Final
Record of Decision
Area 2 of SWMU-11
Dugway Proving Ground,
Dugway, Utah

Prepared for:
U.S. Army Environmental Command

March 2022

Prepared by:
North Wind Services, LLC

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Prepared for:

U.S. Army Environmental Command
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ACRONYMS AND ABBREVIATIONS

µR/hr	microroentgen per hour
ARAR	applicable or relevant and appropriate requirement
Army	U.S. Army
BCG	biotic concentration guideline
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
cpm	counts per minute
CSM	conceptual site model
DCGL	Derived Concentration Guideline Level
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DOE	Department of Energy
DPG	Dugway Proving Ground
DWMRC	Utah Division of Waste Management and Radiation Control
EPA	U.S. Environmental Protection Agency
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FS	Feasibility Study
ft	feet
ft^2	square feet
GCL	Geosynthetic clay liner
GM	Geiger Mueller
GPR	ground penetrating radar
HDPE	high-density polyethylene

IC	Institutional Control
LTM	long-term maintenance
LUC	land use control
LUCIP	Land Use Control Implementation Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mg/L	milligrams per liter
MoU	Memorandum of Understanding
mrem/yr	millirem per year
NCP	National Contingency Plan
North Wind	North Wind Services, LLC
NPL	National Priorities List
NRC	U.S. Nuclear Regulatory Commission
O&M	operations and maintenance
pCi/g	picocuries per gram
PP	Proposed Plan
PTW	principal threat waste
RACER®	Remedial Action Cost Engineering and Requirements
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radioactivity
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit

TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TR	trench
U.S.	United States
UDEQ	Utah Department of Environmental Quality
USAEC	U.S. Army Environmental Command
UU/UE	Unrestricted Use/Unrestricted Exposure
VOC	volatile organic compound

1 DECLARATION FOR THE DECISION

1.1 Site Name and Location

- Site Name: Area 2 of Solid Waste Management Unit 11 (SWMU-11).
- Site Location: Dugway Proving Ground (DPG), Tooele County, Utah.
- National Priorities List (NPL) Status: DPG is not listed on the NPL.

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the U.S. Army (Army) Selected Remedy for Area 2 of SWMU-11 at DPG, Dugway, Utah. Records indicate Area 2 was never licensed by the U.S. Nuclear Regulatory Commission (NRC). During 2016, the Department of Defense (DoD) and the NRC finalized a memorandum of understanding (MoU) for the coordination of response actions for DoD sites containing radioactive material that are not licensed by the NRC (NRC-DoD MoU, 2016). The Remedy was selected pursuant to the MoU and in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practical, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – 40 Code of Federal Regulations (CFR) Part 300, and the U.S. Environmental Protection Agency (EPA) Remedial Investigations (RI)/Feasibility Study (FS) Guidance 540/G-89/004 (EPA, 1988).

The ROD is based on the administrative record for Area 2 of SWMU-11. DPG maintains this administrative record, which is available for public review. Supporting agencies, consisting of the Utah Department of Environmental Quality (UDEQ) Division of Waste Management and Radiation Control (DWMRC) and the NRC, concur with the Selected Remedy.

1.3 Assessment of the Site

The response action selected in this ROD is necessary to protect public health or welfare or the environment from the potential exposure hazards associated with radiologically impacted soil and metallic debris found in disposal trenches TR-5 and TR-6 of Area 2 of SWMU-11.

1.4 Description of the Selected Remedy

The Army developed and evaluated remedial alternatives for Area 2 of SWMU-11 through an FS completed in 2020 (North Wind, 2020a). Based on the results of the FS, the Army selected Alternative 4 – Excavation, Disposal, and Backfilling as the Selected Remedy to address radiologically impacted soil and metallic debris in Area 2 of SWMU-11. Confirmation soil sampling and a magnetometer survey will be performed to ensure all radiologically impacted materials had been removed. Removal of all soil and debris from trenches TR-5 and TR-6 prevents the direct contact to or exposure from contaminated materials, and the radiological hazard to current and future receptors is eliminated.

The excavation of radiologically impacted soil and metallic debris will be completed by qualified personnel via standard excavation practices and technology such as the use of backhoes or clamshell excavators. Staging areas will be used to prepare impacted materials for disposal and transport. The area will be graded to reduce the potential for ponding and collapse of trench walls, lined to prevent groundwater contamination, and bermed to prevent runoff. The off-site transportation of wastes resulting

from excavation will meet Federal and State of Utah shipping and manifesting regulations. Excavated soil and debris will be transported to an approved off-site disposal facility or landfill. The excavated area will be backfilled with clean soil and local fill dirt, if available. Backfilling, grading, and restoring the surface with native vegetation after excavation will prevent stormwater runoff and erosion.

Excavation will be completed to meet unrestricted (i.e., residential) standards, or Unrestricted Use/Unrestricted Exposure (UU/UE). Confirmation soil sampling and a magnetometer survey or use of a Field Instrument for the Detection of Low Energy Radiation (FIDLER) or Geiger Mueller (GM) probe would be performed to ensure all radiologically impacted materials had been removed from the trenches and adjacent areas. After confirmation of the removal of contamination to UU/UE levels, the trenches will be backfilled with clean material.

Health and safety monitoring of excavation and remediation workers, including on-site air monitoring, will be performed during excavation, disposal staging operations, and backfilling activities. Dust and surface water controls will also be implemented. Administrative activities will include documentation, planning, engineering design of the remedial alternative, and meetings.

1.5 Statutory Determinations

The Selected Remedy for Area 2 of SWMU-11 is protective of human health and the environment, complies with promulgated federal and state requirements that are applicable or relevant and appropriate requirements (ARARs) to the remedial action, is cost effective, and utilizes permanent solutions and treatment technologies to the maximum extent practicable.

This Remedy satisfies the statutory preference for treatment to reduce the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element of the remedy. In accordance with the *Remediation Technologies Screening Matrix and Reference Guide, Federal Remediation Technologies Roundtable,* Section 2.6.2 (EPA, 1994), excavation and off-site disposal of soil, sediment, and sludge are considered treatment technologies.

Because this remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above unlimited use and unrestricted exposure levels, a 5-year review will not be required for this remedial action.

1.6 ROD Data Certification Checklist

In accordance with the EPA *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedial Selection Decision Document* (EPA, 1999), the following table serves both as a data certification checklist and a guide that indicates where information can be found in the Decision Summary of the ROD (Section 2).

Information	Document Location
Cleanup levels established for contaminants of concern (COCs) and the basis for these levels.	Section 2.4.3, Conceptual Site Model
Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the risk assessment and ROD.	Section 2.5, Current and Potential Future Land and Resource Uses
Potential land and groundwater use that will be available at the site as a result of the Selected Remedy.	Section 2.5, Current and Potential Future Land and Resource Uses

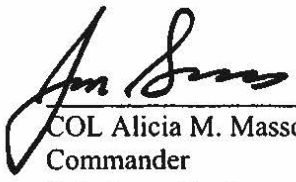
Information	Document Location
COCs and their respective concentrations.	Section 2.6, Summary of Site Risks
Potential risk represented by the COCs.	Section 2.6, Summary of Site Risks
Estimated capital, annual operations and maintenance (O&M), and total present worth costs, and the number of years over which the remedy cost estimates are projected.	Section 2. 9.1, Summary of Estimated Costs and Table 2
How source materials constituting principal threats and source materials are addressed.	Section 2.10, Principal Threat Wastes
Key factor(s) that led to selecting the remedy (i.e., describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).	Section 2.12, Statutory Determinations

Additional information for Area 2 of SWMU-11 can be found in the Administrative Record file located at the following location:

Utah Department of Environmental Quality
Division of Waste Management and Radiation Control
195 North 1950 West
Salt Lake City, UT 84114-4880
801-536-0200

1.7 Authorizing Signature

On the basis of the FS performed for Area 2 of SWMU-11, the Selected Remedy meets the remedial action requirements set forth in CERCLA, as amended, and the NCP. This ROD will be incorporated into the Administrative Record file for the Area 2 SWMU-11 site, and be available for public review at the locations described in Section 2.3 (Community Participation). This signature sheet documents the Army's approval of the Selected Remedy for Area 2 of SWMU-11.



MAR 07 2022

COL Alicia M. Masson
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Fort Sam Houston, TX 78234

Date

2 DECISION SUMMARY

The Decision Summary identifies the Selected Remedy, explains how the Remedy fulfills statutory and regulatory requirements, and provides a substantive summary of the Administrative Record that supports the remedy selection decision.

2.1 Site Name, Location, and Description

DPG is located in southern Tooele County, Utah, on approximately 800,000 acres of Federal land managed by the Army (Figure 1). The Army is the lead agency for the investigation and cleanup of Area 2 of SWMU-11, and support agencies include the Utah DWMRC and the NRC. The U.S. Army Environmental Command (USAEC) managed execution of the FS and the Proposed Plan (PP), and preparation of the ROD under the Army's Active Installation Defense Environmental Restoration Program (DERP) on behalf of DPG.

The DPG facility is bordered to the northeast by the Cedar Mountains and to the north-northwest by Wendover Air Force Range. DPG currently serves as the Army's designated Major Range Test Facility for chemical and biological defense. SWMU-11, also known as DPG-011 and the East Granite Holding Area, is located in the remote southwest portion of DPG and covers approximately 3.4 acres within a small canyon on the east side of Granite Mountain. SWMU-11 is divided into two distinct areas: Area 1 and Area 2. Area 1 of SWMU-11 was previously evaluated and closed under the Resource Conservation and Recovery Act (RCRA) and corrective action requirements of the DWMRC. Area 2 (0.86 acres) of SWMU-11 is a radiological disposal area of concern and consists of two trenches (TR-5 and TR-6) and the area adjacent to the trenches (Figure 2).

2.2 Site History and Enforcement Activities

In the DPG RCRA Facility Application, Area 2 of SWMU-11 was one of seven reported radioactive landfills. Historic records regarding radiological materials handling were summarized in the 2009 Phase II RCRA Facility Investigation (RFI) (Parsons, 2009). Specific records regarding radiological materials disposed at SWMU-11 are limited. The East Granite Holding Area (i.e., SWMU-11) is not identified in available literature as being associated with the testing of radiological munitions conducted at DPG in the 1950s and 1960s. Historical inspection records indicate that buried wastes in the SWMU-11 area consisted primarily of "contaminated rags and papers." Inspection records from the U.S. Atomic Energy Commission indicate that low-level radioactive waste materials were repackaged for sea disposal in the Able Area. Waste from this activity may have also been disposed at the DPG burial area corresponding to SWMU-11 after the sea disposal program was discontinued. Available documentation states that operation of the DPG radioactive waste disposal facility was discontinued in the early 1960s and that materials previously possessed under the Material License were transferred offsite during 1962 (NRC, 2001). Historical records indicate that the latest potential use of the SWMU-11 area for radiation-related operations was 1977. By extension, the last potential opportunity for radiological material to be added to trenches TR-5 and TR-6 would also be 1977.

Radioactive waste materials from laboratory activities in other areas of DPG were stored in a CONEX container at SWMU-11 to protect individual storage containers from the elements. Materials stored in the CONEX container included Tritium and Carbon-14. In March 1980, contaminated glassware was removed from the CONEX by the DPG radiation safety officer and disposed at an off-site location. During the 2005 Phase II RFI, no waste remained in the CONEX container (Parsons, 2009). The CONEX container was determined to be radiologically clear and was removed in 2017 (Marsh, 2017).

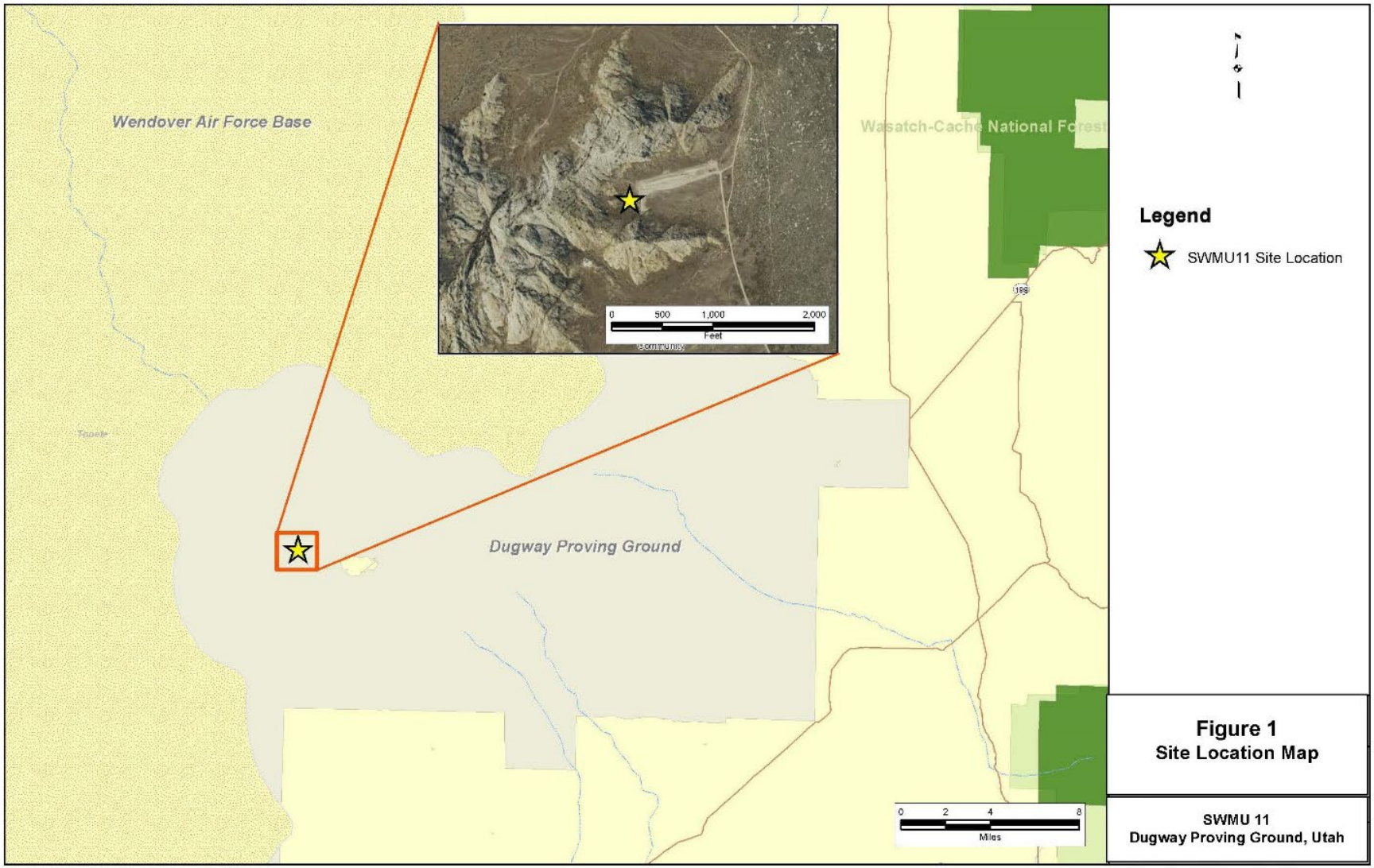
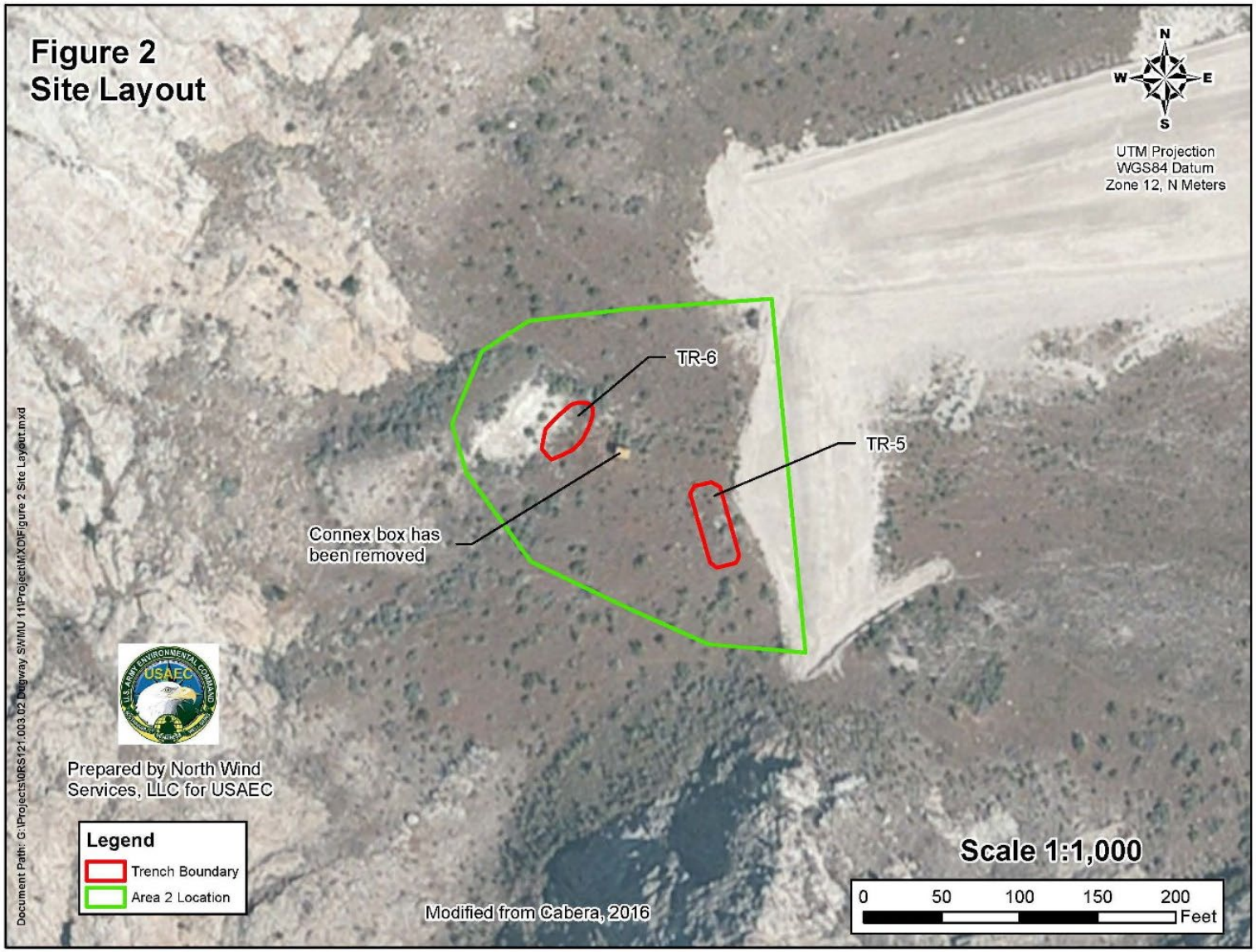


Figure 1. Site Location.



From: Cabrera, 2016

Figure 2. Site Layout.

In June 2000, DPG notified the NRC about potential radiological waste at SWMU-11. During a limited survey of the area conducted in September 2000, NRC personnel were unable to detect any radioactivity significantly above background levels. In March 2001, the NRC stipulated that any required decommissioning activities at SWMU-11 could take place under the radioactive materials license currently held by DPG. However, in March 2006, the NRC notified DPG that the NRC would evaluate if a new license was necessary to conduct decommissioning activities; as a result of the evaluation, no new license was issued. The current radioactive materials license was for possession of sealed sources associated with an irradiator. During 2016, the DoD and the NRC finalized a MoU for the coordination of response actions for DoD sites with radioactive materials not licensed by the NRC (NRC-DoD MoU, 2016). Pursuant to the MoU, the remaining investigation and remediation activities at Area 2 of SWMU-11 are being addressed under CERCLA.

The previous investigations conducted to define the current nature and extent of contamination at Area 2 of SWMU-11 are briefly detailed below.

2.2.1 2005-2009 Phase II Investigation

While investigating TR-1 through TR-4 and the surrounding area with geophysical and radiological scans during the 2005 Phase II RFI of SWMU-11 (Parsons, 2009), two additional burial trenches on the west side of TR-4 were discovered and subsequently designated as TR-5 and TR-6. The area was designated as Area 2. A magnetometer and radiological survey were conducted, and various samples were collected to identify anomalies and elevated radioactivity.

At TR-6, the test pit excavation identified various types of debris, including small metal tubes from approximately 7 feet (ft) below ground surface (bgs) that had low levels of radioactivity with signatures consistent with Cesium-137. Other types of debris, including the metal drums containing solidified sand and drum cores, did not exhibit detectable levels of radioactivity. Soils underlying these materials were screened for radiation during test pit excavation and were detected at background radiation levels. However, due to the uncertainties associated with the contents of the metallic cylinders, they were not shipped for laboratory analyses. Thus, in the absence of more conclusive laboratory analysis, the waste in TR-6 was considered unidentified.

Additionally, non-radiological chemical results included detections of metals, semi-volatile organic compounds (SVOCs), and dioxins/furans at TR-5 and TR-6. In subsequent evaluations, these non-radiological chemical results were determined not to be COCs. Groundwater sampling results from SWMU-11 were also used to assess potential impacts to groundwater by site-related contamination. Groundwater samples were analyzed for volatile organic compounds (VOCs), perchlorate metals, water quality analytes, gross alpha and beta radioactivity, gamma spectrometry, and Strontium-90; no unusual results were detected. Further investigation of the radiological portion of Area 2 at SWMU-11 was recommended in the Phase II RFI (Parsons, 2009).

2.2.2 2014 Investigation

In 2014, Cabrera performed a non-intrusive (i.e., surface scanning) investigation at Area 2 of SWMU-11 using surficial gross gamma radiological and geophysical scans (i.e., using a hand-held Schondstedt magnetometer and ground penetrating radar [GPR]), as identified in the RI/FS Work Plan. The Schondstedt magnetometer and GPR investigation defined the lateral and vertical extent of TR-5 and TR-6.

A visual inspection detected surface debris consisting of metal tubes and possible soil piles at TR-6 and buried metal was detected with the Schondstedt magnetometer in these low soil mounds, suggesting that debris was spread out and then covered with a thin layer of soil.

This investigation served to confirm the Phase II surface scanning results. No laboratory samples were collected during this investigation.

2.2.3 2016 Investigation

In 2016, Cabrera completed the intrusive portion of the investigation (as identified in the RI/FS Work Plan) using core scanning, downhole gamma logging, and collection of samples for confirmatory laboratory analytical testing. The investigation included 15 soil boring locations, 34 soil samples, and one debris sample. Concentrations of Bismuth-214, Lead-214, Radium-226, and Strontium-90 were detected at TR-5 and Cesium-137 was detected at TR-6.

Since there were no exceedances for any chemical samples (i.e., VOCs, SVOCs, or metals) above the toxicity characteristic leaching procedure (TCLP) regulatory limits presented in 40 CFR 261.24, it was concluded that it was unlikely that any wastes generated from the excavation of the trenches would result in hazardous or "mixed" waste. An arsenic result from a solidified sand sample determined that TCLP analysis of the contents of drums within TR-6 may be warranted in future remedy implementation (North Wind, 2020b).

2.2.4 2020 Characterization Report

The Characterization Report (North Wind, 2020b) summarized prior investigations at Area 2 of SWMU 11, reviewed the existing data set to ensure adequacy and useability to support the planned FS, and developed site-specific Derived Concentration Guideline Levels (DCGLs) for soil, consistent with 10 CFR Part 20, Subpart E, as referenced in the 2016 MoU (NRC-DoD MoU, 2016). The development of DCGLs and area classifications were based on procedures described in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM; NUREG-1575).

Site-specific DCGLs for the radionuclide COCs in soil were developed using the Residual Radioactivity (RESRAD) ONSITE computer code (Kamboj et al., 2018) for the Resident Farmer and the Industrial Worker scenarios. The Resident Farmer was selected as the critical group for DCGL development for unrestricted release under 10 CFR 20.1402, based on a dose of 25 millirem per year (mrem/yr). An Industrial Worker was selected as the critical group for DCGL development for restricted release under 10 CFR 20.1403, based on a dose of 100 mrem/yr.

2.2.5 2020 Feasibility Study

The FS (North Wind, 2020a) evaluated human and ecological receptors and exposure routes, established remedial action objectives (RAOs), developed ARARs, and evaluated six remedial alternatives to address site-related contaminants that pose an unacceptable risk to human health or the environment.

The conceptual site model (CSM) discussed in Section 2.4.3 provides an evaluation of human and ecological receptors and exposure routes. RAOs, described further in Section 2.7, were established based on the known current conditions and the potential risks to human receptors identified during the FS.

Seven evaluation criteria, including overall protection of human health and the environment; compliance with chemical-, location-, and action-specific ARARs; long- and short-term effectiveness; reduction of toxicity, mobility, volume, and mass of contamination; implementability; and cost, were used to evaluate each remedial alternative in an individual and comparative analysis.

2.2.6 2021 Proposed Plan

The PP (North Wind, 2021) presented the findings of the FS (North Wind, 2020a). The PP identified the Preferred Alternative for addressing radiologically impacted soil and debris at Area 2 of SWMU-11 as Alternative 4 – Excavation, Disposal, and Backfilling. Alternative 4 meets the threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and provides the best balance of tradeoffs among the six alternatives with respect to balancing and modifying criteria (i.e., long- and short-term effectiveness; reduction of toxicity, mobility, volume, and mass of contamination; implementability; and cost).

2.3 Community Participation

The PP (North Wind, 2021) and documents associated with Area 2 of SWMU-11 were made available to the public in March 2021 through a Factsheet and Public Notice. A Factsheet was submitted to stakeholders on March 10, 2021, and a Public Notice was published in the Tooele Transcript Bulletin on March 11, 2021, alerting the public of the availability of the PP and associated documents in the Administrative Record and several Information Repositories. The Administrative Record is maintained at the following location:

Utah Department of Environmental Quality
Division of Waste Management and Radiation Control
195 North 1950 West
Salt Lake City, Utah 84114

Electronic copies were also made available for download and viewing at the following website managed by DPG:

https://www.dugway.army.mil/Documents/PublicNotice_SWMU11_Proposed_Plan.pdf

A public comment period was held from March 28, 2021 to May 2, 2021. The option for a public meeting was made available to the community. The Army did not receive comments regarding the PP, or requests for a public meeting. A copy of the Factsheet and Public Notice are included in **Appendix A**.

2.4 Site Characteristics

2.4.1 Physical Description

DPG covers approximately 800,000 acres in Tooele County in western Utah. DPG is bordered to the northeast by the Cedar Mountains and to the north-northwest by Wendover Air Force Range. SWMU-11, also known as DPG-011 and the East Granite Holding Area, is located in the remote southwest portion of DPG and lies within a small canyon on the east side of Granite Mountain. SWMU 11 is divided into two distinct areas: Area 1 and Area 2. Area 1 of SWMU 11 consists of three closed trenches (TR-1, TR-2, and TR-3) running roughly east-west along the north side of the canyon and a fourth backfilled trench (TR-4) running north-south. Area 1 of SWMU-11 was previously evaluated and closed under the RCRA and corrective action requirements of the DWMRC. Area 2 (0.86 acres) of SWMU 11 is the radiological disposal area and consists of two trenches (TR-5 and TR-6) and the area adjacent to the trenches. Area 2 previously contained a CONEX container; however, it was determined to be radiologically clear and was removed in 2017 (Marsh, 2017). Available evidence indicates that radiological materials were stored in the CONEX container and disposed in trenches TR-5 and TR-6 as early as the mid-1950s, although specific records regarding materials disposed at Area 2 of SWMU 11 are limited.

2.4.2 Environmental and Site Characteristics

Geology

SWMU-11 is located at the mouth of a small, northeast-trending colluvial valley along the eastern side of Granite Mountain. The general topography at SWMU-11 is gently sloping down to the east, with an average elevation of 4,375 ft above mean sea level. The valley is flanked to the south by a small ridge of granite that extends from the main Granite Mountain area, and to the north and west by granite outcroppings characteristic of Granite Mountain. To the east, the valley is open to the broad expanse of the Dugway Basin. Granite Mountain is an isolated, north-south trending mountain block approximately 8 miles long × 6 miles wide. The southern two-thirds of the mountain are dominated by dark colored gneiss and gneissic granite with a thin sliver of schists and phyllites at the extreme southern end. The northern one-third of the mountain is made up of intrusive leuco-granitic rocks that form a gradational contact with the gneissic granite to the south. Quaternary-aged lacustrine, alluvium, and colluvium deposits are present along the flanks of Granite Mountain, including the small valley where SWMU-11 is located. Away from the mountain, the surrounding basin floor consists of aeolian sand and silt deposits and Quaternary-aged playa and lacustrine sediments associated with deposits of ancient Lake Bonneville and older pluvial lakes (Parsons, 2009).

Hydrogeology

Groundwater in the area of SWMU-11 is part of the Dugway Valley aquifer system. Groundwater in this region is generally characterized by high total dissolved solids (TDS) and very flat hydraulic gradients. However, the flanks of Granite Mountain, including the SWMU-11 site, constitute a local recharge zone for basin groundwater. In these localized zones, groundwater is deeper and of higher quality than groundwater beneath the basin floor. As groundwater flows from the local recharge area toward the basin floor, it becomes increasingly laden with dissolved mineral constituents; consequently, the quality of groundwater becomes greatly diminished. Depth to groundwater near the eastern boundary of SWMU-11 is approximately 61 ft bgs based on water-level measurements from MW-01. An attempt to install a second groundwater well in the western portion of SWMU-11 near TR-5 did not reach saturated conditions but rather encountered competent granite bedrock from 72.5 ft bgs to the terminal drilling depth of 90 ft bgs. Groundwater flow at SWMU-11 is likely to the east or northeast based on the local topographic gradient present at the site (Parsons, 2009).

Due to the overall low quality of groundwater in the western DPG region, there have been no potable water resources developed in the Granite Mountain area. A non-potable water supply well is located 6 miles west-northwest of SWMU-11 and is reportedly “very salty” and provides water only for hand washing and toilet flushing purposes at the U.S. Air Force Strategic Training Range Complex west of Granite Mountain. Another non-potable water well, located approximately 4 miles northwest of SWMU-11, is used only for dust suppression. Based on the laboratory TDS measurement of 1,770 milligrams per liter (mg/L) from the groundwater samples collected at SWMU-11 (MW-01) (Parsons, 2009), the local groundwater is Class 2 (i.e., drinking water quality) per Utah Administrative Code R317-6-3 (DWQ, 2019).

2.4.3 Conceptual Site Model

A CSM was developed to depict the potential relationship or exposure pathway between radiologically impacted soil and debris and receptors. An exposure pathway describes the means by which a receptor can be exposed to radiologically impacted soil and debris at Area 2 of SWMU-11. Based on the results of the FS (North Wind, 2020a) and Characterization Report (North Wind 2020b), the CSM was updated to address the critical groups and exposure pathways.

Critical Groups

The Resident Farmer and the Industrial Worker were selected as the critical groups and site-specific DCGLs for the radionuclide COCs in soil were developed for both. DCGLs were developed for two dose scenarios: (1) residential (i.e., unrestricted), which requires no LUCs (or long-term maintenance [LTM]) based on a dose of 25 mrem/yr; and (2) industrial (i.e., restricted release), which occurs after the loss of LUCs or LTM based on a dose of 100 mrem/yr.

The Resident Farmer was selected as the critical group for DCGL development for unrestricted release under 10 CFR 20.1402. A Resident Farmer critical group results in more conservative DCGLs (i.e., lower concentrations) than an industrial use critical group due primarily to the increased dose from the consumption of food grown onsite and occupancy time considerations.

An Industrial Worker was selected as the critical group for DCGL development for restricted release under 10 CFR 20.1403. The Industrial Worker is considered to be representative of the current and likely future use of the DPG site.

The Preferred Alternative – Excavation, Disposal, and Backfilling – complies with the ARAR for unrestricted release (10 CFR 20.1402). As a result, restricted release (10 CFR 20.1403) is no longer applicable to this remedy and DCGLs for unrestricted release are applied.

Exposure Pathways

Soil

Radiological COCs in soil and debris pose the highest potential exposure for human and ecological receptors. The radiological COCs in soil (Radium-226, Lead-214, Bismuth-214, Strontium-90, and Niobium-94) could be transported via wind or water erosion, could be redistributed via burrowing animals, and could be assimilated into the food chain via plant uptake or direct ingestion by animals. In addition, constituents in soil could leach and migrate towards the water table as precipitation percolates through the trenches. Small metal tubes in TR-6 contain signatures of Cesium-137; however, it has not been fully identified. Despite these "sealed" radioactive sources, the possibility of a leak due to aging, an accident, damage, or poor manufacture could cause releases or migration of radioactive contamination in TR-6.

The identified or potential exposure routes for the site include the following:

- Direct radiation,
- Inhalation of re-suspended dust, and
- Direct ingestion of soil.

The Radon exposure pathway is not included in the dose assessment for the Resident Farmer or Industrial Worker scenarios, which is consistent with the guidance provided in NUREG-1757, Volume 2, Appendix J.

Groundwater

The groundwater pathway was evaluated during the FS for Area 2 of SWMU-11 using a Resident Farmer scenario. Conservative parameter values were used for the groundwater pathway, basing the parameter values for the unsaturated and saturated zones on the typical properties of sand. Results of the RESRAD

ONSITE computer code (Kamboj et al., 2018) show that the travel time of radionuclides to the aquifer for all radiological COCs of interest are greater than the 1,000-year model period. Therefore, radiological COCs will not migrate to the groundwater during the assessment period. Evidence from the attempt by Parsons (2009) to install a groundwater monitoring well near Area 2 of SWMU-11 indicates that the development of a water well in this area of the site may not be possible. Therefore, the groundwater pathway is not a significant contributor to the receptor doses at Area 2 of SWMU-11 and does not pose a concern for potential exposure to human or ecological receptors.

2.5 Current and Potential Future Land and Resource Uses

DPG is a federal facility and an active military installation. Area 2 of SWMU-11 does not currently house any administrative buildings, family housing, industrial facilities, or barracks, and no future construction projects or residential housing are planned for this area. Future land use is anticipated to be consistent with the current land use. Groundwater was determined to be of overall low quality in the western DPG region, and no potable water resources have been developed in the area. Local groundwater is listed as Utah Class 2 drinking water quality groundwater (Parsons, 2009). Groundwater usage is not anticipated to change.

Current and future land users were identified as site Industrial Workers and ecological receptors. Because access to the site is restricted, trespassers are not expected at the site under current conditions. Anticipated future receptors are site Industrial Workers and ecological receptors; Resident Farmers or Residential Users are potential land users in the distant future.

2.6 Summary of Site Risks

This section summarizes the site risks associated with radiological constituents in soil and debris, the potential receptors and exposure pathways, and an ecological risk screening for Area 2 of SWMU-11. Based on the presence of unacceptable risks to site Industrial Workers and ecological receptors, a remedial action is being recommended to reduce the risks.

A human health and ecological risk assessment, which was performed as part of the Phase II RFI (Parsons, 2009), was primarily focused on trenches TR-1 through TR-4, while samples collected from TR-5 and TR-6 remained uncharacterized. Investigations by Cabrera in 2014 and 2016, as part of the RI/FS Work Plan, further delineated and characterized radiological contaminants in the Area 2 trenches. A data review performed by North Wind during the Characterization Report (North Wind, 2020b) concluded that the data sets were of sufficient quality for use with the intended purpose of defining the nature and extent of radiological impacts at TR-5 and TR-6.

2.6.1 Radiological Contaminants of Concern

Radioactive materials present in soil and debris at Area 2 of SWMU-11 consist of radionuclides that emit ionizing radiation in the form of alpha particles, beta particles, and gamma rays. Area 2 of SWMU-11 is known to contain Radium-226, Lead-214, Bismuth-214, Strontium-90, Niobium-94, and may also contain Cesium-137.

The following is a brief description of each COC, the maximum concentration detected, and background concentrations. Site average background concentration data are from the Phase II RFI (Parsons, 2009):

- Radium-226 was found in TR-5 soil at a maximum concentration of 3,040 pCi/g. The average background concentration of Radium-226 in non-impacted soils near Area 2 of SWMU-11 is 1.3 pCi/g. It has a half-life of 1,600 years, and its decay chain emits alpha particles, beta particles, and gamma radiation.

- Lead-214 was found in TR-5 soil at a maximum concentration of 2,200 pCi/g. The average background concentration of Lead-214 in non-impacted soils is 1.3 pCi/g. It has a half-life of 27 minutes, and is part of the Radium-226 decay chain.

- Bismuth-214 was found in TR-5 soil at a maximum concentration of 2,100 pCi/g. The average background concentration of Bismuth-214 in non-impacted soils is 1.3 pCi/g. It has a half-life of 20 minutes, and is part of the Radium-226 decay chain.

- Strontium-90 was found in TR-5 soil at a maximum concentration of 19.2 pCi/g. An average background concentration of Strontium-90 in non-impacted soils near Area 2 of SWMU-11 has not been determined. It has a half-life of 28.8 years, and its chain emits beta particles. By substituting for calcium, it may concentrate in bones and cause bone cancer.

- Niobium-94 was found in TR-5 soil at a maximum concentration of 8.9 pCi/g. An average background concentration of Niobium-94 in non-impacted soils near Area 2 of SWMU-11 has not been determined. It has a half-life of 20,300 years, and emits beta particles and gamma radiation when it decays.

- Cesium-137 was not detected in Area 2 but is likely associated with metallic debris in TR-6. The average background concentration of Cesium-137 in non-impacted soils is 1.1 pCi/g. It has a half-life of 30.2 years, and its decay chain emits beta and gamma radiation.

2.6.2 Potential Receptors and Exposure Pathways

Site industrial workers and ecological receptors were identified as current and anticipated future receptors. Resident Farmers or Residential Users are potential receptors in the distant future.

The identified or potential exposure routes for Area 2 of SWMU-11 include direct radiation, inhalation of re-suspended dust, and direct ingestion of soil.

2.6.3 Ecological Risk Screening

Ecological receptors may also encounter radiological COCs in soil at TR-5 and TR-6. Current and future use by ecological receptors is expected to remain unchanged. During the FS (North Wind, 2020a), radiation exposure of terrestrial plants and animals was evaluated using the RESRAD-BIOTA computer model, a tool for implementing the Department of Energy (DOE) "Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" (DOE, 2002). Based on the results of the RESRAD-BIOTA output, the only exceedance of the terrestrial animal biotic concentration guidelines (BCGs) was for the maximum soil concentrations of Radium-226 at TR-5 (3,040 pCi/g). However, it is highly unlikely that any population of animals would only be exposed to the maximum soil concentration. Therefore, the average soil concentration (136.6 pCi/g) is considered a better metric of the soil concentration to which the terrestrial animals would be exposed. Based on the average soil concentrations at TR-5 and TR-6, the BCGs would not be exceeded. This evaluation confirmed that there are no ecological COCs and therefore, remedial actions are not required to address ecological exposure pathways.

2.6.4 Basis for Action

The response action selected by the Army and outlined in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of radiologically impacted soil and debris into the environment.

2.7 Remedial Action Objectives

RAOs are site-specific clean-up objectives that are established based on the nature and extent of contamination, the resources that are currently and potentially threatened, the current and potential future land uses, the potential for human and ecological exposure, and ARARs. Development of the RAOs for Area 2 of SWMU-11 focused on reducing the potential for radiological exposure, thereby limiting the dose to receptors. The following RAOs were developed for Area 2 of SWMU-11 based on the known current conditions and the potential risks to human receptors identified during the FS:

1. Prevent direct contact to or external exposure from surface and subsurface soil and debris (i.e., metal tubes) contaminated with Radium-226, Strontium-90, Bismuth-214, Niobium-94, Lead-214, and Cesium-137 by human receptors, with consideration to current and reasonably anticipated future land uses. The radiological criteria for unrestricted release is a dose limit of 25 mrem/yr.

2. Reduce the potential for migration of soil contaminated with Radium-226, Strontium-90, Bismuth-214, Niobium-94, Lead-214, and Cesium-137 to areas beyond the trenches (i.e., buffer zones surrounding the trenches, air, and groundwater).

2.8 Description of Alternatives

The following six remedial alternatives were developed, screened, and evaluated as part of the FS and designed to satisfy the RAOs. The remedial alternatives developed include:

- Alternative 1 – No Action;
- Alternative 2 –LUCs;
- Alternative 3 – Containment through Capping;
- Alternative 4 – Excavation, Disposal, and Backfilling;
- Alternative 5 – Excavation, Sorting, Screening, and Disposal; and
- Alternative 6 – Soil Stabilization

These remedial alternatives provide a representative cross-section of typical alternatives that may be suitable for implementation as a remedial action at this site based on the nature and extent of contamination. However, in accordance with EPA protocols, the FS does not recommend a Preferred Alternative. Instead, it provides sufficient information for decision-makers to compare alternatives and select an appropriate cleanup strategy for the site. The decision process and supporting information to identify a preferred remedy for the remedial action are presented in the PP (North Wind, 2021). A complete discussion of the six remedial alternatives considered for Area 2 of SWMU-11 can be found in the FS with additional discussion in the PP. The Preferred Alternative for Area 2 of SWMU-11 is Alternative 4, Excavation, Disposal, and Backfilling.

2.9 Summary of Comparative Analysis of the Alternatives

In accordance with the NCP, the alternatives for Area 2 SWMU-11 were evaluated using the nine criteria identified in 40 CFR 300.430(e)(9). The acceptability or performance of each alternative against the criteria is evaluated individually so that relative strengths and weaknesses may be identified. These criteria are classified as follows:

- Threshold criteria
  - Protection of human health and the environment
  - Compliance with ARARs
- Primary balancing criteria
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, and volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost
- Modifying criteria
  - Community acceptance
  - State/support agency acceptance

An evaluation of the six remedial alternatives requiring detailed analysis was conducted against the threshold criteria, primary balancing criteria, and modifying criteria and a summary of this can be found in Table 1.

In addition, an analysis was conducted to compare the six alternatives against each other in order to determine the Preferred Alternative. A detailed analysis of the six alternatives measured against the evaluation criteria and the comparison to one another can be found in the FS and the PP.

2.9.1 Summary of the Estimated Costs

The estimated remedy cost information presented in Table 2 is based on the best available information regarding the anticipated scope of the Selected Remedy. Changes in the cost elements may occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file or Explanation of Significant Differences, or an amendment to the ROD. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30% of the actual project cost.

2.9.2 State Acceptance

The Utah DWMRC has reviewed and concurs with the Preferred Alternative as presented in this Final PP.

2.9.3 Community Acceptance

No comments were received regarding the PP during the public comment period.

2.10 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment(s) to address the principal threats posed by a site wherever practicable (40 CFR 300.430(a)(1)(iii)(A) of the NCP). Identifying principal threat wastes (PTWs) combines concepts of both hazard and risk. PTWs are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. A source material is a material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of

contaminants to groundwater, surface water, or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, if present, nonaqueous phase liquids in groundwater may be viewed as a source material, which is not the case at Area 2 of SWMU-11.

Conversely, non-PTWs are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

Radiologically impacted soils and debris (i.e., small metal tubes) present in trenches TR-5 and TR-6 do not constitute a PTW to human health or the environment but are a Radioactive Source Material identified at Area 2 of SWMU-11. Radium-226, Lead-214, Bismuth-214, Strontium-90, Niobium-94, and Cesium-137 have been identified as radioactive materials present in soil and debris that consist of radionuclides that emit ionizing radiation in the form of alpha particles, beta particles, and gamma rays. These materials would present a risk to human health or the environment should exposure occur through direct radiation, inhalation of re-suspended dust, and direct ingestion of soil if the material is moved, handled, or disturbed.

Alternatives 4 (Excavation, Disposal, and Backfilling) addresses the Radioactive Source Material by physically removing all radiologically impacted soil and debris within the trenches and preventing direct contact to or external exposure from contaminated materials. This alternative would also prevent further migration of the soil COCs to areas beyond the trenches, such as buffer zones surrounding the trenches, air, and groundwater.

2.11 Selected Remedy

2.11.1 Summary of the Rationale for the Selected Remedy

Based on the requirements of CERCLA and the NCP, and on a detailed analysis of the response alternatives using the nine criteria, the Army has selected Alternative 4 (Excavation, Disposal, and Backfilling) as the preferred remedy for Area 2 of SWMU-11**.** Excavation, Disposal, and Backfilling represents the best balance of tradeoffs between balancing and modifying criteria. This remedy will be protective of human health and the environment and will comply with ARARs. This remedy was selected over the other remedies for the following reasons:

- RAOs are achieved by physically removing radiologically impacted soil and debris, thereby preventing direct contact to or external exposure from contaminated materials.
- Further migration of COCs to areas beyond the trenches (i.e., buffer zones, air, and groundwater) is prevented.
- This alternative achieves short-term and long-term effectiveness and permanence by physically removing, as well as reducing the toxicity, mobility, volume, and mass of, the contaminated soil and debris.
- This alternative can be implemented to meet ARARs and will achieve UU/UE through the excavation of radiologically impacted soil and debris.

Implementation of this alternative will not require long-term O&M because excavation, disposal, and backfilling should occur within a few months' timeframe. Alternative 4 involves slightly increased health and safety risks to site workers relative to Alternatives 1, 2, 3, and 6, and reduced risk in comparison to Alternative 5. However, all worker health and safety risks will be managed and mitigated during all activities.

Alternative 4 was selected over the other alternatives because it is expected to be effective and achieve significant and permanent contaminant reduction in an acceptable period at a cost comparable to other active treatment technologies. The Selected Remedy is protective of the human health and the environment, compliant with ARARs, cost-effective, and utilizes permanent solutions and common treatment technologies (as referenced in EPA, 1994) to the maximum extent applicable. In addition, both the NRC and Utah DWMRC concur with the Selected Remedy as presented in the Final PP.

2.11.2 Description of the Selected Remedy

The primary component of the selected remedy (Alternative 4, Excavation, Disposal, and Backfilling) is the physical removal of radiologically impacted soil and debris from trenches TR-5 and TR-6, transport to an off-site facility, and backfilling, grading, and revegetation.

Administrative activities to be completed before excavation began would include documentation, planning, engineering design of the remedial alternative, and meetings.

Standard excavation practices and technology will be implemented, and equipment may include backhoes or clamshell excavators. Excavation and services and materials necessary for the transportation of excavated soil and debris to an approved off-site disposal facility or landfill will be utilized. A total of 572 CY from both trenches will be excavated to a depth of 7 ft bgs.

Temporary staging areas will be used to prepare impacted soil and debris for disposal and transport; these areas will be graded to reduce the potential for ponding and collapse of trench walls, lined to prevent groundwater contamination, and bermed to prevent runoff. The off-site transportation of wastes resulting from excavation must meet Federal and State of Utah shipping and manifesting regulations. Excavated soil and debris will be transported to an approved landfill (i.e., the Energy Solutions-Clive Facility) for low-level waste disposal. The excavated area will be backfilled with certified clean soil; a local fill dirt location may be available. Backfilling, grading, and restoring the surface with native vegetation following excavation are necessary to prevent stormwater runoff and erosion.

To ensure the excavation was completed to meet unrestricted (i.e., residential) standards, or UU/UE, confirmation soil sampling for radionuclides and a magnetometer survey or use of a FIDLER or GM probe will be performed to ensure all radiologically-impacted materials have been removed. The extent of each trench has previously been evaluated, and the general dimensions and extent of contamination within each individual trench are known and described in Section 2.8.4.

While excavation and disposal of impacted soil and debris eliminates the environmental and health concerns associated with direct contact of radiologically impacted soil and debris, consideration must be given to the health and safety of site industrial/remedial workers. On-site air monitoring and dust and vapor control provisions will be necessary during excavation operations. Excavation activities can result in the release of fugitive dusts and runoff from disturbed soil. Dust controls could include water sprays or application of chemical dust suppressants. Surface water controls may also be required. Excavation activities at Area 2 of SWMU-11 will create minimal disturbance of the overall operational activities of the surrounding facilities. The total estimated timeframe for completion of all activities is approximately 2 years.

2.12 Statutory Determinations

Under CERCLA and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with ARARs, are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss the Selected Remedy that meets these statutory requirements.

2.12.1 Protection of Human Health and the Environment

The selected remedy (Alternative 4) will protect human health and the environment by permanently removing radiologically impacted soil and debris from trenches TR-5 and TR-6. Removal of radiologically impacted materials will prevent direct contact to or external exposure from surface and subsurface soil and debris (i.e., metal tubes) contaminated with Radium-226, Strontium-90, Bismuth-214, Niobium-94, Lead-214, and Cesium-137 by human receptors. The dose limit of 25 mrem/yr, the radiological criteria for unrestricted release, will be achieved with Alternative 4.

2.12.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and 40 CFR 300.430(f)(1)(ii)(B) of the NCP state that on-site remedial actions selected in a ROD must attain those ARARs that are identified at the time of ROD signature or provide grounds for invoking a waiver under 300.430(f)(1)(ii)(C).

Alternative 4 complies with all chemical-specific, location-specific, and action-specific ARARs identified for Area 2 of SWMU-11. The most critical ARAR developed for Area 2 of SWMU-11 is Radiological Criteria for Unrestricted Use (Residential) (10 CFR 20.1402).

Unrestricted (i.e., Residential) Use, or UU/UE, is achieved immediately through the excavation of radiologically impacted soil and debris from the trenches and has long-term effectiveness and permanence. Alternative 4 will also comply with transportation of hazardous waste to a disposal facility per State Law, Title 19, Chapter 6, Solid and Hazardous Waste Act.

2.12.3 Cost Effectiveness

Alternative 4 (Excavation, Disposal, and Backfilling) was chosen as the Selected Remedy because it provides the best balance among criteria used to evaluate the alternatives considered in the detailed analysis. The alternative was found to achieve both protection of human health and the environment, and to meet the statutory requirements of Section 121 of CERCLA. The Selected Remedy was found to be cost-effective.

The present worth of the cost to complete the selected remedy is approximately $592,787. This cost includes documentation, planning, engineering design of the remedial alternative, and meetings related to remedy implementation.

2.12.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The Army has determined, with concurrence from UDEQ and the NRC, that the Selected Remedy provides the best balance of trade-offs among the alternatives considered with respect to the five-balancing criteria set out in 40 CFR 300.430(f)(1)(i)(B). As such, it represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective and timely manner for the soil and debris at Area 2 of SWMU-11. The Army has determined that Alternative 4 meets the definition of treatment, satisfies the statutory preference for treatment, and provides the best balance of trade-offs in terms of the five balancing criteria.

2.12.5 Five-Year Requirement

Because this remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site exceeding levels that allow for unlimited use and unrestricted exposure, a 5-year review will not be required for this remedial action.

2.13 Document of Significant Changes

The PP for Area 2 of SWMU-11 (North Wind, 2021) was made available for public comment from March 28 to May 2, 2021. The PP identified Alternative 4 (Excavation, Disposal, and Backfilling) as the Preferred Alternative for the remediation of radiologically impacted soil and debris. No verbal or written comments were submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the PP, were necessary or appropriate.

3 RESPONSIVENESS SUMMARY

This section provides a summary of the public comments regarding the PP for remedial action at Area 2 of SWMU-11 and the Army response to comments. At the time of the public review, the Army had selected Alternative 4 (Excavation, Disposal, and Backfilling) as the Preferred Alternative for the site.

A public comment period was scheduled from March 28 to May 2, 2021. The Army did not receive any public comments concerning the PP or remedial alternatives.

3.1 Stakeholder Comments and Lead Agency Responses

The UDEQ DWMRC and the NRC concurred with the selected remedy that was presented in the PP. The Army did not receive any public comments.

3.2 Technical and Legal Issues

No technical or legal issues were identified during the public comment period.

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TABLES

Table 1. Alternatives Summary and Evaluation Comparison.

Evaluation Criteria for Remedial Alternatives	Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Containment (Capping) and LUCs	Alternative 4 Excavation, Disposal, & Backfilling	Alternative 5 Excavation, Sorting, Screening, & Disposal	Alternative 6 Soil Stabilization
Threshold Criteria. Requirements that each alternative must meet in order to be eligible for selection						
Overall Protection of Human Health and the Environment Determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.	Does not provide overall protection to human health or the environment. Does not reduce or control potential radiological exposure to soil or debris. Impacted materials would not be removed, reduced, or controlled.	A low level of protection to human health is provided by reducing the potential for radiological exposure in soil and debris. However, radiologically impacted materials are not eliminated or reduced, and the impact on the environment remains the same.	Capping of TR-5 and TR-6 would provide protection to human health and the environment by providing a physical barrier capable of eliminating direct contact to or exposure by current and future receptors from radiologically impacted soil.	Excavation of radiologically impacted soil and debris in trenches TR-5 and TR-6 provides protection to human health and the environment by preventing direct contact to or external exposure from contaminated soil and radiological debris.	Excavation of radiologically impacted (above screening limits) soil and debris in trenches TR-5 and TR-6 provides protection to human health and the environment by preventing direct contact to or external exposure from contaminated soil and radiological debris.	Pressure-injecting grout into TR-5 and TR-6 would provide protection to human health and the environment by limiting direct contact to or exposure by current and future receptors from radiologically impacted waste.
Compliance with ARARs Evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.	ARARs are not met with the No Action alternative, as no remedy would be implemented.	The chemical-specific ARARs for Restricted (Industrial) (10 CFR 20.1403) use is met.	The chemical-specific ARARs for Restricted (Industrial) (10 CFR 20.1403) use is met	The chemical-specific ARARs for Unrestricted (Residential) (10 CFR 20.1402) use is met	The chemical-specific ARARs for Unrestricted (Residential) (10 CFR 20.1402) use is met.	The chemical-specific ARAR for Restricted (Industrial) (10 CFR 20.1403) use is met.
Balancing Criteria. Used to weigh major tradeoffs among alternatives						
Long-Term Effectiveness and Permanence Considers the ability of an alternative to maintain protection of human health and the environment over time.	The No Action alternative is not effective or permanent for reducing radiological COCs over time, aside from natural radioactive decay. Potential exposure risks associated with radiological COCs would remain with no controls or long-term management plan.	Alternative 2 provides a low level of long-term effectiveness and permanence through the use of LUCs. Radiologically impacted materials would remain in the trenches and the risk of human receptor exposure through potentially complete pathways would remain indefinitely.	Alternative 3 would achieve long-term effectiveness and permanence through a GCL cap at TR-5 and TR-6, combined with LUCs. Capping material would require routine maintenance and inspection by a work crew.	Alternative 4 would achieve long-term effectiveness and permanence through the physical removal of radiologically impacted soil and debris from TR-5 and TR-6.	Alternative 5 would achieve long-term effectiveness and permanence through the physical removal of radiologically impacted soil and debris (above screening limits) from TR-5 and TR-6.	Alternative 6 would achieve long-term effectiveness and permanence through cement grouting of soil and debris at TR-5 and TR-6. LUCs would also be implemented. Integrity of the grout would require periodic maintenance and inspection by a work crew.
Reduction of Mobility, Toxicity, Volume, or Mass Evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.	The No Action alternative does not employ any treatment that would reduce the toxicity, mobility, volume, or mass of impacted material. Natural attenuation processes may reduce radiological COCs over time, but no monitoring will be performed.	Alternative 2 does not provide a reduction in toxicity, mobility, volume, or mass, and radiological COCs would remain in soil and debris.	Alternative 3 would permanently reduce the mobility of radiological COCs in soil through erosion and surface water control. However, the toxicity, volume, and mass of radiological COCs in soil would not be reduced.	Alternative 4 would permanently reduce the toxicity, mobility, volume, and mass of radiological COCs via the physical removal of impacted soil and debris.	Alternative 5 would permanently reduce the toxicity, mobility, volume, and mass of radiological COCs via the physical removal of impacted soil and debris (above screening limits).	Alternative 6 would permanently reduce the mobility of radiological COCs in soil and debris through erosion and surface water control. However, the toxicity, volume, and mass of radiological COCs in soil would not be reduced.
Short-Term Effectiveness Considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.	No activities would be implemented that would present potential short-term exposure risks to human health or the environment.	Would result in minimal exposure risks to industrial workers or other human receptors via institutional controls.	Implementation of GCL caps, combined with LUCs, would result in an immediate reduction in potential exposure to site industrial workers.	Implementation of Alternative 4 would be immediately effective upon excavation of impacted soil and debris; however, removal activities may result in minimal exposure risks to the construction/industrial workers. Controls will be put in place.	Implementation of Alternative 5 would be immediately effective upon excavation of impacted materials; however, removal activities may result in minimal exposure risks to the construction /industrial workers. Controls will be put in place.	Implementation of soil stabilization, combined with LUCs, would result in an immediate reduction in potential exposure to site industrial workers.

Table 1. (continued).

Evaluation Criteria for Remedial Alternatives	Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Containment (Capping) and LUCs	Alternative 4 Excavation, Disposal, & Backfilling	Alternative 5 Excavation, Sorting, Screening, & Disposal	Alternative 6 Soil Stabilization
Implementability Considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.	Alternative 1 is implementable, in that no action would be taken.	Alternative 2 is considered technically feasible, and services and materials should be readily available. Requires administrative planning.	Installation of GCL caps and LUCs is technically feasible, and services and materials for both should be readily available. Requires administrative planning and design of GCL caps.	Alternative 4 is technically implementable via standard excavation practices and technology. Excavation activities should not interfere with ongoing operations at DPG.	Alternative 5 is technically implementable via standard excavation practices and technology. Excavation activities should not interfere with ongoing operations at DPG. Implementing the technology used for sorting and screening of soil and debris on-site may not be feasible given that UU/UE is achievable with Alternative 4 at a lower cost.	Alternative 6 is technically feasible, and services and materials for high-pressure injection of cement grout should be available. Testing, including pilot test and geotechnical testing, would be required, as well as administrative planning.
Cost Includes estimated capital and annual O&M costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30%.	No Cost No capital or operations and maintenance costs	$167,000 Costs for labor and materials (i.e., fencing and signage); annual and periodic site inspections; maintenance, administrative documentation, and planning tasks; meetings; and 5-year reviews.	$383,000 Capital costs for labor and materials, construction, installation, and testing. LUCs would be implemented. Annual and periodic inspections would be required, as well as maintenance, administrative documentation, and planning tasks; meetings; and 5-year reviews.	$593,000 Labor and materials to excavate and backfill the trenches, set up containment areas, perform confirmation soil sampling, transport impacted materials off-site, and restore the surface with native vegetation. Costs for administrative documentation, planning, and meetings. Does not include LUCs.	$1,439,000 Labor and materials for excavation, soil containment, soil and debris sampling, backfilling of trenches, transport of materials off-site, and restoration of the trench area. Equipment would be needed for sorting and screening of radiological material. Costs for administrative documentation, planning, and meetings. Does not include LUCs.	$487,000 Capital costs for labor and materials, construction, installation, and testing. LUCs would be implemented. Annual and periodic inspections would be required, as well as maintenance, administrative documentation, and planning tasks; meetings; and 5-year reviews.
Modifying Criteria. Require review of the remedial alternatives by stakeholders						
State Acceptance Considers whether the state and NRC agree with the analyses and recommendations, as described in the FS and PP.	The Utah DWMRC and the NRC have reviewed and concur with the Preferred Alternative as presented in this Final PP.					
Community Acceptance Considers whether the local community agrees with the preferred alternative. Comments received on the PP are an important indicator of community acceptance.	No comments were received on the Final PP during the public comment period.					

Notes:
Remedial Action Cost Engineering and Requirements (RACER®) software utilized to develop the cost estimates.
All costs are estimated to an accuracy of +50 to -30% per the *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA, 2000).

Table 2. Cost Analysis of Remedial Alternatives.

Alternatives	Assumptions	Inputs	Total Cost	Capital Costs	Total O&M and Periodic Costs	Present Worth Value
Timeframe: 30 years*						
Alternative 1 - No Action	No Action	None	$0	$0	$0	$0
Alternative 2 - Land Use Controls	Administrative LUCs (Site Use Controls, Remedial Design, Land Use Control Implementation Plan [LUCIP], Long-Term Stewardship Plan, and LUCIP Meetings), Signs, Inspections, and Engineering Controls (i.e., fencing around both trenches individually or both trenches as one).	1 Remedial Design (medium complexity) 1 LUCIP Plan (medium complexity) 1 LTS Plan (medium complexity) 2 LUCIP meetings 4 signs Annual Inspections	$167,000	$146,000	$19,000	$161,000
Alternative 3 - Containment of TR-5 and TR-6 and LUCs	Capping (RCRA Hazardous Waste GCL), Administrative LUCs (Site Use Controls, Remedial Design, LUCIP, Long-Term Stewardship Plan, and LUCIP Meetings), Signs, Inspections, and Engineering Controls (i.e., fencing around both trenches individually or both trenches as one).	RCRA C cap (2) Protective cover minimum of 3 ft cap design 120 ft × 70 ft (8,400 ft^2 for TR-5 and TR-6) 40-mil HDPE geomembrane 36-inch protective cover Safety Level D personal protective equipment	$383,000	$ 156,000	$116,000	$383,000
Alternative 4 - Excavate, Dispose Off-Site, and Backfill with Clean Soil	Excavate both TR-5 and TR-6, Temporary Containment for Excavated Materials, Confirmation Soil Sampling/Radiological Survey, Backfill with Certified Clean Material, Restore Surface Vegetation, and Disposal at ES-Clive Disposal Facility. No associated O&M or periodic costs.	Documentation, planning, and meetings Excavate a total of 572 CY from both trenches Excavate to a depth of 7 ft bgs Trucked to ES-Clive for disposal (approx. 80 miles) Backfill with certified clean material	$593,000	$593,000	$0	$593,000
Alternative 5 - Excavate, Sort, Screen, and Dispose Off-Site	Excavate both TR-5 and TR-6, Temporary Containment for Excavated Materials, Mobilization and Demobilization Equipment, On-Site Radiological Screening, Confirmation Soil Sampling/Radiological Survey, Backfill with Certified Clean Material, Restore Surface Vegetation, and Disposal at ES-Clive Disposal Facility. No associated O&M or periodic costs.	Documentation, planning, and meetings Mobilization and demobilization of soil screening technology Excavate a total of 572 CY from both trenches Excavate to a depth of 7 ft bgs Sort and screen 572 CY of material Assume 20% containment Trucked to ES-Clive for disposal (approximately 80 miles)	$1,439,000	$1,439,000	$0	$1,439,000
Alternative 6 – Soil Stabilization	High-Pressure Injection of Grout into both TR-5 and TR-6, Pilot Test and Geotechnical Testing, Administrative LUCs (Site Use Controls, LUCIP, Long-Term Stewardship Plan, and LUCIP Meetings), Signs, Inspections, and Engineering Controls (i.e., fencing around both trenches individually or both trenches as one).	Cement grout injected under pressure across surface area of 1,782 ft^2 Injected to a depth of 10 ft bgs Injection radius of influence 6 ft in diameter Pilot test and geotechnical testing	$487,000	$454,000	$29,000	$481,000

Notes:
Periodic and O&M costs are estimated over 30 years.
Total cost represents the rounded present worth value considering a discount rate of 1.5% for 30 years.
Expected accuracy range of -30 to +50%. Costs are rounded to nearest $1,000 per EPA guidance.

*All costs incurred in Year 1 and Year 2 for Alternatives 4 and 5.

Appendix A

Factsheet and Public Notice

Invitation to Comment on the Proposed Cleanup of Area 2 of Solid Waste Management Unit (SWMU)-11 Dugway Proving Ground, Tooele County, Utah U.S. Army Environmental Command

The U.S. Army invites the public to comment on a Proposed Plan to clean up contamination resulting from the disposal of radiological-contaminated materials at Area 2 of Solid Waste Management Unit 11 (SWMU-11) at the Dugway Proving Ground in Tooele County, Utah.

This Fact Sheet summarizes the Army's cleanup plan and encourages members of the public to provide comments during the public comment period (March 28 through May 2, 2021). The Proposed Plan and associated documents related to the site are available in the Administrative Record and several Information Repositories. You can also request an electronic copy of the Plan by email. The Proposed Plan is available for viewing and download at:

https://www.dugway.army.mil/Documents/PublicNotice_SWMU11_Proposed_Plan.pdf.

The Army's Preferred Cleanup Remedy

Based on site investigations, the Army has determined that remedial actions are required at Area 2 of SWMU-11, a 0.86-acre area where two disposal trenches, TR-5 and TR-6, were previously filled with soil and debris containing radiological contaminants. The preferred cleanup approach for Area 2 of SWMU-11 involves excavation of contaminated soil and debris, disposal of excavated materials at an offsite facility, and backfilling of the excavations with clean fill and topsoil. This cost-effective approach would (1) remove radiologically impacted soils and debris from the site, (2) prevent direct contact with contaminated soil and debris or exposure to radiation, and (3) avoid potential migration of contaminants to areas beyond the trenches. The Army believes this approach is preferable to the other alternatives it considered, which included no action, land use controls, containment (i.e., capping), sorting of excavated material for off-site disposal of the contaminated portion, and soil stabilization.

Site Contamination

Between 2005 and 2016, Army investigations of Area 2 of SWMU-11 included geophysical and radiological surveys and scanning; excavation; sampling of surface and subsurface soil and materials; and the installation, sampling, and analysis of groundwater monitoring wells.

Tell Us What You Think
Public Comment Period
March 28 through May 2, 2021

During the public comment period, you can request information and/or submit written comments to the following:

By Mail:

U.S. Army Environmental Command
ATTN: Mail Stop 112, AMIM-AEC-M
(Linda Albrecht 321-8)
JBSA Fort Sam Houston, TX 78234-7588

By email:

Linda Albrecht
linda.b.albrecht.civ@mail.mil

Within the public comment period, you may also request a public meeting about the Proposed Plan, to be held in Tooele County, Utah, where you can state your views about the cleanup.

For more information, see the Administrative Record located at:

Utah Department of Environmental Quality
Div. Waste Management and Radiation Control
195 North 1950 West
Salt Lake City, UT 84114-4880
801-536-0200

Or these Information Repositories:

Dugway Proving Ground DEP
Building 5330, Room 2107
Valdez Circle
Dugway, UT 84022
435-831-2545 or 435-831-3560

Tooele County Library
128 West Vine Street
Tooele, UT 84074-2059
435-882-2182

J. Willard Marriott Library
The University of Utah
295 South 1500 East
Salt Lake City, UT 84112
801-581-8558

The investigations established that radiological contaminants of concern (COCs) are present within trenches TR-5 and TR-6 and pose a potential health risk; other chemical contaminants are not a concern. The areal extent of the trenches is approximately 782 square feet (TR-5) and 800 square feet (TR- 6), respectively, and trench depths do not exceed 7 feet. No evidence of groundwater contamination by radiological contaminants has been found. Computer models indicate a travel time of radionuclides to groundwater is greater than 1,000 years. Radiological contaminants in soil and debris pose a potential exposure risk to human and ecological receptors. Soil contaminants could be transported via wind or water erosion, be redistributed via burrowing animals, and be assimilated into the food chain via plant uptake or direct ingestion by animals. Contaminants could leach and migrate towards the water table as precipitation percolates through the trenches. The metal tubes in TR-6 could leak due to aging, an accident, or damage, causing a release or migration of radioactive contamination.

Goals

The Army established cleanup goals for protecting human health and the environment based on current site conditions and potential risks. These include:

- Preventing direct contact to surface and subsurface soil and debris contaminated with radiological contaminants by human receptors, as well as exposure to radiation, at a dose limit of 25 millirem (mrem) per year;
- Reducing the potential for migration of radiologically contaminated soil to areas beyond the trenches (areas surrounding the trenches, air and groundwater).

Radiological Contaminants

Radioactive materials present at Area 2 of SWMU-11 consist of radionuclides that emit ionizing radiation in the form of alpha particles, beta particles, and gamma rays. The maximum concentrations of radiological COCs found in soil and debris include:

TR-5 Soil:

- Radium-226: 3,040 pCi/g*
- Lead-214: 2,200 pCi/g
- Bismuth-214: 2,100 pCi/g
- Strontium-90: 19.2 pCi/g
- Niobium-94: 8.9 pCi/g

TR-6 Debris:

- Cesium-137: Not detected but likely associated with metallic debris in TR-6.

*pCi/g – picocuries per gram

Your Comments

As described in the Proposed Plan and other documents in the Administrative Record file, the Army considered several ways to meet the cleanup goals. The Army believes that the preferred cleanup alternative will achieve those goals without disruption to the community. Before making a final decision, we want to hear what you think. We encourage you to learn more about the Proposed Plan and to make your views and concerns known. The cleanup plan that is finally chosen will be described in a Decision Document that will include a summary of comments received and how the comments may have influenced the final decision.

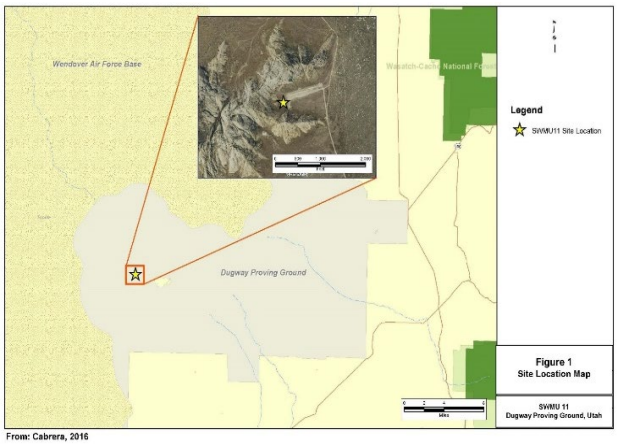

Figure 1 Site Location

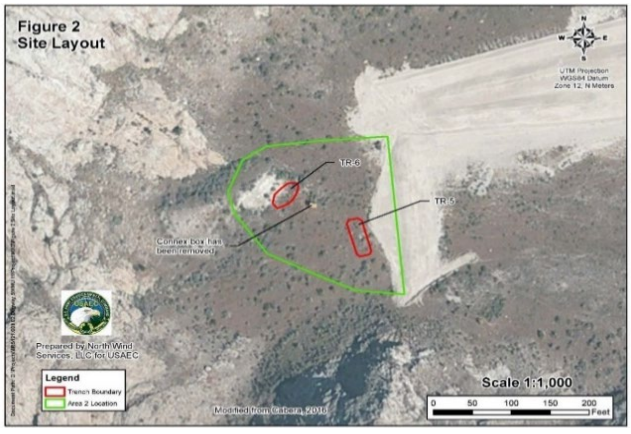

Figure 2 Area 2 Trenches TR-5 and TR-6

Public Notice
U.S. Army Seeks Public Input on the Proposed Cleanup of Area 2 of Solid Waste Management Unit (SWMU-11), Dugway Proving Ground, Tooele County, Utah

The U.S. Army (Army) invites the public to comment on the Proposed Plan to clean up contamination resulting from the disposal of radiological-contaminated materials at Area 2 of Solid Waste Management Unit (SWMU-11) at the Dugway Proving Ground in Tooele County, Utah. Based on site investigations, the Army has determined that remedial actions are required at Area 2 of SWMU-11, a 0.86-acre area where two disposal trenches, TR-5 and TR 6, were previously filled with soil and debris containing radiological contaminants.

This Proposed Plan identifies the preferred cleanup approach for Area 2 of SWMU-11 as excavation of contaminated soil and debris, disposal of excavated materials to an offsite facility, and backfilling of the excavations with clean fill and topsoil. This cost-effective approach would (1) remove radiologically impacted soils and debris from the site, (2) prevent direct contact with contaminated soil and debris or exposure to radiation, and (3) avoid potential migration of contaminants to areas beyond the trenches. The Army believes this approach is preferable to the other alternatives it considered, which were evaluated using EPA's nine criteria in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The Proposed Plan and associated documents are part of the administrative record and are available for public review at the locations listed below. The Proposed Plan is available for viewing and download at https://www.dugway.army.mil/Documents/PublicNotice_SWMU11_Proposed_Plan.pdf.

Utah Department of Environmental Quality Div. Waste Management and Radiation Control 195 North 1950 West Salt Lake City, UT 84114-4880 801-536-0200	Tooele County Library 128 West Vine Street Tooele, UT 84074-2059 435-882-2182
Dugway Proving Ground DEP Building 5330, Room 2107 Valdez Circle Dugway, UT 84022 435-831-2545 or 435-831-3560	J. Willard Marriott Library The University of Utah 295 South 1500 East Salt Lake City, UT 84112 801-581-8558

THE PUBLIC COMMENT PERIOD IS MARCH 28 THROUGH MAY 2, 2021

The Army is seeking comments from the public about the Proposed Plan. Comments received within the public comment period will be considered before the Army makes a final decision on the remedy at Area 2 of SWMU 11. Within the public comment period, you may also request that a public meeting be held to discuss the Proposed Plan. Please submit written comments, requests for a copy of the Proposed Plan, or other requests to:

U.S. Army Environmental Command
ATTN: Mail Stop 112, AMIM-AEC-M
Linda Albrecht 321-8
JBSA Fort Sam Houston, TX 78234-7588
linda.b.albrecht.civ@mail.mil
865-599-0055