



**Addendum to the Site Evaluation Report for the Spill on
2/1/57 of Unknown of Seepage Basin Pipe Leak from 904-
44G (NBN) (WSRC-RP-2003-4049, Revision 0, June 2003)
(U)**

SEMS Number: 61

SRNS-RP-2023-00689

Revision 1

July 2025

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Printed in the United States of America

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and
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LIST OF ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	constituent of concern
COPC	constituent of potential concern
EN	essential nutrient
EPC	exposure point concentration
FFA	Federal Facility Agreement
ft	feet
ft ²	square feet
GPR	ground penetrating radar
GSA	General Separations Area
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HWMF	hazardous waste management facility
ISOCS	in situ object counting system
LLC	limited liability company
m	meter
m ²	square meter
mg/kg	milligrams per kilogram
NA	not applicable
NBN	no building number
ND	non-detect
O&M	operations and maintenance
pCi/g	picoCuries per gram
pCi/L	picoCuries per liter
pCi/mL	picoCuries per milliliter
PCB	polychlorinated biphenyl
POC	point of compliance
PRG	preliminary remediation goal
PTSM	principal threat source material
RBA	risk-based activity
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RME	reasonable maximum exposure
ROD	record of decision
RSL	regional screening level
SCDES ¹	South Carolina Department of Environmental Services
SE	site evaluation
SER	site evaluation report

¹ South Carolina Department of Environmental Services (SCDES) was previously known as South Carolina Department of Health and Environmental Control prior to July 1, 2024.

LIST OF ACRONYMS AND ABBREVIATIONS (*continued*)

SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
UCL	upper confidence limit
URMA	underground radioactive material area
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
WSRC	Westinghouse Savannah River Company

1.0 INTRODUCTION

The purpose of this addendum to the *Site Evaluation Report for the Spill on 2/1/57 of Unknown of Seepage Basin Pipe Leak from 904-44G (NBN) (U)* (WSRC 2003) is to document the results of a formal data evaluation and subsequent maintenance action to support the administrative path forward for the 904-44G Spill Site Evaluation Area. The name is a misnomer as there is no pipe leak associated with this area. For the purposes of this document, the area will be referred to as the “904-44G spill release area”.

The H-Area Hazardous Waste Management Facility (HWMF) includes four closed seepage basins (904-44G, 904-45G, 904-46G, and 904-56G) that formerly received wastewater from the H-Area Separations Facilities (Figure 1). These unlined seepage basins operated from 1955 to 1988 and received acidic, low-level radioactive wastewater containing primarily tritium with smaller amounts of other radionuclides including uranium and cesium. In February 1957, during early operations of Seepage Basin 904-44G, liquid effluent from the same low pH waste stream was observed seeping through the side berm of the basin. The seepage was stopped by adding soil to the berm and adjusting the basin pH to reduce the seepage rate. The release impacted roughly 1,160 square meters (m² [12,500 square feet {ft²]]) including approximately 30 meters (m [100 feet {ft}]) of a ditch leading southeast to Road 4 and approximately 60 m (200 ft) of ditch going south along Road 4. After the seepage was stopped, the impacted soil was either turned over or covered with additional soil.

The 904-44G spill release area was initially investigated in 2002 under the Savannah River Site (SRS) Site Evaluation (SE) program and placed in Federal Facility Agreement (FFA) Appendix C, *Resource Conservation and Recovery Act/ Comprehensive Environmental response, Compensation and Liability Act (RCRA/CERCLA) Units* due to the presence of a “hot spot”. A field start for the 904-44G spill release area was scheduled for September 2024.

In May 2023, Core Team representatives from the United States Environmental Protection Agency (USEPA), the South Carolina Department of Environmental Services (SCDES), and U.S. Department of Energy (USDOE) met to discuss the status of the 904-44G spill release area and reach agreement on the administrative path forward. Topics covered at that meeting included a

description of the history/background, nature and extent of contamination including consideration of radioactive decay, and the results of a preliminary data evaluation (i.e., human health risk screening and a principal threat source material (PTSM) evaluation). In August 2023, a second meeting was held, and the Core Team agreed that removal of the hot spot as a maintenance action (hot spot excavation) per the SRS Operations and Maintenance (O&M) Plan was appropriate (USDOE 2023). The Core Team agreed that formal documentation of the updated risk assessment was warranted in an addendum to the 2003 Site Evaluation Report (SER). Upon regulatory approval of the addendum, the 904-44G spill release area will be moved from Appendix C to Appendix G.2, *Areas Determined to Require No Further Response Action*, and FFA Appendices C, D, E, and G, as applicable, revised to reflect those changes (USDOE 2023).

In accordance with those Core Team agreements, an updated streamlined human health risk assessment (HHRA) and a PTSM evaluation using the data collected in 2002 are presented in this addendum. A description of the maintenance action performed, and post-O&M concentration activity levels is also provided.

This addendum also recognizes that activities and restrictions in the general area, within which the 904-44G spill release area is located, are managed under the SRS RCRA Permit Renewal for the H-Area HWMF. Therefore the location of an Underground Radioactive Material Area (URMA) in relation to the 904-44G spill release area is identified and data from soil samples collected during the installation of RCRA point-of-compliance (POC) wells is summarized in this addendum.

2.0 H-AREA HAZARDOUS WASTE MANAGEMENT FACILITY RCRA PERMIT RENEWAL

Seepage Basin 904-44G was closed under RCRA in 1991 and is part of the H-Area HWMF in accordance with the SRS RCRA Permit Renewal. The 904-44G spill release area is located adjacent to the H-Area HWMF cap/cover system and is within the H-Area HWMF coverage area for corrective action, post closure care, and the groundwater monitoring well network (including the POC wells, Figure 1).

2.1 Underground Radioactive Material Area

The 904-44G spill release area is encompassed by a larger area designated as an URMA due to subsurface contamination originating from the H-Area Seepage Basins and remaining subsurface infrastructure from the former HWMF Treatment Facility (that no longer operates). Therefore, the larger area designated as an URMA is inclusive of the 904-44G spill release site and is covered by the SRS Site Use/Site Clearance Program and no unauthorized digging/excavation is allowed. Figure 2 shows the location of the URMA and associated Buffer Area.

2.2 Point of Compliance Well Clusters

The SRS RCRA Permit Renewal for the H-Area HWMF requires groundwater monitoring at the POC wells. Groundwater samples are collected four times per year from the POC well clusters. POC clusters HBS-100 and HSB-101 monitor groundwater associated with the former operation of Seepage Basin 904-44G. These wells are outside the basin perimeter fence in the area impacted by the seepage basin release. The wells were installed in 1987 using auger and mud rotary drilling methods. During drilling, soil samples were collected from the vadose zone every 1.5 m (5 ft) down to a depth of 7.6 m (25 ft). Samples were screened for alpha, beta-gamma, and tritium. No readings were detected above background levels.

The well cluster closest to the 904-44G spill release area is HSB-100. Figure 1 shows locations of POC well clusters HSB-100, HSB-101, and HSB-102. The HSB-100 cluster contains two wells; the “D” well is screened in the water table aquifer and the deeper “C” well is screened in the lower aquifer below a tan clay layer. HSB-100D is screened from 6.4 to 12.5 m (21 to 41 ft) below ground surface and is approximately 7.6 m (25 ft) from soil sample HSB1-04. In addition, well HSB-100D is down gradient of soil sample location HSB1-04.

In 2022, the groundwater maximum concentrations at well HSB-100D are presented for the following radionuclides: gross alpha (2.88J pCi/L), nonvolatile beta (46.8 pCi/L), tritium (3.69 pCi/mL), cesium-137 (not detected), and uranium-238 (0.152J pCi/L). In the lower aquifer well HSB-100C, all the above-mentioned contaminants were not detected. Result values qualified with a “J” indicate the analyte was detected but was not able to be reliably quantified by the laboratory (i.e., estimated values). These low concentrations indicate that groundwater near soil sample

location HSB1-04 was neither impacted by the operation of Seepage Basin 904-44G nor the 1957 release of effluent to the ground surface.

3.0 904-44G SPILL RELEASE AREA BACKGROUND

The SER for the Spill from Seepage Basin 904-44G provides details of the area description, operational history, waste characteristics, sampling/monitory history, and potential exposure pathways (i.e., soil, air, surface water, groundwater) for the investigation conducted in 2002 (WSRC 2003) and is summarized below.

The 904-44G spill release area was investigated in 2002 under the SRS SE program. The following information summarizes the site investigation effort, data interpretation, and conclusions as described in the SER.

- A radiological survey was performed in April 2002. The survey confirmed this area as a "Clean Area" in accordance with SRS procedures.
- In June 2002, an In Situ Object Counting System (ISOCs) survey was conducted to better define the location of the spill.
- A ground penetrating radar (GPR) survey was conducted to identify underground interferences and aid in the selection of sample locations. The sample locations were chosen to avoid the interferences in the vicinity.
- In July 2002, composite soil sampling was performed for target analyte list constituents (inorganics) and target compound list compounds (organic chemicals, pesticides, and polychlorinated biphenyls [PCBs]), as well as gross alpha and nonvolatile beta and gamma pulse height analysis at 0 to 0.3 m (0 to 1 ft) and 0.3 m to 1.2 m (1 to 4 ft) depth intervals. Soil sampling was performed at 25 locations, including 3 background locations using a hand auger. Twenty-three of the locations (HSB1-04 through HSB1-26) were distributed evenly throughout the spill area and along the drainage ditch. There is a gap in the sequence of sample locations (HSB1-17 does not exist), due to an error during the layout of the sample locations. The remaining three locations (HSB1-01 through HSB1-03) were selected upgradient of the 904-44G spill release area based on the surface water flow path and identified as site-specific

background samples. A total of 55 samples were collected. A map of the sampling locations from the SER (WSRC 2003) is shown in Figure 3.

A review of the analytical results for these constituents indicated that arsenic, iron, 13 radiological isotopes, gross alpha, and nonvolatile beta were in soil samples at concentrations above the USEPA Region IX residential preliminary remediation goals (PRGs) or SRS risk-based activities (RBAs)². The USDOE believes that the arsenic exceedances are naturally occurring or due to pre-SRS farming activities. The iron exceedances are naturally occurring. The majority of the radiological exceedances are naturally occurring or a result of atmospheric deposition from nuclear bomb testing. However, the radiological exceedances at sample location HSB1-04 are believed to be the result of the liquid effluent from Seepage Basin 904-44G seeping through the side berm at this location. Sample location HSB1-04 is the closest location to the release area and is 8.2 m (27 ft) from the fence surrounding Seepage Basin 904-44G (Figure 4).

Of the 13 radiological isotopes that were detected in soil samples above their RBAs, six (actinium-228, bismuth-214, lead-212, lead-214, potassium-40, and thallium-208) are naturally occurring isotopes that are decay products of uranium or thorium with half-lives of fewer than 24 hours (USDOE 1996). These isotopes are not a result of SRS operations. This is supported by the fact that most of the exceedances (272 out of 281) are less than twice the site-specific background mean from the up-gradient background locations at the corresponding depth.

Six of the remaining seven isotope exceedances (americium-241, cobalt-60, plutonium-239/240, uranium-233/234, uranium-235, and uranium-238), as well as the gross alpha and nonvolatile beta exceedances, were detected at concentrations above their residential RBAs at sample location HSB1-04 only. All of these isotopes were in use at SRS as either reactor fuel or isotopes produced in the reactors (WSRC 1996) and were present in the seepage basin effluent. The presence of these isotopes at a single location suggests that these exceedances are the result of a release of seepage basin water at this location.

The remaining radiological isotope (cesium-137) is produced from nuclear fission. Approximately 35 million curies of cesium-137 were released into the atmosphere during nuclear bomb testing.

² USEPA Region IX PRGs (nonrads) and SRS RBAs (rads) are risk-based thresholds that were current at the time of the SER publication in 2003. Current nomenclature uses USEPA regional screening levels (RSLs) for nonrads and USEPA PRGs for rads.

Most of these releases have been deposited to the earth as fallout (USDOE 1996). All of the exceedances, with the exception of the two exceedances found at sample location HSB1-04, are most likely anomalies caused by atmospheric deposition from nuclear bomb testing. This is supported by the fact that the exceedances are scattered throughout the 904-44G spill release area including all three of the up-gradient background locations. Also, the samples did not contain other isotopes such as antimony-125, cobalt-60, or europium, which would typically be present in samples as a result of spill materials from SRS separations facilities. However, the two exceedances found at sample location HSB1-04 are most likely the result of a release of seepage basin water, since they do contain the isotopes which would typically be present as a result of spill materials from SRS separations facilities.

Based on these findings, the 2003 SER recommended that the Spill on 2/01/57 of Unknown of Seepage Basin Pipe Leak from 904-44G (NBN) be removed from Appendix G.1, *Areas to Be Investigated*, and transferred to Appendix C, *RCRA/CERCLA Units*, for further evaluation and action, as needed. The 904-44G spill release area was transferred to Appendix C in 2003.

4.0 SUPPLEMENTAL DATA EVALUATION

This evaluation uses the definitive quality level data for soil samples collected in 2002 for the 904-44G spill release area but updates the risk information with decay-corrected data and current risk threshold criteria described in more detail below. Appendix H of the SER provides all analytical results and a data screening summary of constituents that were above the risk-based screening thresholds that were in effect at the time the SER was published in 2003. The maximum detected concentrations/activities in the 0 to 0.3 m (0 to 1 ft) and 0.3 m to 1.2 m (1 to 4 ft) soil intervals are summarized in Tables 1 and 2 respectively. The output from the ProUCL software (version 5.2) (USEPA 2022) for each analyte is summarized in Table 1 for the 0 to 0.3 m (0 to 1 ft) interval.

The half-life of cesium-137 is 30.1 years and the half-life of cobalt-60 is 5.3 years. Since the data presented in the SER was collected and analyzed in 2002, the activities of these two isotopes were adjusted to acknowledge their decay over the last 21 years to provide a more accurate data evaluation that is representative of current conditions. Therefore, the original analytical results were adjusted assuming a laboratory analysis date of September 1, 2002, and a decay-corrected

date of September 1, 2023. The decay-adjusted activities of cesium-137 and cobalt-60 are shown in Table 3.

The data was processed in accordance with the protocols in Module 2 – Data Processing of the *Environmental Compliance and Area Completion Projects Regulatory Document Handbook* (SRNS 2023).

4.1 Streamlined Human Health Risk Assessment

A streamlined approach that uses standardized lookup tables to estimate risk has been used for this evaluation. The evaluation estimates the risk potential in the absence of a remedial action and provides a basis for documenting whether a remedial action is necessary. The streamlined HHRA was conducted in accordance with the Human Health Risk protocols described in Module 6 of the *Environmental Compliance and Area Completion Projects Regulatory Document Handbook* (SRNS 2023).

4.1.1 Receptors and Exposure Scenarios

4.1.1.1 Future Resident Exposure Scenario

The hypothetical future resident exposure scenario is a standard USEPA scenario which evaluates long-term risks to individuals expected to have unrestricted use of the unit. It assumes that residents live on the unit and are exposed chronically, both indoors and outdoors, to unit contaminants. The future resident scenario includes adults and children who will be exposed to the contaminated media. The standard exposure assumptions are 26 years, 350 days/year, 24 hours/day.

4.1.1.2 Future Industrial Worker Exposure Scenario

The future industrial worker exposure scenario is also a standard USEPA scenario which addresses long-term risks to workers who are chronically exposed to unit contaminants while working within an industrial setting. The future industrial worker is an adult who hypothetically works on-unit in an industrial setting for the majority of time. The standard exposure assumptions are 25 years, 250 days/year, 8 hours/day.

The primary exposure routes for evaluation relative to the resident and industrial worker scenarios include incidental ingestion, dermal contact, inhalation of windblown dust or volatile constituents, and external exposure from radionuclides.

The exposure media evaluated in this streamlined HHRA is the 0 to 0.3 m (0 to 1 ft) surface soil interval. Exposure to potential contamination in subsurface soil (all depths) is documented in the PTSM evaluation.

4.1.2 Sources of Risk-Based Threshold Values

The USEPA publishes regional screening levels (RSLs) for non-radiological constituents and PRGs for radiological constituents. These are risk-based concentrations (or activity concentrations) that can be used to evaluate potentially contaminated waste sites. Both RSLs and PRGs combine current USEPA toxicity values with standard exposure factors that represent reasonable maximum exposure (RME) conditions to estimate contaminant concentrations in exposure media that the agency considers protective of humans over a lifetime. The concentrations are based on direct exposure pathways for which generally accepted methods, models, and assumptions have been developed for specific land use conditions.

The *USEPA Regional Screening Levels* website provides generic exposure scenario tables and is the source of the RSLs (for non-radiological constituents) used in this evaluation (USEPA 2023a). The summary table uses all default parameters for both the residential and industrial worker scenarios. The RSL website was accessed in June 2023.

The *USEPA Preliminary Remediation Goals for Radionuclides* website also provides generic exposure scenario tables and is the source of the PRGs (for radiological constituents) used in this evaluation (USEPA 2023b). The PRGs for a residential scenario are obtained by using the calculator function to derive site-specific PRG values that are calculated by using all the default parameters with the exception of those that apply to the fruit and vegetable consumption pathways. The PRGs for an industrial worker scenario are obtained from the generic tables that assumes all default exposure assumptions. The PRG website was accessed in June 2023.

4.1.3 Constituents of Potential Concern Screening

The process to identify constituents of potential concern (COPCs) is described below. Residential values for soil media that represent unrestricted land use are used in this initial step.

- For noncarcinogens, compare unit maximum concentration to 0.1 RSL soil concentration.
- For carcinogens, compare unit maximum concentration to the RSL or PRG soil concentration.
- Compare unit maximum concentration of the naturally occurring (nonanthropogenic) constituents to 2X (two times) SRS average background soil concentration (WSRC 2006).
- Constituents exceeding both the residential soil RSL or PRG screening thresholds and the background screen are identified as COPCs and are carried forward to the risk/hazard calculation step.

The results of the COPC screening are provided in Table 4. The following constituents were identified as human health COPCs for surface soil (0 to 0.3 m [0 to 1 ft] interval): aluminum, arsenic, chromium, iron, lead, manganese, vanadium, cesium-137, potassium-40, thorium-232 and uranium-238.

4.1.4 Risk / Hazard Calculation

The process to identify constituents of concern (COCs) is summarized below.

- Segregate carcinogenic (risk) and non-carcinogenic (hazard) constituents. Risk and hazard estimates are based on the RME exposure point concentration (EPC), which is defined as the lesser of the maximum concentration and the 95% upper confidence limit (UCL) on the mean concentration.
- For carcinogens, the risk estimate = $(EPC / PRG \text{ or } RSL) \times 1E-06$ to calculate the total chemical risk, total radiological risk, and total media risk. Constituents with an individual cancer risk $\geq 1E-06$ are identified as COCs.
- For noncarcinogens, the hazard quotient (HQ) = (EPC / RSL) to calculate the total media hazard index (HI). If the total media HI < 1 , then no COCs are identified. If the total media HI ≥ 1 , then the constituents are segregated based on relevant target organs. HQs are summed

according to target organs. Constituents are identified as COCs if the total organ HQ ≥ 0.1 and the total organ HI ≥ 1 .

- Constituents identified as COCs are further evaluated in the refinement of constituents of concern step (i.e., uncertainty evaluation).

Tables 5 and 6 provide the results of the risk and hazard calculations for the resident and industrial worker scenarios respectively. Arsenic, chromium, cesium-137, potassium-40, thorium-232 and uranium-238 were identified as COCs in surface soil (0-1 ft) for both the hypothetical future resident and future industrial worker scenarios.

4.1.5 Refinement of Constituents of Concern

A recommendation of whether a COC should be carried forward for further remedial evaluation is based on a thorough analysis of each COC as described in the *Constituents of Concern Refinement Process* protocol in Module 8 of the *Environmental Compliance and Area Completion Projects Regulatory Document Handbook* (SRNS 2023). The uncertainty evaluation using relevant lines-of-evidence to support a recommendation to identify refined constituents of concern (RCOCs) that are problems warranting a remedial response action is provided below.

Arsenic

Arsenic was identified as a COC in surface soil (0 to 0.3 m [0 to 1 ft]) for both the future resident (risk = 5.0E-06) and the future industrial worker (risk = 1.1E-06) scenarios.

Arsenic was detected in 20 of 22 unit-specific surface soil samples, with 18 of the detects being estimated values (i.e., "J" qualified). Concentrations in unit surface soil ranged from non-detect (ND) to 5.41 mg/kg with an average concentration of 2.99 mg/kg. Sample location HSB1-09 had the highest detected concentration. The 95% UCL on the mean used in the risk calculation was 3.42 mg/kg. The residential RSL for soil media is 0.68 mg/kg and the industrial worker RSL for soil media is 3.0 mg/kg.

Arsenic is a naturally occurring constituent that is common in the environment. The maximum detected concentration in the SRS soil background dataset is 22.9 mg/kg (WSRC 2006). The maximum detected soil concentration at this unit is within the range of concentrations found in background soil at SRS.

Arsenic is widely distributed in the earth's crust, being present in soil and minerals. Organic arsenic compounds are used as pesticides, primarily in cotton fields and in fruit orchards. However, no arsenic pesticides were used at SRS. Arsenic pesticides were commonly used to combat the boll weevil by local cotton farmers prior to the establishment of SRS.

Arsenic is not recommended for further remedial evaluation as a human health RCO in surface soil for any receptor scenario based on the following lines of evidence:

- It is a naturally occurring constituent that is common in SRS background soils.
- Unit concentrations are within the SRS background soil concentration range.
- It does not appear to be unit related since it is indistinguishable from background.

Chromium

Chromium was identified as a COC in surface soil (0 to 0.3 m [0 to 1 ft]) for both the future resident (risk = 8.0E-05) and the future industrial worker (risk = 3.8E-06) scenarios.

Chromium was detected in 22 of 22 unit-specific surface soil samples, with 13 of the detects being estimated values (i.e., "J" qualified). Concentrations in unit surface soil ranged from 10.1 mg/kg to 35.9 mg/kg with an average concentration of 21.5 mg/kg. Sample location HSB1-09 had the highest detected concentration. The 95% UCL on the mean used in the risk calculation was 24.0 mg/kg. The residential RSL for soil media is 0.3 mg/kg and the industrial worker RSL for soil media is 6.3 mg/kg (RSLs for hexavalent chromium).

Chromium is a naturally occurring constituent that is common in the environment. The maximum concentration in the SRS soil background dataset is 54.3 mg/kg (WSRC 2006). Soil concentrations from this unit are within the range of concentrations found in background soil.

The chromium results used in this evaluation are based on a laboratory analysis of total chromium. However, the USEPA RSL website does not publish a RSL for total chromium. Therefore, the risk estimate conservatively used the hexavalent chromium RSL (residential RSL = 0.30 mg/kg and industrial worker RSL = 6.3 mg/kg) to perform the data screening. This overly conservative approach tends to bias the calculation high since it assumes that all of the total chromium detects are hexavalent chromium (most toxic form). Based on unit history and the environmental

conditions, it is likely that the trivalent form of chromium is most prevalent at this unit. In addition, the RSLs for trivalent chromium are 1.2E+05 mg/kg for the residential exposure scenario and 1.8E+06 mg/kg for the industrial worker exposure scenario. Unit maximum detected concentration (35.9 mg/kg) are well below these thresholds.

Chromium is not recommended for further remedial evaluation as a human health RCO in surface soil for any receptor scenario based on the following lines of evidence:

- It is a naturally occurring constituent that is common in SRS background soils.
- Unit concentrations are within the SRS background soil concentration range.
- It does not appear to be unit related since it is indistinguishable from background.
- The screening risk calculation is biased high due to use of the overly conservative hexavalent chromium RSL.
- The unit maximum detected concentration is below the residential and industrial RSLs for trivalent chromium.

Potassium-40

Potassium-40 was identified as a COC in surface soil (0 to 0.3 m [0 to 1 ft]) for both the future resident (risk = 2.1E-05) and the future industrial worker (risk = 1.4E-05) scenarios.

Potassium-40 was detected in 22 of 22 unit-specific surface soil samples, with none of the detects being estimated values (i.e., "J" qualified). Activity concentrations in unit surface soil ranged from 0.69 pCi/g to 9.52 pCi/g with an average activity concentration of 2.24 pCi/g. Sample location HSB1-04 had the highest detected activity concentration. The 95% UCL on the mean used in the risk calculation was 2.98 pCi/g. The residential PRG for soil media is 0.14 pCi/g and the industrial worker PRG for soil media is 0.22 pCi/g.

Potassium-40 is a naturally occurring constituent that is common in the environment. The SRS soil background maximum activity concentration is 8.53 pCi/g (WSRC 2006). Only one of the 22 detected potassium-40 values (9.52 pCi/g) exceeds the SRS background maximum activity concentration; all other results are below.

Potassium-40 is a naturally occurring constituent of primordial origin with a half-life of 1.2 billion years. Primordial nuclides are those that are long-lived and have existed in the earth's crust throughout history. The main contributors to external exposure from primordial nuclides are potassium-40, uranium-238, and thorium-232 (and their daughter products).

Potassium-40 is not associated with any of the reactor processes at SRS.

Potassium-40 is not recommended for further remedial evaluation as a human health RCO in surface soil for any of the receptor scenarios based on the following lines of evidence:

- It is a naturally occurring constituent that is common in SRS background soils.
- Only 1 of the 22 detected results is above the SRS background maximum activity concentration.
- It does not appear to be unit related since it is indistinguishable from background.
- Potassium-40 is not associated with any of the reactor processes and is not considered a DOE-added constituent.

Thorium-232

Thorium-232 was identified as a COC in surface soil (0 to 0.3 m [0 to 1 ft]) for both the future resident (risk = 1.8E-04) and the future industrial worker (risk = 1.1E-04) scenarios.

Thorium-232 was not measured directly in the laboratory. Actinium-228, lead-212 and thallium-208 are daughter products of thorium-232 and can be used to estimate its activity since these isotopes are in secular equilibrium. Actinium-228 had the highest detected activity concentrations from the entire decay chain and was used to calculate the statistics as a surrogate for thorium-232. The daughter products are not evaluated separately since they are considered in the thorium-232 PRG.

Thorium-232 (actinium-228) was detected in 22 of 22 unit-specific surface soil samples, with none of the detects being estimated values (i.e., "J" qualified). Activity concentrations in unit surface soil ranged from 1.04 pCi/g to 3.73 pCi/g with an average activity concentration of 1.51 pCi/g. Sample location HSB1-23 had the highest detected activity concentration. The 95% UCL on the

mean used in the risk calculation was 1.75 pCi/g. The thorium-232 residential PRG for soil media is 0.0099 pCi/g and the industrial worker PRG for soil media is 0.015 pCi/g.

Background comparisons for the thorium-232 series includes consideration of the range of activity concentrations for the entire decay chain (i.e., includes daughter products). The SRS soil background maximum detected activity concentration is 6.75 pCi/g, based on the radium-228 result (WSRC 2006). Soil activity concentrations from this unit are within SRS background activity concentrations.

Thorium-232 is a naturally occurring constituent of primordial origin with a half-life of 14 billion years. As previously discussed, primordial nuclides are those that are long lived and have existed in the earth's crust throughout history. The main contributors to external exposure from primordial nuclides are potassium-40, uranium-238, and thorium-232 (and their daughter products). Thorium series activity concentrations at this unit are typical of natural thorium.

Thorium-232 is not recommended for further remedial evaluation as a human health RCOC in surface soil for any of the receptor scenarios based on the following lines of evidence:

- It is a naturally occurring constituent that is common in SRS background soils.
- Unit activity concentrations are within the SRS soil background activity concentration range.
- It does not appear to be unit related since it is indistinguishable from background.

Uranium-238

Uranium-238 was identified as a COC in surface soil (0 to 0.3 m [0 to 1 ft]) for both the future resident (risk = 5.0E-05) and the future industrial worker (risk = 3.1E-05) scenarios.

Uranium-238 was measured directly in the laboratory at the one location that exceeded the gross alpha screening criteria. The screening criteria of 20 pCi/g was exceeded at location HSB1-04 in the 1-4 ft interval (gross alpha = 39.2 pCi/g). Therefore, alpha spectroscopy was performed for all samples (including the 0 to 0.3 m [0 to 1 ft] interval) from sample location HSB1-04. The uranium-238 result from the 0 to 0.3 m (0 to 1 ft) interval = 1.22 pCi/g.

Lead-214 and bismuth-214 are daughter products of uranium-238 and can be used to estimate its activity since these isotopes are in secular equilibrium. The results from sample location HSB1-04

are uranium-238 = 1.22 pCi/g, lead-214 = 1.06 pCi/g, and bismuth-214 = 0.977 pCi/g. Since there is only one measured uranium-238 result for the entire exposure area, lead-214 results were used as a surrogate to calculate the 95% UCL statistic for uranium-238 since there are lead-214 results from all sample locations in the 904-44G spill release area.

Uranium-238 (lead-214) was detected in 12 of 22 unit-specific surface soil samples, with none of the detects being estimated values (i.e., "J" qualified). Activity concentrations in unit surface soil ranged from ND to 1.06 pCi/g with an average activity concentration of 0.471 pCi/g. Sample location HSB1-04 had the highest detected activity concentration. The 95% UCL on the mean used in the risk calculation was 0.628 pCi/g. The uranium-238 residential PRG for soil media is 0.013 pCi/g and the industrial worker PRG for soil media is 0.02 pCi/g.

Background comparisons for the uranium-238 series includes consideration of the range of activity concentrations for the entire decay chain (i.e., includes daughter products). The SRS soil background maximum detected activity concentration is 2.78 pCi/g, based on the thorium-230 result; the maximum detected activity concentration for uranium-238 is 1.9 pCi/g. Soil activity concentrations from this unit are within SRS background activity concentrations.

Uranium-238 is a naturally occurring constituent of primordial origin with a half-life of 4.5 billion years. As previously discussed, primordial nuclides are those that are long lived and have existed in the earth's crust throughout history. The main contributors to external exposure from primordial nuclides are potassium-40, uranium-238, and thorium-232 (and their daughter products). Uranium series activity concentrations at this unit are typical of natural uranium.

Uranium-238 is not recommended for further remedial evaluation as a human health RCOC in surface soil for any of the receptor scenarios based on the following lines of evidence:

- It is a naturally occurring constituent that is common in SRS background soils.
- Unit activity concentrations are within the SRS soil background activity concentration range.
- It does not appear to be unit related since it is indistinguishable from background.

Cesium-137

Cesium-137 was identified as a COC in surface soil (0 to 0.3 m [0 to 1 ft]) for both the future resident (risk = 1.2E-05) and the future industrial worker (risk = 7.7E-06) scenarios.

Cesium-137 was detected in 21 of 22 unit-specific surface soil samples, with 1 of the detects being and an estimated value (i.e., "J" qualified). Activity concentrations in unit surface soil ranged from ND to 10 pCi/g (decay-adjusted = 6.16 pCi/g) with an average decay-adjusted activity concentration of 0.47 pCi/g. Sample location HSB1-04 had the highest detected activity concentration. The 95% UCL on the mean used in the risk calculation was 0.696 pCi/g. The residential PRG for soil media is 0.061 pCi/g and the industrial worker PRG for soil media is 0.091 pCi/g.

Cesium-137 is a result of nuclear fission and does not occur naturally in soil. However, cesium-137 is common in SRS background soils as a result of fallout from nuclear weapons testing. Maximum activity concentration in SRS background soils is 3.3 pCi/g and the mean activity concentration is 0.142 pCi/g (WSRC 2006).

The cesium-137 at sample location HSB1-04 is unit related and is the result of the liquid effluent from Seepage Basin 904-44G seeping through the side berm. It is within the boundaries/oversight of the SRS RCRA Permit Renewal for the H-Area HWMF.

The cesium-137 95th percentile detected in SRS background soils is 0.34 pCi/g, which is low when compared to “typical” anthropogenic fallout levels generally recognized at 1 pCi/g or less. To account for the variability in background concentrations of cesium-137 and for consistency with generally recognized fallout levels, the cleanup level has been set at two times (2X) the 95th percentile of SRS background soil represented at 0.68 pCi/g. This activity concentration equates to a residential risk of < 1E-04 and is within the USEPA target risk range.

The SRS cleanup level of 0.68 pCi/g for free release (unrestricted use) has been established in recently approved SRS Record of Decision documents, including: the *Record of Decision Remedial Alternative Selection for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit (U)* (SRNS 2018) and the *Record of Decision Remedial Alternative Selection for the Lower Three Runs Integrator Operable Unit (U)* (SRNS 2021).

Due to radioactive decay since the time that the spill was initially discovered in 1957 and subsequently sampled in 2002, the decay-adjusted activity concentration of cesium-137 in 2023 over the entire exposure area (95% UCL = 0.696 pCi/g) essentially meets the established cleanup level of 0.68 pCi/g. However, the decay-corrected cesium-137 activity level at location HSB1-04 of 6.3 pCi/g is an order of magnitude greater than the cleanup level. Therefore, cesium-137 is considered a RCOC and should be evaluated for remedial action as it represents a problem warranting action in surface soil.

4.1.6 HHRA Conclusion

Cesium-137 is identified as a RCOC and problem warranting action at hotspot location HSB1-04 in surface soil.

4.2 Principal Threat Source Material Evaluation

To determine whether contaminated source soils should be preliminarily considered PTSM, a simple quantitative assessment evaluating the toxicity of the source is used as described in the *Evaluation of PTSM at SRS Waste Units* protocol in Module 6 of the *Environmental Compliance and Area Completion Projects Regulatory Document Handbook* (SRNS 2023).

The PTSM evaluation considers the cumulative effects of both the potential risk from carcinogenic constituents and the adverse health effects from noncarcinogens to human receptors. Because the future land use scenario for the 904-44G spill release area is industrial, the toxicity assessment of the source material is based on the potential exposure of a future industrial worker.

The maximum detected concentration/activity from the 0 to 0.3 m (0 to 1 ft) and 0.3 m to 1.2 m (1 to 4 ft) intervals (i.e., all depths) was used in this evaluation (Tables 1 and 2). Cesium-137 and cobalt-60 activity concentrations were decay-adjusted (Table 3).

The *USEPA Regional Screening Levels* website (USEPA 2023a) for non-radiological constituents and the *USEPA Preliminary Remediation Goals for Radionuclides* website (USEPA 2023b) were used as the source of the risk-based thresholds used in this evaluation. Industrial worker thresholds from the generic tables were used in the data screening effort with the following exception related to the uranium isotopes described below.

As discussed in the HHRA, uranium-238 and its daughter products in the Uranium Series are in secular equilibrium in the 0 to 0.3 m (0 to 1 ft) interval: uranium-238 = 1.22 pCi/g; uranium-233/234 (assume 234) = 0.922 pCi/g; lead-214 = 1.06 pCi/g; and bismuth-214 = 0.977 pCi/g. Uranium is a naturally occurring radioactive material that is primordial in origin and the activities of these isotopes are within SRS soil background activity levels (SRS background soil maximum = 1.9 pCi/g). Therefore, the default peak risk PRG that assumes secular equilibrium throughout the entire Uranium Series decay chain was used in the HHRA evaluation of the 0 to 0.3 m (0 to 1 ft) interval.

In contrast, the Uranium Series isotopes are not in secular equilibrium in the 0.3 m to 1.2 m (1 to 4 ft) interval: uranium-238 = 18.9 pCi/g; uranium-233/234 = 17.4 pCi/g; lead-214 = 1.1 pCi/g; and bismuth-214 = 1.01 pCi/g. The lead-214 and bismuth-214 activities are consistent with SRS soil background levels as described above but are not in secular equilibrium with the uranium-238 and uranium 233/234 activities.

All uranium used at SRS was highly purified elementally and daughter products were removed as part of the process. Since uranium-234 (half-life = 2.46×10^5 years), uranium-235 (half-life = 7.04×10^8 years) and uranium-238 (half-life = 4.47×10^9 years) have very long half-lives, no decay chain products have had an opportunity to measurably in-grow during the 75-year existence of the SRS. Therefore, the assumption of secular equilibrium does not apply and the default peak risk PRG (infinite time period) is not appropriate for the uranium isotopes in the 0.3 m to 1.2 m (1 to 4 ft) interval.

The PRG website acknowledges a site-specific situation where a purified radionuclide was recently disposed or released and offers a user-defined time period option. This option operates just like the default infinite time option but calculates the peak risk PRG at a user-defined time in the future. Therefore, the PRGs for uranium-234, uranium-235 and uranium-238 were calculated using this option and the 1000-year peak time frame option was selected.

The source material is preliminarily considered to be PTSM if the cumulative risk exceeds one of the following toxicity threshold criteria:

- Carcinogens - greater than 1×10^{-3} industrial worker risk

- Noncarcinogens – industrial worker HI greater than 10

For carcinogens, the individual risk is calculated by multiplying the ratio of the EPC over the RSL or PRG by $1E-06$. In the preliminary screen, the unit maximum concentration for every detected constituent is used as the EPC. Each of these risks is summed to calculate the cumulative carcinogenic risk of the source. For noncarcinogens, an individual HQ is equal to the ratio of the EPC over the RSL. These HQs are summed to derive the HI. If the threshold criteria for PTSM are not exceeded based on a maximum concentration, then PTSM is not present and further evaluation is not necessary.

4.2.1 PTSM Evaluation Results

The results of the PTSM screening are shown in Table 7. The total cumulative risk = $4.7E-04$ and $HI = 0.22$. These screening results are below the established thresholds and there is no PTSM at the 904-44G spill release area.

The risk for thorium-232 (risk = $2.4E-04$) makes up a significant portion of the total cumulative risk estimate. However, the Thorium Series isotopes are within SRS background activities and are not unit related. Similarly, potassium-40 has a risk = $4.4E-05$ and contributes to the cumulative risk estimate, but it is not unit related.

Cesium-137 (risk = $1.5E-04$), uranium-234 (risk = $2.1E-06$), uranium-235 (risk = $4.1E-06$) and uranium 238 (risk = $1.3E-05$) are the primary drivers for the PTSM determination. The total cumulative risk for these constituents, that are consistent with a release from the Seepage Basin 904-44G, = $1.7E-04$. Maximum detected activity concentrations of all unit related constituents are in the 0.3 m to 1.2 m (1 to 4 ft) interval.

4.2.2 PTSM Evaluation Conclusion

No PTSM RCOCs are identified.

4.3 Data Evaluation Summary

The 904-44G spill release area is located adjacent to the H-Area HWMF cap/cover system and is within the H-Area HWMF coverage area for corrective action, post closure care, an existing URMA, and the groundwater monitoring well network.

In surface soil (0 to 0.3 m [0 to 1 ft]), cesium-137 is the only potential risk driver at one sample location. The decay-adjusted 95% UCL of 0.696 pCi/g was used to calculate the risk for both the resident and industrial worker scenarios (residential risk = 1.2E-05; industrial risk = 7.7E-06). The established cleanup level for unrestricted land use is based on a SRS background concentration of 0.68 pCi/g. The 95% UCL for the entire 904-44G spill release area dataset essentially meets the cleanup level. However, the decay-corrected cesium-137 activity level at location HSB1-04 of 6.3 pCi/g is an order of magnitude greater than the cleanup level. Therefore, cesium-137 is considered a RCOC.

There is no PTSM in the all-depths soil interval (0 to 0.3 m [0 to 1 ft] and 0.3 m to 1.2 m [1 to 4 ft]). All seepage basin spill related constituents (i.e., cesium-137 and uranium 234, uranium-235 and uranium-238) have maximum detected activity concentrations that are in the 0.3 m to 1.2 m (1 to 4 ft) interval at sample location HSB1-04.

Sample location HSB1-04 represents a hotspot. The decay-corrected cesium-137 activity concentrations in the 0 to 0.3 m (0 to 1 ft) and 0.3 m to 1.2 m (1 to 4 ft) intervals are 6.2 pCi/g and 13.9 pCi/g, respectively. Excavation of the HSB1-04 hotspot (0 to 1 ft depth) will ensure Cs-137 surface soil concentrations meet the background RG level of 0.68 pCi/g over the entire exposure area.

5.0 O&M HOTSPOT EXCAVATION

The SRS Operations and Maintenance Plan (WSRC 1996) allows for operational/maintenance activities to be conducted at SRS within FFA RCRA/CERCLA units or SE Areas. The CERCLA O&M Plan status/completion is documented in the annual FFA Removal Action Report. The site-specific O&M Plan (SRNS 2024) for the 904-44G spill release area describes the O&M activities for excavation of soil exceeding acceptable background levels for cesium-137 for routine worker protection in support of long-term post-closure care maintenance at the H Area HWMF. The O&M action was performed at the HSB1-04 hotspot and surrounding area.

The O&M activities included the following:

- Soil sampling to define the area of excavation
- Establish excavation boundary

- Excavation of surface soil down to a minimum depth of 0.3 m (1 ft)
- Containerization and disposal of excavated soil; and
- Backfill excavated area with crusher run to grade.

As part of the O&M activities, a soil sampling plan was executed to define the area requiring excavation, support development of any radiological controls for the excavation, and provide data for characterization of the soils for disposal at E Area. On January 13, 2024, soil samples were collected at nine locations around the HSB1-04 hotspot from 0 - 0.3 m (0-1 ft) depth and at a tenth location adjacent to HSB1-04 from 0-0.3 m and 0.3-0.61 m (0-1 and 1-2 ft) (Figure 5). The 2024 sample locations are identified as 904-44G-1 through 904-44G-10. Samples were collected using hand augers. All samples were analyzed for cesium-137 while soil from location 10 was also analyzed for waste characterization constituents. Quality control samples included one split sample, one field duplicate sample, and a rinsate/equipment blank. Laboratory results were verified to the definitive data quality level. Table 8 summarizes the results for cesium-137.

The maximum concentration of cesium-137 (1.36 pCi/g) in the 0-0.3 m (0-1 ft) interval was lower than measured in the 2002 sampling event and was detected in the middle of the excavation area at location 904-44G-5. Cesium-137 at sample 904-44G-10, located adjacent to the 2002 HSB1-04 hotspot, was 0.434 pCi/g. Results at four of the ten locations exceeded the 0.68 pCi/g cleanup level. The mean concentration of cesium-137 at the excavation perimeter samples was 0.552 pCi/g which is less than the cleanup level of 0.68 pCi/g.

5.1 Soil Excavation

On May 7, 2024, SRS Site Services Division excavated soil above the background cesium-137 concentration down to 0.3 m (1 ft) below ground surface using a Case 821E Wheel Loader and a CAT 420 Backhoe (Figure 6). A total volume of approximately 14.1 m³ (18.5 cubic yards) was excavated. The area of excavation (approximately 6.1 m by 7.6 m [20 ft by 25 ft]) was defined by using the soil sampling strategy discussed in Section 5.0. The excavation limit extended beyond the 2024 soil sample perimeter locations and included soil at the HSB1-04 hotspot. No unanticipated field conditions were encountered.

Per the SRS Radiation Protection Department and Generator Certification Official instruction, waste generated by performance of this maintenance action was containerized, certified, and disposed as Low-Level Waste at the E-Area Slit Trenches (Figure 7). Characterization samples were taken prior to the start of excavation and these data were used for waste determination. All waste (approximately 19.1 m³ [25 cubic yards]) consisting of soil and job control waste was placed in two 23 m³ (30 cubic yard) capacity roll off containers and transported to the E-Area Slit Trench Disposal Units.

The depth of excavation to a minimum depth of 0.3 m (1 ft) was verified by field measurement and documented with photos of the measurements (Figure 8).

After verification and documentation was complete, the excavation was filled and graded with crusher run gravel to provide positive uniform sheet flow drainage (maximum slope of 2%) toward the perimeter drainage ditch. The gravel area will be used as a parking area for sampling the nearby wells (Figure 9).

6.0 CONCLUSION

The cesium-137 hotspot at location HSB1-04 has been excavated through a maintenance action under the SRS O&M Plan. The decay-corrected 95% UCL for the entire exposure area without the hotspot is 0.351 pCi/g, which is less than the cleanup level of 0.68 pCi/g. This calculation uses the 2002 data set excepting HSB1-04. Cesium-137 surface soil concentrations are consistent with background levels over the entire exposure area. Therefore, it is recommended that the 904-44G spill release area be moved to Appendix G.2, *Areas Determined to Require No Further Response Action*.

7.0 REFERENCES

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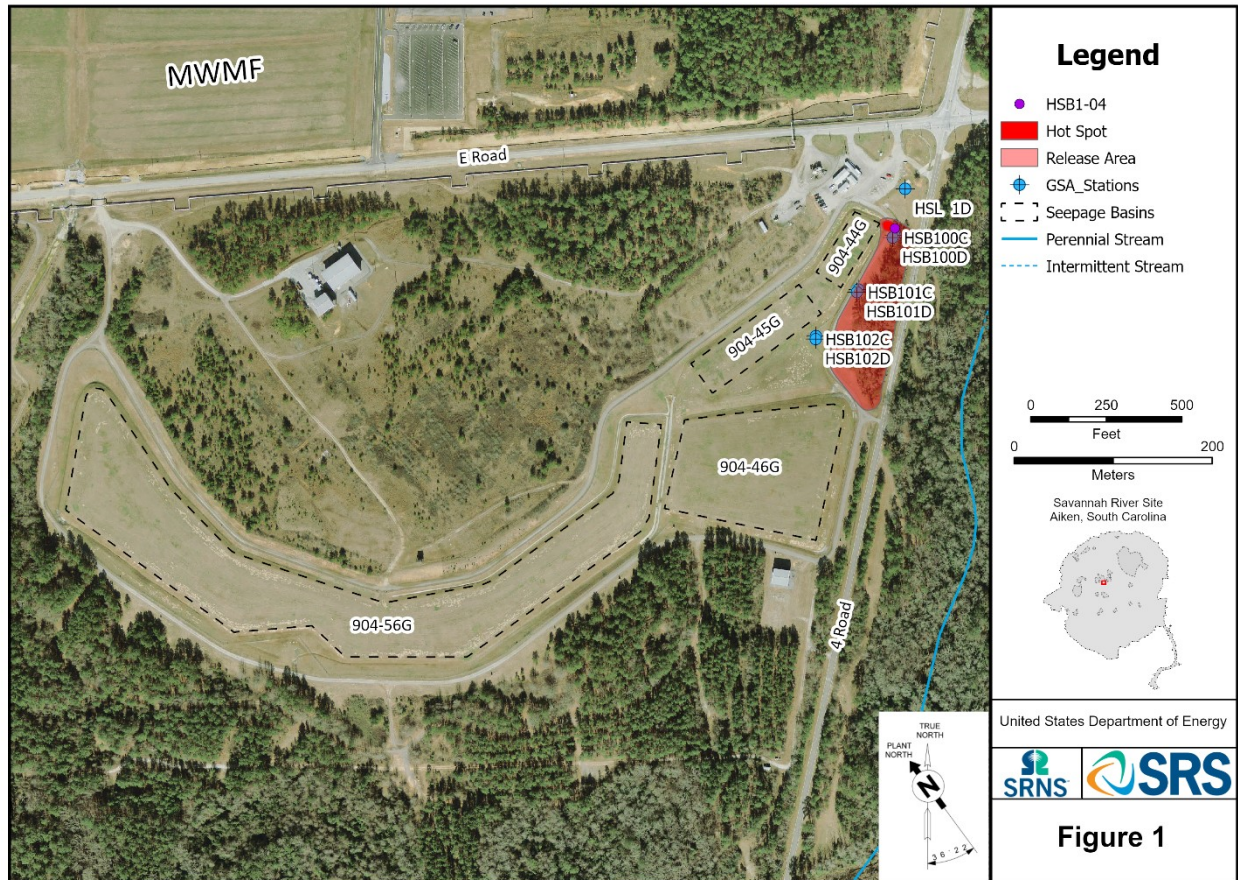


Figure 1. H-Area Hazardous Waste Management Facility Showing Location of 1957 Spill Area and Cesium-137 Hot Spot

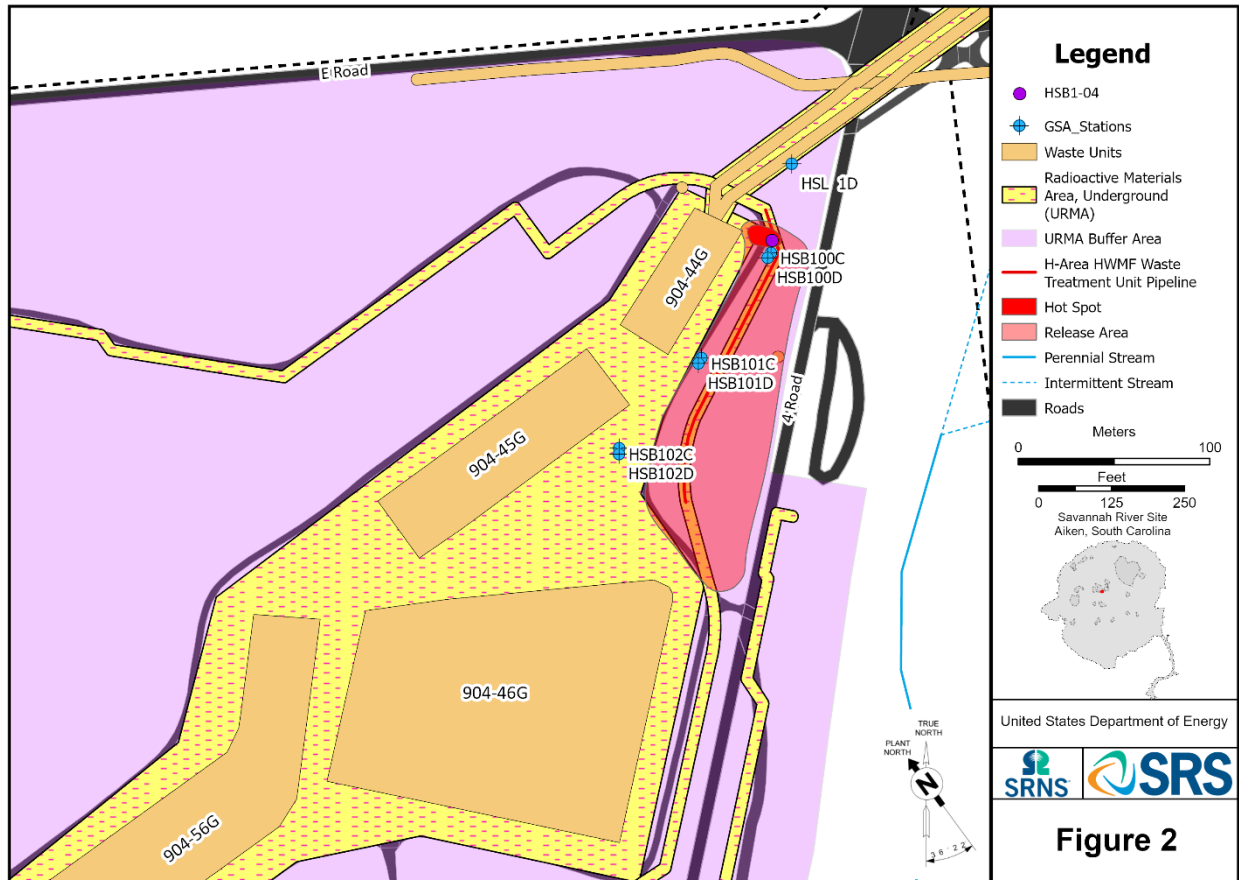


Figure 2. H-Area Hazardous Waste Management Facility Underground Radioactive Materials Area and Associated Buffer Area

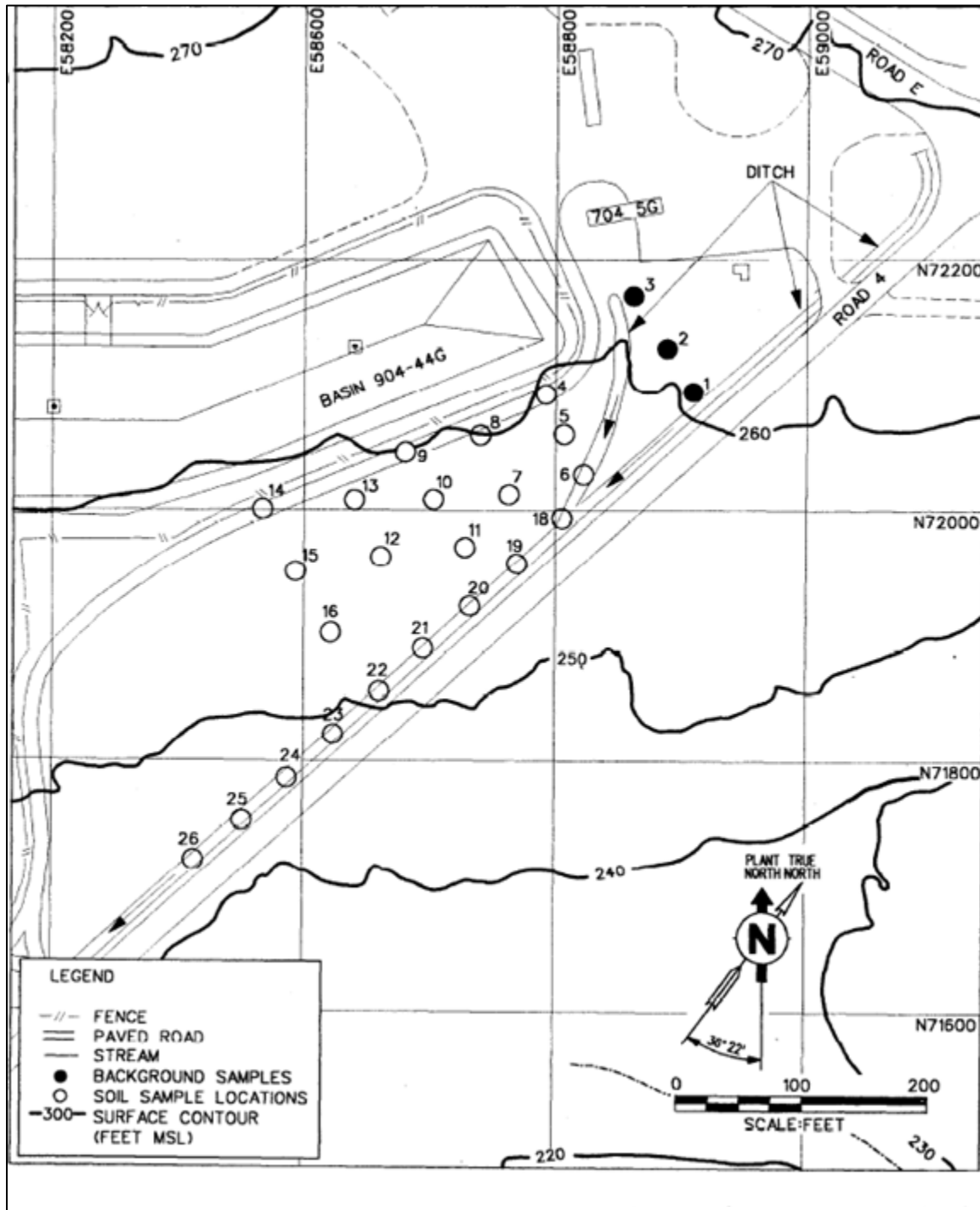


Figure 3. Soil Sample Locations from the 2003 Site Evaluation Report (WSRC 2003)

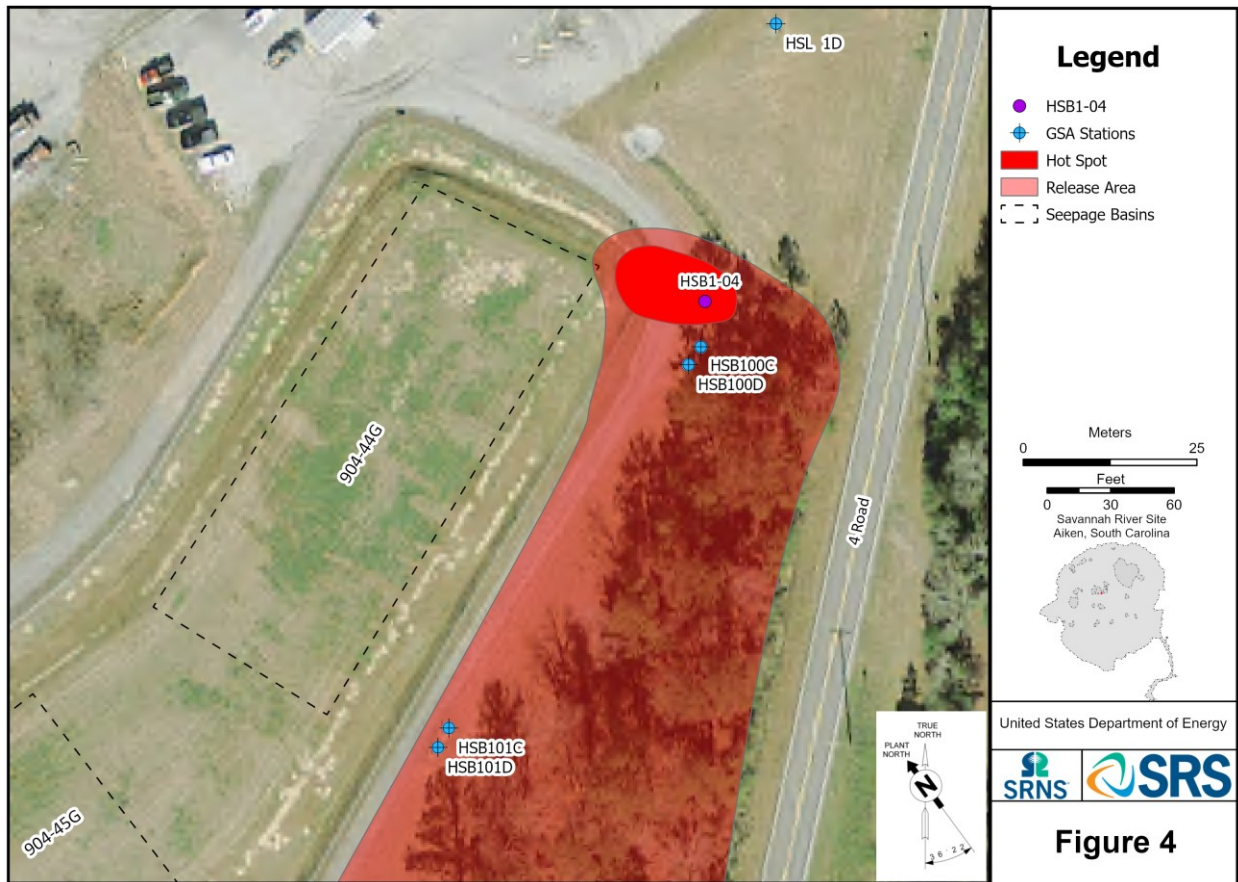


Figure 4. 904-44G Spill Release Area Hot Spot and Location of Sample HSB1-04

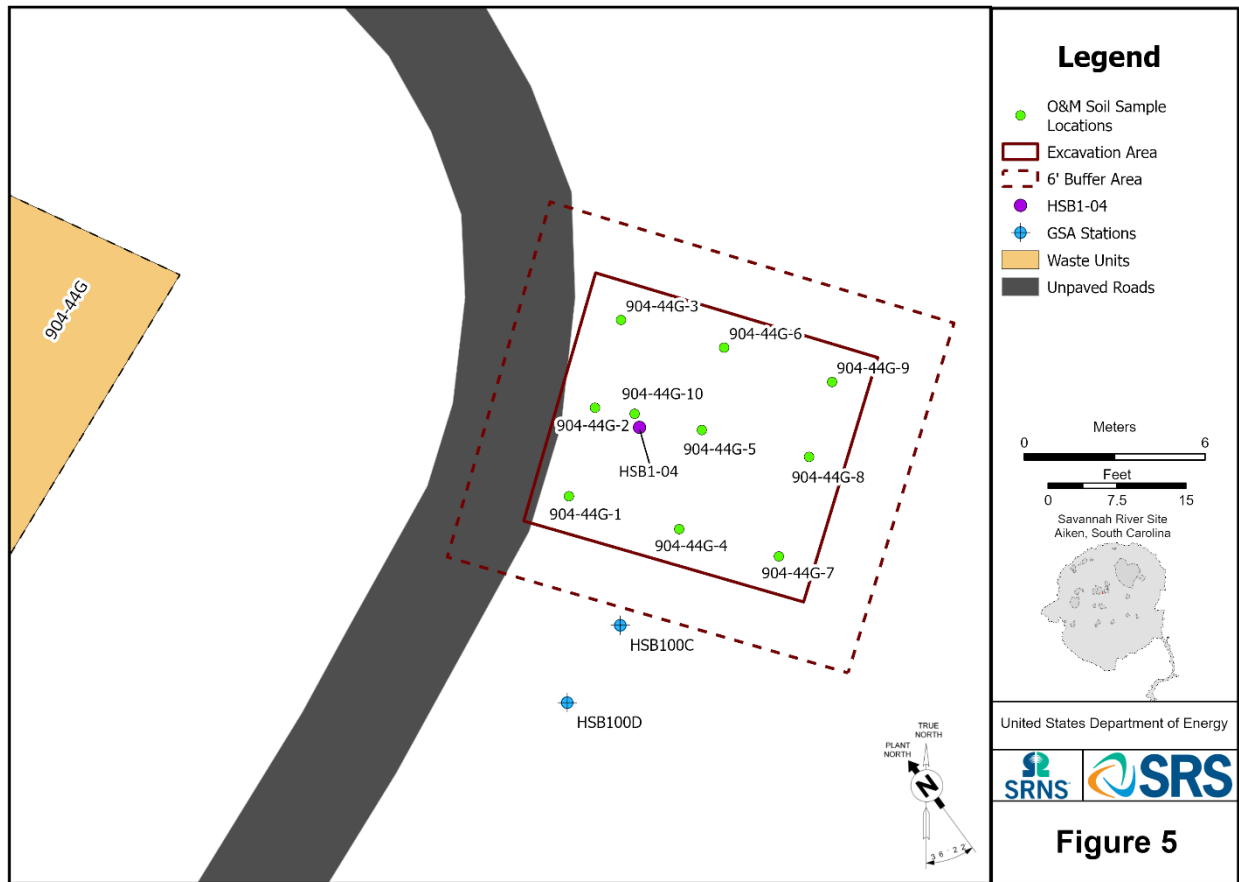


Figure 5. O&M Soil Sample Locations and Excavation Limits at the 904-44G Spill Release Area Hot Spot



Figure 6. Equipment Used for the 904-44G Spill Release Area Soil Excavation (2024)



Figure 7. Containerization of Excavated Material from the 904-44G Spill Release Area (2024)



Figure 8. Verification of Excavated Depth at the 904-44G Spill Release Area (2024)



Figure 9. 904-44G Spill Release Area After Excavation Completion (2024)

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Table 1. Maximum Detected Concentrations at 904-44G Spill Release Area (0-1 ft interval)

Sample Location	Analyte	Analytical Method	Qualifier	95% UCL	DISTR Code	UCL Method	Max Result	Result Units	Top Sample Interval (ft)	Bottom Sample Interval (ft)
HSB1-14	ALUMINUM	EPA6010B		1.85E+04	N	1	2.86E+04	mg/kg	0	1
HSB1-19	ANTIMONY	EPA6010B	J	1.03E+00	N	2	1.75E+00	mg/kg	0	1
HSB1-09	ARSENIC	EPA6010B		3.42E+00	N	2	5.41E+00	mg/kg	0	1
HSB1-04	BARIUM	EPA6010B		3.06E+01	N	1	4.72E+01	mg/kg	0	1
HSB1-15	CALCIUM	EPA6010B		6.19E+02	G	3	1.41E+03	mg/kg	0	1
HSB1-09	CHROMIUM	EPA6010B	J	2.40E+01	N	1	3.59E+01	mg/kg	0	1
HSB1-18	COBALT	EPA6010B	J	1.00E+00	N	2	1.44E+00	mg/kg	0	1
HSB1-09	COPPER	EPA6010B	J	3.80E+00	N	2	7.48E+00	mg/kg	0	1
HSB1-09	IRON	EPA6010B		1.81E+04	N	1	2.91E+04	mg/kg	0	1
HSB1-25	LEAD	EPA6010B		2.02E+01	N	1	6.78E+01	mg/kg	0	1
HSB1-04	MAGNESIUM	EPA6010B		3.24E+02	N	1	7.98E+02	mg/kg	0	1
HSB1-04	MANGANESE	EPA6010B		1.08E+02	N	1	2.87E+02	mg/kg	0	1
HSB1-13	NICKEL	EPA6010B	J	4.12E+00	N	2	6.14E+00	mg/kg	0	1
HSB1-04	POTASSIUM	EPA6010B		2.06E+02	G	3	5.29E+02	mg/kg	0	1
HSB1-09	VANADIUM	EPA6010B		4.12E+01	N	1	6.87E+01	mg/kg	0	1
HSB1-09	ZINC	EPA6010B		2.15E+01	N	1	3.57E+01	mg/kg	0	1
HSB1-13	MERCURY	EPA7471A		6.07E-02	N	1	1.32E-01	mg/kg	0	1
HSB1-05	DDE	EPA8081A		2.83E-03	X	2	4.92E-03	mg/kg	0	1
HSB1-05	DDT	EPA8081A		2.84E-03	X	2	2.16E-03	mg/kg	0	1
HSB1-25	1,1-DICHLOROETHYLENE	EPA8260B		--	--	--	1.22E-03	mg/kg	0	1
HSB1-26	DICHLOROMETHANE (METHYLENE CHLORIDE)	EPA8260B	J	6.04E-04	N	2	1.09E-03	mg/kg	0	1
HSB1-16	STYRENE	EPA8260B	J	2.40E-04	X	2	8.29E-04	mg/kg	0	1
HSB1-04	TOLUENE	EPA8260B	J	4.97E-04	N	2	9.38E-04	mg/kg	0	1
HSB1-26	BIS(2-ETHYLHEXYL) PHTHALATE (DEHP)	EPA8270C		3.71E-01	N	2	1.22E+00	mg/kg	0	1
HSB1-04	STRONTIUM-90	RADA-004	J	--	--	--	1.70E+00	pCi/g	0	1
HSB1-04	URANIUM-233/234	RADA-011		--	--	--	9.22E-01	pCi/g	0	1
HSB1-04	URANIUM-238	RADA-011		6.28E-01	N	2	1.22E+00	pCi/g	0	1
HSB1-23	ACTINIUM-228	RADA-013		1.75E+00	N	1	3.73E+00	pCi/g	0	1
HSB1-04	BISMUTH-214	RADA-013		5.04E-01	N	2	9.77E-01	pCi/g	0	1
HSB1-04	CESIUM-137 ¹	RADA-013		6.96E-01	L	9	1.00E+01	pCi/g	0	1
HSB1-23	LEAD-212	RADA-013		1.49E+00	N	1	3.22E+00	pCi/g	0	1
HSB1-04	LEAD-214	RADA-013		6.28E-01	N	2	1.06E+00	pCi/g	0	1
HSB1-04	POTASSIUM-40	RADA-013		2.98E+00	G	3	9.52E+00	pCi/g	0	1
HSB1-23	THALLIUM-208	RADA-013		5.73E-01	N	1	1.24E+00	pCi/g	0	1

Distribution Code:

N - Normal Distribution
L - Lognormal Distribution
G - Gamma Distribution
X - Non-Parametric

UCL Method Code: (as determined by ProUCL)

- 1) Student's t UC
- 2) Kaplan-Meier (KM) t UCL
- 3) Adjusted Gamma UCL
- 4) KM Approximate Gamma UCL
- 5) Hall's Bootstrap UC
- 6) Land's H-Statistic (H) UCL
- 7) KM Adjusted Gamma UCL
- 8) 95% Approximate Gamma UCL
- 9) 95% H-UCL (KM-log)

¹ Cs137 95% UCL EPC calculated using data that has been decay-adjusted to September 1, 2023 as shown in Table 3.
UCL = Upper Confidence Limit

Table 2. Maximum Detected Concentrations at 904-44G Spill Release Area (1-4 ft interval)

SAMPLE LOCATION	ANALYTE	ANALYTICAL METHOD	QUALIFIER	RESULT	RESULT UNITS	TOP SAMPLE INTERVAL	BOTTOM SAMPLE INTERVAL
HSB1-07	ALUMINUM	EPA6010B		35200	mg/kg	1	4
HSB1-19	ANTIMONY	EPA6010B	J	1.63	mg/kg	1	4
HSB1-13	ARSENIC	EPA6010B		7.52	mg/kg	1	4
HSB1-24	BARIUM	EPA6010B		58.4	mg/kg	1	4
HSB1-09	CALCIUM	EPA6010B	J	1590	mg/kg	1	4
HSB1-10	CHROMIUM	EPA6010B	J	48.3	mg/kg	1	4
HSB1-21	COBALT	EPA6010B	J	1.57	mg/kg	1	4
HSB1-09	COPPER	EPA6010B	J	6.33	mg/kg	1	4
HSB1-09	IRON	EPA6010B		36300	mg/kg	1	4
HSB1-07	LEAD	EPA6010B		10.7	mg/kg	1	4
HSB1-19	MAGNESIUM	EPA6010B	J	232	mg/kg	1	4
HSB1-24	MANGANESE	EPA6010B	J	200	mg/kg	1	4
HSB1-22	NICKEL	EPA6010B	J	6.1	mg/kg	1	4
HSB1-24	POTASSIUM	EPA6010B		211	mg/kg	1	4
HSB1-09	SODIUM	EPA6010B	J	119	mg/kg	1	4
HSB1-09	VANADIUM	EPA6010B		88.9	mg/kg	1	4
HSB1-09	ZINC	EPA6010B		315	mg/kg	1	4
HSB1-04	MERCURY	EPA7471A		0.913	mg/kg	1	4
HSB1-04	1,1-DICHLOROETHYLENE	EPA8260B		0.00163	mg/kg	1	4
HSB1-10	ACETONE	EPA8260B	J	0.00192	mg/kg	1	4
HSB1-18	DICHLOROMETHANE (METHYLENE CHLORIDE)	EPA8260B	J	0.00302	mg/kg	1	4
HSB1--04	ETHYLBENZENE	EPA8260B	J	0.000363	mg/kg	1	4
HSB1-04	STYRENE	EPA8260B	J	0.000692	mg/kg	1	4
HSB1-04	TOLUENE	EPA8260B	J	0.00092	mg/kg	1	4
HSB1-15	XYLENES	EPA8260B	J	0.000254	mg/kg	1	4
HSB1-24	BENZALDEHYDE	EPA8270C	J	0.0553	mg/kg	1	4
HSB1-15	BIS(2-ETHYLHEXYL)PHTHALATE (DEHP)	EPA8270C	J	1.69	mg/kg	1	4
HSB1-23	CYANIDE	EPA9014	J	0.521	mg/kg	1	4
HSB1-04	STRONTIUM-90	RADA-004		4.81	pCi/g	1	4
HSB1-04	AMERICIUM-241	RADA-011		1.38	pCi/g	1	4
HSB1-04	PLUTONIUM-238	RADA-011	J	0.57	pCi/g	1	4
HSB1-04	PLUTONIUM-239/240	RADA-011		6.69	pCi/g	1	4
HSB1-04	URANIUM-233/234	RADA-011		17.4	pCi/g	1	4
HSB1-04	URANIUM-235	RADA-011		1.15	pCi/g	1	4
HSB1-04	URANIUM-238	RADA-011		18.9	pCi/g	1	4
HSB1-16	ACTINIUM-228	RADA-013		1.93	pCi/g	1	4
HSB1-16	BISMUTH-214	RADA-013		1.01	pCi/g	1	4
HSB1-04	CESIUM-137	RADA-013		22.6	pCi/g	1	4
HSB1-04	COBALT-60	RADA-013		0.0618	pCi/g	1	4
HSB1-16	LEAD-212	RADA-013		1.64	pCi/g	1	4
HSB1-16	LEAD-214	RADA-013		1.1	pCi/g	1	4
HSB1-18	POTASSIUM-40	RADA-013		2.66	pCi/g	1	4
HSB1-16	THALLIUM-208	RADA-013		0.648	pCi/g	1	4

Table 3. Decay-Adjusted Activities for Cesium-137 and Cobalt-60

SAMPLE LOCATION	ANALYTE	QUAL	ORIGINAL RESULT ¹ (pCi/g)	DECAY ADJUSTMENT FACTOR	DECAY-ADJUSTED RESULT ² (pCi/g)	INTERVAL (FT)
HSB1-04	CESIUM-137		10	0.616	6.16	0-1
HSB1-05	CESIUM-137		0.549	0.616	0.338184	0-1
HSB1-06	CESIUM-137		0.155	0.616	0.09548	0-1
HSB1-07	CESIUM-137		0.0797	0.616	0.0490952	0-1
HSB1-08	CESIUM-137		0.101	0.616	0.062216	0-1
HSB1-09	CESIUM-137		0.0902	0.616	0.0555632	0-1
HSB1-10	CESIUM-137		0.299	0.616	0.184184	0-1
HSB1-11	CESIUM-137		0.154	0.616	0.094864	0-1
HSB1-12	CESIUM-137		0.821	0.616	0.505736	0-1
HSB1-13	CESIUM-137		1.72	0.616	1.05952	0-1
HSB1-14	CESIUM-137		0.211	0.616	0.129976	0-1
HSB1-15	CESIUM-137		0.645	0.616	0.39732	0-1
HSB1-16	CESIUM-137		0.547	0.616	0.336952	0-1
HSB1-18	CESIUM-137	U	0.0219	NA ³	NA ³	0-1
HSB1-19	CESIUM-137		0.247	0.616	0.152152	0-1
HSB1-20	CESIUM-137		0.0757	0.616	0.0466312	0-1
HSB1-21	CESIUM-137		0.0489	0.616	0.0301224	0-1
HSB1-22	CESIUM-137		0.166	0.616	0.102256	0-1
HSB1-23	CESIUM-137		0.118	0.616	0.072688	0-1
HSB1-24	CESIUM-137		0.196	0.616	0.120736	0-1
HSB1-25	CESIUM-137		0.214	0.616	0.131824	0-1
HSB1-26	CESIUM-137		0.34	0.616	0.20944	0-1
HSB1-04	CESIUM-137		22.6	0.616	13.9216	1-4
HSB1-05	CESIUM-137	J	0.0204	0.616	0.0125664	1-4
HSB1-06	CESIUM-137	U	0.00684	NA ³	NA ³	1-4
HSB1-07	CESIUM-137	U	0.0147	NA ³	NA ³	1-4
HSB1-08	CESIUM-137	U	-0.000415	NA ³	NA ³	1-4
HSB1-09	CESIUM-137	U	-0.00221	NA ³	NA ³	1-4
HSB1-10	CESIUM-137	J	0.0371	0.616	0.0228536	1-4
HSB1-11	CESIUM-137	U	0.01	NA ³	NA ³	1-4
HSB1-12	CESIUM-137		0.0601	0.616	0.0370216	1-4
HSB1-13	CESIUM-137		0.047	0.616	0.028952	1-4
HSB1-14	CESIUM-137	U	-0.00144	NA ³	NA ³	1-4
HSB1-15	CESIUM-137	J	0.0434	0.616	0.0267344	1-4
HSB1-16	CESIUM-137	J	0.0371	0.616	0.0228536	1-4
HSB1-18	CESIUM-137	U	0.00079	NA ³	NA ³	1-4
HSB1-19	CESIUM-137	J	0.025	0.616	0.0154	1-4
HSB1-20	CESIUM-137	U	-0.0107	NA ³	NA ³	1-4
HSB1-21	CESIUM-137	U	-0.00262	NA ³	NA ³	1-4
HSB1-22	CESIUM-137	U	0.00124	NA ³	NA ³	1-4
HSB1-23	CESIUM-137	U	0.00697	NA ³	NA ³	1-4
HSB1-24	CESIUM-137	U	0.00115	NA ³	NA ³	1-4
HSB1-25	CESIUM-137	U	-0.00118	NA ³	NA ³	1-4
HSB1-26	CESIUM-137	U	0.00883	NA ³	NA ³	1-4
HSB1-04	COBALT-60 ⁴		0.0618	0.063	0.00389919	1-4

1 - Original Result assumes a laboratory analysis date of September 1, 2002.
 2 - Decay-Adjusted Result assumes a date of September 1, 2023.
 3 - NA = not applicable, nondetects (U-qualified) were not decay-adjusted.
 4 - Cobalt-60 had only 1 detect in the entire dataset (0-1 ft and 1-4 ft).

Table 4. Human Health COPC Screening for 904-44G Spill Release Area (0-1 ft)

Analyte	Maximum Concentration ¹	Qual	Human Health Screening Value	Human Health Screening Value Source ²	Exceeds Human Health Screening Value?	2X Average Background Concentration ³	Exceeds 2X Average Background ⁴	COPC ⁵
Inorganics (mg/kg)								
ALUMINUM	28600		7.7E+03	0.1xRSL	YES	1.05E+04	YES	YES
ANTIMONY	1.75	J	3.1E+00	0.1xRSL	NO	2.69E+00	NO	NO
ARSENIC	5.41		6.8E-01	RSL	YES	4.28E+00	YES	YES
BARIUM	47.2		1.5E+03	0.1xRSL	NO	3.91E+01	YES	NO
CALCIUM	1410		EN ⁶	Nutrient	NO	4.76E+02	YES	NO
CHROMIUM ⁷	35.9	J	3.0E-01	RSL	YES	1.54E+01	YES	YES
COBALT	1.44	J	2.3E+00	0.1xRSL	NO	1.55E+00	NO	NO
COPPER	7.48	J	3.1E+02	0.1xRSL	NO	4.34E+00	YES	NO
IRON	29100		5.5E+03	0.1xRSL	YES	1.27E+04	YES	YES
LEAD	67.8		4.0E+01	0.1xRSL	YES	1.03E+01	YES	YES
MAGNESIUM	798		EN ⁶	Nutrient	NO	2.75E+02	YES	NO
MANGANESE	287		1.8E+02	0.1xRSL	YES	1.53E+02	YES	YES
MERCURY	0.132		1.1E+00	0.1xRSL	NO	7.10E-02	YES	NO
NICKEL	6.14	J	1.5E+02	0.1xRSL	NO	3.48E+00	YES	NO
POTASSIUM	529		EN ⁶	Nutrient	NO	2.16E+02	YES	NO
VANADIUM	68.7		3.9E+01	0.1xRSL	YES	3.91E+01	YES	YES
ZINC	35.7		2.3E+03	0.1xRSL	NO	9.47E+00	YES	NO
Organics (mg/kg)								
1,1-DICHLOROETHYLENE	0.00122		2.3E+01	0.1xRSL	NO	--	--	NO
BIS(2-ETHYLHEXYL) PHTHALATE	1.22		3.9E+01	RSL	NO	--	--	NO
DICHLOROMETHANE (METHYLENE CHLORIDE)	0.00109	J	3.5E+01	0.1XRSL	NO	--	--	NO
STYRENE	0.000829	J	6.0E+02	0.1xRSL	NO	--	--	NO
TOLUENE	0.000938	J	4.9E+02	0.1xRSL	NO	--	--	NO
Pesticides/PCBs (mg/kg)								
DDE	0.00492		2.0E+00	RSL	NO	--	--	NO
DDT	0.00216		1.9E+00	RSL	NO	--	--	NO
Radionuclides (pCi/g)								
CESIUM-137 ⁸	6.16		6.1E-02	PRG	YES	0.28	YES	YES
POTASSIUM-40	9.52		1.4E-01	PRG	YES	2.33	YES	YES
STRONTIUM-90	1.7	J	4.2E+00	PRG	NO	0.75	YES	NO
THORIUM-232 ⁹	3.73		9.9E-03	PRG	YES	1.80	YES	YES
ACTINIUM-228	3.73		NA	NA	--	--	--	--
LEAD-212	3.22		NA	NA	--	--	--	--
THALLIUM-208	1.24		NA	NA	--	--	--	--
URANIUM-238 ¹⁰	1.22		1.3E-02	PRG	YES	1.01	YES	YES
URANIUM-233/234	0.922		NA	NA	--	--	--	--
LEAD-214	1.06		NA	NA	--	--	--	--
BISMUTH-214	0.977		NA	NA	--	--	--	--

1 Maximum detected concentration from 0-1 ft soil interval (HSB1-04 through HSB1-26) as identified in Table 1.
2 Nonradiological RSLs are default residential soil values from the EPA Regional Screening Levels Table (carcinogen RSL = 1; noncarcinogen RSL HQ = 0.1), dated May 2023. If a substance causes both cancer and noncancer effects, the more stringent criteria is used. Radiological PRGs are residential site-specific values derived using the EPA Preliminary Remediation Goals website calculator (dated February 2023) and eliminating the fruit and vegetable consumption pathways. All other inputs are default values.
3 Background screening values obtained from Background Soils Statistical Summary Report for Savannah River Site, ERD-EN-2005.0223, Rev. 1, 10/06, App. B.-1.
4 For screening purposes, maximum concentration of only the naturally-occurring (nonanthropogenic) constituents are compared to 2X average background concentration.
5 Constituents are identified as COPCs if the maximum detected concentration exceeds the human health screening value and the 2X average background concentration.
6 EN = essential nutrient, RSL not available for this constituent.
7 Chemical analysis for total chromium. A total chromium RSL is not available; hexavalent chromium RSL used as a conservative screen.
8 Cs137 original analytical result from September 2002 (10 pCi/g) was decay adjusted to September 2023 (6.16 pCi/g) as identified in Table 3.
9 Th232 was not measured directly in the laboratory. Ac228, Pb212 and Tl208 are daughter products of Th232 and can be used to estimate its activity since these isotopes are in secular equilibrium. The highest detected activity in the entire decay chain was used in this assessment. The daughter products are not screened separately since they are considered in the Th232 PRG for the entire decay chain.
10 U238 was measured directly in the laboratory. U234, Pb214 and Bi214 are daughter products of U238 and can be used to estimate its activity since these isotopes are in secular equilibrium. The highest detected activity in the entire decay chain was used in this assessment. The daughter products are not screened separately since they are considered in the U238 PRG for the entire decay chain.
NA = not applicable per footnotes 9 and 10 above.

Table 5. Residential Risk/Hazard Estimate for 904-44G Spill Release Area (0-1 ft)

Analyte ¹	Exposure Point Concentration ²	Residential RSL/PRG ³	Residential Hazard Estimate (HQ) ⁴ (unitless)	Residential Risk Estimate ⁵ (unitless)	COC? ⁶
Noncarcinogenic Hazard Estimate (mg/kg)					
ALUMINUM	1.85E+04	7.7E+04	2.41E-01	--	NO
IRON	1.81E+04	5.5E+04	3.28E-01	--	NO
ARSENIC	3.42E+00	3.5E+01	9.77E-02	--	NO
CHROMIUM ⁷	2.40E+01	2.3E+02	1.04E-01	--	NO
LEAD	2.02E+01	4.0E+02	5.05E-02	--	NO
MANGANESE	1.08E+02	1.8E+03	5.99E-02	--	NO
VANADIUM	4.12E+01	3.9E+02	1.06E-01	--	NO
Total Media Hazard Index (HI) =			9.87E-01		
Carcinogenic Risk Estimate (mg/kg)					
ARSENIC	3.42E+00	6.8E-01	--	5.0E-06	YES
CHROMIUM ⁷	2.40E+01	3.0E-01	--	8.0E-05	YES
Total Chemical Risk =				8.5E-05	
CESIUM-137 ⁸	6.96E-01	6.1E-02	--	1.2E-05	YES
POTASSIUM-40	2.98E+00	1.4E-01	--	2.1E-05	YES
THORIUM-232 ⁹	1.75E+00	9.9E-03	--	1.8E-04	YES
URANIUM-238 ¹⁰	6.28E-01	1.3E-02	--	5.0E-05	YES
Total Radiological Risk =				2.6E-04	
Total Media Risk =				3.4E-04	

- 1 Analytes that were identified as COPCs in Table 4.
- 2 EPC = exposure point concentration: this preliminary calculation is the lesser of the 95%UCL and the maximum detected concentration.
- 3 Nonradiological RSLs are default residential soil values from the EPA Regional Screening Levels table, dated May 2023. Radiological PRGs are site-specific soil values derived from the EPA Preliminary Remediation Goals calculator website (dated February 2023) and eliminating the fruit and vegetable consumption pathway.
- 4 Residential Hazard Estimate (HQ) = EPC / RSL
- 5 Residential Risk Estimate = (EPC / RSL or PRG) x 1E-06
- 6 For noncarcinogens, no constituents are identified as COCs if the total media hazard index < 1. For carcinogens, constituents are identified as COCs if the individual cancer risk > 1E-06.
- 7 Chemical analysis for total chromium. A total chromium RSL is not available; hexavalent chromium RSL conservatively used to calculate risk.
- 8 Cs137 95%UCL EPC calculated using data that has been decay-adjusted to September 1, 2023 as shown in Table 3.
- 9 Th232 was not measured directly in the laboratory. Ac228, Pb212 and Tl208 are daughter products of Th232 and can be used to estimate its activity since these isotopes are in secular equilibrium. The highest detected activity in the entire decay chain was used in this calculation. The 95%UCL is calculated from the Ac228 analytical results. A separate risk calculation for daughter products is not provided since they are considered in the Th232 PRG for the entire chain.
- 10 U238 was only measured in 1 sample and a 95%UCL could not be calculated. U234, Pb214 and Bi214 are daughter products of U238 and can be used to estimate its activity since these isotopes are in secular equilibrium. The highest detected activity in the entire decay chain was used in this calculation. The 95%UCL is calculated from the Pb214 analytical results. A separate risk calculation for daughter products is not provided since they are considered in the U238 PRG for the entire chain.

Table 6. Industrial Risk/Hazard Estimate for 904-44G Spill Release Area (0-1 ft)

Analyte ¹	Exposure Point Concentration ²	Industrial RSL/PRG ³	Industrial Hazard Estimate (HQ) ⁴ (unitless)	Industrial Risk Estimate ⁵ (unitless)	COC? ⁶
Noncarcinogenic Hazard Estimate (mg/kg)					
ALUMINUM	1.85E+04	1.1E+06	1.68E-02	--	NO
ARSENIC	3.42E+00	4.8E+02	7.13E-03	--	NO
CHROMIUM ⁷	2.40E+01	3.5E+03	6.85E-03	--	NO
IRON	1.81E+04	8.2E+05	2.20E-02	--	NO
LEAD	2.02E+01	8.0E+02	2.52E-02	--	NO
MANGANESE	1.08E+02	2.6E+04	4.15E-03	--	NO
VANADIUM	4.12E+01	5.8E+03	7.10E-03	--	NO
Total Media Hazard Index (HI) =			8.93E-02		
Carcinogenic Risk Estimate (mg/kg)					
ARSENIC	3.42E+00	3.0E+00	--	1.1E-06	YES
CHROMIUM ⁷	2.40E+01	6.3E+00	--	3.8E-06	YES
Total Chemical Risk =				4.9E-06	
CESIUM-137 ⁸	6.96E-01	9.1E-02	--	7.7E-06	YES
POTASSIUM-40	2.98E+00	2.2E-01	--	1.4E-05	YES
THORIUM-232 ⁹	1.75E+00	1.5E-02	--	1.1E-04	YES
URANIUM-238 ¹⁰	6.28E-01	2.0E-02	--	3.1E-05	YES
Total Radiological Risk =				1.7E-04	
Total Media Risk =				1.7E-04	

1 Analytes that were identified as COPCs in Table 4.
2 EPC = exposure point concentration is the lesser of the 95%UCL and the maximum detected concentration.
3 Nonradiological RSLs are default industrial worker soil values from the EPA Regional Screening Levels Table, dated May 2023. Radiological PRGs are default industrial worker soil values from the EPA Preliminary Remediation Goals Table, dated February 2023.
4 Industrial Hazard Estimate (HQ) = EPC / RSL
5 Industrial Risk Estimate = (EPC / RSL or PRG) x 1E-06
6 For noncarcinogens, no constituents are identified as COCs if the total media hazard index < 1. For carcinogens, constituents are identified as COCs if the individual cancer risk > 1E-06.
7 Chemical analysis for total chromium. A total chromium RSL is not available; hexavalent chromium RSL conservatively used to calculate risk.
8 Cs137 95%UCL EPC calculated using data that has been decay-adjusted to September 1, 2023 as shown in Table 3.
9 Th232 was not measured directly in the laboratory. Ac228, Pb212 and Tl208 are daughter products of Th232 and can be used to estimate its activity since these isotopes are in secular equilibrium. The highest detected activity in the entire decay chain was used in this calculation. The 95%UCL is calculated from the Ac228 analytical results. A separate risk calculation for daughter products is not provided since they are considered in the Th232 PRG for the entire decay chain.
10 U238 was only measured in 1 sample and a 95%UCL could not be calculated. U234, Pb214 and Bi214 are daughter products of U238 and can be used to estimate its activity since these isotopes are in secular equilibrium. The highest detected activity in the entire decay chain was used in this calculation. The 95%UCL is calculated from the Pb214 analytical results. A separate risk calculation for daughter products is not provided since they are considered in the U238 PRG for the entire decay chain.

Table 7. PTSM Screening for 904-44G Spill Release Area (all depths)

STATION	ANALYTE	QUAL	MAXIMUM CONCENTRATION ¹ (mg/kg or pCi/g)	INTERVAL		NONCARCINOGENIC HAZARD ESTIMATE		CARCINOGENIC RISK ESTIMATE	
				Top (ft)	Bot (ft)	IW RSL ² (mg/kg)	IW HQ Estimate ⁴	IW RSL ² /PRG ³ (mg/kg or pCi/g)	IW Risk Estimate ⁵
Inorganics									
HSB1-07	ALUMINUM		35200	1	4	1.10E+06	3.20E-02	--	--
HSB1-19	ANTIMONY	J	1.75	0	1	4.70E+02	3.72E-03	--	--
HSB1-13	ARSENIC		7.52	1	4	--	--	3.00E+00	2.51E-06
HSB1-24	BARIUM		58.4	1	4	2.20E+05	2.65E-04	--	--
HSB1-09	CALCIUM	J	1590	1	4	EN ⁷	--	--	--
HSB1-10	CHROMIUM ⁶	J	48.3	1	4	1.80E+06	2.68E-05	6.3	7.67E-06
HSB1-21	COBALT	J	1.57	1	4	3.50E+02	4.49E-03	--	--
HSB1-09	COPPER	J	7.48	0	1	4.70E+04	1.59E-04	--	--
HSB1-09	IRON		36300	1	4	8.20E+05	4.43E-02	--	--
HSB1-25	LEAD		67.8	0	1	8.00E+02	8.48E-02	--	--
HSB1-04	MAGNESIUM		798	0	1	EN ⁷	--	--	--
HSB1-04	MANGANESE		287	0	1	2.60E+04	1.10E-02	--	--
HSB1-13	NICKEL	J	6.14	0	1	2.20E+04	2.79E-04	--	--
HSB1-04	POTASSIUM		529	0	1	EN ⁷	--	--	--
HSB1-09	SODIUM	J	119	1	4	EN ⁷	--	--	--
HSB1-09	VANADIUM		88.9	1	4	5.80E+03	1.53E-02	--	--
HSB1-09	ZINC		315	1	4	3.50E+05	9.00E-04	--	--
HSB1-04	MERCURY		0.913	1	4	4.60E+01	1.98E-02	--	--
Organics									
HSB1-05	DDE		0.00492	0	1	--	--	9.30E+00	5.29E-10
HSB1-05	DDT		0.00216	0	1	--	--	8.50E+00	2.54E-10
HSB1-04	1,1-DICHLOROETHYLENE		0.00163	1	4	1.00E+03	1.63E-06	--	--
HSB1-10	ACETONE	J	0.00192	1	4	1.10E+06	1.75E-09	--	--
HSB1-18	DICHLOROMETHANE (METHYLENE CHLORIDE)	J	0.00302	1	4	--	--	1.00E+03	3.02E-12
HSB1-04	ETHYLBENZENE	J	0.000363	1	4	--	--	2.50E+01	1.45E-11
HSB1-16	STYRENE	J	0.000829	0	1	3.50E+04	2.37E-08	--	--
HSB1-04	TOLUENE	J	0.000938	0	1	4.70E+04	2.00E-08	--	--
HSB1-15	XYLENES	J	0.000254	1	4	2.50E+03	1.02E-07	--	--
HSB1-24	BENZALDEHYDE	J	0.0553	1	4	--	--	8.20E+02	6.74E-11
HSB1-15	BIS(2-ETHYLHEXYL)PHTHALATE (DEHP)	J	1.69	1	4	--	--	1.60E+02	1.06E-08
HSB1-23	CYANIDE	J	0.521	1	4	1.50E+02	3.47E-03	--	--
Radionuclides									
HSB1-04	AMERICIUM-241		1.38	1	4	--	--	4.67E+00	2.96E-07
HSB1-04	CESIUM-137 ⁸		13.9	1	4	--	--	9.07E-02	1.53E-04
HSB1-04	COBALT-60 ⁸		0.0039	1	4	--	--	4.83E-02	8.07E-08
HSB1-04	PLUTONIUM-238	J	0.57	1	4	--	--	1.41E+01	4.04E-08
HSB1-04	PLUTONIUM-239/240		6.69	1	4	--	--	1.22E+01	5.48E-07
HSB1-04	POTASSIUM-40		9.52	0	1	--	--	2.19E-01	4.35E-05
HSB1-04	STRONTIUM-90		4.81	1	4	--	--	9.00E+00	5.34E-07
	THORIUM-232 ⁹		3.73			--	--	1.53E-02	2.44E-04
HSB1-23	ACTINIUM-228		3.73	0	1	--	--	--	--
HSB1-23	LEAD-212		3.22	0	1	--	--	--	--
HSB1-23	THALLIUM-208		1.24	0	1	--	--	--	--
HSB1-04	URANIUM-235 ¹⁰		1.15	1	4	--	--	2.83E-01	4.06E-06
HSB1-04	URANIUM-238 ¹⁰		18.9	1	4	--	--	1.39E+00	1.36E-05
HSB1-04	URANIUM-233/234 ¹⁰		17.4	1	4	--	--	8.39E+00	2.07E-06
HSB1-16	LEAD-214		1.1	1	4	--	--	4.87E+05	2.26E-12
HSB1-04	BISMUTH-214		1.01	1	4	--	--	--	--
						Hazard Index	2.21E-01	Cumulative Risk	4.72E-04
						PTSM?¹¹	NO	PTSM?¹²	NO

1 - Maximum detected concentration from all soil sample depth intervals (HSB1-04 through HSB1-26).
2 - Nonradiological IW RSLs are default industrial worker soil values from the EPA Regional Screening Levels Table, dated May 2023.
3 - Radiological IW PRGs are default industrial worker soil values from the EPA Preliminary Remedial Goals Table, dated February 2023.
4 - Hazard Estimate = maximum concentration / RSL concentration
5 - Risk Estimate = (maximum concentration / RSL or PRG concentration) x 1E-06
6 - Laboratory result is for total Cr. Screening performed assuming Cr+3 (noncarcinogenic HQ) and Cr+6 (carcinogenic risk).
7 - EN = essential nutrient, RSL not available for this constituent.
8 - Cs137 and Co60 original analytical results from September 2002 (22.6 pCi/g and 0.618 pCi/g respectively) were decay-adjusted to September 2023 (13.9 pCi/g and 0.0039 pCi/g respectively) as identified in Table 3.
9 - Th232 was not measured directly in the laboratory. Ac228, Pb212 and Tl208 are daughter products of Th232 and can be used to estimate its activity since these constituents are in secular equilibrium. The highest detected activity in the entire decay chain was used in this assessment. The daughter products are not screened separately since they are considered in the Th232 PRG for the entire decay chain.
10 - Site specific PRGs were calculated for U234, U235 and U238 using a 1000 year peak time frame option using the USEPA Preliminary Remediation Goals for Radionuclides calculator function.
11 - Unit potentially has PTSM if HI ≥ 10 for noncarcinogenic constituents.
12 - Unit potentially has PTSM if cumulative risk ≥ 1E-03 for carcinogenic constituents.

Table 8. 2024 Soil Sample Results for Cesium-137 (all intervals)

SAMPLE LOCATION	ANALYTE	ANALYTICAL METHOD	QUALIFIER	RESULT	RESULT UNIT	INTERVAL (FT)
904-44G-1	CESIUM-137	EPA901.1		1.22	pCi/g	0-1
904-44G-2	CESIUM-137	EPA901.1	U	0.0809	pCi/g	0-1
904-44G-3	CESIUM-137	EPA901.1		0.304	pCi/g	0-1
904-44G-4	CESIUM-137	EPA901.1		1.01	pCi/g	0-1
904-44G-5	CESIUM-137	EPA901.1		1.36	pCi/g	0-1
904-44G-6	CESIUM-137	EPA901.1		0.382	pCi/g	0-1
904-44G-7	CESIUM-137	EPA901.1		0.762	pCi/g	0-1
904-44G-8	CESIUM-137	EPA901.1		0.424	pCi/g	0-1
904-44G-9	CESIUM-137	EPA901.1		0.228	pCi/g	0-1
904-44G-9 ¹	CESIUM-137	GA-01-RMOD		0.232	pCi/g	0-1
904-44G-10	CESIUM-137	EPA901.1		0.434	pCi/g	0-1
904-44G-10	CESIUM-137	EPA901.1		0.477	pCi/g	1-2
904-44G-10 ²	CESIUM-137	EPA901.1		0.268	pCi/g	0-1

1 - Laboratory split sample for location 904-44G-9

2 - Field duplicate sample for location 904-44G-10