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Solid Waste Management Unit Assessment Report Work Plan for Los Alamos Canyon Borrow Pit, Revision 1

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EXECUTIVE SUMMARY

A former borrow pit in Los Alamos Canyon has been used for the final disposition of sediment removed from the Los Alamos Canyon low-head weir basins, which captured sediment during ephemeral flow events and required excavation to maintain sediment-capture capacity. Sediment was emplaced in the borrow pit in 2011, 2012, 2013, and 2014. Analysis of sediment samples collected from the weir basins in 2013 and 2014, before excavation, indicates the sediments are not likely to pose an unacceptable risk to human health. The sediments removed in 2011 and 2012 were not sampled because of post–Las Conchas Fire Emergency actions. The New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) directed Los Alamos National Laboratory (the Laboratory) to prepare a solid waste management unit assessment report (SAR) work plan to investigate the sediments placed in the borrow pit and to determine whether the site should be designated a solid waste management unit or an area of concern. This work plan identifies the investigation activities proposed to collect the data needed to investigate the area and to prepare a SAR. The proposed investigation activities include collecting sediment samples from within the borrow pit; analyzing the samples collected for inorganic, organic, and radionuclide constituents; evaluating the analytical data to identify chemicals of potential concern (COPCs); and screening of potential human health risks and doses associated with COPCs. This SAR work plan also provides a history of activities that have occurred at the borrow pit associated with the emplacement of sediment removed from the sediment basins and as-built information and photographs of current conditions at the site.

During a September 9, 2016, meeting with NMED-HWB representatives in Santa Fe, New Mexico, NMED-HWB staff provided verbal comments on the SAR work plan submitted in August. NMED-HWB staff recommended that the Laboratory submit Revision 1 to the SAR Work Plan. Revision 1 to the SAR work plan provides additional details on the locations and depths of proposed sampling and fixes errors in contour elevations in as-built drawings.

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1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Los Alamos National Security, LLC (LANS). The Laboratory is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers approximately 39 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 to 7800 ft above mean sea level.

The Laboratory is participating in a national effort by DOE to reduce risk to human health and the environment at its facilities. The goal of the Laboratory's effort is to ensure that past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, the Laboratory is currently investigating sites potentially contaminated by past Laboratory operations. The sites under investigation are designated as solid waste management units (SWMUs) and areas of concern (AOCs).

This SWMU assessment report (SAR) work plan addresses a former borrow pit located within Los Alamos Canyon at the Laboratory (Figure 1.0-1). This borrow pit was used to permanently emplace sediments removed from basins located immediately upgradient of the Los Alamos Canyon low-head weir, which was constructed to reduce downstream flood potential beyond the Laboratory boundary post–Cerro Grande fire. The sediments emplaced within the borrow pit are potentially contaminated with hazardous chemicals and radionuclides. For this reason, the sediments placed in the borrow pit are being evaluated as a potential SWMU or AOC. The New Mexico Environment Department (NMED), pursuant to the New Mexico Hazardous Waste Act, regulates cleanup of hazardous wastes and hazardous constituents. DOE regulates cleanup of radioactive contamination, pursuant to DOE Order 458.1, Administrative Change 3, "Radiation Protection of the Public and the Environment," and DOE Order 435.1, "Radioactive Waste Management." Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy. The purpose of this SAR work plan is to comply with Section X.C of the 2016 Compliance Order on Consent, which states that "DOE shall develop and implement a preliminary screening plan (including sampling and investigation activities and schedule for those activities) for such newly discovered potential SMWU or AOC, and provide NMED with the results of the preliminary screening." The results of investigation activities identified in this work plan will be submitted to NMED in a SAR.

1.1 Work Plan Overview

A report of the 2013 sampling and excavation activities was submitted to NMED (LANL 2013, 251741). A notice of disapproval (NOD) for the 2013 excavation report was issued by NMED (NMED 2015, 600271), requesting additional information related to the borrow pit and the sediments. A response to the NOD and a revised excavation report were submitted to NMED in 2015 (LANL 2015, 600513). An NOD for the revised report was issued by NMED on December 1, 2015 (NMED 2015, 601032), directing the Laboratory to submit Revision 2 of the 2013 excavation report and to prepare a SAR for the sediments placed in the borrow pit.

The requirements for Revision 2 of the excavation report and the SAR were discussed during a June 21, 2016, meeting between representatives of the NMED Hazardous Waste Bureau (NMED-HWB), NMED Surface Water Quality Bureau, DOE, and LANS. NMED-HWB requested that the response to the NOD be addressed in a SAR work plan. Using this approach, NMED indicated that Revision 2 would not be required, and once investigation activities proposed in the SAR work plan were complete, the results should be submitted in a SAR. NMED-HWB representatives indicated that the sediments within the borrow pit would be need to be sampled to adequately characterize the material to prepare the SAR. Therefore, this work plan has been prepared to support the preparation of the SAR for the Los Alamos Canyon borrow pit.

Section 2 of this SAR work plan provides a description and history of the borrow pit, summarizes previous characterization of the sediments placed in the borrow pit, and presents analytical data for the sediments. Section 3 describes the proposed investigation activities, including sampling and analysis and data evaluation. Section 4 presents a milestone schedule for conducting the investigation activities and preparing the SAR.

Appendix A contains acronyms and abbreviations, a metric conversion table, and data qualifier definitions. Appendix B contains site photographs. Appendix C presents as-built drawings of the borrow pit and associated runoff controls. Appendix D presents the analytical data from previous sediment sampling. Appendix E presents the results of sediment runoff modeling using Revised Universal Soil Loss Equation 2 (RUSLE2) software.

1.2 Work Plan Objectives

The objectives of the investigation described in this work plan are to characterize hazardous and radionuclide constituents potentially present in the borrow pit sediments and to evaluate whether these sediments potentially pose an unacceptable risk to human health. The work plan identifies the activities that will be performed to meet these objectives.

2.0 BACKGROUND

2.1 General Site Information

The Los Alamos Canyon borrow pit consists of a pit located in Los Alamos Canyon approximately one-half mile west of the Laboratory boundary at NM 4 (Figure 1.0-1). In late spring/early summer of 2011, 2012, 2013, and 2014, sediments were removed from basins located behind the Los Alamos Canyon low-head weir and placed in the borrow pit. Sediments were removed annually to increase the storm water detention capacity of the Los Alamos weir before each corresponding year's monsoon season. The pit is located above the 100-yr flood plain and is proposed as the location for the final disposition of sediments excavated from the three basins[1] behind the Los Alamos Canyon low-head weir (Figure 2.1-1).

Following placement in the pit, sediments have been stabilized by revegetation to prevent erosion. A runoff control berm below the sediments provides further protection against off-site transport of surface eroded sediments. Surface dimensions of the sediments placed in the borrow pit is approximately 230 ft in the downslope orientation (generally east-west direction) and 170 ft in the cross-slope direction (generally north-south direction). The deepest depth of sediments is estimated to be 12 ft and the average depth is 5 to 8 ft. Sediment depth tapers on all sides to native ground. Appendix C of this report shows a plan view and cross-section of the area.

The borrow pit has been used only to manage sediments removed from behind the Los Alamos Canyon low-head weir. No other materials have been managed or placed at the site. These sediments consist of soils and canyon sediments originating in the watershed upstream of the weir. These materials were

[1] The three basins of the Los Alamos weir are identified from west to east and upgradient to downgradient as the upper basin (basin 1), middle basin (basin 2), and lower basin (basin 3), with the lower basin directly upgradient of the Los Alamos weir gabion structure.

eroded and transported downstream during precipitation events and deposited in the basins behind the weir. The upstream watershed includes portions of the Laboratory, portions of the Los Alamos townsite, and U.S. Forest Service land.

Visual inspection of the borrow pit occurs biannually and after every flow event greater than 50 cubic feet per second at gage station E042.1. If erosion or any other issues are noted that require follow-up maintenance, maintenance is scheduled and conducted. The latest visual inspection report is presented in Appendix E.

2.2 History of Placement of Sediments in the Borrow Pit

The borrow pit has been used four times for disposition of sediments removed from the Los Alamos Canyon low-head weir sediment basins. An estimated 16,400 yd^3 of Los Alamos weir sediments was placed in the borrow pit between 2011 and 2014[2]. Several removal activities were preceded by on-site sampling of the material. Sediment disposition–related activities at the borrow pit are described below by year and are summarized in Table 2.2-1.

2011

The first placement of sediments into the borrow pit occurred in July 2011, immediately following the Las Conchas wildfire in June 2011. Sediment was removed from all three basins behind the weir as a post-fire response action in anticipation of post-fire flooding. Approximately 1200 yd^3 of sediments was removed and placed at the borrow pit. The 2011 excavation activities are shown in Figure B-1 in Appendix B. Before emplacement of the sediment in 2011, a demarcation of original ground was made by placing an 80- by 100-ft 12-mil polyethylene nylon reinforced plastic sheet. The sediment was placed on the demarcation liner and compacted in lifts. Afterwards, the sediment pile was sprayed with tackifier to prevent wind or water erosion. These activities were described in a report submitted to NMED summarizing post–Las Conchas mitigation actions (LANL 2011, 206488). The sediments were stabilized by reseeding, and a berm was constructed below the sediments to contain runoff. No sediment samples were collected to represent concentrations of constituents in 2011 excavation material placed in the borrow pit.

2012

In August 2012, approximately 2000 yd^3 of sediments was removed from the Los Alamos weir basins and placed in the borrow pit. Sampling was also not performed before 2012 excavation activities were undertaken. Sediment was removed from the upper and middle basins to increase storm water ponding capacity. Excavation activities in 2012 are shown in Figures B-2 through B-4 in Appendix B. Sediments were not removed from the lower basin because of ponding conditions (Figure B-3). Before the sediments were emplaced, the demarcation liner installed in 2011 was extended, and the extended edge of the liner is visible in Figure B-4. Excavated sediment was placed and compacted in lifts on top of 2011 sediments in the borrow pit. The sediments were stabilized by reseeding, and berm maintenance was conducted.

2013

In April 2013, approximately 6000 yd^3 of sediments was removed from the Los Alamos weir sediment basins and emplaced at the borrow pit. Excavation activities in 2013 are shown in Figures B-5 through

[2] Sediment removal and placement estimates are based on the size and number of trucks used to transport material to the borrow pit during removal activities. Estimates are based on truck volumes of sediments; actual compacted volumes are approximately three-quarter times the reported trucked volume.

B-7. Sediments from the lower basin that had accumulated following the Las Conchas wildfire floods were excavated. The sediments were placed over the sediments deposited in 2012, compacted in lifts, and seeded. Maintenance was also performed on the runoff retention berm.

Six composite sediment samples were collected in January 2013 before removal activities and are discussed in section 2.4 of this work plan. The 2013 sediment removal and characterization activities were described in detail in the excavation report submitted to NMED (LANL 2013, 251741) and a revision to the report (LANL 2015, 600513).

2014

In April 2014, approximately 7200 yd^3 of sediment deposition caused by the catastrophic floods of September 2013 was removed from the upper and middle sediment basins and placed in the borrow pit. Excavation activities in 2014 are shown in Figures B-8 through B-10. The sediments were placed over the 2013 sediments, compacted, and hydroseeded. Maintenance was also performed on the runoff retention berm. Twelve composite sediment samples were collected before removal activities and the results of sampling are discussed in section 2.4 of this work plan.

2015

No excavation activities occurred at the Los Alamos weir in 2015. However, in November 2015, additional clean-fill material was placed on the runoff retention berm, raising the berm height and the deepest ponding depth behind the berm to approximately 2 ft. The berm was seeded and covered with erosion-control matting. Figure B-11 shows the runoff retention berm immediately after construction.

2.3 Current Conditions

Current site conditions as of June 2016 are shown Figures B-12 through B-14 in Appendix B. As-built drawings of the sediments emplaced in the borrow pit, as well as erosion controls installed at the borrow pit, are presented in Appendix C. Appendix C includes all the technical specifications for placement of borrow pit material and installation of storm water controls. The area is well vegetated with no visual evidence of rilling or erosion. The latest visual inspection report can be found in Appendix E.

2.4 Results of Previous Sampling

2.4.1 Sediment Sampling

The excavation activities performed in 2011 and 2012 were part of emergency actions taken after the Las Conchas wildfire, and sampling of the sediments was not performed. The sediments in the basins behind the weir were sampled before the 2013 and 2014 excavations. Figures 2.4-1 and 2.4-2 show the 2013 and 2014 sampling locations of the composite samples collected. Tables 2.4-1 and 2.4-2 list the composite subsample points grouped by location identification number (labeled “Location ID”). Sample compositing occurred by mixing all samples subsample points, presented in the table under the column labeled “Subsample Point ID,” and submitting that samples for analysis with the Location ID presented in the corresponding row in the table

Preliminary screening of the analytical results from sediment samples collected in 2013 and 2014 show that hazardous constituents and radionuclides were detected below residential screening levels. Screenings were performed by comparing detected concentrations and activities to residential soil screening levels (SSLs) and screening action levels (SALs). Details of these sampling events and the screenings are presented below.

In 2013, composite samples were collected from each of six locations. Samples were analyzed for target analyte list (TAL) metals, total cyanide, dioxins and furans, herbicides, pesticides, polychlorinated biphenyls (PCBs), americium-241, gamma-emitting radionuclides, isotopic plutonium, strontium-90, and tritium. Table 2.4-3 summarizes the samples collected and analyses requested in 2013. Table 2.4-4 presents inorganic chemicals detected above background values (BVs) for canyon sediments (LANL 1998, 059730). Table 2.4-5 presents detected organic chemicals, and Table 2.4-6 presents the toxic equivalency (TEQ) of detected dioxin and furan congeners. Table 2.4-7 presents radionuclides detected or detected above BVs/fallout values (FVs). Analytical data are provided in Appendix D.

Inorganic chemicals detected above BVs in 2013 include barium, beryllium, calcium, cobalt, copper, cyanide, iron, lead, manganese, nickel, and zinc (Table 2.4-4). None of the inorganic chemicals detected above BVs were detected above residential SSLs (NMED 2015, 600915). Organic chemicals detected in 2013 include 4-(2,4-dichlorophenoxy)butyric acid (2,4-DB); 4,4’-dichlorodiphenyldichloroethylene (4,4’-DDE); 4,4’-dichlorodiphenyltrichloroethane (4,4’-DDT); methylchlorophenoxypropionic acid (MCPP); and six dioxin and furan congeners (and Table 2.4-5). None of the organic chemicals were detected above residential SSLs, and the TEQ of the detected dioxin and furan congeners was less than the residential SSL for 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD) (Table 2.4-6). Radionuclides detected above FVs in 2013 include americium-241, cesium-137, and plutonium-239/240. No radionuclides detected above FVs were detected above residential SALs (Table 2.4-7) (LANL 2015, 600929).

In 2014, composite samples were collected from each of 12 locations and analyzed for gamma-emitting radionuclides, strontium-90, tritium, americium-241, isotopic plutonium, TAL metals, pesticides/PCBs, herbicides, dioxins and furans, and total cyanide. Table 2.4-8 summarizes the samples collected and analyses requested. No inorganic chemicals were detected above BVs. Table 2.4-9 presents detected organic chemicals, and Table 2.4-10 presents the TEQs of detected dioxin and furan congeners. Table 2.4-11 presents radionuclides detected or detected above BVs/FVs. Analytical data are provided in Appendix D.

Organic chemicals detected in 2014 include Aroclor-1260; 4,4’-DDE; 4,4’-DDT; dieldrin; and 13 dioxin and furan congeners (Table 2.4-10). None of the organic chemicals were detected above residential SSLs, and the TEQ of the detected dioxin and furan congeners was less than the residential SSL for 2,3,7,8-TCDD. Radionuclides detected above FVs in 2014 include americium-241, plutonium-238, and plutonium-239/240 (Table 2.4-11). No radionuclides detected above FVs were detected above residential SALs (LANL 2015, 600929).

2.4.2 Surface Water Sampling

Figure 2.4-3 shows the storm water sampling location where grab samples were collected by NMED-DOE Oversight Bureau (NMED-DOE-OB) on September 13, 2013. The samples were analyzed for dioxins and furans, PCB congeners, americium-241, strontium-90, plutonium isotopes, uranium isotopes, and gross-alpha and gross-beta radioactivity. Surface water sampling results are presented in Table 2.4-12. All results were compared with the applicable water-quality standards for the receiving stream, Los Alamos Canyon. Los Alamos Canyon waters are classified in New Mexico Administrative Code (NMAC) 20.6.4.128 as ephemeral or intermittent. The comparison showed that gross-alpha activity was detected at 2.5 times the applicable water-quality standard for livestock watering, and PCBs were detected at 3.6 times the water-quality standard for the human health-organism only. Gross-alpha activity and PCBs concentrations detected in the samples are within the range of activities and concentrations in undeveloped background watersheds (LANL 2013, 239557; LANL 2012, 219767).

2.5 RUSLE2 Modeling

NMED's December 1, 2015, disapproval of Revision 1 of the 2013 excavation report (LANL 2015, 600513; NMED 2015, 601032) required the Laboratory to submit "stormwater modeling results" demonstrating the adequacy of the erosional controls established at the borrow pit. Additional details related to the modeling were discussed in a June 21, 2016, meeting among representatives of NMED, DOE, and LANS. During the meeting, NMED stated that erosional controls for similar sites covered under the National Pollutant Discharge Elimination System Construction General Permit were typically evaluated using the U.S. Department of Agriculture RUSLE2 software. Therefore, it was agreed that the requirements in the disapproval letter for storm water modeling would be met through modeling using RUSLE2.

Appendix E provides the details and results of modeling using the RUSLE2 software used to determine estimated annual soil loss from rill and interrill erosion at the former borrow pit where excavated sediments have been placed.

Two scenarios were modeled: Scenario 1 represents current conditions reflecting existing site stabilization activities (i.e., revegetation and sediment retention berm), and Scenario 2 represents nonstabilized conditions (i.e., without revegetation and sediment retention berm). Results of the RUSLE2 calculations indicate the site discharges under Scenario 1, current conditions, are estimated as 0.0087 tons/acre/yr of sediment past the berm or a total of 0.8 ft^3 of sediment in 10 yr. By comparison, Scenario 2, nonstabilized conditions, showed a discharge of 0.3 tons/acre/yr of sediment or a total of 29 ft^3 of sediment in 10 yr.

The RUSLE2 modeling results for the current conditions indicate relatively minor erosional loss from the sediment disposal area and very low delivery of sediment past the sediment basin. These results are consistent with field observations that indicate controls, including revegetation, have been very effective in stabilizing the site (Appendix E, Attachment E-1). The RUSLE2 modeling results for the nonstabilized scenario, Scenario 2, indicate substantially higher erosion losses would have been expected in the absence of erosion controls. These results also confirm the effectiveness of the controls established at the site. The results of the RUSLE2 modeling do not indicate the need for additional controls at the site.

3.0 PROPOSED INVESTIGATION ACTIVITIES

3.1 Sampling and Analysis

3.1.1 Sampling Locations and Depth Intervals

Sampling and analysis of the sediments in the borrow pit will be performed to identify hazardous and radionuclide constituents currently present in the sediments and to evaluate whether they would pose a potential unacceptable human health risk or dose. Per the June 21, 2016, meeting with NMED-HWB, the Laboratory proposes to collect samples at eight borehole locations within the footprint of the fill area in the borrow pit at approximate locations and sampling depths shown in Figure 3.1-1. Borehole locations were biased towards areas of the borrow pit that were a minimum of 3 ft thick. ~~The fill area will be gridded and eight representative sampling locations will be identified. Grids will be selected to represent approximately equal volumes of the fill (i.e., grid surface areas will be larger where fill is thin and smaller where fill is thick).~~

As-built technical specifications presented in Appendix C will be used to estimate the thickness of the fill in the borrow pit. The actual thickness at each location will be verified by hand-augering until the installed demarcation liner is encountered.

At each borehole sampling location, samples will be collected from three depth intervals as shown in Figure 3.1-1. The first interval will be the top 1 ft of the sediment fill or the top one-third of the sediment fill profile if the total thickness is less than 3 ft. This interval represents the most recently applied fill and the material most available for exposure to receptors. The second interval will be in the middle 1 ft of the profile or the middle one-third if the total thickness is less than 3 ft. The third interval will be the bottom 0 to 12 ft of sediment fill profile or the bottom one-third of the profile if the total thickness is less than 3 ft. This deepest interval is likely to be representative of sediment disposed of in 2011 and 2012 that has not been characterized previously. All sampling locations will beare sited within the footprint of the 2011 placement of sediments. Actual borehole locations and sampling depths may be adjusted based on field conditions.

3.1.2 Sample Analyses

Sediment samples will be analyzed for the same suite of analytes used during the 2013 and 2014 sampling of the Los Alamos low-head weir sediments. Inorganic analyses will include TAL metals and total cyanide. Organic analyses will include dioxins/furans, herbicides, PCBs, and pesticides. Radionuclide analyses will include americium-241, gamma-emitting radionuclides, isotopic plutonium, strontium-90, and tritium. Table 3.1-1 summarizes the samples to be collected and the analyses to be performed, including analytical method numbers.

3.1.3 Investigation Methods

The standard operating procedures (SOPs) cited below are available at http://www.lanl.gov/environment/plans-procedures.php.

3.1.3.1 Surface Samples

Surface sediment samples will be collected in accordance with SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples. Stainless-steel shovels, spades, scoops, and bowls will be used for ease of decontamination. Samples collected for analyses will be placed in the appropriate sample containers depending on the analytical method requirement.

3.1.3.2 Subsurface Samples

Subsurface samples will be collected using hand augers or power-assisted augers. The hand auger is advanced by turning the auger into the sediment until the barrel is filled. The auger is removed and the sample is placed in a stainless-steel bowl. Hand-auger samples will be collected in accordance with ER-SOP-20069, Soil, Tuff, and Sediment Sampling.

3.1.3.3 Geodetic Surveys

Geodetic surveys of sampling locations will be conducted in accordance with the current version of EP-ERSS-SOP-5028, Coordinating and Evaluating Geodetic Surveys. The surveyors will use a Trimble GeoXT hand-held global positioning system (GPS), or equivalent, for the surveys. The coordinate values will be expressed in the New Mexico State Plane Coordinate System (transverse mercator), Central Zone, North American Datum 1983. Elevations will be reported as per the National Geodetic Vertical Datum of 1929. All GPS equipment used will meet the accuracy requirements specified in the SOP.

3.1.3.4 Chain of Custody for Samples

The collection, screening, and transport of samples will be documented on standard forms generated by the Laboratory's Sample Management Office. These forms include sample collection logs, chain-of-custody forms, and sample container labels. Sample collection logs will be completed at the time of sample collection and signed by the sampler and a reviewer who will verify the logs for completeness and accuracy. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. Chain-of-custody forms will be completed and signed to verify that the samples are not left unattended.

3.1.3.5 Quality Assurance/Quality Control Samples

Quality assurance and quality control samples will include field duplicate and equipment rinsate samples. These samples will be collected following the current version of SOP-5059, Field Quality Control Samples. Field duplicate samples will be collected at an overall frequency of at least 1 for every 10 regular samples.

3.1.3.6 Equipment Decontamination

Equipment for sampling will be decontaminated before and after sampling activities to minimize the potential for cross-contamination. Dry decontamination methods will be used to avoid the generation of liquid waste and to minimize the investigation-derived waste (IDW). Dry decontamination uses disposable paper towels and over-the-counter cleaner, such as Fantastik or equivalent. All sampling and measuring equipment will be decontaminated in accordance with SOP-5061, Field Decontamination of Equipment.

3.1.3.7 Investigation-Derived Waste

IDW generated by the proposed investigation activities may include, but is not limited to, excavated sediment, contact waste such as personal protective equipment, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

All IDW generated during field investigation activities will be managed in accordance with applicable U.S. Environmental Protection Agency (EPA) and NMED regulations, DOE orders, and Laboratory requirements.

3.2 Data Evaluation

The analytical data will be evaluated to identify chemicals of potential concern (COPCs) and to identify potential unacceptable human-health risks associated with COPCs.

3.2.1 Identification of COPCs

COPCs are chemicals and radionuclides that may be present as a result of releases from SWMUs or AOCs. Sediments that deposited in the Los Alamos weir basins contain a complex mix of sources of contaminants. These contaminates may be sourced from SWMUs or AOCs, natural background sediments derived from Bandelier Tuff, global fallout of radionuclides, urban development in the Los Alamos townsite, and ash from wildfires (LANL 2016, 601433). Some of these non-SWMU or non-AOC sources are discussed below.

Inorganic chemicals and some radionuclides occur naturally, and inorganic chemicals and radionuclides detected because of natural background are not considered COPCs. Similarly, some radionuclides may be present as a result of fallout from historical nuclear weapons testing, and these radionuclides are also not considered COPCs. The Laboratory has collected data on background concentrations of many inorganic chemicals, naturally occurring radionuclides, and fallout radionuclides. These data have been used to develop media-specific BVs and FVs (LANL 1998, 059730). For inorganic chemicals and radionuclides for which BVs or FVs exist, identification of COPCs includes background comparisons, which are described below. If no BVs or FVs are available, COPCs are identified based on detection status (i.e., if the inorganic chemical or radionuclide is detected, it is identified as a COPC unless available information indicates it is not present as a result of a release from the SWMU or AOC).

Organic chemicals may also be present as a result of anthropogenic activities unrelated to the SWMU or AOC or, to a lesser extent, from natural sources. Because no background data are available for organic chemicals, background comparisons cannot be performed in the same manner as for inorganic chemicals or radionuclides. Therefore, organic COPCs are identified on the basis of detection status (i.e., the organic chemical is detected). Organic chemicals that are clearly present from sources other than releases from a SWMU or AOC, and for which there are no known releases from a SWMU or AOC, may be eliminated as COPCs and not evaluated further.

3.2.1.1 Inorganic Chemical and Radionuclide Background Comparisons

COPCs are identified for inorganic chemicals and radionuclides according to Laboratory procedures EP-SOP-10071, Background Comparisons for Inorganic Chemicals, and EP-SOP-10073, Background Comparisons for Radionuclides (available at http://www.lanl.gov/environment/plans-procedures.php). Inorganic COPCs are identified by comparing site data with BVs and maximum concentrations in a background data set and using statistical comparisons, as applicable (LANL 1998, 059730). Radionuclides are identified as COPCs based on background comparisons and statistical methods if BVs or FVs are available or based on detection status if BVs or FVs have not been established.

Background data are generally available for inorganic chemicals in soil, sediment, and tuff (LANL 1998, 059730). A BV may be either a calculated value from the background data set (upper tolerance limit or the 95% upper confidence bound on the 95th quantile) or a detection limit (DL). When a BV is based on a DL, there is no corresponding background data set for that analyte/media combination.

For inorganic chemicals, data are evaluated by sample media to facilitate comparison with media-specific background data. To identify inorganic COPCs, the first step is to compare the sampling result with BVs. If all results are below BV, the inorganic chemical is not a COPC. If sampling results are above the BV and sufficient data are available (eight or more sampling results and five or more detections), statistical tests are used to compare the site sample data with the background data set for the appropriate media. If statistical tests cannot be performed because of insufficient data or a high percentage of nondetections, the sampling results are compared with the BV. If at least one sampling result is above the BV, the inorganic chemical is identified as a COPC unless lines of evidence can be presented to establish the inorganic chemical is not a COPC. Such lines of evidence include, but are not limited to, comparison with the background data set concentrations, number of detections above the BV, number of nondetections in the data set, and site history. When an inorganic chemical is not detected but has a DL above the BV, the same evaluation is performed using DLs instead of BVs. If no BV is available, detected inorganic chemicals are identified as COPCs.

Radionuclides are identified as COPCs based on comparisons with BVs for naturally occurring radionuclides or with FVs for fallout radionuclides. Thorium-228, thorium-230, thorium-232, uranium-234, uranium-235/236, and uranium-238 are naturally occurring radionuclides. Americium-241, cesium-137, plutonium-238, plutonium-239/240, strontium-90, and tritium are fallout radionuclides having FVs.

Naturally occurring radionuclides detected at activities above their respective BVs are identified as COPCs in the same manner as inorganic chemicals. If there is no associated BV or FV and the radionuclide is detected, it is retained as a COPC.

The FVs for the fallout radionuclides apply to sediment regardless of sample depth. The radionuclide is eliminated as a COPC if activities are similar to fallout activities or lines of evidence can be presented to establish the radionuclide is not a COPC.

3.2.1.2 Statistical Methods

If inorganic chemicals or radionuclides are detected above BVs or FVs, statistical methods may be used to determine whether the constituents are COPCs. The statistical tests will be used to evaluate potential differences between the distributions in the site data and the background data. These tests are used for testing hypotheses about data from two potentially different distributions (e.g., a test of the hypothesis that site concentrations are elevated above background levels). Nonparametric tests most commonly performed include the Gehan test (modification of the Wilcoxon Rank Sum test) and the quantile test (Gehan 1965, 055611; Gilbert and Simpson 1990, 055612).

The Gehan test is recommended when between 10% and 50% of the data sets are nondetections. It handles data sets with nondetections reported at multiple DLs in a statistically robust manner (Gehan 1965, 055611; Millard and Deverel 1988, 054953). The Gehan test is not recommended if either of the two data sets has more than 50% nondetections. If there are no nondetected concentrations in the data, the Gehan test is equivalent to the Wilcoxon Rank Sum test. The Gehan test is the preferred test because of its applicability to a majority of environmental data sets and its recognition and recommendation in EPA-sponsored workshops and publications.

The quantile test is better suited to assessing shifts in a subset of the data. The quantile test determines whether more of the observations in the top chosen quantile of the combined data set come from the site data set than would be expected by chance, given the relative sizes of the site and background data sets. If the relative proportion of the two populations being tested is different in the top chosen quantile of the data from that of the remainder of the data, the distributions may be partially shifted because of a subset of site data. This test is capable of detecting a statistical difference when only a small number of concentrations are elevated (Gilbert and Simpson 1992, 054952). The quantile test is the most useful distribution shift test where samples from a release represent a small fraction of the overall data collected. The quantile test is applied at a prespecified quantile or threshold, usually the 80th percentile. The test cannot be performed if more than 80% (or, in general, more than the chosen percentile) of the combined data are nondetected values. It can be used when the frequency of nondetections is approximately the same as the quantile being tested. For example, in a case with 75% nondetections in the combined background and site data set, application of a quantile test comparing 80th percentiles is appropriate. However, the test cannot be performed if nondetections occur in the top chosen quantile. The threshold percentage can be adjusted to accommodate the detection rate of an analyte or to look for differences further into the distribution tails. The quantile test is more powerful than the Gehan test for detecting differences when only a small percentage of the site concentrations are elevated.

If the differences between two distributions appear to occur far into the tails, the slippage test may be performed. This test evaluates the potential for some of the site data to be greater than the maximum concentration in the background data set if, in fact, the site data and background data came from the same distribution. This test is based on the maximum concentration in the background data set and the number ("n") of site concentrations that exceed the maximum concentration in the background set (Gilbert and Simpson 1990, 055612, pp. 5–8). The result (p-value) of the slippage test is the probability that "n" site samples (or more) exceed the maximum background concentration by chance alone. The test accounts for the number of samples in each data set (number of samples from the site and number of samples from background) and determines the probability of "n" (or more) exceedances if the two data sets came from identical distributions. This test is similar to the BV comparison in that it evaluates the largest site measurements but is more useful than the BV comparison because it is based on a statistical hypothesis test, not simply on a statistic calculated from the background distribution.

For all statistical tests, a p-value less than 0.05 will be the criterion for accepting the null hypothesis that site sampling results are different from background.

3.2.2 Human-Health Risk Screening Evaluation

After COPCs have been identified, a human-health risk screening evaluation will be performed to assess whether the sediments in the borrow pit pose potential unacceptable human health risk. For each COPC, an exposure point concentration (EPC) will be calculated. For evaluation of the borrow pit, the entire data set (i.e., all locations and depths) will be used to determine EPCs. If there are sufficient data (i.e., eight samples and five detections) to calculate an upper confidence limit (UCL), the UCL will be used as the EPC. UCLs will be calculated using the EPA ProUCL statistical software package. If there are not sufficient data to calculate a UCL, the maximum detected concentration will be used as the EPC. Risk will be evaluated using NMED's SSLs for the residential scenario (NMED 2015, 600915). If there are no NMED SSLs for a COPC, the EPA residential screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) will be used, adjusted to 10^{-5} risk for carcinogens.

Carcinogenic risk will be evaluated for all inorganic and organic COPCs having a carcinogenic endpoint for the residential scenario. The carcinogenic risk associated with each COPC will be calculated by dividing the EPC by the residential SSL and multiplying by 10^{-5}. The carcinogenic risks for each COPC will then be summed to determine the cumulative risk, which will be compared to NMED's target of 1×10^{-5}.

Noncarcinogenic risk will be evaluated for all inorganic and organic COPCs having a noncarcinogenic endpoint for the residential scenario. The noncarcinogenic hazard quotient (HQ) for each COPC will be calculated by dividing the EPC by the residential SSL. The HQs for each COPC will then be summed to determine the hazard index (HI), which will be compared to NMED's target of 1.

In addition to carcinogenic and noncarcinogenic risk, the potential radiological dose for the residential scenario will also be evaluated for all radionuclide COPCs. Dose will be evaluated using the Laboratory's SALs for the residential scenario (LANL 2015, 600929). The dose for each radionuclide COPC will be evaluated by dividing the EPC by the residential SAL and multiplying by 25 mrem/yr. The doses for each COPC will then be summed to determine the total dose, which will be compared with the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

4.0 SCHEDULE

Preparation for investigation activities is anticipated to take approximately 2 mo. Fieldwork is expected to take 2 wk, and preparation of the SAR is anticipated to take approximately 4 mo after fieldwork activities are completed, which includes time for sample analysis and reporting. The total duration to implement the investigation and submit the SAR is anticipated to be approximately 7 mo. The Laboratory intends to initiate investigation activities following the approval of the SAR work plan by the NMED-HWB.

5.0 REFERENCES

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID or ESH ID. This information is also included in text citations. ER IDs were assigned by the Environmental Programs Directorate's Records Processing Facility (IDs through 599999), and ESH IDs are assigned by the Environment, Safety, and Health (ESH) Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED-HWB and the ESH Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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