized below.

Radionuclide	STF [a]	Lab ID [b]	Concentration (pCi/L) [c]	2 sigma uncertainty (pCi/L) [c]	MDA [d] (pCi/L)
Ra-228	15-2009	15-06845	0.258	0.243	0.223
Ra-228	15-2010	15-06922	0.501	0.324	0.292
Th-230	15-5007	15-05066	0.857	0.344	0.089
Th-230	15-5008	15-05611	0.229	0.187	0.090

Notes:
a. STF = Sample Tracking Form
b. Lab ID = Laboratory Identifier
c. pCi/L = picocuries per liter
d. MDA = minimum detectable activity

Ra-228 STF 15-2010 method blank results exceed the laboratory derived acceptance criteria; +/-0.50 pCi/L. Using professional judgment positive Ra-228 results are qualified as estimated (J). The Ra-228 results for 20A-025990, 12A-025991, 12A-025992, 10A-025993, 12B-026031 and 12A-025992 LREP are qualified as estimated (J). The positive Ra-228 result for Rinsate Blank 12B-026031 is qualified as estimated (J) based upon the Ra-228 method blank result.

Based upon the Ra-228 STF 15-2009 method blank results the Ra-228 results for 12B-026028, 20A-025959 and 19A-025988 are qualified as estimated (J).

Based upon the Th-230 method blank results, the Th-230 results for 12B-026028, 12B-026030, 20A-025959, 20A-025987, 19A-025988, 20A-025990, 12A-025991 and 20A-025960 LREP are qualified as estimated (J).

Field Blank 12B-026028 was collected with samples collected on 05/18/2015. Positive field blank results are summarized below.

Radionuclide	STF [a]	Lab ID [b]	Concentration (pCi/L) [c]	2 sigma uncertainty (pCi/L) [c]	MDA [d] (pCi/L)
Gross Alpha	15-1037	15-04756	1.092	1.070	1.484
Ra-228	15-2009	15-04756	0.232	0.214	0.195
U-234	15-4013	15-04756	0.095	0.112	0.085
Th-230	15-5007	15-04756	0.235	0.191	0.091

Notes:
a. STF = Sample Tracking Form
b. Lab ID = Laboratory Identifier
c. pCi/L = picocuries per liter
d. MDA = minimum detectable activity

The Ra-228 and Th-230 results for field blank 12B-026028 are qualified as estimated (J) based upon the method blank results.

Based upon 12B-026028 field blank results, the gross alpha results for 20A-025959, 20A-025987, 19A-025988, 19A-025989 and 10A-025993 are qualified as estimated (J).

Based upon 12B-026028 field blank results, the U-234 results for 12A-025991 and 10A-025993 qualified as estimated (J).

Data Package 15G-0150, -0153, etc.

Positive aqueous method blank results are summarized below.

Radionuclide	STF [a]	Lab ID [b]	Concentration (pCi/L) [c]	2 sigma uncertainty (pCi/L) [c]	MDA [d] (pCi/L)
Gross Beta	15-1040	15-04963	0.3691	0.233	0.334
Ra-228	15-2011	15-07135	0.469	0.296	0.277
Th-230	15-5010	15-07353	0.685	0.323	0.156

Notes:
a. STF = Sample Tracking Form
b. Lab ID = Laboratory Identifier
c. pCi/L = picocuries per liter
d. MDA = minimum detectable activity

No results are qualified based upon gross beta method blank results.

Based upon the Th-230 method blank results, the Th-230 results for 12B-026000, 12B-026000 LREP, 12B-026047, 12B-026032, 12B-026002, 12B-026003 and 12B-026004 are qualified as estimated (J).

Based upon the Ra-228 method blank results, the Ra-228 results for 12B-025995, 12B-025996, 12B-026001, 12B-026047 and 12B-026000 LREP are qualified as estimated (J).

Using professional judgment the Th-230 results for 12B-025995, 12B-025996, 12B-025997 and 12B-026001 are qualified as estimated (J). Positive method blank, equipment rinsate blank and field blank results indicate that Th-230 field sample results near the MDA may be impacted by blank results as well as spectral resolution of the thorium 229 (Th-229) tracer and Th-230 analyte isotopic peaks.

Rinsate Blank Sample 12B-026031 is associated with samples collected on 05/26/2015 and these results are reported in laboratory Data Package 15G-0130, 15G-0134, 15G-0140 and 15G-0146. The positive Ra-228 result for rinsate blank 12B-026031 is qualified as estimated (J) based upon the Ra-228 method blank result. No field sample results are qualified based upon the 12B-026031 equipment rinsate blank results.

Rinsate Blank Sample 12B-026032 was collected with samples collected on 05/27/2015 and 05/28/2015. The positive Th-230 result is qualified as estimated (J) based upon the method blank result. No field sample results are qualified based upon the 12B-026032 equipment rinsate blank results.

Data Package 15G-0158, 0161, etc.

Positive aqueous method blank results are summarized below.

Radionuclide	STF [a]	Lab ID [b]	Concentration (pCi/L) [c]	2 sigma uncertainty (pCi/L) [c]	MDA [d] (pCi/L)
Gross Alpha	15-1044	15-05319	-0.533	0.784	1.305
Th-230	15-5011	15-07690	0.300	0.202	0.130
Th-230	15-5012	15-07760	1.689	0.553	0.174
Th-230	15-5014	15-08452	0.323	0.215	0.139

Notes:
a. STF = Sample Tracking Form
b. Lab ID = Laboratory Identifier
c. pCi/L = picocuries per liter
d. MDA = minimum detectable activity

Based upon the negative Gross Alpha method blank result, the Gross Alpha results for 12B-026010 and 12B-026008 are qualified as UJ.

Based upon the Th-230 method blank results, the Th-230 results for 10A-026005, 10A-026006, 12B-026033, 10A-026052, 12B-026010, 23A-026014, 23A-026015, 23A-026016, 23A-026017, 22A-026018, 22A-026019, 12B-026008, 12B-026049, 10A-026006 LREP, 23A-026015 LREP and 22A-026018 LREP are qualified as estimated (J).

Rinsate Blank Sample 12B-026033 is associated with samples collected on 06/01/2015 and 06/02/2015. Positive equipment rinsate blank results are summarized below.

Radionuclide	STF [a]	Concentration (pCi/L) [b]	2 sigma uncertainty (pCi/L) [b]	MDA [c] (pCi/L)
Ra-228	15-2012	0.388	0.266	0.247
Th-230	15-5011	0.292	0.196	0.144

Notes:
a. STF = Sample Tracking Form
b. pCi/L = picocuries per liter
c. MDA = minimum detectable activity

The Th-230 result for Rinsate Blank Sample 12B-026033 is qualified as estimated (J) based upon the Th-230 method blank result.

Based upon the Ra-228 rinsate blank result for 12B-026033, the Ra-228 results for 10A-026006 and 12B-026050 are qualified as estimated (J).

Field blank 12B-026028 was collected on 05/18/2015. These results are reported in laboratory Data Package 15G-0130. Positive field blank results are summarized below.

Radionuclide	STF [a]	Lab ID [b]	Concentration (pCi/L) [c]	2 sigma uncertainty (pCi/L) [c]	MDA [d] (pCi/L)
Gross Alpha	15-1037	15-04756	1.092	1.070	1.484
Ra-228	15-2009	15-04756	0.232	0.214	0.195
U-234	15-4013	15-04756	0.095	0.112	0.085
Th-230	15-5007	15-04756	0.235	0.191	0.091

Notes:
a. STF = Sample Tracking Form
b. Lab ID = Laboratory Identifier
c. pCi/L = picocuries per liter
d. MDA = minimum detectable activity

No Gross Alpha results are qualified based upon the field blank result.

The Ra-228 and Th-230 results for field blank 12B-026028 are qualified as estimated (J) based upon the method blank results.

The U-234 results for 12B-026010, 12B-026008 and 12B-026049 are qualified as estimated (J) based upon the12B-026028 field blank result.

Data Package 15G-0165

This package contains results of sediment samples analyzed using gamma spectroscopy. The laboratory reported three preparation method blanks in this package. The lab also analyzed weekly backgrounds as well as daily blanks on each day that samples were analyzed. The following ranges apply to all detectors for all method blanks using the Marinelli® configuration.

Radionuclide	Lower Control Limit (pCi/g)	Upper Control Limit (pCi/g)
Ac-228	-0.490	0.490
Pb-214	-0.330	0.330
Th-234	-6.10	6.10

No results are qualified based upon Marinelli® method blank results.

Daily blank results (QDBM) were reported for all detectors. Th-234 results from detector 1 are summarized below. The Th-234 acceptance criterion for detector 1 is -0.074 to 0.254 pCi/g.

Sample	Radionuclide	Result (pCi/g) [a]	2 Sigma +/- (pCi/g) [a]	MDA [b] (pCi/g) [a]
15-05464 (15-0071)	Th-234	0.180	0.203	0.091

Notes:
a. pCi/g = picocuries per gram
b. MDA = minimum detectable activity

Using professional judgment the Th-234 result for 23A-026020 is qualified as estimated (J). These results are summarized below.

Sample	Radionuclide	Result (pCi/g) [a]	2 Sigma +/- (pCi/g) [a]	MDA [b] (pCi/g) [a]
23A-026020	Th-234	0.385	0.255	0.121

Notes:
a. pCi/g = picocuries per gram
b. MDA = minimum detectable activity

Weekly backgrounds were included in the data package. Non-compliant weekly blanks were re-analyzed. No results are qualified based upon the weekly blank results.

5.2.2 Off-site Laboratory – Chemical Analyses

All equipment rinsate blanks, the field blank and method blanks associated with samples analyzed for radon were non-detect for radon.

Equipment rinsate blank and field blank results were reported in laboratory Data Package 1505326. Arsenic, lithium, potassium and benzene are reported as U in these samples.

All VOC trip blank, equipment rinsate blank and method blank results were reported as non-detected (U) in all chemical data packages.

For elements in several data packages, low level concentrations of arsenic, lithium and/or potassium were detected in the preparation blanks, laboratory instrument blanks and field blanks. In most cases, the lithium and potassium field sample concentrations are significantly greater than the blank results such that the lithium and potassium results are not qualified. The exceptions to this are as follows:

Data Package 1505470

The potassium method blank concentration, MDL and RL are summarized below.

Analyte	Type of Blank	MDL (µg/L)	Blank Concentration (µg/L)	RL (µg/L)
Potassium	IP150529-21MB	200	290	1,000

Based upon the method blank result, the potassium result for Sample 12B-025995 is reported as non-detected (U) at the reporting limit.

Data Package 1505503

The maximum concentration of the contaminants detected in the preparation blanks, laboratory instrument blanks and field blanks and the RL concentrations are summarized below.

Analyte	Type of Blank	MDL (µg/L)	Blank Concentration (µg/L)	RL (µg/L)
Potassium	IP150529-21MB	290	200	1,000
Lithium	12B-026032EB	3	5.8	10
Potassium	12B-026032EB	200L	580	1,000

Based upon the method blank, the potassium result for 12B-026032 EB is reported as non-detected (U) at the reporting limit.

In all other samples potassium, arsenic and lithium field sample concentrations are significantly greater than the method blank, instrument blank and equipment blank results. No additional lithium, potassium or arsenic results are qualified based upon the equipment blank, instrument and method blank results.

Data Package 1505521

The maximum concentration of the contaminants detected in the preparation blanks, laboratory instrument blanks and field blanks and the RL concentrations are summarized below.

Analyte	Type of Blank	MDL (µg/L)	Blank Concentration (µg/L)	RL (µg/L)
Lithium	12B-026032EB	3	5.8	10
Potassium	12B-026032EB	200	580	1,000
Arsenic	IP150603-2MB	0.36	-1.1	2

The arsenic result for the method blank is reported at less than the MDL, as a result Samples 12B-026003 and 12B-026002 are qualified as estimated low (J-) and Sample 12B-026004 is qualified as UJ. The potassium and lithium field sample concentrations are significantly greater than the blank concentrations.

Data Package 15006014

The maximum concentration of the contaminants detected in the preparation blanks, laboratory instrument blanks and field blanks and the RL concentrations are summarized below.

Analyte	Type of Blank	MDL (µg/L)	Blank Concentration (µg/L)	RL (µg/L)
Arsenic	IP150603-2MB	0.036	-0.11	0.2
Lithium	CCB 4	0.30	0.30	1.0
Potassium	CCB 4	20	15.3	100

Note that evaluating continuing calibration blank (CCB) blank results requires consideration of the 10X field sample dilution. Using professional judgment the arsenic results for 10A-026005 and 10A-026006 are qualified as estimated (J-) biased low. Lithium and potassium field sample concentrations are significantly greater than the continuing calibration blank results. No lithium and potassium results are qualified based upon instrument and method blank results.

5.3 SAMPLE SPECIFIC CHEMICAL (TRACER) RECOVERIES (RADIOLOGICAL RESULTS ONLY)

The laboratory did tabulate the radioisotope tracer recoveries on the Form 1s. Laboratory derived tracer recoveries were used for this evaluation. The laboratory derived tracer acceptance criteria are summarized below.

Tracer	% Recovery
Th-229	72.8-140.4%
U-232 [a]	81.0-139.9%
Ba-133 [b]	50.0-90.0%

Notes:
a. U-232 = uranium 232
b. Ba-133 = barium-133

All tracer recoveries fell within these limits in all groundwater and surface water radiological data packages except for the following: within Data Packages 15G-0105 and -0107, the laboratory noted that the Th-229 tracer for method blank 15-04176 was double spiked by mistake. The Th-229 recovery was 195.1%. No field sample results are qualified based upon this tracer recovery exceedance.

5.4 MATRIX SPIKE AND MATRIX SPIKE/MATRIX SPIKE DUPLICATE

5.4.1 On-site Laboratory – Radiological Analyses

For all water analyses except gross alpha and gross beta, a chemical tracer is added that serves as an MS (see Section 5.3 for a discussion of tracer recoveries). Matrix spikes were performed for gross alpha and gross beta samples in all water sample batches. Gross alpha and gross beta MS recoveries were within laboratory acceptance criteria; i.e., had a Z-score between -3 and +3, in all water packages with the following exceptions.

Data Packages 15G-0130, -0134, etc.

The laboratory analyzed Maywood Sample 20A-025960 as the MS sample for Gross Alpha and Gross Beta analyses. The GA Z-score and percent recovery (%R) are -15.81 and 36.8%, respectively. Due to this exceedance, the gross alpha results for 12B-026028, 20A-025959, 20A-025960, 20A-025960 LREP, 20A-025987, 19A-025988, 19A-025989, 12A-025992, 12A-025992 LREP and 10A-025993 are qualified as estimated low biased (J-). The gross alpha results for 12B-026030 and 12B-026031 are qualified as UJ.

Data Packages 15G-0150, -0153, etc.

The laboratory analyzed Maywood Sample 12B-026003 as the MS sample for Gross Alpha and Gross Beta analyses. The GA Z-score and percent recovery (%R) are -5.01 and 66.7%, respectively. Due to this exceedance, the gross alpha results for 12B-025996, 12B-026003 and 12B-026003 LREP are qualified as estimated low biased (J-) and the gross alpha result for 12B-026032 is qualified as UJ.

Data Packages 15G-0105 and -0107

The laboratory analyzed Maywood Samples 22A-085001 and 09A-085017 DISS as the MS sample for Gross Alpha and Gross Beta analyses. The following matrix spike result does not meet the acceptance criteria.

Radionuclide	STF Identifier	Lab Identifier	Z Factor	% Recovery
Gross Beta	15-1030	09A-085017 DISS	-4.68	84.3%

Sample 09A-085017 DISS was also analyzed as a laboratory duplicate for gross alpha and gross beta analyses. The gross beta laboratory duplicate precision acceptance criterion was not met. Using professional judgment the gross beta results for 09A-085017 DISS and 09A-085017 DISS LREP are qualified as estimated low biased (J-) by the data validator.

Sediments were analyzed by gamma spectrometry and there are no MS analyses for analysis of solids by gamma spectrometry. The LCS results were used to evaluate the analytical accuracy, and the laboratory replicate results and field replicate results were used to evaluate the analytical precision.

5.4.2 Off-site Laboratory – Chemical Analyses

Data Package 1505370

Maywood Sample 20A-025960 in was analyzed as the aqueous ICP-MS MS/MSD pair. The acceptance criteria are recoveries between 75-125% and relative percent differences (RPDs) less than 20%. All MS and MSD recoveries and the RPDs between the MS and MSD recoveries were within these control limits. For all other chemical elements data packages, a non-Maywood sample was analyzed as the MS sample or the MS/MSD pair. No results were qualified based upon the absence of MS or MS/MSD results.

For VOCs, aqueous Sample 20A-025960 in Data Package 1505370 was analyzed as the MS/MSD pair. The laboratory reported only benzene. All MS and MSD recoveries were between control limits of 83% to 117% and the RPD between the MS and MSD recoveries was within the control limit of 20%.

Data Packages 1505503 and 1505521

Maywood Sample 12B-026000 was analyzed as the aqueous MS/MSD pair. The laboratory reported only benzene. MS/MSD results that exceed the laboratory's acceptance criteria are summarized below.

Analyte	Spike (µg/L)	MS% Recovery	MSD% Recovery	%RPD	LCS Acceptance
Benzene	10	-166,211	-166,205	0	83-117%/20%

The MS/MSD was performed on 12B-026000 undiluted. The benzene concentration in the sample was greater than the highest calibration standard and the spike concentration was too low to properly assess the MS/MSD recoveries. No results are qualified as a result of the MS/MSD results in 1505503. For all other VOC data packages, there were no MS/MSD results reported. LCS/LCSD results were used to assess method accuracy and precision. No field results were qualified due to the absence of MS/MSD results.

There were no MS or MS/MSD results reported for radon. LCS/LCSD results were used to assess method accuracy and precision. No field results were qualified due to the absence of MS/MSD results.

5.5 LABORATORY CONTROL SAMPLES

5.5.1 On-site Laboratory – Radiological Analyses

All LCS recoveries for aqueous sample alpha spectrometry and gross alpha/gross beta analyses (groundwater and surface water samples) were within the laboratory's acceptance criteria with the following exceptions:

Data Packages 15G-0105 and -0107

The following LCS recovery exceeds the laboratory derived acceptance criteria.

Radionuclide	STF Identifier	Lab Identifier	%Deviation Range Criteria	%Deviation
Ra-228	15-2007	15-04417	+37.5% to -17.1%	-25.2%

Based upon the low biased LCS recovery the Ra-228 results for 22A-085001, 22085001 LREP, 22A-085002, 22A-085024, 12B-085022, 09A-085016 and 09A-085017 DISS are qualified as estimated (J-). The reported results may be biased low. Also based upon the low biased LCS recovery the Ra-228 result for 22A-085023 is qualified as UJ. A false non-detect is possible.

Data Packages 15G-0130, -0134, etc.

LCS recoveries that exceed the laboratory derived acceptance criteria are summarized below.

Radionuclide	STF Identifier	Lab Identifier	%Deviation Range Criteria	%Deviation
Ra-228	15-2009	15-06846	+37.5% to -17.1%	-32.9%

Based upon the low biased LCS recovery the Ra-228 results for 12B-026028, 20A-025959, 20A-025960, 20A-025987, 19A-025988 and 19A-025989 are qualified as estimated (J-). The reported results may be biased low. The Ra-228 results for 12B-026030 and 20A-025960 LREP are qualified as UJ. A false negative is possible.

Data Packages 15G-0150, -0153, etc.

LCS recoveries that exceed the laboratory derived acceptance criteria are summarized below.

Radionuclide	STF Identifier	Lab Identifier	%Deviation Range Criteria	%Deviation
Ra-228	15-2011	15-07136	+37.5% to -17.1%	-17.8%

Based upon the low biased LCS recovery, the Ra-228 results for 12B-025995, 12B-025996, 12B-025997, 12B-026001, 12B-026000, 12B-026000 LREP and 12B-026047 are qualified as estimated (J-). The reported results may be biased low. The Ra-228 result for rinsate blank 12B-026032 is qualified as UJ. A false negative is possible.

Data Package 15G-0158, -0161, etc.

LCS recoveries that exceed the laboratory derived acceptance criteria are summarized below.

Radionuclide	STF Identifier	Lab Identifier	%Deviation Range Criteria	%Deviation
Ra-228	15-2014	15-07861	-17.1% to 37.5%	-29.7%
Ra-226	15-3014	15-07938	-14.5% to 18.5%	-21.8%

Based upon the low biased LCS recoveries, the Ra-228 results for 23A-026017, 12B-026008 and 23A-026016 LREP, and the Ra-226 results for 10A-026005, 10A-026006 and 12B-026009 are qualified as estimated (J-). The reported results may be biased low. The Ra-228 results for 23A-026016, 22A-026018, 22A-026019 and 12B-026049, and the Ra-226 results for 12B-026033, 10A-026052, 12B-026010, 12B-026012, 12b-026050 and 10A-026005 LREP are qualified as UJ. False non-detects are possible.

For alpha spectroscopy LCS results, Th-228 and Th-232 are not reported because Th-230 is the only thorium isotope in the LCS. For gamma spectroscopy LCS (Data Package 15G-0165), all LCS results are within the laboratory's established acceptance criteria.

5.5.2 Off-site Laboratory – Chemical Analyses

For elements analyzed using ICP/MS, all aqueous LCS results were within the laboratory's acceptance criteria of 80-120%.

For VOCs, all LCS and LCSD recoveries were within acceptance limits of 83-117% and the RPDs between LCS and LCSD recoveries were all less than the not-to-exceed value of 20%.

For radon, all LCS and LCSD recoveries were within acceptance limits of 75-125%.

5.6 FIELD REPLICATES AND LABORATORY REPLICATES

5.6.1 Field Replicates

There are no replicate precision QC limits for thorium isotopes in water since there are no action levels for these analytes. The control limits of 4.24μ, where μ is the required method uncertainty, are shown in the "Control Limits when Mean of the Replicate Pair less than Action Level" tables (hereafter referred to as the Tables) below. A more detailed discussion of the origin of these limits is described within the *Radionuclide Data Quality Evaluation Guidance* (USACE 2009). For thorium isotopes, the validator compared the difference between a given set of results relative to the method blank results. If the difference between the field replicate results was less than the method blank result, the data were not qualified.

Please note that the radiological control limits shown in the Tables are applied to both the field replicate and laboratory replicate results and are only applicable when the mean of the replicate results is less than the action level. If the mean is greater than the action level, the control limit value will be presented in the narrative bullets below.

Control Limits when Mean of the Replicate Pair less than Action Level

Sediment	
Radionuclide	**Control Limit Difference Factor 4.24μ (pCi/g)**
Pb-214	0.464
Ac-228	0.689
Th-234	8.65

Water	
Radionuclide	**Control Limit Difference Factor 4.24μ (pCi/L)**
Ra-226	1.17
Ra-228	1.93
U-234	3.24
U-238	1.99
Gross Alpha (900.0)	6.11
Gross Beta (900.0)	5.91
Gross Alpha (7110C)	4.73

The following field replicate (FREP) pairs were submitted for both radiological and chemical parameters (except for sediment pair 22A-026023/22A-026048, which was only analyzed for radiological solid parameters Th-232, Ra-226 and U-238, and surface water pair 22A-085001/22A-085023, which was only analyzed for isotopic thorium and uranium, Ra-226, Ra-228, Gross Alpha and Gross Beta).

Field Replicate Pairs Submitted		
12B-026000/12B-026047 (aq)	12B-026008/12B-026049 (aq)	12B-026012/12B-026050 (aq)
22A-085001/22A-085023 (aq)	22A-026023/22A-026048 (sed)	

All field replicate pair results were within USACE QC limits shown in the Tables for the radionuclides of concern except for the following.

Data Packages 15G-0150, -0153, etc.

Samples 12B-026000 and 12B-026047 are a field replicate pair. Results are summarized below.

Analyte	12B-026000			12B-026047		
	Result (pCi/L) [a]	Uncertainty (pCi/L) [a]	MDA [b] (pCi/L) [a]	Result (pCi/L) [a]	Uncertainty (pCi/L) [a]	MDA [b] (pCi/g) [a]
Gross Alpha	7.630	2.119	3.205	4.456	2.000	3.149
Gross Beta	923.06	14.71	5.515	1040.297	15.987	7.027
Ra-228	0.882	0.327	0.279	0.714	0.365	0.333
Ra-226	0.395	0.281	0.319	0.311	0.227	0.217
U-234	0.100	0.123	0.173	0.137	0.133	0.144
U-235	0.000	0.253	0.081	0.000	0.248	0.080
U-238	0.089	0.105	0.081	-0.010	0.062	0.144
Th-228	0.123	0.132	0.166	0.120	0.140	0.196
Th-230	0.576	0.285	0.166	0.559	0.286	0.148
Th-232	-0.001	0.060	0.077	-0.001	0.063	

Notes:
a. pCi/L = picocuries per liter
b. MDA= minimum detectable activity

The gross beta control limit is 11.8% and calculated difference factor is 11.9%. The gross beta results for 12B-026000, 12B-026000 LREP, 12B-026047 and 12B-026047 LREP are qualified as estimated (J). No other results are qualified based upon the field replicate precision.

5.6.2 Laboratory Replicates

For the chemical testing, only Maywood Interim Storage Site (MISS) groundwater field replicate sample pairs were analyzed. Field duplicate RPDs are less than 35% for all radon-222 results, and less than 20% for all positive elements results greater than 5X the reporting limit or differ by less than the reporting limit for all positive elements results less than 5X the reporting limit. For VOC (benzene) analyses, all RPD values are less than 50%.

The following aqueous laboratory replicate pairs were submitted for radiological analyses.

Laboratory Replicate Pairs Submitted		
20A-025960 / 20A-025960LREP	20A-025990 / 20A-025990LREP	20A-025992 / 20A-025992LREP
12B-026000 / 12B-026000LREP	12B-025997 / 12B-025997LREP	12B-026047 / 12B-026047LREP
10A-026005 / 10A-026005LREP	10A-026006 / 10A-026006LREP	12B-026009 / 12B-026009LREP
23A-026014 / 23A-026014LREP	23A-026016 / 23A-026016LREP	23A-026015 / 23A-026015LREP
22A-026018 / 22A-026018LREP	22A-085001 / 22A-085001LREP	09A-085016 / 09A-085016LREP
09A-085017 DISS and LREP		

All laboratory replicate difference factors are within the control limits except for the following:

Data Packages 15G-0105 and -0107

Sample 09A-085017 DISS was analyzed as a laboratory replicate sample for the gross alpha and gross beta analyses. Results are summarized below.

Analyte	09A-085017 DISS			09A-085017 DISS LREP		
	Result (pCi/L) [a]	Uncertainty (pCi/L) [a]	MDA [b] (pCi/L) [a]	Result (pCi/L) [a]	Uncertainty (pCi/L) [a]	MDA [b] (pCi/g) [a]
Gross Alpha	24.152	2.531	3.202	26.957	2.407	2.901
Gross Beta	89.262	5.526	5.500	104.417	7.447	8.535

Notes:
a. pCi/L = picocuries per liter
b. MDA= minimum detectable activity

The gross beta results exceed the precision acceptance criterion. The gross beta results for 09A-085017 DISS and 09A-085017 DISS LREP are qualified as estimated (J).

Data Package 1505370

For elements, only Data Package 1505370 contained laboratory replicate results for Maywood samples. All laboratory duplicate RPDs for elements are less than 20%.

5.6.3 Laboratory Duplicates

All samples requiring testing for Rn-222 were tested in duplicate. Laboratory duplicate analyses should have relative percent differences (RPDs) equal to or less than the % 2 sigma counting uncertainty plus 10%. All acceptance criteria were met except for the following:

Data Package 1505470

The Rn-222 result for Sample 12B-025996 and its laboratory duplicate are outside of acceptance criteria. The native sample result was reported as 199 +/- 34 pCi/L and the duplicate as 276 +/- 42 pCi/L. Sample 12B-025996 is qualified as estimated (J) as a result of the laboratory duplicate.

Data Package 1505370

Sample 20A-025960 was tested as a laboratory duplicate pair. The native sample result was reported as 1,170 +/- 140 pCi/L and the duplicate as 830 +/- 100 pCi/L. Sample 20A-025960 is qualified as estimated (J) as a result of these laboratory duplicate results.

5.6.4 Quality Assurance Split Samples

In addition to field replicates, there were four QA split samples collected and sent to an independent laboratory, Test America-St. Louis, (TA) which performed the same radiological analyses as the samples sent to UFML. The four samples are: 22a-085001 (surface water), 22A-026023 (sediment), 20A-025990 (groundwater), and 12B-025997 (groundwater). The QC acceptance criteria for the QA split sample pairs are that the results must be within a factor of two for aqueous pairs and within a factor of four for the sediment pair. For waters, data between a factor of two and three of each other should be considered as a minor discrepancy and data greater than a factor of three should be considered a major discrepancy while for soils data between a factor of four and five of each other should be considered as a minor discrepancy and data greater than a factor of five should be considered a major discrepancy. If one result was non-detect and the other a low-level positive detect, professional judgment was used to evaluated and qualify the data if needed.

Please also note that split samples for GA and GB will no longer be collected since the Ra-224 and its alpha and beta-emitting progeny will begin decaying away when the sample has been collected. Since the GA must be analyzed by the on-site lab within 48 hours of collection, the difference in the analysis times translates to a difference in the degree of decay of these radioisotopes making comparison less meaningful. Therefore, the GA and GB QA split results are not discussed here. All split results were within the QC limits noted above with the following exceptions.

For surface water split Sample 22a-085001, the Ra-228 result from the UFML and TA labs are 0.42 J pCi/L and 0.11 U pCi/L, respectively. Using professional judgment, no additional qualification is made. The UFML and TA results for U-234 are 0.07 U pCi/L and 0.17 pCi/L, respectively. The TA U-234 result is qualified estimated, J.

For groundwater Sample 20A-025990, the UFML and TA Ra-226 results are 0.12 U pCi/L and 0.57 pCi/L, respectively. The UFML may be a false non-detect and is qualified estimated non-detect, UJ. For U-238, the UFML and TA results are 0.02 U pCi/L 0.048 pCi/L, respectively. While the difference between the non-detect reporting value and the positive detect are greater than a factor of two, no qualifiers are added due to the very low levels. For Th-228 and Th-230, the UFML results are 0.01 U pCi/L and 0.35 J pCi/L, respectively while the values for TA are 0.12 pCi/L and 0.067 pCi/L, respectively. The TA values are only slightly above the MDC values. Using professional judgment, no additional qualifiers are added to the Th-228 and Th-230 results. All other results are within a factor of two of each other.

For groundwater Sample 12B-025997, the Ra-228 results for UFML and TA are 0.81 J pCi/L and 0.0081 U pCi/L, respectively. No additional qualifiers are required. All other results are either both non-detect or are within a factor of two of each other.

For sediment split Sample 22A-026023, all differences between the UFML results and the QA split sample lab results were within QC limits.

5.7 RADIONUCLIDE QUANTITATION AND IMPLIED DETECTION LIMITS (RADIOLOGICAL)

The laboratory reported the results with analytical uncertainties.

Some results are reported as negative results within the water data packages. Based upon USACE Guidance Radionuclide Data Quality Evaluation Guidance (USACE 2009), “Negative results that have uncertainties greater than the absolute value of the result, qualify the results U” and “for negative results that have uncertainties smaller than their absolute value, qualify the data “R” as rejected.” All reported negative results are qualified as U or UJ in all data packages.

If a result is greater than its minimum detectable activity (MDA), but less than its uncertainty, the probability that the result is greater than the MDA is greater than the probability that the result is less than the MDA. Such results are qualified as estimated (J) and are listed below for each data package.

5.7.1 Data Packages 15G-0105 and -0107.

No results were qualified estimated J based upon this criterion.

5.7.2 Data Packages 15G-0130, -0134, etc.

Sample ID [a]	Radionuclide	Result (pCi/L)	2 Sigma (pCi/L)	MDA (pCi/L) [b]
12B-026028	U-234	0.095	0.112	0.085
20A-025960	U-235	0.081	0.096	0.073
12A-025992 LREP	U-235	0.094	0.112	0.085
12A-025992 LREP	Ra-226	0.202	0.204	0.136

Notes:
a. Sample ID = Sample Identifier
b. MDA = minimum detectable activity

5.7.3 Data Packages 15G-0150, -0153, etc.

The following results are greater than their MDA, but less than their uncertainties and are therefore qualified estimated J.

Sample ID [a]	Radionuclide	Result (pCi/L)	2 Sigma (pCi/L)	MDA (pCi/L) [b]
12B-025995	Ra-226	0.172	0.174	0.116
12B-025995	U-235	0.110	0.112	0.074
12B-025995	Th-230	0.142	0.153	0.131
12B-026000	U-238	0.089	0.105	0.081
12B-026000 LREP	U-234	0.097	0.114	0.087
12B-026000 LREP	U-235	0.097	0.114	0.087

Notes:
a. Sample ID = Sample Identifier
b. MDA = minimum detectable activity

5.7.4 Data Package 15G-0158, -0161, etc.

The following results are greater than their MDAs, but less than their uncertainties and are therefore qualified estimated J.

Sample ID [a]	Radionuclide	Result (pCi/L)	2 Sigma (pCi/L)	MDA (pCi/L) [b]
10A-026006	Th-230	0.160	0.166	0.143
22A-026019	Th-228	0.090	0.107	0.082
12B-026049	U-238	0.096	0.114	0.087

Notes:
a. Sample ID = Sample Identifier
b. MDA = minimum detectable activity

No results in sediment Data Package 15G-0165 were qualified due to analytical uncertainties.

5.8 CHEMICAL SEPARATION SPECIFICITY (RADIONUCLIDES)

The energy of the radionuclide of interest must be within 40 kiloelectron volt (keV) of the theoretical energy for that radionuclide for samples analyzed by alpha spectroscopy. This criterion is not applied to results that are less than the MDA. All energies for radionuclides of interest analyzed by alpha spectroscopy were within 40 keV of their theoretical energies.

5.9 TARGET RADIONUCLIDE LIST IDENTIFICATION (RADIONUCLIDES)

This criterion is applied to gamma spectroscopy test results only. Only environmental monitoring sediment samples were analyzed by gamma spectroscopy. All observed peak energies were within 2 keV of the theoretical energy for all results.

5.10 MATRIX DENSITY VARIABILITY (RADIONUCLIDES)

This criterion only applies to sediment samples analyzed by gamma spectroscopy. All matrix density results are between 70-130%.

5.11 MISCELLANEOUS METALS QC

Maywood Sample 20A-025960 was analyzed as the aqueous ICP-MS serial dilution sample for arsenic, potassium and lithium (data package 1505370). ICP-MS serial dilution results that exceed the 15% acceptance criteria are summarized below.

Elements	Sample Result (µg/L)	Serial Dilution (µg/L)	%D	Action
Lithium	176	216	23	J
Potassium	3400	4190	23	J

The serial dilution percent difference for both lithium and potassium is 23%. The lithium and potassium results for 20A-025960 are both qualified as estimated (J). The serial dilution test in all other backfill element data packages was either performed on non-Maywood samples or not reported. No results were qualified based upon the absence of serial dilution results.

All ICP-MS method acceptance criteria were met for ICP-MS internal standard recoveries.

5.12 MISCELLANEOUS VOC QC

For VOCs, the laboratory reported three surrogates, 4-bromofluorobenzene, toluene-d8 and dibromofluoromethane. All surrogate recoveries were within the laboratory's acceptance criteria for aqueous samples.

All VOC internal standard results were within the laboratory's acceptance criteria, and all acceptance criteria for instrument tuning were met for all samples.

5.13 HOLDING TIMES

All sample analyses holding time requirements were satisfied.

6.0 DISCUSSION

All data was validated by an independent third party data validator. All data was generated using methods acceptable to the New Jersey Department of Environmental Protection (NJDEP) as evidenced by current laboratory certification for these methods. The results of the validation indicate that 100% of the data was acceptable; i.e., not rejected. Attachment A and Attachment B contain the radiological on-site laboratory data packages and chemical (plus radon) off-site laboratory data packages, respectively. Attachment C contains the data validation reports.

7.0 REFERENCES

ASTM 2009, *Standard for High-Resolution Gamma-Ray Spectrometry for Soil Sample.* ASTM C1402-04.

ANSI 1999, *Calibration and Use of Germanium Spectrometers for the Measurement of Gamma-Ray Emissions Rates of Radionuclides.* ANSI N42.14-99.

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EPA 1980, *Prescribed Procedures for Measurement of Radioactivity in Drinking Water.* EPA/600/4-80/032, August.

USACE 2009, *Radionuclide Data Quality Evaluation Guidance,* USACE Kansas City and St. Louis Districts, May 2009.

USACE 2013, *General Environmental Protection Plan, Revision 2*. Prepared by Shaw Environmental for USACE Kansas City District, June 2013.

USACE 2015, *Uniform Federal Projects – Quality Assurance Project Plan, Revision 3*. Prepared by Cabrera Services Inc. for USACE, November 2015.

USACE 2016, *Annual Environmental Monitoring Report, 2015.* Prepared by Cabrera Services Inc. for USACE, May 2016.

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Attachment A
Radiological Data Packages

(Provided in File 2 of 2)

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Attachment B
Chemical Data Packages

(Provided in File 2 of 2)

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Attachment C
Data Validation Reports

(Provided in File 2 of 2)

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