EMID-700403

DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

APR 2 2 2019

Mr. John E. Kieling
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Dear Mr. Kieling:

Subject: Submittal of the Addendum to the Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area

Enclosed please find two hard copies with electronic files of the "Addendum to the Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area." This addendum to the 2018 "Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 2" (Phase II IR) evaluates the nature and extent of contamination and potential human health and ecological risks for Solid Waste Management Unit (SWMU) 02-014. This site was identified as a new SWMU during efforts to discover the source of polychlorinated biphenyl (PCB) contamination from investigation sampling at Area of Concern 02-011(a)(ii). SWMU 02-014 consists of three former electrical transformer stations that served buildings in Technical Area 02. The investigations revealed that PCB contamination at this site was more extensive than expected, and remediation of soil contamination was required. As a result, investigation and remediation activities could not be completed in time for the results to be included in the Phase II IR.

Pursuant to Section XXIII.C of the Compliance Order on Consent (Consent Order), a pre-submission review meeting was held with U.S. Department of Energy Environmental Management Los Alamos Field Office (EM-LA); Newport News Nuclear BWXT-Los Alamos, LLC (N3B); and the New Mexico Environment Department (NMED) on April 17, 2019, to discuss the investigation results and recommendation for this site. This report is being submitted to fulfill Fiscal Year 2019 Milestone 6 in Appendix B of the 2016 Consent Order.

If you have any questions, please contact Brenda Bowlby at (505) 551-2957 (brenda.bowlby@em-la.doe.gov) or Cheryl Rodriguez at (505) 665-5330 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosures:
1. Two hard copies with electronic files – Addendum to the Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area (EM2019-0090)

cc (letter with hard-copy enclosure[s]):
K. Rich, N3B
C. Rodriguez, EM-LA

cc (letter with CD/DVD enclosure[s]):
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April 2019
EM2019-0090

Addendum to the Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area

N3B Los Alamos

EM2019-0090

Addendum to the Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area

April 2019

Responsible program director:

Printed Name	Signature	Title	Organization	Date
Michael O. Erickson		Program Director	RCRA Remediation Program	4/17/19

Responsible N3B representative:

Printed Name	Signature	Title	Organization	Date
Erich Evered		Program Manager	N3B Environmental Remediation Program	4/17/19

Responsible DOE EM-LA representative:

Printed Name	Signature	Title	Organization	Date
Arturo Q. Duran		Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	4/22/19

EXECUTIVE SUMMARY

This addendum to the 2018 "Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 2" (Phase II IR) evaluates the nature and extent of contamination and potential human health and ecological risks for Solid Waste Management Unit (SWMU) 02-014. This SWMU is located within Technical Area 02 (TA-02) at Los Alamos National Laboratory (LANL or the Laboratory). This site was identified as a new SWMU during efforts to discover the source of polychlorinated biphenyl (PCB) contamination from investigation sampling at Area of Concern (AOC) 02-011(a)(ii). SWMU 02-014 consists of three former electrical transformer stations that served buildings in TA-02. The investigations revealed that PCB contamination at this site was more extensive than expected and remediation of soil contamination was required. As a result, investigation and remediation activities could not be completed in time for the results to be included in the Phase II IR. Remediation activities were planned for completion in late 2018/early 2019 with the results to be provided in an addendum to the Phase II IR.

Characterization data for SWMU 02-014 consist of results from samples collected in 2007, 2010, 2017, and 2018. Removal of PCB-contaminated soil was conducted to address potentially unacceptable risk for industrial workers and recreational users in the depth interval 0.0–1.0 ft below ground surface (bgs) and to meet the Toxic Substances Control Act bulk PCB remediation waste cleanup level for low-occupancy areas. Soil was excavated during 2018 and removal areas were expanded both laterally and vertically based on confirmation sampling results. A total of 282 yd^3 of PCB-contaminated soil was excavated and packaged for transportation to an off-site disposal facility.

Following completion of investigation sampling and remediation activities, characterization data for SWMU 02-014 were evaluated in the same manner as described in the Phase II IR for the other SWMUs and AOCs within Middle Los Alamos Canyon Aggregate Area to identify chemicals of potential concern, evaluate nature and extent of contamination, and assess risk to human health. SWMU 02-014 was determined to not pose an unacceptable human health risk or dose under the industrial, recreational, residential, and construction worker scenarios. As described in the Phase II IR, ecological risk was evaluated for all SWMUs and AOCs within the TA-02 core area, including SWMU 02-014, rather than by individual SWMU or AOC. The Phase II IR concluded no potential ecological risks exist for the TA-02 core area. Based on the results of data evaluations presented in this addendum, the Department of Energy Environmental Management Los Alamos Field Office and Newport News Nuclear BWXT-Los Alamos, LLC, recommend corrective action complete without controls for SWMU 02-014.

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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). 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 36 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas that are separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft above mean sea level.

The Laboratory has been a participant in a national effort by DOE to clean up sites and facilities formerly involved in weapons research and development. The goal of this effort is to ensure 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 has investigated sites potentially contaminated by past Laboratory operations.

This investigation report addendum addresses one solid waste management unit (SWMU) within the Middle Los Alamos Canyon Aggregate Area at the Laboratory. This site is potentially contaminated with both hazardous and radioactive components. 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 5400.5, "Radiation Protection of the Public and the Environment"; DOE Order 435.1, "Radioactive Waste Management"; and DOE Order 458.1, "Administrative Change 3, Radiation Protection of the Public and the Environment." 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.

Corrective actions at the Laboratory are subject to a Compliance Order on Consent (the Consent Order). This investigation report addendum describes work activities that were completed in accordance with the Consent Order.

1.1 General Site Information

The Middle Los Alamos Canyon Aggregate Area consists of 80 SWMUs and areas of concern (AOCs), 40 of which did not warrant investigation (LANL 2008, 101669.12). The remaining 40 SWMUs and AOCs underwent sampling activities in 2007 and Phase II investigation sampling activities in 2010. These 40 sites are located at Technical Area 02 (TA-02), TA-21, and TA-26 and include 13 SWMUs and 27 AOCs. Details of previous investigations, including the results of the 2007 sampling activities, are provided in the "Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 1" (LANL 2008, 101669.12). Results from sampling activities conducted in 2010 for the 40 sites, as well as supplemental sampling performed in 2017 are provided in the "Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 2" (Phase II IR) (N3B 2018, 700091).

1.2 Purpose of Investigation

During the course of the Phase II investigation activities being conducted to discover a source of polychlorinated biphenyl (PCB) contamination at storm drain AOC 02-011(a)(ii), a new SWMU (SWMU 02-014) was discovered. SWMU 02-014 consists of three former electrical transformer stations in TA-02. The investigations revealed that PCB contamination at this site was more extensive than expected and remediation of soil contamination was required. As a result, investigation and remediation activities could not be completed in time for the results to be included in the Phase II IR. Remediation activities

were planned for completion in late 2018/early 2019 with the results to be provided in an addendum to the Phase II IR.

All analytical data collected during the 2018–2019 remediation and investigation activities are presented and evaluated in this addendum, in conjunction with decision-level data previously associated with AOC 02-011(a)(ii), and are now associated with SWMU 02-014.

1.3 Document Organization

This investigation report addendum is organized in six sections, including this introduction, with multiple supporting appendixes. Section 2 provides an overview of the scope of the activities performed at the site. Section 3 presents an overview of the operational history of the site, summaries of previous investigations, results of the field activities performed during the 2018–2019 investigation, site contamination, evaluation of the nature and extent of contamination, and summaries of human health and ecological risk-screening assessments. Section 4 presents the conclusions of the nature and extent of contamination and risk assessments. Section 5 discusses recommendations based on applicable data and the risk-screening assessments. Section 6 includes a list of references cited and the map data sources used in all the figures and plates.

The appendixes include acronyms, a metric conversion table, and definitions of data qualifiers (Appendix A); field methods (Appendix B); investigation-derived waste (IDW) management (Appendix C); analytical program descriptions and summaries of data quality (Appendix D); analytical suites and results and analytical reports (Appendix E); and risk-screening assessments (Appendix F).

2.0 SCOPE OF ACTIVITIES

This section presents an overview of activities performed during the implementation of investigation and remediation activities at SWMU 02-014 in 2018–2019. Field activities during previous investigations at AOC 02-011(a) were described in the Phase II IR (N3B 2018, 700091). The field investigation results are presented in detail in section 3 and in the appendixes. The scope of activities for the 2018–2019 investigation included geodetic surveys, surface and shallow-subsurface sampling, soil excavation, health and safety monitoring, waste management activities, and sample analysis.

2.1 Premobilization Activities

Premobilization activities included preparation of work planning documents including a site-specific safety and health plan, site-specific environmental safety and health plan, integrated work document, and quality assurance plan.

2.2 Summary of Field Activities

This section describes the field activities conducted during the 2018–2019 investigation and remediation activities. Additional details regarding the field methods and procedures used to perform these field activities are presented in Appendix B.

2.2.1 Geodetic Survey

Real-time kinematic (RTK) global positioning system (GPS) surveying was conducted to establish the coordinates of sample locations and to lay out planned soil excavation areas. Surveying was performed using Topcon HiPer V Navigation Satellite System antennas coupled with a Topcon FC-5000 Data

Collector Controller. This system was used to stake sampling locations, locations to be left unexcavated (i.e., uncontaminated locations), locations excavated, planned excavation boundaries, and pre- and post-excavation topographic elevations. A light detection and ranging (LiDAR) survey was used for pre- and post-excavation topographic elevation data collection, specifically for excavations too deep to safely check via RTK GPS. The surveyed coordinates for all sampling locations are presented in Table 2.2-1. All coordinates are expressed as State Plane Coordinate System 83, New Mexico Central, U.S. feet. All surveyed coordinates for sampling locations were submitted for upload to the Environmental Information Management Database.

2.2.2 Field Screening

All samples collected were field screened for radioactivity before they were submitted to the Sample Management Office (SMO). A radiological control technician (RCT) conducted radiological screening using a ThermoFisher Model SHP-380, with Eberline Model E600 Geiger Counter, for detection of low-energy radiation. All field results for alpha and beta/gamma radioactivity were recorded on the field sample collection log/chain-of-custody (SCL/COC) forms. The SCLs/COC forms are provided on CD in Appendix E. The radiological screening results are presented in Table 2.2-2.

2.2.3 Surface and Shallow-Subsurface Soil Investigation

Surface and shallow-subsurface samples were collected using a stainless-steel hand auger to collect material within the prescribed sampling intervals. For samples collected at depths greater than 3 ft, 4-in. polyvinyl chloride pipe was decontaminated and inserted into the hole to prevent hole collapse and cross-contamination of samples. A stainless-steel bowl and scoop were used to capture the sample from the hand-auger bucket. The sample was then transferred to sterile sample collection jars for transport to the SMO.

Quality assurance (QA)/quality control (QC) samples consisted of field duplicates and rinsate blanks. Field duplicate samples were collected at a minimum rate of 1 per 10 investigation samples. Rinsate blanks were also collected at a minimum rate of 1 per 10 investigation samples to confirm decontamination of the sampling equipment.

All sample collection activities were coordinated with the SMO. Upon collection, samples remained at all times in the controlled custody of the field team until delivered to the SMO. Sample custody was then relinquished to the SMO for delivery to a preapproved off-site contract analytical laboratory.

2.2.4 Equipment Decontamination

Between collection of each sample and between sampling locations, all field equipment with the potential to contact sample material (e.g., hand augers, sampling scoops, and bowls) was decontaminated using dry decontamination methods to prevent cross-contamination of samples and locations. Rinsate blanks were used to check the effectiveness of decontamination.

2.2.5 Excavation

Excavation of PCB-contaminated soil was performed during 2018–2019. Results of the previous investigations at SWMU 02-014 were used to define the area requiring excavation. The following cleanup goals were considered in defining the excavation area:

- industrial and recreational soil screening levels (SSLs) (11 mg/kg and 5.53 mg/kg, respectively for Aroclor-1254 and 11.1 mg/kg and 10.3 mg/kg, respectively for Aroclor-1260) for the depth interval 0.0–1.0 ft below ground surface (bgs) and
- the Toxic Substances Control Act (TSCA) bulk PCB remediation waste cleanup level (25 mg/kg for total PCBs) for low-occupancy areas.

Based on consideration of the above goals, an excavation area was defined where all soil within the depth interval 0.0–1.0 ft bgs would be removed to address potential risk to industrial workers and recreational users. This area is shown on Plate 1. Within this area, four additional areas requiring deeper excavation were defined to meet the TSCA cleanup level. Excavation depths in these areas ranged from 4.5 ft bgs to 10.5 ft bgs.

The planned excavation areas were staked in the field and soil was excavated to the required depths using a Yanmar mini-excavator and Volvo excavator. Approximately 255 yd^3 of soil was excavated from these areas. Following excavation, confirmatory samples were collected to determine whether additional removal was needed to meet cleanup goals. Based on this evaluation, additional excavation from the interval 0.0–1.0 ft bgs was required to the east of the northeast corner of the original excavation area and to the west at two locations on the west boundary of the original excavation area. One area where additional deeper excavation was required was also identified at the northwest corner of the original excavation area. This area was excavated to a depth of approximately 6 ft bgs. Excavation from these areas resulted in removal of approximately 27 yd^3 of soil.

2.2.6 Health and Safety Measures

Health and safety measures were identified based on the results of previous investigations at SWMU 02-014. Monitoring of airborne particulates was required to monitor for potential exposure to PCBs during soil excavation activities. Airborne particulate measurements were made using a Thermo Andersen MIE Personal Dust Monitor Model 1000. Because heavy equipment was being used for soil excavation, noise monitoring was also conducted using a Quest NoisePro DLX noise level meter.

During excavation of deep interior area I-1, two asbestos-wrapped pipes (assumed to be decommissioned gas and water lines based on conversations with LANL Utilities Management) were exposed within the first 1–2 feet bgs. A “pause work” commenced the afternoon of November 19, 2018, and went to December 03, 2018. During this time, an asbestos abatement plan and integrated work document addendum were developed. The approved asbestos abatement included use of personal protective equipment and collection of airborne asbestos samples. The approved asbestos abatement plan was then implemented and the exposed pipes and wrapping were removed from the excavation and properly packaged and labeled. About 1 yd^3 of waste (pipe, asbestos wrapping, contact waste materials) was generated in the process.

2.2.7 Waste Management

The waste streams associated with investigation and remediation activities included excavated soil, contact waste, and asbestos-containing materials. All investigation-derived waste (IDW), including excavated soil, was managed in accordance with the project waste characterization strategy form (WCSF). All excavated media at SWMU 02-014 was placed in 5.18-yd^3 soft-sided IP-1 bags. IP-1 bags were positioned on pallets for loading and staging. After a bag was sealed, an RCT screened all sides of the bag before releasing the bag for staging at TA-41. Contact waste was stored in labeled 1-gal. plastic bags in the radioactive waste accumulation area on-site until it could be transferred to a 5.18-yd^3 soft-sided IP-1 bag. Temporary storage was within a posted radiological waste storage area at TA-41. All waste containers that were staged at TA-41 were covered with tarps for additional protection from the elements.

The management of IDW is described in greater detail in Appendix C. The WCSF is provided in Appendix C (Attachment C-1 on CD).

2.3 Sample Analyses

The SMO shipped all samples to off-site contract analytical laboratories for the requested analyses. All samples collected during the 2018–2019 investigation and remediation activities were submitted for analysis of PCBs.

Analytical methods and summaries of data quality are presented in Appendix D. Analytical results, analytical reports, and SCLs/COCs are included on CD in Appendix E.

2.4 Deviations

The 2018–2019 sampling and remediation activities at SWMU 02-014 were not addressed in the approved Phase II investigation work plan for Middle Los Alamos Canyon Aggregate Area (LANL 2009, 105073; NMED 2009, 105595). The need for these activities was identified as a result of the Phase II sampling performed at AOC 02-011(a)(ii) and the subsequent discovery of SWMU 02-014.

3.0 FIELD INVESTIGATION RESULTS FOR SWMU 02-014

3.1 Site Description and Operational History

SWMU 02-014 consists of three former electrical transformer stations (structures 02-31, 02-45, and 02-51) that served buildings in TA-02 (Plate 1). This site was identified during efforts to discover the source of PCB contamination identified during investigation sampling at storm drain AOC 02-011(a)(ii). Historical records, including engineering drawings and photographs, were reviewed and three potential sources of PCBs were identified. Former structure 02-31 was an electrical transformer station located 40 ft behind building 02-1. The transformer station was built in 1944 and was removed in 1950. Former structure 02-45 was built in 1954 to serve building 02-44. The transformer station consisted of three transformers mounted across two telephone poles approximately 14 ft above the ground. The transformer station was replaced with another transformer station (structure 02-51). Former structure 02-51 was an electrical transformer station located approximately 20 ft southwest of former structure 02-31 and 20 ft southeast of former structure 02-45. Historical records indicated PCB-containing transformer oil had been used at this former transformer station. Structure 02-51 was constructed in 1961 and demolished in 2003.

3.2 Relationship to Other SWMUs and AOCs

SWMU 02-014 is adjacent to and northwest of AOC 02-011(a) segments (i), (ii), and (iii). SWMU 02-014 is the source of the PCB contamination previously detected at AOC 02-011(a).

3.3 Summary of Previous Investigations

No previous investigations have been performed at SWMU 02-014. The area of SWMU 02-014 was previously sampled as part of the investigations performed for AOC 02-011(a).

3.4 Site Contamination

3.4.1 Soil and Rock Sampling

SWMU 02-014 was sampled during 2017 to characterize the areas potentially requiring removal of PCB-contaminated soil. Samples were collected around areas where PCB contamination was previously detected during the investigation of AOC 02-011(a). Samples were collected at various depth intervals based on previous results, to a maximum of 20 ft bgs or until refusal. Following evaluation of initial results, additional sampling was performed in 2018 to better characterize extent of potential excavation areas. Based on these results, PCB-contaminated soil was excavated during 2018 and confirmation sampling was performed.

3.4.2 Soil and Rock Sample Field-Screening Results

No radiological-screening results exceeded twice the daily site background levels.

3.4.3 Soil and Rock Sample Analytical Results

Decision-level data at SWMU 02-014 consist of results from 270 samples collected from 77 locations in 2007, 2010, 2017, and 2018. The 270 samples include 186 soil/Qal, 6 Qbt 3, 7 Qbt 1g, 1 Qct, and 70 Qbo samples. Plate 1 shows the sample locations and Table 3.4-1 presents the samples collected and the analyses requested for SWMU 02-014.

Inorganic Chemicals

A total of seven samples (five soil and two Qbo) were analyzed for target analyte list (TAL) metals, and three soil samples were analyzed for nitrate, perchlorate, and total cyanide. Table 3.4-2 presents the inorganic chemicals detected or detected above background values (BVs). Figure 3.4-1 shows the spatial distribution of inorganic chemicals detected or detected above BVs. Too few samples were collected per medium to perform statistical tests.

Aluminum was detected above the Qbt 1g, Qct, Qbo BV (3560 mg/kg) in two samples with a maximum concentration of 10,800 mg/kg. Aluminum is retained as a chemical of potential concern (COPC).

Arsenic was detected above the Qbt 1g, Qct, Qbo BV (0.56 mg/kg) in one sample at a concentration of 0.735 mg/kg. Arsenic is retained as a COPC.

Barium was detected above the Qbt 1g, Qct, Qbo BV (25.7 mg/kg) in one sample at a concentration of 57.1 mg/kg. Barium is retained as a COPC.

Cadmium was not detected above the soil BV (0.4 mg/kg) but had detection limits (DLs) (0.497 mg/kg and 0.517 mg/kg) above BV in two samples. The DLs were only 0.097 mg/kg and 0.117 mg/kg above the BVs and the maximum DL is below or equivalent to the three highest concentrations (0.6 mg/kg, 1.4 mg/kg, and 2.6 mg/kg) and the highest DL (2 mg/kg) in the soil background data set. Cadmium is not a COPC.

Calcium was detected above the Qbt 1g, Qct, Qbo BV (1900 mg/kg) in one sample at a concentration of 7260 mg/kg. Calcium is retained as a COPC.

Chromium was detected above the Qbt 1g, Qct, Qbo BV (2.6 mg/kg) in two samples with a maximum concentration of 3.16 mg/kg. Chromium is retained as a COPC.

Iron was detected above the Qbt 1g, Qct, Qbo BV (3700 mg/kg) in one sample at a concentration of 4860 mg/kg. Iron is retained as a COPC.

Magnesium was detected above the Qbt 1g, Qct, Qbo BV (739 mg/kg) in one sample at a concentration of 1270 mg/kg. Magnesium is retained as a COPC.

Nickel was detected above the Qbt 1g, Qct, Qbo BV (2 mg/kg) in two samples with a maximum concentration of 2.76 mg/kg. Nickel is retained as a COPC.

Nitrate was detected in two samples with a maximum concentration of 1.77 mg/kg. Nitrate is naturally occurring, and the concentrations likely reflect naturally occurring levels. In addition, SWMU 02-014 consists of former electrical transformer stations and is not a source of nitrate. Nitrate is not a COPC.

Perchlorate was detected in one sample at a concentration of 0.000813 mg/kg. Perchlorate is retained as a COPC.

Selenium was not detected above the Qbt 1g, Qct, Qbo BV (0.3 mg/kg) but had a DL (0.462 mg/kg) above BV in one sample. Selenium is retained as a COPC.

Vanadium was detected above the Qbt 1g, Qct, Qbo BV (4.59 mg/kg) in one sample at a concentration of 4.95 mg/kg. Vanadium is retained as a COPC.

Zinc was detected above the soil BV (48.8 mg/kg) in one sample at a concentration of 78.2 mg/kg. Zinc is retained as a COPC.

Organic Chemicals

A total of 266 samples (184 soil/Qal, 6 Qbt 3, 7 Qbt 1g, 1 Qct, and 68 Qbo) were analyzed for PCBs, 3 soil samples were analyzed for semivolatile organic compounds (SVOCs) and dioxins/furans, and 2 soil samples were analyzed for volatile organic compounds (VOCs). Table 3.4-3 presents detected organic chemicals other than PCBs, and Table 3.4-4 presents detected PCBs. Figure 3.4-2 shows the spatial distribution of detected organic chemicals other than PCBs, and Plate 2 shows the spatial distribution of PCBs.

Organic chemicals detected at SWMU 02-014 include anthracene; Aroclor-1254; Aroclor-1260; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; fluoranthene; 1,2,3,4,6,7,8-heptachlorodibenzodioxin; 1,2,3,4,6,7,8-heptachlorodibenzofuran; 1,2,3,4,7,8,9-heptachlorodibenzofuran; 1,2,3,4,7,8-hexachlorodibenzodioxin; 1,2,3,6,7,8-hexachlorodibenzodioxin; 1,2,3,7,8,9-hexachlorodibenzodioxin; 1,2,3,4,7,8-hexachlorodibenzofuran; 1,2,3,6,7,8-hexachlorodibenzofuran; 1,2,3,7,8,9-hexachlorodibenzofuran; 2,3,4,6,7,8-hexachlorodibenzofuran; indeno(1,2,3-cd)pyrene; 1,2,3,4,6,7,8,9-octachlorodibenzodioxin; 1,2,3,4,6,7,8,9-octachlorodibenzofuran;

1,2,3,7,8-pentachlorodibenzodioxin; 1,2,3,7,8-pentachlorodibenzofuran; 2,3,4,7,8-pentachlorodibenzofuran; phenanthrene; pyrene; 2,3,7,8-tetrachlorodibenzofuran; and toluene. The detected organic chemicals are retained as COPCs.

Radionuclides

Three soil samples were analyzed for americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, tritium, and strontium-90. Radionuclides were not detected or detected above BVs/fallout values (FVs). There are no radionuclide COPCs at SWMU 02-014.

3.4.4 Nature and Extent of Contamination

The nature and extent of inorganic and organic COPCs at SWMU 02-014 are discussed below.

Inorganic Chemicals

Inorganic COPCs at SWMU 02-014 include aluminum, arsenic, barium, calcium, chromium, iron, magnesium, nickel, perchlorate, selenium, vanadium, and zinc.

Aluminum was detected above the Qbt 1g, Qct, Qbo BV in two samples with a maximum concentration of 10,800 mg/kg. Concentrations decreased with depth and decreased downgradient. The lateral and vertical extent of aluminum are defined.

Arsenic was detected above the Qbt 1g, Qct, Qbo BV in one sample at a concentration of 0.735 mg/kg. Concentrations decreased with depth and decreased downgradient. The lateral and vertical extent of arsenic are defined.

Barium was detected above the Qbt 1g, Qct, Qbo BV in one sample at a concentration of 57.1 mg/kg. Concentrations decreased with depth and decreased downgradient. The lateral and vertical extent of barium are defined.

Calcium was detected above the Qbt 1g, Qct, Qbo BV in one sample at a concentration of 7260 mg/kg. Concentrations decreased with depth and decreased downgradient. The lateral and vertical extent of calcium are defined.

Chromium was detected above the Qbt 1g, Qct, Qbo BV in two samples with a maximum concentration of 3.16 mg/kg. Concentrations did not change substantially with depth (0.42 mg/kg) at location 02-613762 and decreased downgradient. The residential SSL was approximately 31 times the maximum concentration. The lateral extent of chromium is defined and further sampling for vertical extent is not warranted.

Iron was detected above the Qbt 1g, Qct, Qbo BV in one sample at a concentration of 4860 mg/kg. Concentrations decreased with depth and decreased downgradient. The lateral and vertical extent of iron are defined.

Magnesium was detected above the Qbt 1g, Qct, Qbo BV in one sample at a concentration of 1270 mg/kg. Concentrations decreased with depth and decreased downgradient. The lateral and vertical extent of magnesium are defined.

Nickel was detected above the Qbt 1g, Qct, Qbo BV in two samples with a maximum concentration of 2.76 mg/kg. Concentrations did not change substantially with depth (0.5 mg/kg) at location 02-613762 and decreased downgradient. The residential SSL was approximately 565 times the maximum concentration. The lateral extent of nickel is defined and further sampling for vertical extent is not warranted.

Perchlorate was detected in one sample at a concentration of 0.000813 mg/kg. Concentrations increased with depth and increased laterally at location 02-600387. The detected concentration was below the estimated quantitation limit (EQL). Perchlorate was not detected in samples collected downgradient of location 02-600387 at AOC 02-011(a)(i,ii,iii,iv,v,vi) location 02-600407. The residential SSL was approximately 67,400 times the detected concentration. The lateral extent of perchlorate is defined and further sampling for vertical extent is not warranted.

Selenium was not detected above the Qbt 1g, Qct, Qbo BV but had a DL (0.462 mg/kg) above BV in one sample. The residential SSL was approximately 846 times the DL. Further sampling for extent of selenium is not warranted.

Vanadium was detected above the Qbt 1g, Qct, Qbo BV in one sample at a concentration of 4.95 mg/kg. Concentrations decreased with depth and decreased downgradient. The lateral and vertical extent of vanadium are defined.

Zinc was detected above the soil BV in one sample at a concentration of 78.2 mg/kg. Concentrations decreased with depth and increased laterally at location 02-600387. Zinc concentrations decreased downgradient of location 02-600387 at AOC 02-011(a)(i,ii,iii,iv,v,vi) location 02-600407 (59.8 mg/kg at 0.0 ft to 0.5 ft bgs). The lateral and vertical extent of zinc are defined.

Organic Chemicals

Organic COPCs at SWMU 02-014 include anthracene; Aroclor-1254; Aroclor-1260; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; fluoranthene; 1,2,3,4,6,7,8-heptachlorodibenzodioxin; 1,2,3,4,6,7,8-heptachlorodibenzofuran; 1,2,3,4,7,8,9-heptachlorodibenzofuran; 1,2,3,4,7,8-hexachlorodibenzodioxin; 1,2,3,6,7,8-hexachlorodibenzodioxin; 1,2,3,7,8,9-hexachlorodibenzodioxin; 1,2,3,4,7,8-hexachlorodibenzofuran; 1,2,3,6,7,8-hexachlorodibenzofuran; 1,2,3,7,8,9-hexachlorodibenzofuran; 2,3,4,6,7,8-hexachlorodibenzofuran; indeno(1,2,3-cd)pyrene; 1,2,3,4,6,7,8,9-octachlorodibenzodioxin; 1,2,3,4,6,7,8,9-octachlorodibenzofuran; 1,2,3,7,8-pentachlorodibenzodioxin; 1,2,3,7,8-pentachlorodibenzofuran; 2,3,4,7,8-pentachlorodibenzofuran; phenanthrene; pyrene; 2,3,7,8-tetrachlorodibenzofuran; and toluene.

The polycyclic aromatic hydrocarbons (PAHs) anthracene; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; fluoranthene; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene were each detected in 2 samples at location 02-600387 at concentrations ranging from 0.00727 mg/kg to 0.0984 mg/kg. Concentrations of pyrene decreased with depth and concentrations of all other PAHs did not change substantially with depth (0.00176 mg/kg to 0.0455 mg/kg). Concentrations increased laterally at location 02-600387. Of the 22 detected concentrations, 11 were below EQLs. The residential SSLs ranged from approximately 20 times to 1,930,000 times the maximum concentrations, and the residential SSLs of all PAHs except benzo(a)anthracene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene were more than 100 times the maximum concentration. The residential SSL for benzo(a)anthracene was approximately 30 times the maximum concentration, and the industrial SSL was approximately 626 times the maximum concentration (0.0516 mg/kg). The residential SSL for benzo(a)pyrene was approximately 20 times the maximum concentration, and the industrial SSL was approximately 428 times the maximum concentration (0.0551 mg/kg). The residential SSL for indeno(1,2,3-cd)pyrene was approximately 61 times the maximum concentration, and the industrial SSL was approximately 1280 times the maximum concentration (0.0252 mg/kg). Further sampling for extent of PAHs is not warranted.

Aroclor-1254 was detected in 29 samples with a maximum concentration of 7.11 mg/kg. Concentrations increased with depth at locations 02-613122, 02-613124, 02-613700, and 02-61432 and did not change substantially with depth (0.0082 mg/kg) at location 02-61490; only 1 depth was sampled at locations 02-613699 and 02-61492; concentrations decreased with depth at all other locations; and concentrations decreased downgradient. The residential SSL was approximately 1.5 times and the industrial SSL was approximately 14 times the maximum concentration where vertical extent is not defined (0.779 mg/kg at location 02-613700). Aroclor-1254 does not pose an unacceptable risk under the industrial and recreational scenarios (Appendix F, Tables F-4.2-1 through F-4.2-4). Lateral extent of Aroclor-1254 is defined and further sampling for vertical extent is not warranted.

Aroclor-1260 was detected in 242 samples with a maximum concentration of 23.9 mg/kg. Concentrations increased with depth at locations 02-600449, 02-612452, 02-613626, 02-613668, 02-613700, 02-61436, 02-61444, 02-61479, 02-61488, 02-61489, and 02-61553 and did not change substantially with depth (0.001 mg/kg to 0.0426 mg/kg) at locations 02-61435, 02-61451, 02-61482, 02-61486, and 02-61490; only 1 depth was sampled at locations 02-612451, 02-613292, 02-613699, 02-61478, 02-61492, and 02-61539 through 02-61543; and concentrations decreased with depth at all other locations. Concentrations decreased downgradient. Vertical extent is defined at locations where only 1 depth was sampled by decreasing concentrations in deeper samples from nearby locations. The maximum concentration at locations where concentrations increased with depth or did not change substantially with depth (3.3 mg/kg at location 02-613626) was approximately 1.4 times the residential SSL, and the industrial SSL was approximately 3.4 times this concentration. Aroclor-1260 does not pose an unacceptable risk under the industrial and recreational scenarios (Appendix F, Tables F-4.2-1 and F-4.2-3). Lateral extent of Aroclor-1260 is defined and further sampling for vertical extent is not warranted.

A total of 16 dioxin/furan congeners were each detected in 2 or 3 samples with maximum concentrations ranging from 0.000000204 mg/kg to 0.00123 mg/kg. Concentrations at location 02-600387 did not change substantially with depth (0.000000028 mg/kg to 0.00003 mg/kg) or decreased with depth, and only 1 depth was sampled at location 02-600449. Concentrations of 2,3,4,7,8-pentachlorodibenzofuran and 2,3,7,8-tetrachlorodibenzofuran increased downgradient at location 02-600449 and concentrations of all other congeners decreased downgradient or did not change substantially downgradient (0.00000001 mg/kg to 0.00000155 mg/kg). The maximum concentrations were converted to toxicity equivalency concentrations (TECs) using congener-specific toxicity equivalency factors (NMED 2017, 602273). The residential SSL for 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD [not detected but the only dioxin with an SSL]) ranged from approximately 13 times to 2080 times the TECs and was more than 100 times the TECs for all congeners except 1,2,3,4,6,7,8-heptachlorodibenzodioxin; 1,2,3,4,7,8-hexachlorodibenzofuran; 2,3,4,7,8-pentachlorodibenzofuran; and 2,3,7,8-tetrachlorodibenzofuran. The residential SSL for 2,3,7,8-TCDD was approximately 30 times the TEC, and the industrial SSL for 2,3,7,8-TCDD was approximately 143 times the TEC for 1,2,3,4,6,7,8-heptachlorodibenzodioxin (0.00000166 mg/kg). The residential SSL for 2,3,7,8-TCDD was approximately 76 times the TEC, and the industrial SSL for 2,3,7,8-TCDD was approximately 371 times the TEC for 1,2,3,4,7,8-hexachlorodibenzofuran (0.000000641 mg/kg). The residential SSL for 2,3,7,8-TCDD was approximately 13 times the TEC, and the industrial SSL for 2,3,7,8-TCDD was approximately 62 times the TEC for 2,3,4,7,8-pentachlorodibenzofuran (0.00000384 mg/kg). The residential SSL for 2,3,7,8-TCDD was approximately 77 times the TEC, and the industrial SSL for 2,3,7,8-TCDD was approximately 372 times the TEC for 2,3,7,8-tetrachlorodibenzofuran (0.000000639 mg/kg). Further sampling for extent of dioxin and furan congeners is not warranted.

Toluene was detected in one sample at a concentration of 0.000465 mg/kg. Only one depth was sampled at location 02-600387 and concentrations decreased downgradient. The residential SSL is approximately 11,200,000 times the maximum concentration. Lateral extent of toluene is defined and further sampling for vertical extent is not warranted.

Radionuclides

No radionuclide COPCs were identified at SWMU 02-014.

Summary of Nature and Extent

The lateral and vertical extent of inorganic and organic COPCs is defined or no further sampling for extent is warranted at SWMU 02-014.

3.5 Summary of Human Health Risk Screening

Industrial Scenario

The total excess cancer risk for the industrial scenario is 5×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The industrial hazard index (HI) is 0.07, which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–1.0 ft depth interval.

Recreational Scenario

The total excess cancer risk for the recreational scenario is 6×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The recreational HI is 0.2, which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–1.0 ft depth interval.

Construction Worker Scenario

The total excess cancer risk for the construction worker scenario is 6×10^{-7}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The residential exposure scenario is protective of construction workers for noncarcinogenic risk. No radionuclide COPCs were identified in the 0.0–10.0 ft depth interval.

Residential Scenario

The total excess cancer risk for the residential scenario is 1×10^{-5}, which is equivalent to the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The residential HI is 0.8 which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–10.0 ft depth interval.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial, recreational, construction worker, and residential scenarios at SWMU 02-014.

3.6 Summary of Ecological Risk Screening

SWMU 02-014 is within the TA-02 core area. Ecological risk for the TA-02 core area was evaluated in the "Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 2" (N3B 2018, 700091). Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for threatened or endangered [T&E] species), lowest observed adverse effect level (LOAEL) analyses, the relationship of detected concentrations and screening levels to background concentrations, and results of site-specific ecological risk studies, the Phase II IR concluded no potential ecological risks exist for the TA-02 core area, which includes SWMU 02-014.

4.0 CONCLUSIONS

4.1 Nature and Extent of Contamination

Based on the evaluation of the sampling data, the nature and extent of contamination have been defined and/or no further sampling for extent is warranted for SWMU 02-014.

4.2 Summary of Risk-Screening Assessments

4.2.1 Human Health Risk-Screening Assessment

There were no potential unacceptable risks for SWMU 02-014 under the industrial, recreational, and residential scenarios. No radionuclide COPCs were identified for any scenarios. The residential scenario demonstrated protection of construction workers.

SWMU 02-014 is not accessible by the public. Therefore, an as low as reasonably achievable (ALARA) evaluation for radiological exposure to the public is not currently required. An ALARA evaluation will be conducted should DOE plan to release this area.

4.2.2 Ecological Risk-Screening Assessment

Ecological risk was evaluated collectively for sites within the TA-02 core area, including SWMU 02-014, in the "Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 2" (N3B 2018, 700091). Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and results of site-specific ecological risk studies conducted within the TA-02 core area, no potential ecological risks exist for the TA-02 core area, which includes SWMU 02-014.

5.0 RECOMMENDATIONS

SWMU 02-014 was found to pose no potential unacceptable risks to human health under the industrial, recreational, construction worker, and residential scenarios and to ecological receptors. Residual PCB contamination is below the TSCA cleanup level of 25 mg/kg for low-occupancy areas. This site is appropriate for corrective action complete without controls.

6.0 REFERENCES AND MAP DATA SOURCES

6.1 References

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by Newport News Nuclear BWXT-Los Alamos, LLC (N3B) (IDs 700000 and above). IDs are used to locate documents in N3B's Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

EPA (U.S. Environmental Protection Agency), December 2007. "EPA Region 6 Human Health Medium-Specific Screening Levels," U.S. EPA Region 6, Dallas, Texas. (EPA 2007, 099314)

LANL (Los Alamos National Laboratory), September 22, 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-98-4847, Los Alamos, New Mexico. (LANL 1998, 059730)

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N3B (Newport News Nuclear BWXT-Los Alamos, LLC), September 2018. "Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 2," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2018-0039, Los Alamos, New Mexico. (N3B 2018, 700091)

NMED (New Mexico Environment Department), October 2006. "New Mexico Environment Department TPH Screening Guidelines," Santa Fe, New Mexico. (NMED 2006, 094614)

NMED (New Mexico Environment Department), March 25, 2009. "Approval, Middle Los Alamos Canyon Aggregate Area Phase II Work Plan, Revision 1," New Mexico Environment Department letter to D. Gregory (DOE LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 105595)

NMED (New Mexico Environment Department), March 2017. "Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Soil Screening Guidance for Human Health Risk Assessments," Hazardous Waste Bureau and Ground Water Quality Bureau, Santa Fe, New Mexico. (NMED 2017, 602273)

6.2 Map Data Sources

Communication Lines, ksl_comm_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 08 August 2002; as published 28 May 2009.

Drainage: WQH Drainage_arc; Los Alamos National Laboratory, ENV Water Quality and Hydrology Group; 1:24,000 Scale Data; 03 June 2003.

Existing sampling locations: Point Feature Locations of the Environmental Restoration Project Database, er_location_ids_pnt; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2010-0035; 21 January 2010.

Former fences: Phase II Investigation Work Plan for Middle Los Alamos Canyon Aggregate Area, Revision 1; Los Alamos National Laboratory, Environmental Programs; Report LA-UR-09-1206, EP2009-0080; February 2009.

Former structures: Former Structures of the Los Alamos Site, frmr_structures_ply; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2008-0441; 1:2,500 Scale Data; 08 August 2008. Phase II Investigation Work Plan for Middle Los Alamos Canyon Aggregate Area, Revision 1; Los Alamos National Laboratory, Environmental Programs; Report LA-UR-09-1206, EP2009-0080; February 2009.

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LANL Areas Used and Occupied, plan_lanlarea_ply; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; 19 September 2007; as published 04 December 2008.

Potential release sites: Phase II Investigation Work Plan for Middle Los Alamos Canyon Aggregate Area, Revision 1; Los Alamos National Laboratory, Environmental Programs; Report LA-UR-09-1206, EP2009-0080; February 2009.

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Primary Gas Distribution Lines, ksl_gas_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

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Primary Landscape Features, ksl_landscape_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Roads: Paved Road Arcs, ksl_paved_rds_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. Paved Parking, ksl_paved_prking_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 12 August 2002; as published 28 May 2009. Dirt Road Arcs, ksl_dirt_rds_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. Road Centerlines for the County of Los Alamos, lac_centerlin_arc; County of Los Alamos, Information Services; as published 04 March 2009.

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Sewer Line System, ksl_sewer_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

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Storm Drain Line Distribution System, ksl_stormdrn_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Technical area boundaries, plan_tecareas_ply; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 04 December 2008.

Water Lines, ksl_water_arc; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

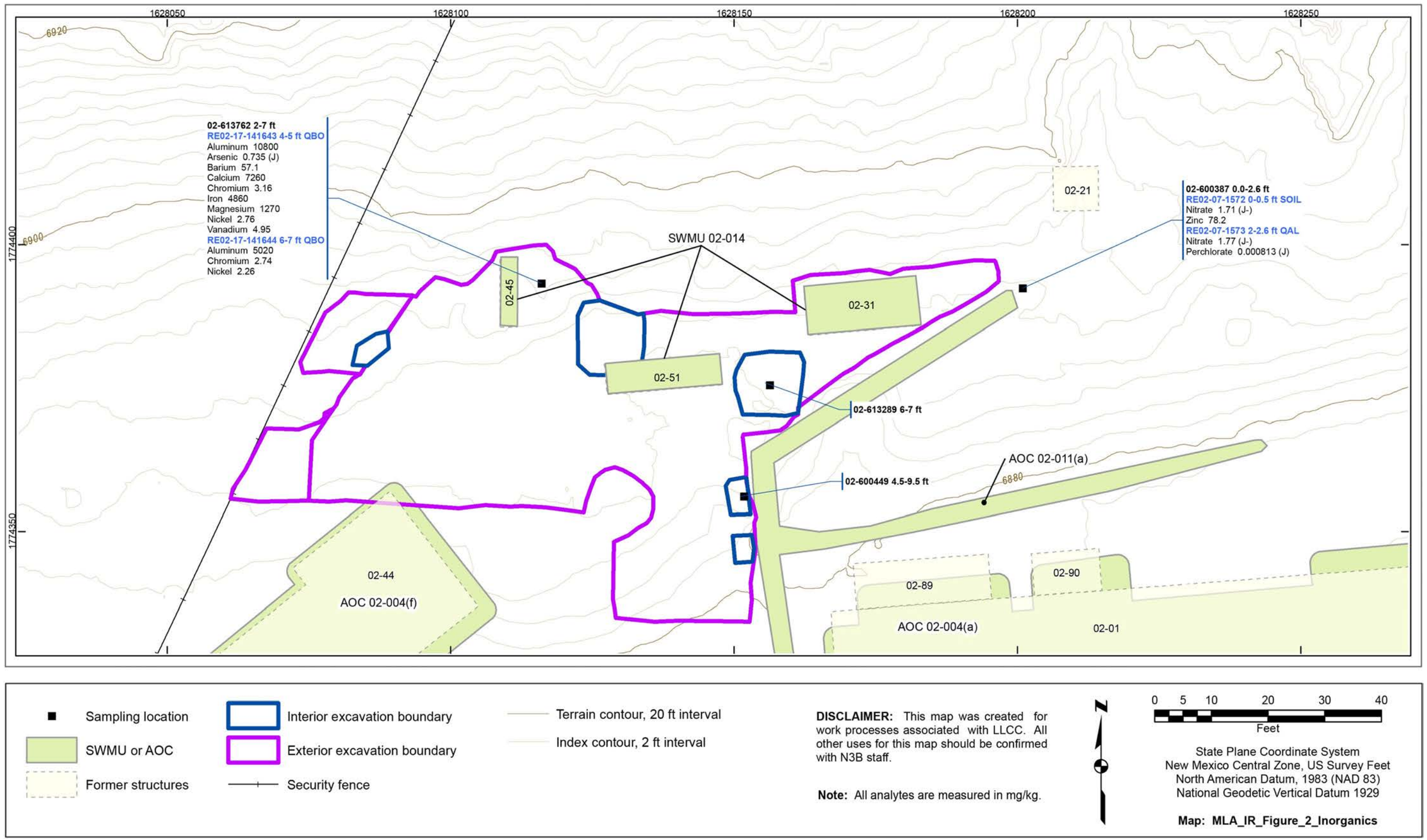

Figure 3.4-1 Inorganic chemicals detected or detected above BVs at SWMU 02-014

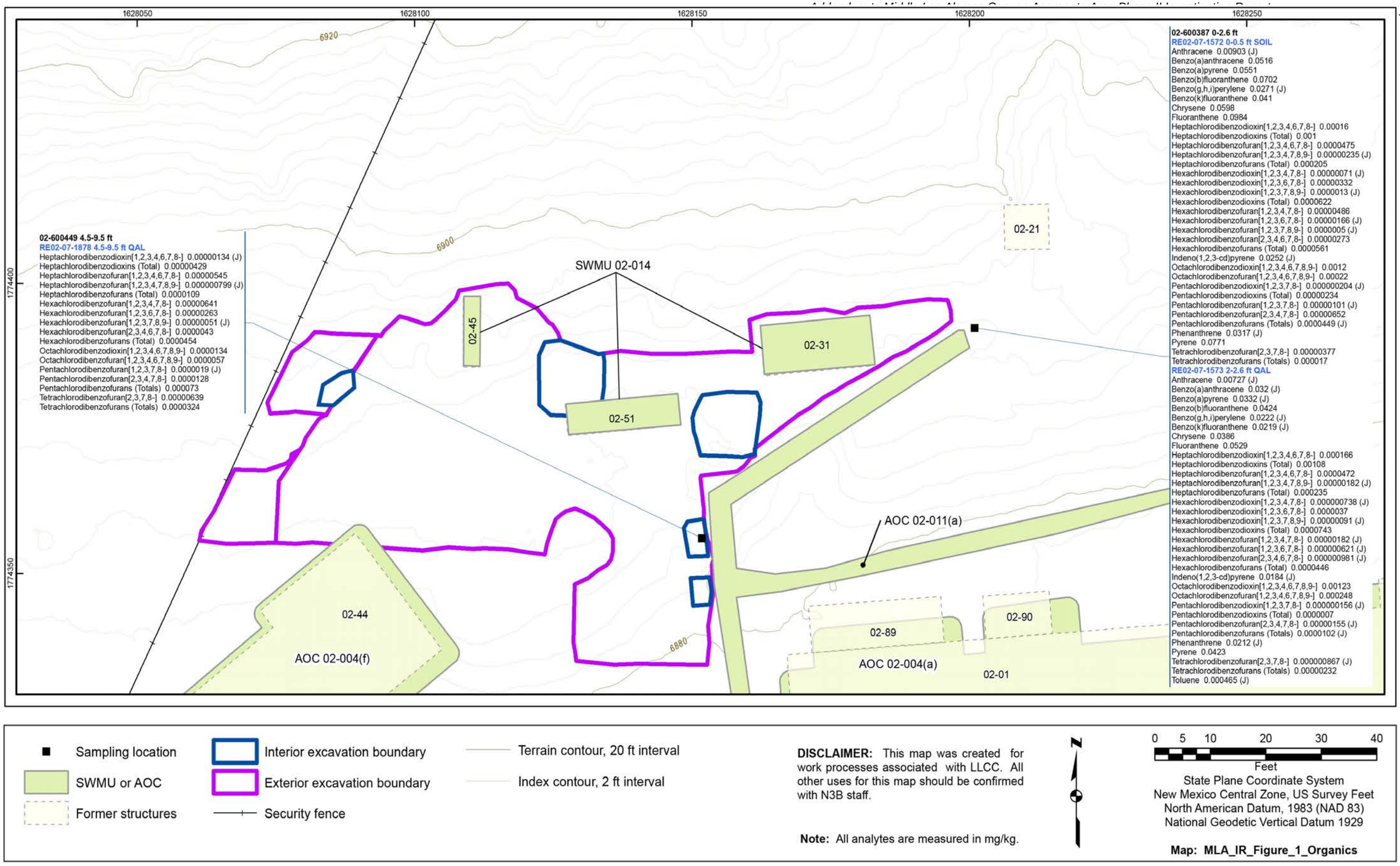

Figure 3.4-2 Organic chemicals other than PCBs detected at SWMU 02-014

Table 2.2-1
Surveyed Coordinates of Sample Locations at SWMU 02-014

Location ID	Easting (ft)	Northing (ft)
02-600387	1628200.95	1774392.37
02-600449	1628151.78	1774356.13
02-612451	1628151.78	1774360.13
02-612452	1628151.78	1774352.13
02-612453	1628147.78	1774356.13
02-613001	1628152.37	1774347.01
02-613002	1628151.78	1774364.13
02-613122	1628147.78	1774348.13
02-613124	1628147.78	1774352.13
02-613287	1628144.19	1774344.67
02-613288	1628144.48	1774365.63
02-613289	1628156.32	1774375.53
02-613292	1628179.77	1774384.08
02-613626	1628139.68	1774352.22
02-613627	1628139.24	1774371.95
02-613667	1628128.70	1774374.69
02-613668	1628132.69	1774348.76
02-613699	1628127.92	1774383.70
02-613700	1628135.67	1774352.38
02-613761	1628116.07	1774386.04
02-613762	1628116.07	1774393.22
02-61432	1628147.47	1774382.07
02-61435	1628098.51	1774371.75
02-61436	1628118.98	1774370.88
02-61437	1628137.16	1774355.10
02-61440	1628157.63	1774384.36
02-61441	1628165.80	1774378.78
02-61442	1628090.23	1774381.14
02-61443	1628087.15	1774367.30
02-61444	1628108.57	1774357.65
02-61447	1628141.00	1774394.41
02-61448	1628155.53	1774369.75
02-61450	1628119.84	1774357.92
02-61451	1628108.41	1774370.00
02-61452	1628134.53	1774366.40
02-61453	1628143.55	1774361.22
02-61454	1628136.89	1774378.94
02-61455	1628144.37	1774369.91
02-61474	1628147.87	1774337.53

Table 2.2-1 (continued)

Location ID	Easting (ft)	Northing (ft)
02-61475	1628134.91	1774331.46
02-61476	1628115.98	1774350.53
02-61477	1628091.65	1774346.90
02-61478	1628095.26	1774363.51
02-61479	1628080.82	1774358.13
02-61480	1628070.92	1774380.57
02-61481	1628082.09	1774394.89
02-61482	1628099.42	1774396.68
02-61483	1628122.09	1774402.79
02-61486	1628175.20	1774361.63
02-61487	1628177.53	1774383.54
02-61488	1628164.78	1774393.19
02-61489	1628177.37	1774392.79
02-61490	1628161.70	1774409.30
02-61491	1628176.65	1774405.29
02-61492	1628157.65	1774417.01
02-61493	1628168.42	1774418.46
02-61494	1628185.18	1774411.65
02-61526	1628195.96	1774398.92
02-61528	1628115.36	1774326.09
02-61529	1628099.68	1774323.29
02-61530	1628071.55	1774346.83
02-61537	1628099.45	1774356.78
02-61538	1628077.29	1774354.58
02-61539	1628074.25	1774359.06
02-61540	1628073.85	1774365.97
02-61541	1628086.43	1774383.55
02-61542	1628185.49	1774387.19
02-61543	1628185.81	1774394.23
02-61544	1628079.96	1774386.23
02-61545	1628069.32	1774365.16
02-61547	1628077.23	1774350.25
02-61548	1628086.82	1774388.51
02-61549	1628083.30	1774380.59
02-61550	1628064.40	1774365.03
02-61551	1628064.79	1774359.02
02-61552	1628074.78	1774376.40
02-61553	1628070.73	1774361.03

Table 2.2-2
Field-Screening Results for Samples Collected at SWMU 02-014

Location ID	Sample ID	Depth (ft)	Alpha (dpm)[a]	Beta/Gamma (dpm)	Background Alpha (dpm)	Background Beta/Gamma (dpm)
02-61538	RELA-18-161238	0–0.9	NDA[b]	1700	18.7	1400
02-61538	RELA-18-161242	1–2	NDA	1600	18.7	1400
02-61539	RELA-18-161243	0–0.9	NDA	1500	18.7	1400
02-61539	RELA-18-161239	1–2	NDA	1500	18.7	1400
02-61540	RELA-18-161240	0–0.9	NDA	1300	18.7	1400
02-61540	RELA-18-161244	1–2	NDA	1500	18.7	1400
02-61541	RELA-18-161245	0–0.9	NDA	1500	18.7	1400
02-61541	RELA-18-161241	1–2	NDA	1500	18.7	1400
02-61541	RELA-18-161976	1–2	NDA	1500	18.7	1400
02-61541	RELA-18-164442	2–3	NDA	NDA	14	12,900
02-61541	RELA-18-164443	4–5	NDA	NDA	14	12,900
02-61541	RELA-18-164444	6–7	NDA	NDA	14	12,900
02-61542	RELA-18-161246	0–0.8	NDA	1200	18.7	1400
02-61542	RELA-18-161250	0–0.8	NDA	1200	18.7	1400
02-61542	RELA-18-161248	1–2	NDA	1200	18.7	1400
02-61543	RELA-18-161247	0–0.8	NDA	1200	18.7	1400
02-61543	RELA-18-161249	1–1.5	NDA	1400	18.7	1400
02-61544	RELA-18-164445	0–1	NDA	NDA	40	4600
02-61544	RELA-18-164486	0–1	NDA	NDA	40	4600
02-61544	RELA-18-164455	2–3	NDA	NDA	40	4600
02-61544	RELA-18-164465	4.25–5	NDA	NDA	40	4600
02-61544	RELA-18-164475	6–7	NDA	NDA	40	4600
02-61545	RELA-18-164446	0–1	NDA	NDA	40	2500
02-61545	RELA-18-164456	2–3	NDA	NDA	40	2500
02-61545	RELA-18-164466	4–5	NDA	NDA	40	2500
02-61545	RELA-18-164476	6–7	NDA	NDA	40	2500
02-61553	RELA-18-164454	0–1	NDA	NDA	40	2500
02-61553	RELA-18-164464	2–3	NDA	NDA	40	2500
02-61553	RELA-18-164474	4–5	NDA	NDA	40	2500
02-61553	RELA-18-164484	6–7	NDA	NDA	40	2500
02-61547	RELA-18-164448	0–1	NDA	NDA	40	4600

Table 2.2-2 (continued)

Location ID	Sample ID	Depth (ft)	Alpha (dpm)	Beta/Gamma (dpm)	Background Alpha (dpm)	Background Beta/Gamma (dpm)
02-61547	RELA-18-164458	2–3	NDA	NDA	40	4600
02-61547	RELA-18-164468	4–5	NDA	NDA	40	4600
02-61547	RELA-18-164478	6–7	NDA	NDA	40	4600
02-61547	RELA-18-164487	6–7	NDA	NDA	40	4600
02-61548	RELA-18-164449	0–1	NDA	NDA	14	12,900
02-61548	RELA-18-164459	2–3	NDA	NDA	14	12,900
02-61548	RELA-18-164485	2–3	NDA	NDA	14	12,900
02-61548	RELA-18-164469	4–4.5	NDA	NDA	14	12,900
02-61548	RELA-18-164479	6–7	NDA	NDA	14	12,900
02-61549	RELA-18-164450	0–1	NDA	NDA	40	4600
02-61549	RELA-18-164460	2–3	NDA	NDA	40	4600
02-61549	RELA-18-164470	4–5	NDA	NDA	40	4600
02-61549	RELA-18-164480	6–7	NDA	NDA	40	4600
02-61550	RELA-18-164451	0–1	NDA	NDA	40	4600
02-61550	RELA-18-164461	2–3	NDA	NDA	40	4600
02-61550	RELA-18-164471	4–5	NDA	NDA	40	2500
02-61550	RELA-18-164488	4–5	NDA	NDA	40	2500
02-61550	RELA-18-164481	6–7	NDA	NDA	40	2500
02-61551	RELA-18-164452	0–1	NDA	NDA	40	2500
02-61551	RELA-18-164462	2–3	NDA	NDA	40	2500
02-61551	RELA-18-164472	4–5	NDA	NDA	40	2500
02-61551	RELA-18-164482	6–7	NDA	NDA	40	2500
02-61552	RELA-18-164453	0–1	NDA	NDA	40	4600
02-61552	RELA-18-164463	2–3	NDA	NDA	40	4600
02-61552	RELA-18-164473	4–5	NDA	NDA	40	4600
02-61552	RELA-18-164483	6-7	NDA	NDA	40	4600

[a] dpm = Disintegrations per minute.

[b] NDA = No detectable activity.

Table 3.4-1
Samples Collected and Analyses Requested at SWMU 02-014

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Dioxins/Furans	Cyanide (Total)
RE02-07-1572	02-600387	0–0.5	ALLH	07-543[a]	07-542	07-543	07-543	07-543	07-543	07-542	07-541	07-542	07-543	07-541	—[b]	07-530	07-542
RE02-07-1573	02-600387	2–2.6	QAL	07-543	07-542	07-543	07-543	07-543	07-543	07-542	07-541	07-542	07-543	07-541	07-541	07-530	07-542
RE02-07-1878	02-600449	4.5–9.5	QAL	07-956	07-956	07-956	07-956	07-956	07-956	07-956	07-956	07-956	07-956	07-956	07-956	07-955	07-956
RE02-10-22130	02-600449	6–6.2	ALLH	—	—	—	—	—	—	—	10-4285	—	—	—	—	—	—
RE02-10-22133	02-612451	6–6.2	ALLH	—	—	—	—	—	—	—	10-4285	—	—	—	—	—	—
RE02-10-22136	02-612452	6–6.2	ALLH	—	—	—	—	—	—	—	10-4285	—	—	—	—	—	—
RE02-10-22137	02-612452	8–8.2	ALLH	—	—	—	—	—	—	—	10-4285	—	—	—	—	—	—
RE02-10-22139	02-612453	6–6.2	ALLH	—	—	—	—	—	—	—	10-4285	—	—	—	—	—	—
RE02-10-22140	02-612453	8–8.2	ALLH	—	—	—	—	—	—	—	10-4285	—	—	—	—	—	—
RE02-10-26105	02-613001	6–6.5	ALLH	—	—	—	—	—	—	—	10-4454	—	—	—	—	—	—
RELA-18-151143	02-613001	6–7	ALLH	—	—	—	—	—	—	—	2018-1518	—	—	—	—	—	—
RE02-10-26106	02-613001	7–7.5	ALLH	—	—	—	—	—	—	—	10-4454	—	—	—	—	—	—
RELA-18-151144	02-613001	8–9	ALLH	—	—	—	—	—	—	—	2018-1518	—	—	—	—	—	—
RE02-17-141630	02-613001	8–9	QBO	—	—	—	—	—	—	—	2017-2020	—	—	—	—	—	—
RE02-17-141631	02-613001	10–11	QBO	—	—	—	—	—	—	—	2017-2020	—	—	—	—	—	—
RE02-17-141632	02-613001	13–14	QBO	—	—	—	—	—	—	—	2017-2020	—	—	—	—	—	—
RE02-17-141633	02-613001	16–17	QBO	—	—	—	—	—	—	—	2017-2020	—	—	—	—	—	—
RE02-17-141634	02-613001	19–20	QBO	—	—	—	—	—	—	—	2017-2020	—	—	—	—	—	—
RE02-10-26107	02-613002	6–6.5	ALLH	—	—	—	—	—	—	—	10-4454	—	—	—	—	—	—
RE02-10-26108	02-613002	8–8.5	ALLH	—	—	—	—	—	—	—	10-4454	—	—	—	—	—	—
RE02-10-26638	02-613122	2–2.2	ALLH	—	—	—	—	—	—	—	10-4707	—	—	—	—	—	—
RE02-10-26639	02-613122	4–4.2	ALLH	—	—	—	—	—	—	—	10-4707	—	—	—	—	—	—
RE02-10-26640	02-613124	6–6.2	ALLH	—	—	—	—	—	—	—	10-4707	—	—	—	—	—	—
RE02-10-26641	02-613124	8–8.2	ALLH	—	—	—	—	—	—	—	10-4707	—	—	—	—	—	—
RELA-18-151133	02-613287	2–3	ALLH	—	—	—	—	—	—	—	2018-1518	—	—	—	—	—	—
RELA-18-151134	02-613287	4–5	ALLH	—	—	—	—	—	—	—	2018-1518	—	—	—	—	—	—
RE02-11-315	02-613287	6–6.2	ALLH	—	—	—	—	—	—	—	11-186	—	—	—	—	—	—
RELA-18-151135	02-613287	6–7	ALLH	—	—	—	—	—	—	—	2018-1518	—	—	—	—	—	—
RE02-11-316	02-613287	8–8.2	ALLH	—	—	—	—	—	—	—	11-186	—	—	—	—	—	—
RE02-17-136051	02-613287	8–9	QBO	—	—	—	—	—	—	—	2017-2087	—	—	—	—	—	—
RE02-11-317	02-613288	6–6.2	ALLH	—	—	—	—	—	—	—	11-186	—	—	—	—	—	—
RE02-11-318	02-613288	8–8.2	ALLH	—	—	—	—	—	—	—	11-186	—	—	—	—	—	—
RE02-11-320	02-613289	6–6.2	ALLH	—	—	—	—	—	—	—	11-209	—	—	—	—	—	—

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Dioxins/Furans	Cyanide (Total)
RE02-17-141635	02-613289	6–7	ALLH	—	—	2017-1985	—	2017-1985	2017-1985	2017-1985	—	—	2017-1985	—	—	—	—
RE02-17-136056	02-613289	6–7	ALLH	—	—	—	—	—	—	—	2017-1983	—	—	—	—	—	—
RELA-18-151137	02-613289	6–7	ALLH	—	—	—	—	—	—	—	2018-1580	—	—	—	—	—	—
RE02-17-136057	02-613289	9–10	ALLH	—	—	—	—	—	—	—	2017-1983	—	—	—	—	—	—
RELA-18-151138	02-613289	9–10	ALLH	—	—	—	—	—	—	—	2018-1580	—	—	—	—	—	—
RELA-18-151139	02-613289	11–11.25	ALLH	—	—	—	—	—	—	—	2018-1587	—	—	—	—	—	—
RE02-17-136058	02-613289	12–13	QBO	—	—	—	—	—	—	—	2017-1983	—	—	—	—	—	—
RE02-17-136059	02-613289	15–16	QBO	—	—	—	—	—	—	—	2017-1983	—	—	—	—	—	—
RE02-17-136060	02-613289	19–20	QBO	—	—	—	—	—	—	—	2017-1983	—	—	—	—	—	—
RE02-11-325	02-613292	4–4.2	ALLH	—	—	—	—	—	—	—	11-235	—	—	—	—	—	—
RE02-11-2218	02-613626	8–9	ALLH	—	—	—	—	—	—	—	11-541	—	—	—	—	—	—
RE02-11-2219	02-613626	10–11	ALLH	—	—	—	—	—	—	—	11-541	—	—	—	—	—	—
RE02-11-2220	02-613627	6–7	ALLH	—	—	—	—	—	—	—	11-541	—	—	—	—	—	—
RE02-11-2221	02-613627	8–9	ALLH	—	—	—	—	—	—	—	11-541	—	—	—	—	—	—
RE02-11-2222	02-613627	10–11	ALLH	—	—	—	—	—	—	—	11-686	—	—	—	—	—	—
RELA-18-151122	02-613667	2–3	ALLH	—	—	—	—	—	—	—	2018-1525	—	—	—	—	—	—
RELA-18-151123	02-613667	4–5	ALLH	—	—	—	—	—	—	—	2018-1525	—	—	—	—	—	—
RE02-11-2523	02-613667	6–6.2	ALLH	—	—	—	—	—	—	—	11-687	—	—	—	—	—	—
RELA-18-151124	02-613667	6–7	ALLH	—	—	—	—	—	—	—	2018-1525	—	—	—	—	—	—
RE02-11-2524	02-613667	8–8.2	ALLH	—	—	—	—	—	—	—	11-687	—	—	—	—	—	—
RELA-18-151125	02-613667	8–9	QBO	—	—	—	—	—	—	—	2018-1525	—	—	—	—	—	—
RE02-11-2525	02-613667	10–10.2	ALLH	—	—	—	—	—	—	—	11-687	—	—	—	—	—	—
RE02-17-136038	02-613667	10–11	QBT3	—	—	—	—	—	—	—	2017-1917	—	—	—	—	—	—
RE02-17-136039	02-613667	13–14	QBO	—	—	—	—	—	—	—	2017-1917	—	—	—	—	—	—
RE02-17-136040	02-613667	16–17	QBO	—	—	—	—	—	—	—	2017-1917	—	—	—	—	—	—
RE02-17-136041	02-613667	19–20	QBO	—	—	—	—	—	—	—	2017-1917	—	—	—	—	—	—
RELA-18-151127	02-613668	2–3	ALLH	—	—	—	—	—	—	—	2018-1573	—	—	—	—	—	—
RELA-18-151128	02-613668	4–5	ALLH	—	—	—	—	—	—	—	2018-1573	—	—	—	—	—	—
RELA-18-151129	02-613668	6–7	ALLH	—	—	—	—	—	—	—	2018-1573	—	—	—	—	—	—
RE02-11-2526	02-613668	8–8.2	ALLH	—	—	—	—	—	—	—	11-729	—	—	—	—	—	—
RELA-18-151130	02-613668	8–9	ALLH	—	—	—	—	—	—	—	2018-1573	—	—	—	—	—	—
RE02-11-2527	02-613668	10–10.2	ALLH	—	—	—	—	—	—	—	11-729	—	—	—	—	—	—
RE02-17-136042	02-613668	10–11	QBO	—	—	—	—	—	—	—	2017-2038	—	—	—	—	—	—
RE02-11-2798	02-613699	12–12.2	QBT3	—	—	—	—	—	—	—	11-904	—	—	—	—	—	—
RE02-11-2799	02-613700	8–8.2	ALLH	—	—	—	—	—	—	—	11-904	—	—	—	—	—	—

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Dioxins/Furans	Cyanide (Total)
RE02-11-2800	02-613700	10–10.2	ALLH	—	—	—	—	—	—	—	11-904	—	—	—	—	—	—
RE02-11-2801	02-613700	12–12.2	ALLH	—	—	—	—	—	—	—	11-904	—	—	—	—	—	—
RE02-11-3145	02-613700	14–14.2	ALLH	—	—	—	—	—	—	—	11-1006	—	—	—	—	—	—
RE02-11-3146	02-613761	6–6.2	ALLH	—	—	—	—	—	—	—	11-1009	—	—	—	—	—	—
RE02-11-3147	02-613761	8–8.2	ALLH	—	—	—	—	—	—	—	11-1009	—	—	—	—	—	—
RE02-11-3148	02-613761	10–10.2	ALLH	—	—	—	—	—	—	—	11-1009	—	—	—	—	—	—
RE02-11-3149	02-613761	12–12.2	QBT3	—	—	—	—	—	—	—	11-1009	—	—	—	—	—	—
RE02-11-3150	02-613761	14–14.2	QBT3	—	—	—	—	—	—	—	11-1009	—	—	—	—	—	—
RELA-18-151117	02-613762	2–3	ALLH	—	—	—	—	—	—	—	2018-1580	—	—	—	—	—	—
RE02-17-141642	02-613762	2–3	ALLH	—	—	2017-2035	—	2017-2035	2017-2035	2017-2035	—	—	2017-2035	—	—	—	—
RE02-17-136025	02-613762	2–3	ALLH	—	—	—	—	—	—	—	2017-2038	—	—	—	—	—	—
RE02-17-141643	02-613762	4–5	QBO	—	—	2017-2035	—	2017-2035	2017-2035	2017-2035	—	—	2017-2035	—	—	—	—
RE02-17-136026	02-613762	4–5	QBO	—	—	—	—	—	—	—	2017-2038	—	—	—	—	—	—
RELA-18-151118	02-613762	4.25–5	QBO	—	—	—	—	—	—	—	2018-1580	—	—	—	—	—	—
RE02-17-136027	02-613762	6–7	QBO	—	—	—	—	—	—	—	2017-2038	—	—	—	—	—	—
RE02-17-141644	02-613762	6–7	QBO	—	—	2017-2035	—	2017-2035	2017-2035	2017-2035	—	—	2017-2035	—	—	—	—
RELA-18-151119	02-613762	6–7	QBO	—	—	—	—	—	—	—	2018-1580	—	—	—	—	—	—
RELA-18-151120	02-613762	8–9	QBO	—	—	—	—	—	—	—	2018-1580	—	—	—	—	—	—
RE02-17-136028	02-613762	8–9	QBO	—	—	—	—	—	—	—	2017-2038	—	—	—	—	—	—
RE02-17-136029	02-613762	11–12	QBO	—	—	—	—	—	—	—	2017-2038	—	—	—	—	—	—
RE02-17-136030	02-613762	14–15	QBO	—	—	—	—	—	—	—	2017-2038	—	—	—	—	—	—
RE02-17-141601	02-613762	16–17	QBO	—	—	—	—	—	—	—	2017-2081	—	—	—	—	—	—
RE02-17-136032	02-613762	19–20	QBO	—	—	—	—	—	—	—	2017-2086	—	—	—	—	—	—
RELA-18-151045	02-61432	2–3	ALLH	—	—	—	—	—	—	—	2018-1534	—	—	—	—	—	—
RELA-18-151046	02-61432	4–5	ALLH	—	—	—	—	—	—	—	2018-1534	—	—	—	—	—	—
RELA-18-151047	02-61432	6.75–7	QBO	—	—	—	—	—	—	—	2018-1534	—	—	—	—	—	—
RELA-18-151048	02-61432	8–8.75	QBO	—	—	—	—	—	—	—	2018-1534	—	—	—	—	—	—
RELA-18-151057	02-61435	2–3	ALLH	—	—	—	—	—	—	—	2018-1458	—	—	—	—	—	—
RELA-18-151058	02-61435	4–5	QBO	—	—	—	—	—	—	—	2018-1458	—	—	—	—	—	—
RELA-18-151059	02-61435	6–7	QBO	—	—	—	—	—	—	—	2018-1458	—	—	—	—	—	—
RELA-18-151062	02-61436	2–3	ALLH	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151063	02-61436	4–5	ALLH	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151064	02-61436	6–7	QBO	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151065	02-61437	6–7	ALLH	—	—	—	—	—	—	—	2018-1573	—	—	—	—	—	—
RELA-18-151066	02-61437	8–9	ALLH	—	—	—	—	—	—	—	2018-1573	—	—	—	—	—	—

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Dioxins/Furans	Cyanide (Total)
RELA-18-151067	02-61437	11–11.8	QBO	—	—	—	—	—	—	—	2018-1573	—	—	—	—	—	—
RELA-18-151069	02-61440	2–3	ALLH	—	—	—	—	—	—	—	2018-1572	—	—	—	—	—	—
RELA-18-151070	02-61440	4–5	ALLH	—	—	—	—	—	—	—	2018-1572	—	—	—	—	—	—
RELA-18-151071	02-61440	6–7	ALLH	—	—	—	—	—	—	—	2018-1572	—	—	—	—	—	—
RELA-18-151072	02-61440	8–9	ALLH	—	—	—	—	—	—	—	2018-1572	—	—	—	—	—	—
RELA-18-151043	02-61441	6–7	QBO	—	—	—	—	—	—	—	2018-1551	—	—	—	—	—	—
RELA-18-151073	02-61441	8–8.5	QBO	—	—	—	—	—	—	—	2018-1551	—	—	—	—	—	—
RELA-18-151075	02-61442	2–3	ALLH	—	—	—	—	—	—	—	2018-1458	—	—	—	—	—	—
RELA-18-151076	02-61442	4–5	QBO	—	—	—	—	—	—	—	2018-1458	—	—	—	—	—	—
RELA-18-151077	02-61442	6–7	QBO	—	—	—	—	—	—	—	2018-1458	—	—	—	—	—	—
RELA-18-151078	02-61442	8–9	QBO	—	—	—	—	—	—	—	2018-1458	—	—	—	—	—	—
RELA-18-151080	02-61443	2–3	ALLH	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151081	02-61443	4–5	QBO	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151082	02-61443	6–7	QBO	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151083	02-61443	8–9	QBO	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151084	02-61443	11–12	QBO	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151086	02-61444	2–3	ALLH	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151087	02-61444	4–5	ALLH	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151088	02-61444	6–7	ALLH	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151089	02-61444	8–8.85	ALLH	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151037	02-61447	0–1	ALLH	—	—	—	—	—	—	—	2018-1596	—	—	—	—	—	—
RELA-18-151038	02-61447	2–3	ALLH	—	—	—	—	—	—	—	2018-1596	—	—	—	—	—	—
RELA-18-151039	02-61447	4–5	QBO	—	—	—	—	—	—	—	2018-1596	—	—	—	—	—	—
RELA-18-151040	02-61447	6–7	QBO	—	—	—	—	—	—	—	2018-1596	—	—	—	—	—	—
RELA-18-151041	02-61447	8–9	QBO	—	—	—	—	—	—	—	2018-1596	—	—	—	—	—	—
RELA-18-151050	02-61448	2–3	ALLH	—	—	—	—	—	—	—	2018-1587	—	—	—	—	—	—
RELA-18-151051	02-61448	4–5	ALLH	—	—	—	—	—	—	—	2018-1587	—	—	—	—	—	—
RELA-18-151052	02-61448	6–7	ALLH	—	—	—	—	—	—	—	2018-1587	—	—	—	—	—	—
RELA-18-151053	02-61448	8–9	ALLH	—	—	—	—	—	—	—	2018-1587	—	—	—	—	—	—
RELA-18-151054	02-61448	11–12	ALLH	—	—	—	—	—	—	—	2018-1587	—	—	—	—	—	—
RELA-18-151055	02-61448	13–14	ALLH	—	—	—	—	—	—	—	2018-1596	—	—	—	—	—	—
RELA-18-151091	02-61450	2–3	ALLH	—	—	—	—	—	—	—	2018-1518	—	—	—	—	—	—
RELA-18-151092	02-61450	4–5	ALLH	—	—	—	—	—	—	—	2018-1518	—	—	—	—	—	—
RELA-18-151094	02-61451	2–3	ALLH	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151095	02-61451	4–5	ALLH	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Dioxins/Furans	Cyanide (Total)
RELA-18-151096	02-61451	6.25–7	QBO	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151097	02-61451	8–9	QBO	—	—	—	—	—	—	—	2018-1501	—	—	—	—	—	—
RELA-18-151099	02-61452	2–3	ALLH	—	—	—	—	—	—	—	2018-1558	—	—	—	—	—	—
RELA-18-151100	02-61452	4–5	ALLH	—	—	—	—	—	—	—	2018-1558	—	—	—	—	—	—
RELA-18-151101	02-61452	6–7	QBO	—	—	—	—	—	—	—	2018-1558	—	—	—	—	—	—
RELA-18-151102	02-61452	8–9	QBO	—	—	—	—	—	—	—	2018-1558	—	—	—	—	—	—
RELA-18-151104	02-61453	2–3	ALLH	—	—	—	—	—	—	—	2018-1572	—	—	—	—	—	—
RELA-18-151105	02-61453	4–5	ALLH	—	—	—	—	—	—	—	2018-1572	—	—	—	—	—	—
RELA-18-151106	02-61453	6–7	ALLH	—	—	—	—	—	—	—	2018-1572	—	—	—	—	—	—
RELA-18-151107	02-61453	8–9	ALLH	—	—	—	—	—	—	—	2018-1572	—	—	—	—	—	—
RELA-18-151109	02-61454	2–3	ALLH	—	—	—	—	—	—	—	2018-1534	—	—	—	—	—	—
RELA-18-151110	02-61454	4–5	ALLH	—	—	—	—	—	—	—	2018-1534	—	—	—	—	—	—
RELA-18-151112	02-61455	2–3	ALLH	—	—	—	—	—	—	—	2018-1551	—	—	—	—	—	—
RELA-18-151113	02-61455	4–5	ALLH	—	—	—	—	—	—	—	2018-1551	—	—	—	—	—	—
RELA-18-151114	02-61455	6–7	ALLH	—	—	—	—	—	—	—	2018-1551	—	—	—	—	—	—
RELA-18-151115	02-61455	8–8.75	ALLH	—	—	—	—	—	—	—	2018-1551	—	—	—	—	—	—
RE02-17-145060	02-61474	2–3	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145072	02-61474	4–5	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145084	02-61474	6–7	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145049	02-61475	0–1	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145061	02-61475	2–3	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145073	02-61475	4–5	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145050	02-61476	0–1	ALLH	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145062	02-61476	2–3	ALLH	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145074	02-61476	4–5	ALLH	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145086	02-61476	6–7	QBO	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145098	02-61476	8–9	QBO	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145110	02-61476	9–10	QBO	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145051	02-61477	0–1	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145063	02-61477	2–3	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145064	02-61478	2–3	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145065	02-61479	2–3	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145077	02-61479	4–5	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145054	02-61480	0–1	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145066	02-61480	2–3	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Dioxins/Furans	Cyanide (Total)
RE02-17-145078	02-61480	4–5	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145090	02-61480	6–7	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145102	02-61480	8–8.5	QBT3	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145055	02-61481	0–1	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145067	02-61481	2–3	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145079	02-61481	4–5	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145091	02-61481	6–7	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145103	02-61481	8–9	QBO	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145115	02-61481	9–10	QBO	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145068	02-61482	2–3	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145080	02-61482	4–5	QBO	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145092	02-61482	6–7	QBT3	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145116	02-61482	8–9	QBO	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145104	02-61482	9–10	QBO	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145057	02-61483	0–1	ALLH	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145069	02-61483	2–3	ALLH	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145081	02-61483	4–5	ALLH	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145093	02-61483	6–7	QBO	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145105	02-61483	8–9	QBO	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145117	02-61483	9–10	QBO	—	—	—	—	—	—	—	2017-2678	—	—	—	—	—	—
RE02-17-145120	02-61486	0–1	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145130	02-61486	2–3	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145131	02-61487	2–3	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145141	02-61487	4–5	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145151	02-61487	5–5.5	QBO	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145132	02-61488	2–3	QBO	—	—	—	—	—	—	—	2017-2695	—	—	—	—	—	—
RE02-17-145142	02-61488	4–4.1	QBO	—	—	—	—	—	—	—	2017-2695	—	—	—	—	—	—
RE02-17-145133	02-61489	2–3	ALLH	—	—	—	—	—	—	—	2017-2695	—	—	—	—	—	—
RE02-17-145143	02-61489	4–5	ALLH	—	—	—	—	—	—	—	2017-2695	—	—	—	—	—	—
RE02-17-145153	02-61489	6–7	QBO	—	—	—	—	—	—	—	2017-2710	—	—	—	—	—	—
RE02-17-145163	02-61489	7–7.5	QBO	—	—	—	—	—	—	—	2017-2710	—	—	—	—	—	—
RE02-17-145124	02-61490	0–1	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145134	02-61490	2–3	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145125	02-61491	0–1	ALLH	—	—	—	—	—	—	—	2017-2695	—	—	—	—	—	—
RE02-17-145135	02-61491	2–3	ALLH	—	—	—	—	—	—	—	2017-2695	—	—	—	—	—	—

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Dioxins/Furans	Cyanide (Total)
RE02-17-145145	02-61491	4–5	QBO	—	—	—	—	—	—	—	2017-2695	—	—	—	—	—	—
RE02-17-145126	02-61492	0–0.5	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145127	02-61493	0–1	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145137	02-61493	2–3	ALLH	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145147	02-61493	4–4.5	QBO	—	—	—	—	—	—	—	2017-2647	—	—	—	—	—	—
RE02-17-145128	02-61494	0–1	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RE02-17-145138	02-61494	2–3	ALLH	—	—	—	—	—	—	—	2017-2667	—	—	—	—	—	—
RELA-18-151015	02-61526	0–1	ALLH	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151020	02-61526	2–3	ALLH	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151021	02-61526	4–5	ALLH	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151022	02-61526	6–7	QCT	—	—	—	—	—	—	—	2018-1458	—	—	—	—	—	—
RELA-18-151017	02-61528	0–1	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151023	02-61528	2–3	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151024	02-61528	4–5	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151018	02-61529	0–1	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151027	02-61529	2–3	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151028	02-61529	4–4.65	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151019	02-61530	0–1	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151030	02-61530	2–3	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151031	02-61530	4–5	QBO	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151032	02-61530	6–7	QBO	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151033	02-61537	2–3	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151034	02-61537	4–5	ALLH	—	—	—	—	—	—	—	2018-1422	—	—	—	—	—	—
RELA-18-151035	02-61537	6–7	ALLH	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151263	02-61537	8–9	QBO	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-151036	02-61537	11–12	QBO	—	—	—	—	—	—	—	2018-1441	—	—	—	—	—	—
RELA-18-161238	02-61538	0–0.9	ALLH	—	—	—	—	—	—	—	N3B-2018-3962-1	—	—	—	—	—	—
RELA-18-161242	02-61538	1–2	ALLH	—	—	—	—	—	—	—	N3B-2018-3962-1	—	—	—	—	—	—
RELA-18-161239	02-61539	1–2	ALLH	—	—	—	—	—	—	—	N3B-2018-3962-1	—	—	—	—	—	—
RELA-18-161244	02-61540	1–2	ALLH	—	—	—	—	—	—	—	N3B-2018-3962-1	—	—	—	—	—	—
RELA-18-164444	02-61541	6–7	QBT1G	—	—	—	—	—	—	—	N3B-2019-380	—	—	—	—	—	—
RELA-18-161248	02-61542	1–2	ALLH	—	—	—	—	—	—	—	N3B-2018-3962-1	—	—	—	—	—	—
RELA-18-161249	02-61543	1–1.5	ALLH	—	—	—	—	—	—	—	N3B-2018-3962-1	—	—	—	—	—	—
RELA-18-164455	02-61544	2–3	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164465	02-61544	4.25–5	QBT1G	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Dioxins/Furans	Cyanide (Total)
RELA-18-164475	02-61544	6–7	QBT1G	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164456	02-61545	2–3	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164466	02-61545	4–5	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164476	02-61545	6–7	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164448	02-61547	0–1	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164458	02-61547	2–3	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164468	02-61547	4–5	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164478	02-61547	6–7	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164459	02-61548	2–3	ALLH	—	—	—	—	—	—	—	N3B-2019-380	—	—	—	—	—	—
RELA-18-164469	02-61548	4–4.5	ALLH	—	—	—	—	—	—	—	N3B-2019-380	—	—	—	—	—	—
RELA-18-164479	02-61548	6–7	QBT1G	—	—	—	—	—	—	—	N3B-2019-380	—	—	—	—	—	—
RELA-18-164470	02-61549	4–5	QBT1G	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164480	02-61549	6–7	QBT1G	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164451	02-61550	0–1	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164461	02-61550	2–3	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164471	02-61550	4–5	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164481	02-61550	6–7	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164462	02-61551	2–3	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164472	02-61551	4–5	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164482	02-61551	6–7	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164453	02-61552	0–1	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164463	02-61552	2–3	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164473	02-61552	4–5	ALLH	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164483	02-61552	6–7	QBT1G	—	—	—	—	—	—	—	N3B-2019-391	—	—	—	—	—	—
RELA-18-164464	02-61553	2–3	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164474	02-61553	4–5	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—
RELA-18-164484	02-61553	6–7	ALLH	—	—	—	—	—	—	—	N3B-2019-412	—	—	—	—	—	—

[a] Analytical request number.

[b] — = Analysis not requested.

Table 3.4-2
Inorganic Chemicals Detected or Detected above BVs at SWMU 02-014

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Arsenic	Barium	Cadmium	Calcium	Chromium	Iron	Magnesium	Nickel	Nitrate	Perchlorate	Selenium	Vanadium	Zinc
Qbt 1g, Qct, Qbo BV[a]				**3560**	**0.56**	**25.7**	**0.4**	1900	**2.6**	**3700**	739	**2**	**na**[b]	**na**	**0.3**	**4.59**	**40**
Soil BV[a]				**29,200**	**8.17**	**295**	**0.4**	6120	**19.3**	**21,500**	4610	**15.4**	**na**	**na**	**1.52**	**39.6**	**48.8**
Industrial SSL[c]				**1,290,000**	**35.9**	**255,000**	**1110**	40,700,000	**505**[d]	**908,000**	5,680,000	**25,700**	**2,080,000**	**908**	**6490**	**6530**	**389,000**
Recreational SSL[e]				**619,000**	**42.9**	**124,000**	**457**	na	**281**[d]	**434,000**	na	**12,400**	**991,000**	**434**	**3100**	**3100**	**186,000**
Residential SSL[c]				**78,000**	**7.07**	**15,600**	**70.5**	13,000,000	**96.6**[d]	**54,800**	20,900,000	**1560**	**125,000**	**54.8**	**391**	**394**	**23,500**
RE02-07-1572	02-600387	0–0.5	SOIL	—[f]	—	—	—	—	—	—	—	—	1.71 (J-)	—	—	—	78.2
RE02-07-1573	02-600387	2–2.6	QAL	—	—	—	0.497 (U)	—	—	—	—	—	1.77 (J-)	0.000813 (J)	—	—	—
RE02-07-1878	02-600449	4.5–9.5	QAL	—	—	—	0.517 (U)	—	—	—	—	—	—	—	—	—	—
RE02-17-141643	02-613762	4–5	QBO	10,800	0.735 (J)	57.1	—	7260	3.16	4860	1270	2.76	NA[g]	NA	0.462 (U)	4.95	—
RE02-17-141644	02-613762	6–7	QBO	5020	—	—	—	—	2.74	—	—	2.26	NA	NA	—	—	—

Notes: Results are in mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs are from LANL (1998, 059730).

[b] na = Not available.

[c] SSLs are from NMED (2017, 602273), unless otherwise noted.

[d] SSLs are for hexavalent chromium.

[e] SSLs are from LANL (2017, 602581).

[f] — = Not detected or not detected above BV.

[g] NA = Not analyzed.

Table 3.4-3
Organic Chemicals other than PCBs Detected at SWMU 02-014

Sample ID	Location ID	Depth (ft)	Media	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Fluoranthene	Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	Heptachlorodibenzodioxins (Total)	Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	Heptachlorodibenzofuran[1,2,3,4,7,8,9-]
Industrial SSL[a]				**253,000**	**32.3**	**23.6**	**32.3**	**25,300**[b]	**323**	**3230**	**33,700**	**na**[c]	**na**	**na**	**na**
Recreational SSL[d]				**86,300**	**88.8**	**8.88**	**88.8**	**8630**[b]	**888**	**8880**	**11,500**	**na**	**na**	**na**	**na**
Residential SSL[a]				**17400**	**1.53**	**1.12**	**1.53**	**1740**[b]	**15.3**	**1530**	**2320**	**na**	**na**	**na**	**na**
RE02-07-1572	02-600387	0–0.5	SOIL	0.00903 (J)	0.0516	0.0551	0.0702	0.0271 (J)	0.041	0.0598	0.0984	0.00016	0.001	0.0000475	0.00000235 (J)
RE02-07-1573	02-600387	2–2.6	QAL	0.00727 (J)	0.032 (J)	0.0332 (J)	0.0424	0.0222 (J)	0.0219 (J)	0.0386	0.0529	0.000166	0.00108	0.0000472	0.00000182 (J)
RE02-07-1878	02-600449	4.5–9.5	QAL	—[e]	—	—	—	—	—	—	—	0.00000134 (J)	0.00000429	0.00000545	0.000000799 (J)

Table 3.4-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Heptachlorodibenzofurans (Total)	Hexachlorodibenzodioxin[1,2,3,4,7,8-]	Hexachlorodibenzodioxin[1,2,3,6,7,8-]	Hexachlorodibenzodioxin[1,2,3,7,8,9-]	Hexachlorodibenzodioxins (Total)	Hexachlorodibenzofuran[1,2,3,4,7,8-]	Hexachlorodibenzofuran[1,2,3,6,7,8-]	Hexachlorodibenzofuran[1,2,3,7,8,9-]	Hexachlorodibenzofuran[2,3,4,6,7,8-]	Hexachlorodibenzofurans (Total)	Indeno(1,2,3-cd)pyrene
Industrial SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	32.3
Recreational SSL[c]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	88.8
Residential SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	1.53
RE02-07-1572	02-600387	0–0.5	SOIL	0.000205	0.00000071 (J)	0.00000332	0.0000013 (J)	0.0000622	0.00000486	0.00000166 (J)	0.0000005 (J)	0.00000273	0.0000561	0.0252 (J)
RE02-07-1573	02-600387	2–2.6	QAL	0.000235	0.000000738 (J)	0.0000037	0.00000091 (J)	0.0000743	0.00000182 (J)	0.000000621 (J)	—	0.000000981 (J)	0.0000446	0.0184 (J)
RE02-07-1878	02-600449	4.5–9.5	QAL	0.0000109	—	—	—	—	0.00000641	0.00000263	0.00000051 (J)	0.00000430	0.0000454	—

Table 3.4-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	Pentachlorodibenzodioxin[1,2,3,7,8-]	Pentachlorodibenzodioxins (Total)	Pentachlorodibenzofuran[1,2,3,7,8-]	Pentachlorodibenzofuran[2,3,4,7,8-]	Pentachlorodibenzofurans (Totals)	Phenanthrene	Pyrene	Tetrachlorodibenzofuran[2,3,7,8-]	Tetrachlorodibenzofurans (Totals)	Toluene
Industrial SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**25,300**	**25,300**	**0.00243**	**na**	**61,100**
Recreational SSL[c]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**8630**	**8630**	**0.00297**	**na**	**47,600**
Residential SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**1740**	**1740**	**0.00049**	**na**	**5220**
RE02-07-1572	02-600387	0–0.5	SOIL	0.0012	0.00022	0.000000204 (J)	0.00000234	0.00000101 (J)	0.00000652	0.0000449 (J)	0.0317 (J)	0.0771	0.00000377	0.000017	NA[f]
RE02-07-1573	02-600387	2–2.6	QAL	0.00123	0.000248	0.000000156 (J)	0.0000007	—	0.00000155 (J)	0.0000102 (J)	0.0212 (J)	0.0423	0.000000867 (J)	0.00000232	0.000465 (J)
RE02-07-1878	02-600449	4.5–9.5	QAL	0.0000134	0.0000057	—	—	0.0000019 (J)	0.0000128	0.000073	—	—	0.00000639	0.0000324	—

Notes: Results are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs are from NMED (2017, 602273), unless otherwise noted.

[b] Pyrene used as a surrogate based on structural similarity.

[c] na = Not available.

[d] SSLs are from LANL (2017, 602581).

[e] — = Not detected.

[f] NA = Not analyzed.

Table 3.4-4
PCBs Detected at SWMU 02-014

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Industrial SSL[a]				**11**	**11.1**
Recreational SSL[b]				**5.53**	**10.3**
Residential SSL[a]				**1.14**	**2.43**
RE02-07-1572	02-600387	0–0.5	SOIL	0.234	0.553
RE02-07-1573	02-600387	2–2.6	QAL	0.0532	0.105
RE02-07-1878	02-600449	4.5–9.5	QAL	—[c]	0.171
RE02-10-22130	02-600449	6–6.2	SOIL	—	0.69
RE02-10-22133	02-612451	6–6.2	SOIL	—	4
RE02-10-22136	02-612452	6–6.2	SOIL	—	1.1
RE02-10-22137	02-612452	8–8.2	SOIL	—	2.14
RE02-10-22139	02-612453	6–6.2	SOIL	—	0.377
RE02-10-22140	02-612453	8–8.2	SOIL	—	0.191
RE02-10-26105	02-613001	6–6.5	SOIL	—	0.536
RELA-18-151143	02-613001	6–7	SOIL	—	5.15
RE02-10-26106	02-613001	7–7.5	SOIL	—	5.48
RELA-18-151144	02-613001	8–9	SOIL	—	1.47
RE02-10-26107	02-613002	6–6.5	SOIL	—	7.98
RE02-10-26108	02-613002	8–8.5	SOIL	—	1.67
RE02-10-26638	02-613122	2–2.2	SOIL	—	0.328
RE02-10-26639	02-613122	4–4.2	SOIL	0.0407 (J)	0.178
RE02-10-26640	02-613124	6–6.2	SOIL	—	2.03
RE02-10-26641	02-613124	8–8.2	SOIL	0.17	1.24
RELA-18-151133	02-613287	2–3	SOIL	—	0.485
RELA-18-151134	02-613287	4–5	SOIL	—	0.769
RE02-11-315	02-613287	6–6.2	SOIL	—	13.9
RELA-18-151135	02-613287	6–7	SOIL	—	1.92
RE02-11-316	02-613287	8–8.2	SOIL	—	12.6
RE02-17-136051	02-613287	8–9	QBO	—	0.586
RE02-11-317	02-613288	6–6.2	SOIL	—	2.48
RE02-11-318	02-613288	8–8.2	SOIL	—	1.07
RE02-11-320	02-613289	6–6.2	SOIL	—	3.39
RELA-18-151137	02-613289	6–7	SOIL	—	0.767
RELA-18-151138	02-613289	9–10	SOIL	—	10.8
RELA-18-151139	02-613289	11–11.25	SOIL	—	20.7

Table 3.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Industrial SSL[a]				11	11.1
Recreational SSL[b]				5.53	10.3
Residential SSL[a]				1.14	2.43
RE02-11-325	02-613292	4–4.2	SOIL	—	0.825
RE02-11-2218	02-613626	8–9	SOIL	0.197	1.03
RE02-11-2219	02-613626	10–11	SOIL	—	3.3
RE02-11-2220	02-613627	6–7	SOIL	1.39	7.29
RE02-11-2221	02-613627	8–9	SOIL	—	4.16
RE02-11-2222	02-613627	10–11	SOIL	—	1.89
RELA-18-151122	02-613667	2–3	SOIL	—	0.199
RELA-18-151123	02-613667	4–5	SOIL	—	0.107
RE02-11-2523	02-613667	6–6.2	SOIL	7.11	13.3
RELA-18-151124	02-613667	6–7	SOIL	—	0.0347
RE02-11-2524	02-613667	8–8.2	SOIL	3.74	6.3
RELA-18-151125	02-613667	8–9	QBO	—	0.013
RE02-11-2525	02-613667	10–10.2	SOIL	4.93	7.73
RELA-18-151127	02-613668	2–3	SOIL	—	0.552
RELA-18-151128	02-613668	4–5	SOIL	—	0.0465
RELA-18-151129	02-613668	6–7	SOIL	—	0.144
RE02-11-2526	02-613668	8–8.2	SOIL	—	1.52
RELA-18-151130	02-613668	8–9	SOIL	—	0.0694
RE02-11-2527	02-613668	10–10.2	SOIL	—	3.21
RE02-11-2798	02-613699	12–12.2	QBT3	0.636 (J)	3.34
RE02-11-2799	02-613700	8–8.2	SOIL	0.0505	0.258
RE02-11-2800	02-613700	10–10.2	SOIL	0.0617	0.327
RE02-11-2801	02-613700	12–12.2	SOIL	0.256 (J)	1.19
RE02-11-3145	02-613700	14–14.2	SOIL	0.779	2.27
RE02-11-3146	02-613761	6–6.2	SOIL	—	10.7
RE02-11-3147	02-613761	8–8.2	SOIL	—	3.85
RE02-11-3148	02-613761	10–10.2	SOIL	—	1.53
RE02-11-3149	02-613761	12–12.2	QBT3	—	1.75
RE02-11-3150	02-613761	14–14.2	QBT3	—	0.0445
RELA-18-151117	02-613762	2–3	SOIL	—	1.82
RELA-18-151118	02-613762	4.25–5	QBO	—	0.0673
RELA-18-151119	02-613762	6–7	QBO	—	0.0464
RELA-18-151120	02-613762	8–9	QBO	—	0.0432

Table 3.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Industrial SSL[a]				11	11.1
Recreational SSL[b]				5.53	10.3
Residential SSL[a]				1.14	2.43
RELA-18-151045	02-61432	2–3	SOIL	0.00811	0.0169
RELA-18-151046	02-61432	4–5	SOIL	—	0.128
RELA-18-151047	02-61432	6.75–7	QBO	—	0.974
RELA-18-151048	02-61432	8–8.75	QBO	0.0618	0.116
RELA-18-151057	02-61435	2–3	SOIL	—	0.00467
RELA-18-151058	02-61435	4–5	QBO	—	0.00253 (J)
RELA-18-151059	02-61435	6–7	QBO	—	0.00755
RELA-18-151062	02-61436	2–3	SOIL	—	0.264
RELA-18-151063	02-61436	4–5	SOIL	—	0.0586
RELA-18-151064	02-61436	6–7	QBO	—	0.288
RELA-18-151065	02-61437	6–7	SOIL	—	0.324
RELA-18-151066	02-61437	8–9	SOIL	—	0.036
RELA-18-151067	02-61437	11–11.8	QBO	—	0.0106
RELA-18-151069	02-61440	2–3	SOIL	—	0.423
RELA-18-151070	02-61440	4–5	SOIL	—	0.257
RELA-18-151071	02-61440	6–7	SOIL	—	3.75 (J)
RELA-18-151072	02-61440	8–9	SOIL	—	0.0545
RELA-18-151043	02-61441	6–7	QBO	—	0.0636
RELA-18-151073	02-61441	8–8.5	QBO	—	0.0277
RELA-18-151075	02-61442	2–3	SOIL	—	0.888
RELA-18-151076	02-61442	4–5	QBO	—	0.911
RELA-18-151077	02-61442	6–7	QBO	—	3.4
RELA-18-151078	02-61442	8–9	QBO	—	0.15
RELA-18-151080	02-61443	2–3	SOIL	—	0.824
RELA-18-151081	02-61443	4–5	QBO	—	0.21
RELA-18-151082	02-61443	6–7	QBO	—	0.028
RELA-18-151083	02-61443	8–9	QBO	—	0.0434
RELA-18-151084	02-61443	11–12	QBO	—	0.016
RELA-18-151086	02-61444	2–3	SOIL	—	0.0227
RELA-18-151087	02-61444	4–5	SOIL	—	0.0356
RELA-18-151088	02-61444	6–7	SOIL	—	0.0283
RELA-18-151089	02-61444	8–8.85	SOIL	—	1.55
RELA-18-151037	02-61447	0–1	SOIL	3.93	8.91

Table 3.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Industrial SSL[a]				11	11.1
Recreational SSL[b]				5.53	10.3
Residential SSL[a]				1.14	2.43
RELA-18-151038	02-61447	2–3	SOIL	0.174	0.348
RELA-18-151039	02-61447	4–5	QBO	0.0461	0.112
RELA-18-151040	02-61447	6–7	QBO	0.15	0.319
RELA-18-151050	02-61448	2–3	SOIL	—	0.0562
RELA-18-151051	02-61448	4–5	SOIL	—	0.0103
RELA-18-151052	02-61448	6–7	SOIL	—	0.0233
RELA-18-151053	02-61448	8–9	SOIL	—	0.00685
RELA-18-151054	02-61448	11–12	SOIL	—	0.591
RELA-18-151055	02-61448	13–14	SOIL	—	0.0707
RELA-18-151091	02-61450	2–3	SOIL	—	0.0224
RELA-18-151092	02-61450	4–5	SOIL	—	0.00351 (J)
RELA-18-151094	02-61451	2–3	SOIL	—	0.067
RELA-18-151095	02-61451	4–5	SOIL	—	0.0382
RELA-18-151096	02-61451	6.25–7	QBO	—	0.0205
RELA-18-151097	02-61451	8–9	QBO	—	0.0244
RELA-18-151099	02-61452	2–3	SOIL	—	21
RELA-18-151100	02-61452	4–5	SOIL	—	0.827
RELA-18-151101	02-61452	6–7	QBO	—	0.307
RELA-18-151102	02-61452	8–9	QBO	—	0.0167
RELA-18-151104	02-61453	2–3	SOIL	—	2.34 (J)
RELA-18-151105	02-61453	4–5	SOIL	—	0.0121
RELA-18-151106	02-61453	6–7	SOIL	—	0.372
RELA-18-151107	02-61453	8–9	SOIL	—	0.0095
RELA-18-151109	02-61454	2–3	SOIL	—	0.022
RELA-18-151110	02-61454	4–5	SOIL	—	0.00136 (J)
RELA-18-151112	02-61455	2–3	SOIL	—	0.00263 (J)
RELA-18-151113	02-61455	4–5	SOIL	—	0.00898
RELA-18-151114	02-61455	6–7	SOIL	—	0.035
RELA-18-151115	02-61455	8–8.75	SOIL	—	0.0112
RE02-17-145060	02-61474	2–3	SOIL	—	1.67
RE02-17-145072	02-61474	4–5	SOIL	—	5.53
RE02-17-145084	02-61474	6–7	SOIL	—	3.54
RE02-17-145049	02-61475	0–1	SOIL	—	0.452

Table 3.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Industrial SSL[a]				11	11.1
Recreational SSL[b]				5.53	10.3
Residential SSL[a]				1.14	2.43
RE02-17-145061	02-61475	2–3	SOIL	—	0.073
RE02-17-145073	02-61475	4–5	SOIL	—	0.0395
RE02-17-145050	02-61476	0–1	SOIL	—	1.29
RE02-17-145062	02-61476	2–3	SOIL	—	0.0178
RE02-17-145074	02-61476	4–5	SOIL	—	0.0478
RE02-17-145086	02-61476	6–7	QBO	—	0.053
RE02-17-145098	02-61476	8–9	QBO	—	0.1
RE02-17-145110	02-61476	9–10	QBO	—	0.023
RE02-17-145051	02-61477	0–1	SOIL	—	5
RE02-17-145063	02-61477	2–3	SOIL	—	1.21
RE02-17-145064	02-61478	2–3	SOIL	—	2.41
RE02-17-145065	02-61479	2–3	SOIL	—	1.25
RE02-17-145077	02-61479	4–5	SOIL	—	1.57
RE02-17-145054	02-61480	0–1	SOIL	—	0.976
RE02-17-145066	02-61480	2–3	SOIL	—	0.0653
RE02-17-145078	02-61480	4–5	SOIL	—	0.179
RE02-17-145090	02-61480	6–7	SOIL	—	0.063
RE02-17-145102	02-61480	8–8.5	QBT3	—	0.101
RE02-17-145055	02-61481	0–1	SOIL	—	0.551
RE02-17-145067	02-61481	2–3	SOIL	—	0.192
RE02-17-145079	02-61481	4–5	SOIL	—	0.12
RE02-17-145091	02-61481	6–7	SOIL	—	0.0876
RE02-17-145103	02-61481	8–9	QBO	—	0.0505
RE02-17-145115	02-61481	9–10	QBO	—	0.0243
RE02-17-145068	02-61482	2–3	SOIL	—	0.642
RE02-17-145080	02-61482	4–5	QBO	—	0.77
RE02-17-145092	02-61482	6–7	QBT3	—	0.471
RE02-17-145116	02-61482	8–9	QBO	—	0.456
RE02-17-145104	02-61482	9–10	QBO	—	0.641
RE02-17-145057	02-61483	0–1	SOIL	—	0.132
RE02-17-145069	02-61483	2–3	SOIL	—	0.0309
RE02-17-145081	02-61483	4–5	SOIL	—	0.0079
RE02-17-145093	02-61483	6–7	QBO	—	0.0107

Table 3.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Industrial SSL[a]				11	11.1
Recreational SSL[b]				5.53	10.3
Residential SSL[a]				1.14	2.43
RE02-17-145105	02-61483	8–9	QBO	—	0.00545
RE02-17-145117	02-61483	9–10	QBO	—	0.00353 (J)
RE02-17-145120	02-61486	0–1	SOIL	—	0.3
RE02-17-145130	02-61486	2–3	SOIL	—	0.333
RE02-17-145131	02-61487	2–3	SOIL	—	0.768
RE02-17-145141	02-61487	4–5	SOIL	—	1.59
RE02-17-145151	02-61487	5–5.5	QBO	—	0.476
RE02-17-145132	02-61488	2–3	QBO	—	1.6
RE02-17-145142	02-61488	4–4.1	QBO	—	2.25
RE02-17-145133	02-61489	2–3	SOIL	—	0.456
RE02-17-145143	02-61489	4–5	SOIL	—	0.422
RE02-17-145153	02-61489	6–7	QBO	—	0.0512
RE02-17-145163	02-61489	7–7.5	QBO	—	0.733
RE02-17-145124	02-61490	0–1	SOIL	0.0366	0.0572
RE02-17-145134	02-61490	2–3	SOIL	0.0284	0.0449
RE02-17-145125	02-61491	0–1	SOIL	—	0.016
RE02-17-145135	02-61491	2–3	SOIL	—	0.00456
RE02-17-145145	02-61491	4–5	QBO	—	0.00623
RE02-17-145126	02-61492	0–0.5	SOIL	0.0418	0.0792
RE02-17-145127	02-61493	0–1	SOIL	0.0248	0.043
RE02-17-145137	02-61493	2–3	SOIL	0.00632	0.011
RE02-17-145147	02-61493	4–4.5	QBO	0.00327 (J)	0.006
RE02-17-145128	02-61494	0–1	SOIL	0.0344	0.066
RE02-17-145138	02-61494	2–3	SOIL	—	0.00525
RELA-18-151015	02-61526	0–1	SOIL	—	0.531
RELA-18-151020	02-61526	2–3	SOIL	—	0.0232
RELA-18-151021	02-61526	4–5	SOIL	—	0.0439
RELA-18-151022	02-61526	6–7	QCT	—	0.00279 (J)
RELA-18-151017	02-61528	0–1	SOIL	—	0.0791
RELA-18-151023	02-61528	2–3	SOIL	—	0.0491
RELA-18-151024	02-61528	4–5	SOIL	—	0.00672
RELA-18-151018	02-61529	0–1	SOIL	—	3.77
RELA-18-151027	02-61529	2–3	SOIL	0.149	0.0754

Table 3.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Industrial SSL[a]				11	11.1
Recreational SSL[b]				5.53	10.3
Residential SSL[a]				1.14	2.43
RELA-18-151028	02-61529	4–4.65	SOIL	0.0401	0.0451
RELA-18-151019	02-61530	0–1	SOIL	—	1.68
RELA-18-151030	02-61530	2–3	SOIL	—	0.1
RELA-18-151031	02-61530	4–5	QBO	—	0.0251
RELA-18-151032	02-61530	6–7	QBO	—	0.0375
RELA-18-151033	02-61537	2–3	SOIL	—	23.9
RELA-18-151034	02-61537	4–5	SOIL	—	7.09
RELA-18-151035	02-61537	6–7	SOIL	—	0.614
RELA-18-151263	02-61537	8–9	QBO	—	1.44
RELA-18-151036	02-61537	11–12	QBO	—	2.48
RELA-18-161238	02-61538	0–0.9	SOIL	—	17.3
RELA-18-161242	02-61538	1–2	SOIL	—	1.1
RELA-18-161239	02-61539	1–2	SOIL	—	5.28
RELA-18-161244	02-61540	1–2	SOIL	—	12.3
RELA-18-164444	02-61541	6–7	QBT1G	—	0.963
RELA-18-161248	02-61542	1–2	SOIL	—	1.43
RELA-18-161249	02-61543	1–1.5	SOIL	—	6.77
RELA-18-164455	02-61544	2–3	SOIL	—	1.1
RELA-18-164465	02-61544	4.25–5	QBT1G	—	0.00375
RELA-18-164475	02-61544	6–7	QBT1G	—	0.413
RELA-18-164456	02-61545	2–3	SOIL	—	2.03
RELA-18-164466	02-61545	4–5	SOIL	—	0.446
RELA-18-164476	02-61545	6–7	SOIL	—	0.041
RELA-18-164448	02-61547	0–1	SOIL	—	0.921
RELA-18-164458	02-61547	2–3	SOIL	—	0.0299
RELA-18-164468	02-61547	4–5	SOIL	—	0.104
RELA-18-164478	02-61547	6–7	SOIL	—	0.00849
RELA-18-164459	02-61548	2–3	SOIL	—	0.684
RELA-18-164469	02-61548	4–4.5	SOIL	—	2.98
RELA-18-164479	02-61548	6–7	QBT1G	—	0.578
RELA-18-164470	02-61549	4–5	QBT1G	—	4.17
RELA-18-164480	02-61549	6–7	QBT1G	—	3.65
RELA-18-164451	02-61550	0–1	SOIL	—	5.35

Table 3.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Industrial SSL[a]				11	11.1
Recreational SSL[b]				5.53	10.3
Residential SSL[a]				1.14	2.43
RELA-18-164461	02-61550	2–3	SOIL	—	0.115
RELA-18-164471	02-61550	4–5	SOIL	—	0.157
RELA-18-164481	02-61550	6–7	SOIL	—	0.0342
RELA-18-164462	02-61551	2–3	SOIL	—	0.155
RELA-18-164472	02-61551	4–5	SOIL	—	0.169
RELA-18-164482	02-61551	6–7	SOIL	—	0.0631
RELA-18-164453	02-61552	0–1	SOIL	—	1.18
RELA-18-164463	02-61552	2–3	SOIL	—	0.031
RELA-18-164473	02-61552	4–5	SOIL	—	0.0205
RELA-18-164483	02-61552	6–7	QBT1G	—	0.0248
RELA-18-164464	02-61553	2–3	SOIL	—	0.834
RELA-18-164474	02-61553	4–5	SOIL	—	0.828
RELA-18-164484	02-61553	6–7	SOIL	—	1.25

Notes: Results are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs are from NMED (2017, 602273), unless otherwise noted.

[b] SSLs are from LANL (2017, 602581).

[c] — = Not detected.

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

AK	acceptable knowledge
ALARA	as low as reasonably achievable
AOC	area of concern
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BV	background value
CCV	continuing calibration verification
COC	chain of custody
Consent Order	Compliance Order on Consent
COPC	chemical of potential concern
DAF	dilution attenuation factor
D&D	decontamination and decommissioning
DL	detection limit
DOE	Department of Energy (U.S.)
dpm	disintegrations per minute
Eh	oxidation-reduction potential
EPA	Environmental Protection Agency (U.S.)
EPC	exposure point concentration
EQL	estimated quantitation limit
ESL	ecological screening level
FV	fallout value
GPS	global-positioning system
HI	hazard index
HQ	hazard quotient
ICS	interference check sample
ICV	initial calibration verification
IDW	investigation-derived waste
IR	investigation report
IS	internal standard
K_d	soil-water partition coefficient
K_{oc}	organic carbon-water partition coefficient
K_{ow}	octanol-water partition coefficient

LANL	Los Alamos National Laboratory
LAL	lower acceptance limit
LCS	laboratory control sample
LiDAR	light detection and imaging
LLW	low-level waste
LOAEL	lowest observed adverse effect level
MDC	minimum detectable concentration
MDL	method detection limit
mmHg	millimeters of mercury
MS	matrix spike
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NDA	no detectable activity
NMED	New Mexico Environment Department
NOAEL	no observed adverse effect level
OWR	Omega West Reactor
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
%R	percent recovery
%RSD	percent relative standard deviation
RCT	radiological control technician
RfD	reference dose
RPD	relative percent difference
RTK	real-time kinematic
SCL	sample collection log
SF	slope factor
SMO	Sample Management Office
SOP	standard operating procedure
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
T&E	threatened and endangered
TA	technical area

TAL	target analyte list
TCDD[2,3,7,8]	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEC	toxicity equivalency concentration
TEF	toxic equivalency factor
TSCA	Toxic Substances Control Act
UAL	upper acceptance limit
UCL	upper confidence limit
VOC	volatile organic compound
WBR	water boiler reactor
WCSF	waste characterization strategy form

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control parameters.

Appendix B

Field Methods

B-1.0 INTRODUCTION

This appendix summarizes field methods implemented during the 2018–2019 sampling and remediation activities at Solid Waste Management Unit (SWMU) 02-014 within the Middle Los Alamos Canyon Aggregate Area at Los Alamos National Laboratory (LANL or the Laboratory). Descriptions of field methods for previous investigations at SWMU 02-014 are included in the Phase II Investigation Report for Middle Los Alamos Canyon Aggregate, Revision 2 (N3B 2018, 700091). Table B-1.0-1 summarizes the field investigation methods, and the following sections provide more detailed descriptions of these methods.

B-2.0 FIELD-SCREENING METHODS

This section summarizes the field-screening methods used during the investigation activities. Field-screening results are presented in Table 2.2-2 of the addendum.

All soil/tuff samples were screened for radioactivity before submittal to the Sample Management Office (SMO). Samples submitted to the SMO were screened in the field by radiological control technicians (RCTs) using a ThermoFisher Model SHP-380, with Eberline Model E600 Geiger Counter, for detection of low-energy radiation. Gross alpha and beta/gamma screening measurements were recorded on the sample collection log/chain-of-custody (SCL/COC) forms and are reported in Table 2.2-2.

The outside of sealed sample containers, as well as sampling tools and equipment, were screened using smears and counted by the Ludlum Model 3030 Alpha Beta Sample Counter for detection of removable alpha and beta contamination.

B-3.0 FIELD-SCREENING INSTRUMENT CALIBRATION

The RCT calibrated field screening instruments daily before local background levels for radioactivity were measured. Instruments were calibrated using plutonium-239 and chloride-36 sources for alpha and beta emissions, respectively. All calibrations met the manufacturer's specifications and specifications in the applicable radiation detection instrument manual.

B-4.0 SURFACE AND SUBSURFACE SAMPLING

This section summarizes the methods used for collecting surface and subsurface samples.

B-4.1 Sample Collection

Surface and shallow subsurface samples were collected using a stainless-steel hand auger to collect material within the prescribed sampling intervals. For samples collected at depths greater than 3 ft, 4-in. polyvinyl chloride pipe was decontaminated and inserted into the hole to prevent hole collapse and cross-contamination of samples. A stainless-steel bowl and scoop were used to capture the sample from the hand-auger bucket. The sample was then transferred to sterile sample collection jars. Samples were appropriately labeled, sealed with custody seals, and documented before transporting to the SMO. Samples were transported to the SMO for processing and shipment to off-site contract analytical laboratories. The SMO personnel reviewed and approved the SCLs and accepted custody of the samples.

B-4.2 Subsurface Sampling Methods

Subsurface samples were collected in accordance with approved subcontractor procedures technically equivalent to standard operating procedure (SOP) ER-SOP-20069, “Soil, Tuff, and Sediment Sampling.” Borehole samples were collected in a stainless-steel split-spoon core-barrel sampler that retrieved core in 2.5-ft intervals. The samples collected, listed by location and depth, are provided in tables for each site in the addendum to the Phase II investigation report.

Core retrieved from the subsurface was field screened for radioactivity and was visually inspected and logged. Following inspection, the 2.5-ft core section to be sampled was removed from the core barrel and placed in a stainless-steel bowl and homogenized. The material was crushed, if necessary, with a decontaminated rock hammer and stainless-steel spoon to allow core material to fit into sample containers.

No samples were collected for volatile organic compound (VOC) analysis. The sample collection tools were decontaminated immediately before each sample was collected in accordance with an approved subcontractor procedure technically equivalent to ER-SOP-5061, “Field Decontamination of Equipment” (section B-5.4).

B-4.3 Quality Control Samples

Quality assurance/quality control samples were collected in accordance with an approved subcontractor procedure technically equivalent to ER-SOP-20235, R0, “Sample Containers, Preservation, and Field Quality Control.” The quality control samples included field duplicates and field rinsate blanks. Field duplicate samples were collected from the same material as a regular investigation sample and submitted for the same analyses. Field duplicate samples were collected at a frequency of at least 1 duplicate sample for every 10 samples submitted to the SMO. A total of 6 field duplicate samples were collected.

Field rinsate blanks were collected to evaluate field decontamination procedures. Rinsate blanks were collected by rinsing sampling equipment (i.e., auger buckets, sampling bowls, and scoops) with deionized water after decontamination. The rinsate water was collected in a sample container and submitted to the SMO. A total of four field rinsate samples were collected.

B-4.4 Decontamination of Sampling Equipment

The split-spoon core barrels and all other sampling equipment that came (or could have come) in contact with sample material were decontaminated after each core was retrieved and logged. Decontamination included wiping the equipment with Fantastik and paper towels. The drilling equipment was decontaminated before mobilization of the drill rig to another borehole to avoid cross-contamination between samples and borehole locations. Residual material adhering to equipment was removed using dry decontamination methods such as the use of wire brushes and scrapers. Decontamination activities were performed in accordance with an approved subcontractor procedure technically equivalent to ER-SOP-5061, “Field Decontamination of Equipment.” Field rinsate blank samples were collected in accordance with an approved procedure technically equivalent to ER-SOP-5059, “Field Quality Control Samples.”

B-5.0 SOIL REMEDIATION

B-5.1 Radiological Controls

Heavy equipment entering and leaving the site was monitored for radioactivity using smear samples. Heavy equipment screening smears were taken by the RCT and counted by a Ludlum Model 3030 Alpha Beta Sample Counter for detection of removable alpha and beta contamination. A ThermoFisher Model SHP-380, with Eberline Model E600 Geiger Counter, was used for direct screening of alpha and beta contamination of personnel after completing daily work, as requested. Any tools and personnel entering an excavation were screened out by an RCT.

B-5.2 Soil Excavation

Between November 7, 2018, and December 17, 2018, approximately 282 yd^3 of polychlorinated biphenyl–(PCB-) contaminated soil was removed from the excavation sites at SWMU 02-014. Soil was removed from the entire excavation area to a depth of 1 ft and deeper excavation was performed at five interior areas to depths of 4.5 ft to 10.5 ft. Excavation areas are shown on Plate 1.

The planned extent and depths of excavations were initially identified based on the results of previous sampling for PCBs. Following collection and analysis of confirmation samples, several areas were identified where excavation had to be extended vertically within the interior of the original area (interior areas) or laterally beyond the original excavation area. Excavation was determined to be complete upon confirmation of excavation depth and extent using several methods. Both the Topcon HiPer V real-time kinematic (RTK) global positioning system (GPS) unit and visual measurements were used to confirm the 1-ft excavation depth and extent. RTK GPS and visual tape measurements were used to confirm depth extent of most of the deep, interior excavations. Elevation was recorded at the original surface and at the bottom of the excavation at locations no more than 2 ft apart and these elevations were compared to confirm the planned excavation depth was reached. Points along the edges were often slightly higher than the central depth because of sloping during the excavation process and some sloughing of surface material. For the deepest interior excavation, a laser tape measure was affixed to a 10 ft × 2 in. × 4 in. wood beam to safely check the depth of excavation. In addition, 10-ft, 10.5-ft, and 11-ft lengths were marked with tape on the excavator arm for a second visual check.

Both a Yanmar mini-excavator and Volvo excavator were used for excavation as well as the placement and tamping of backfill and base course materials. Excavated material was placed in 5.18-yd^3 soft-sided IP-1 bags with 6-mil polypropylene built-in inner liners. After an IP-1 bag was filled, the inner liners of the bags were sealed per manufacturer's instructions and discussions with the waste management coordinator and Field Execution Team lead. Once sealed, IP-1 bags were secured to a telehandler and moved to Technical Area 41 (TA-41) where they were staged.

During excavation of deep interior area I-1, two asbestos-wrapped pipes (assumed to be decommissioned gas and water lines based on conversations with LANL Utilities Management) were exposed within the first 1–2 feet below ground surface (bgs). A "pause work" commenced the afternoon of November 19, 2018, and went to December 3, 2018. During this time, an asbestos abatement plan and integrated work document addendum were developed. The approved asbestos abatement plan was then implemented and the exposed pipes and wrapping were removed from the excavation and properly packaged and labeled. Abatement took place from December 4, 2018, through December 6, 2018. About 1 yd^3 of waste (pipe, asbestos wrapping, contact waste materials) is estimated to have been generated in the process.

Restoration at SWMU 02-014 began on December 18, 2018, and was completed on January 28, 2019. Fill was first placed into the deep excavation areas. Material was spread and compressed by the Volvo excavator in 6–8-in. lifts to 1 ft below grade (same level as the 1-ft deep excavation) and tamped after

each lift using the approximately 1-yd^3 bucket. Visual and tape measure methods were used to confirm that fill was deposited to 4–6 in. below grade. Base course was then placed on top of the fill. Visual observation and the Topcon RTK GPS system were used to confirm that base course was deposited as close to original grade as possible.

B-6.0 GEODETIC SURVEYING

RTK GPS surveying was conducted using Topcon HiPer V Navigation Satellite System antennas coupled with a Topcon FC-5000 Data Collector Controller. This system was used to stake sampling locations, locations to be left unexcavated (i.e., uncontaminated locations), locations excavated, planned excavation boundaries, and pre- and post-excavation topographic elevations. Light detection and ranging (LiDAR) was also used for pre- and post-excavation topographic elevation data collection, specifically for excavations too deep to safely check via RTK GPS.

If a planned sampling location needed to be offset more than 1 ft because of surface or subsurface obstructions, the relocated point was re-surveyed. Surveyed coordinates for sampling locations of samples submitted to the SMO are presented in Table 2.2-1 of the addendum.

B-7.0 INVESTIGATION-DERIVED WASTE STORAGE AND DISPOSAL

All excavated media at SWMU 02-014 was placed in 5.18-yd^3 soft-sided IP-1 bags. IP-1 bags were positioned on pallets for loading and staging. After the bag was sealed, an RCT screened all sides of the bag before releasing the bag for staging at TA-41. Temporary storage was within a posted radiological waste storage area at TA-41. All waste containers that were staged at TA-41 were covered with tarps for additional protection from the elements.

All investigation-derived waste (IDW) was managed in accordance with the project waste characterization strategy form (WCSF) and an approved subcontractor procedure technically equivalent to ER-DIR-SOP-10021, R1, “Characterization and Management of Environmental Programs Waste.” Contact waste was stored in labeled 1-gal. plastic bags in the radioactive waste accumulation area on-site until it could be transferred to a 5.18-yd^3 soft-sided IP-1 bag.

B-8.0 DEVIATIONS FROM THE WORK PLAN

The 2018–2019 sampling and remediation activities at SWMU 02-014 were not in the approved Phase II investigation work plan for Middle Los Alamos Canyon Aggregate Area (LANL 2009, 105073; NMED 2009, 105595). The need for these activities was identified as a result of the Phase II sampling performed at Area of Concern 02-011(a) and the subsequent identification of a new SWMU.

B-9.0 REFERENCES

The following reference list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Laboratory’s Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory’s Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by Newport News Nuclear BWXT-Los Alamos, LLC (N3B) (IDs 700000 and above). IDs are used to locate documents in N3B’s Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that

NMED has the references to review documents. The set is updated when new references are cited in documents.

LANL (Los Alamos National Laboratory), February 2009. "Phase II Investigation Work Plan for Middle Los Alamos Canyon Aggregate Area, Revision 1," Los Alamos National Laboratory document LA-UR-09-1206, Los Alamos, New Mexico. (LANL 2009, 105073)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), September 2018. "Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 2," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2018-0039, Los Alamos, New Mexico. (N3B 2018, 700091)

NMED (New Mexico Environment Department), March 25, 2009. "Approval, Middle Los Alamos Canyon Aggregate Area Phase II Work Plan, Revision 1," New Mexico Environment Department letter to D. Gregory (DOE LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 105595)

Table B-1.0-1
Summary of Field Investigation Methods

Method	Summary
Hand-Auger Sampling	This method is typically used for sampling soil or sediment at depths of less than 10–15 ft, but in some cases may be used to collect samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in. inside diameter), creating a vertical hole that can be advanced to the desired sampling depth. When the desired depth was reached, the auger was decontaminated before advancing the hole through the sampling depth. The sample material was transferred from the auger bucket to a stainless-steel sampling bowl before the various required sample containers were filled.
Split-Spoon Core-Barrel Sampling	A stainless-steel core barrel was advanced using a hollow-stem auger drilling rig. The core barrel extracted a continuous length of soil and/or rock. The split-spoon core barrel is a cylindrical barrel split lengthwise so the two halves can be separated to expose the core sample. If necessary, pieces small enough to fit into the sample container were removed from the core using a decontaminated rock hammer or stainless-steel spoon. The section of core in the core barrel was then screened for radioactivity. A portion of the core was then collected as a discrete sample from the desired depth for remaining analyses.
Handling, Packaging, and Shipping of Samples	Field team members sealed and labeled samples before packing them to ensure the sample containers and the containers used for transport were free of external contamination. Field team members packaged all samples to minimize the possibility of breakage during transport. After all environmental samples were collected, packaged, and preserved, a field team member transported them to the SMO. The SMO arranged to ship the samples to the analytical laboratories.
Sample Control and Field Documentation	The collection, screening, and transport of samples were documented on standard forms generated by the SMO. These included SCLs and sample container labels. SCLs were completed at the time of sample collection, and the logs were signed by the sampler and a reviewer who verified the logs for completeness and accuracy. Corresponding labels were initialed and applied to each sample container, and custody seals were placed around each sample container. SCLs were completed and signed to verify that the samples were not left unattended.
Field Quality Control Samples	Field quality control samples were collected as follows: *Field Duplicates*: At a frequency 10%; collected at the same time as a regular sample and submitted for the same analyses. *Equipment Rinsate Blank*: At a frequency of 10%; collected by rinsing decontaminated sampling equipment with deionized water, which was collected in a sample container and submitted for laboratory analysis.
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination was used to minimize the generation of liquid waste. Dry decontamination included the use of a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by use of a commercial cleaning agent (nonacid, waxless cleaners) and paper wipes.
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on U.S. Environmental Protection Agency guidance for environmental sampling, preservation, and quality assurance. Specific requirements for each sample were printed on the SCL provided by the SMO (size and type of container [e.g., glass, amber glass, and polyethylene]). All samples were preserved by placing them with ice in insulated containers to maintain a temperature of 4°C.

Table B-1.0-1 (continued)

Method	Summary
Coordinating and Evaluating Geodetic Surveys	Geodetic surveys focused on obtaining survey data of acceptable quality to use during project investigations. Geodetic surveys were conducted with Topcon HiPer V Navigation Satellite System Antennas coupled with a Topcon FC-5000 Data Collection Controller. All coordinates were expressed as State Plane Coordinate System 83, NM Central, U.S. feet. All elevation data were reported relative to the National Geodetic Vertical Datum of 1983.
Management of Environmental Restoration Project Waste, Waste Characterization	IDW was managed, characterized, and stored in accordance with an approved WCSF that documented the site history, field activities, and characterization approach for each waste stream managed. Waste characterization complied with on- or off-site waste acceptance criteria. All stored IDW was marked with appropriate signage and labels. Drummed IDW was stored on pallets to prevent deterioration of containers. A waste storage area was established before waste was generated. Waste storage areas were located in controlled areas of the Laboratory to prevent unauthorized personnel from inadvertently adding or managing wastes. Each container of waste generated was individually labeled with waste classification, item identification number, and radioactivity category (if applicable), immediately following containerization. All waste was segregated by classification and compatibility to prevent cross-contamination. Management of IDW is described in Appendix C.

Appendix C

Investigation-Derived Waste Management

C-1.0 INTRODUCTION

This appendix describes management of the investigation-derived waste (IDW) generated during the 2018–2019 investigation and remediation activities at solid waste management unit (SWMU) 02-014 within the Middle Los Alamos Canyon Aggregate Area of Los Alamos National Laboratory (the Laboratory) and during sampling activities conducted in 2017 to characterize the area requiring remediation. In general, IDW generated during the investigation and remediation activities was managed in accordance with approved subcontractor procedures technically equivalent to standard operating procedure (SOP) EP-DIR-SOP-10021, R1, "Characterization and Management of Environmental Program Waste." This procedure incorporates the requirements of applicable U.S. Environmental Protection Agency and New Mexico Environment Department regulations, and U.S. Department of Energy orders.

Waste characterization strategy forms (WCSFs) were prepared to address characterization approaches, on-site management, and final disposition options for wastes. Analytical data and information on wastes generated during previous investigations and/or acceptable knowledge (AK) were used to complete the WCSF. WCSF EP2016-0128 was prepared in October 2016 to address Middle Los Alamos Canyon Aggregate Area site characterization activities. WCSF EM2018-0021 was prepared in July 2018 to address SWMU 02-014 remediation activities. The WCSFs are provided in Attachment C-1 (on CD).

The selection of waste containers was based on appropriate U.S. Department of Transportation requirements, waste types, and estimated volumes of IDW to be generated. Immediately following containerization, each waste container was individually labeled with a unique identification number and with information regarding waste classification, contents, and radioactivity, if applicable.

Wastes were staged in clearly marked, appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements were based on the type of IDW and its classification. Container and storage requirements were detailed in the WCSFs and approved before waste was generated.

To the extent possible, investigation and remediation activities were conducted in a manner that minimized the generation of waste.

C-2.0 WASTE STREAMS

The IDW streams generated and managed during the investigation are described below and are summarized in Table C-2.0-1. The waste stream numbers correspond with those identified in the WCSFs. Waste streams 1, 2, 5, and 6 are the same for the two WCSFs.

- WCSF Waste Stream #1: Contact Waste—This waste stream is composed of solid waste generated during investigation and removal activities that has come into contact with contaminated environmental media and equipment. This includes, but is not limited to, personal protective equipment (e.g., gloves), plastic sheeting (e.g., tarps, liners), plastic and glass sample bottles, disposable sampling supplies (e.g., filters, tubing, plastic bags), and dry decontamination wastes (e.g., paper items). Less than 1 yd^3 of contact waste was generated and was combined with excavated media.
- WCSF Waste Streams #2, #5, and #6—No municipal solid waste (waste stream #2), petroleum-contaminated soils (waste stream #5), or decontamination fluids (waste stream #6) were generated.

- WCSF EP2016-0128 Waste Stream #3: Drill cuttings—This waste stream consisted of sediment, soil, and rock removed during mechanical auger drilling. Approximately 4 yd3 of drill cuttings was generated during this investigation and stored in 55-gal. drums.
- WCSF EP2016-0128 Waste Stream #4/WCSF EM2018-0021 Waste Stream # 3: Environmental Media—This waste stream consists of contaminated soil, sediment, and tuff excavated to remove media that exceeds polychlorinated biphenyl cleanup levels. Approximately 279 yd3 of this waste was generated. This waste stream also includes media from surface and subsurface sampling.
- WCSF EM2018-0021 Waste Stream #4: Excavated Debris—This waste stream consists of residual manmade debris encountered during soil excavation. Debris encountered during the soil excavation includes asbestos-wrapped pipe. Approximately 1 yd^3 of this waste was generated.

Table C-2.0-1
Summary of IDW Generation and Management

WCSF EP2016-0128 Waste Stream #	WCSF EM2018-0021 Waste Stream #	Waste Stream	Waste Type	Volume	Characterization Method	On-Site Management	Disposition
1	1	Contact waste	LLW[a] TSCA[b]	<1 yd3	AK and analytical results of site characterization	Plastic bags, 5.18 yd^3 IP-1 hard-side bags	Energy Solutions, Clive UT
2	2	Municipal solid waste	n/a[c]	0	n/a	n/a	n/a
3	n/a	Drill cuttings	Industrial	4 yd^3	Direct sampling	55-gal. drum	Waste Control Specialists, Andrews TX
4	3	Environmental media	LLW TSCA	280 yd^3	AK and analytical results of site characterization	5.18 yd^3 IP-1 hard side bags	Energy Solutions, Clive UT
n/a	4	Excavated debris	LLW TSCA	1 yd^3	AK and analytical results of site characterization	5.18 yd^3 IP-1 hard-side bags	Energy Solutions, Clive UT
5	5	Petroleum-contaminated soils	n/a	0	n/a	n/a	n/a
6	6	Decontamination fluids	n/a	0	n/a	n/a	n/a

[a] LLW = Low-level waste.

[b] TSCA = Toxic Substances Control Act.

[c] n/a = Not applicable.

Attachment C-1

Waste Characterization Strategy Forms
(on CD included with this document)

Appendix D

Analytical Program

D-1.0 INTRODUCTION

This appendix discusses the analytical methods and data-quality review for samples collected during investigations at Solid Waste Management Unit (SWMU) 02-014 within the Middle Los Alamos Canyon Aggregate Area at Los Alamos National Laboratory (LANL or the Laboratory). All decision-level data presented in the investigation report addendum are evaluated, including data from samples collected in 2007, 2010, 2017, and 2018. Additionally, this appendix gives a summary of the effects of data-quality issues on the acceptability of the analytical data.

The results of the quality assurance/quality control (QA/QC) procedures were used to estimate the accuracy, bias, and precision of the analytical measurements. Samples for QC include method blanks, matrix spikes (MSs), laboratory control samples (LCSs), internal standards, initial calibration verifications (ICVs) and continuing calibration verifications (CCVs), surrogates, and tracers.

The type and frequency of laboratory QC analyses are described in the statements of work for analytical laboratories. Other QC factors, such as sample preservation and holding times, were also assessed in accordance with the requirements outlined in Standard Operating Procedure (SOP) 5056, “Sample Containers and Preservation.”

The following SOPs were used for data validation:

- SOP-5161, “Routine Validation of Volatile Organic Compound (VOC) Analytical Data”
- SOP-5162, “Routine Validation of Semivolatile Organic Compound (SVOC) Analytical Data”
- SOP-5163, “Routine Validation of Organochlorine Pesticide (PEST) and Polychlorinated Biphenyl (PCB) Analytical Data”
- SOP-5165, “Routine Validation of Metals Analytical Data”
- SOP-5166, “Routine Validation of Gamma Spectroscopy, Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Analytical Data”
- SOP-5169, “Routine Validation of Dioxin Furan Analytical Data (EPA Method 1618 and SW-846 EPA Method 8290)”
- SOP-5191, “Routine Validation of LC/MS/MS Perchlorate Analytical Data” (SW-846 EPA Method 6850)

Routine data validation was performed for each data package (referred to by a request number), and analytical data were reviewed and evaluated based on U.S. Environmental Protection Agency (EPA) National Functional Guidelines, where applicable (EPA 1994, 048639; EPA 1999, 066649). As a result of the data validation and assessment efforts, qualifiers are assigned to the analytical records as appropriate. The data qualifier definitions are provided in Appendix A. Sample collection logs (SCLs) and chain of custody forms (COCs) are provided in Appendix E (on CD included with this document). The analytical data, instrument printouts, and data validation reports are provided in Appendix E.

D-2.0 ANALYTICAL DATA ORGANIZATION

Historical data evaluated in this report were collected during Resource Conservation and Recovery Act facility investigations, other corrective actions, and other investigations. All historical investigation samples were submitted to and analyzed by approved off-site laboratories. These data are determined to be of sufficient quality for decision-making purposes and have been reviewed and revalidated to current QA standards.

D-3.0 INORGANIC CHEMICAL ANALYSES

Seven samples collected at SWMU 02-014 were analyzed for inorganic chemicals. Seven samples were analyzed for target analyte list (TAL) metals; three samples were analyzed for nitrate; three samples were analyzed for perchlorate; and three samples were analyzed for total cyanide. The analytical methods used for inorganic chemicals are listed in Table D-1.0-1.

Tables in the addendum to the investigation report summarize all samples collected and the analyses requested for the investigation of SWMU 02-014. All analyses conducted during the investigation are presented in Appendix E (on CD included with this document).

D-3.1 Inorganic Chemical QA/QC Samples

QA/QC samples are used to produce measures of the reliability of the data. The results of the QA/QC analyses performed on a sample provide confidence about whether the analyte is present and whether the concentration reported is accurate. To assess the accuracy and precision of inorganic chemical analyses, this investigation included analyses of LCSs, preparation blanks, MSs, laboratory duplicate samples, interference check samples (ICSs), and serial dilution samples. Each of these QA/QC sample types is described briefly in the paragraphs below.

The LCS serves as a monitor of the overall performance of each step during the analysis, including sample digestion. For inorganic chemicals in soil or tuff, LCS percent recoveries (%R) should fall within the control limits of 75% to 125% (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962).

The preparation blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing; it is extracted and analyzed in the same manner as the corresponding environmental samples. Preparation blanks are used to measure bias and potential cross-contamination. All inorganic chemical results should be below the method detection limit (MDL).

MS samples assess the accuracy of inorganic chemical analyses. These samples are designed to provide information about the effect of the sample matrix on the sample preparation procedures and analytical technique. The MS acceptance criterion is 75% to 125% recovery, inclusive, for all spiked analytes (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962).

Laboratory duplicate samples assess the precision of inorganic chemical analyses. All relative percent differences (RPDs) between the sample and laboratory duplicate should be ±35% for soil (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962).

The ICSs assess the accuracy of the analytical laboratory's interelement and background correction factors used for inductively coupled plasma emission spectroscopy. The ICS %R should be within the acceptance range of 80% to 120%. The QC acceptance limits are ±20%.

Serial dilution samples measure potential physical or chemical interferences and correspond to a sample dilution ratio of 1:5. The chemical concentration in the undiluted sample must be at least 50 times the MDL (100 times for inductively coupled plasma mass spectroscopy) for valid comparison. For sufficiently high concentrations, the RPD should be within 10%.

D-3.2 Data-Quality Results for Inorganic Chemicals

The majority of the analytical results for inorganic chemicals were either not assigned a qualifier or qualified as not detected (U) because the analytes were not detected by the respective analytical methods. These data do not have any quality issues associated with the values presented.

D-3.2.1 Maintenance of COC

SCL/COC forms were maintained properly for all samples analyzed for inorganic chemicals (see Appendix E, on CD included with this document).

D-3.2.2 Sample Documentation

All samples analyzed for inorganic chemicals were properly documented on SCL/COC forms in the field (see Appendix E, on CD included with this document).

D-3.2.3 Sample Dilutions

Some samples were diluted for inorganic chemical analyses. No qualifiers were applied to any inorganic chemical sample results because of dilutions.

D-3.2.4 Sample Preservation

Preservation criteria were met for all samples analyzed for inorganic chemicals.

D-3.2.5 Holding Times

Holding-time criteria were met for all samples analyzed for inorganic chemicals.

D-3.2.6 ICVs and CCVs

ICV and CCV criteria were met for all samples analyzed for inorganic chemicals.

D-3.2.7 Interference Check Sample and/or Serial Dilutions

One vanadium result was qualified as estimated (J) because the serial dilution sample RPD exceeded criteria.

D-3.2.8 Laboratory Duplicate Samples

One barium result was qualified as estimated (J) because the duplicate result exceeded the RPD requirements.

One nickel result was qualified as estimated (J) because a duplicate sample was not prepared and/or analyzed with the samples for unspecified reasons.

D-3.2.9 Blanks

A total of 21 TAL metals results were qualified as not detected (U) because the sample result was less than 5 times the concentration of the related analyte in the method blank.

D-3.2.10 MS Samples

Six TAL metals results were qualified as estimated and biased high (J+) because the spike percent recovery value is less than 30%.

One calcium result and two nitrate results were qualified as estimated and biased low (J-) because the MS %R value was less than the lower acceptance limit (LAL) but greater than 30%.

Three antimony results were qualified as estimated not detected (UJ) because the MS %R value was less than the LAL but greater than 30%.

One aluminum result was qualified as estimated and biased high (J+) because of MS recovery problems.

D-3.2.11 LCS Recoveries

No inorganic chemical results were qualified because of LCS recovery.

D-3.2.12 Detection Limits

A total of 28 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the instrument detection limit and the estimated detection limit.

D-3.2.13 Rejected Results

No inorganic chemical results were qualified as rejected (R).

D-4.0 ORGANIC CHEMICAL ANALYSES

A total of 266 samples (plus 28 field duplicates) collected at SWMU 02-014 were analyzed for organic chemicals. A total of 266 samples (plus 28 field duplicates) were analyzed for polychlorinated biphenyls (PCBs), 2 samples were analyzed for volatile organic compounds (VOCs); 3 samples were analyzed for semivolatile organic compounds (SVOCs); and 3 samples were analyzed for dioxins and furans. The analytical methods used for organic chemicals are listed in Table D-1.0-1.

Tables within the addendum to the investigation report summarize all samples collected at SWMU 02-014 and the analyses requested. All organic chemical results are provided on CD in Appendix E.

D-4.1 Organic Chemical QA/QC Samples

QA/QC samples are used to produce measures of the reliability of the data. The results of the QA/QC analyses performed on a sample provide confidence about whether the analyte is present and whether the concentration reported is accurate. To assess the accuracy and precision of organic chemical analyses, this investigation included calibration verifications and the analysis of LCSs, method blanks, MSs, surrogates, and internal standards (ISs). Each of these QA/QC sample types is described briefly in the paragraphs below.

Calibration verification is the establishment of a quantitative relationship between the response of the analytical procedure and the concentration of the target analyte. There are two aspects of calibration verification: initial and continuing. The initial calibration verifies the accuracy of the calibration curve as well as the individual calibration standards used to perform the calibration. The continuing calibration ensures that the initial calibration is still holding and correct as the instrument is used to process samples.

The continuing calibration also serves to determine that analyte identification criteria such as retention times and spectral matching are being met.

The LCS is a sample of a known matrix that has been spiked with compounds that are representative of the target analytes, and it serves as a monitor of overall performance on a “controlled” sample. The LCS is the primary demonstration, on a daily basis, of the ability to analyze samples with good qualitative and quantitative accuracy. The LCS recoveries should within the method-specific acceptance criteria.

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing; it is extracted and analyzed in the same manner as the corresponding environmental samples. Method blanks are used to assess the potential for sample contamination during extraction and analysis. All target analytes should be below the contract-required detection limit in the method blank.

MS samples are used to measure the ability to recover prescribed analytes from a native sample matrix and consist of aliquots of the submitted samples spiked with a known concentration of the target analyte(s). Spiking typically occurs before sample preparation and analysis. The spike sample recoveries should be between the LAL and the upper acceptance limit (UAL).

A surrogate compound (surrogate) is an organic compound used in the analyses of target analytes that is similar in composition and behavior to the target analytes but not normally found in environmental samples. Surrogates are added to every blank, sample, and spike to evaluate the efficiency with which analytes are recovered during extraction and analysis. The recovery percentage of the surrogates must be within specified ranges or the sample may be rejected or assigned a qualifier.

ISs are chemical compounds added to every blank, sample, and standard extract at a known concentration. They are used to compensate for (1) analyte concentration changes that might occur during storage of the extract, and (2) quantitation variations that can occur during analysis. ISs are used as the basis for quantitation of target analytes. The %R for ISs should be within the range of 50% to 200%.

D-4.2 Data-Quality Results for Organic Chemicals

The majority of the analytical results for organic chemicals were either not assigned a qualifier or qualified as not detected (U) because the analytes were not detected by the respective analytical methods. These data do not have any quality issues associated with the values presented.

One dioxin/furan result was qualified as estimated (J) because the analytical laboratory qualified the detected result as estimated.

D-4.2.1 Maintenance of COC

SCL/COC forms were maintained properly for all samples analyzed for organic chemicals (see Appendix E, on CD included with this document).

D-4.2.2 Sample Documentation

All samples analyzed for organic chemicals were properly documented on the SCL in the field (see Appendix E, on CD included with this document).

D-4.2.3 Sample Dilutions

Some samples were diluted for organic chemical analyses. No qualifiers were applied to any organic chemical sample results because of dilutions.

D-4.2.4 Sample Preservation

Preservation criteria were met for all samples analyzed for organic chemicals.

D-4.2.5 Holding Times

Holding-time criteria were met for all samples analyzed for organic chemicals.

D-4.2.6 ICVs and CCVs

Ten SVOC and eight VOC results were qualified as estimated not detected (UJ) because the initial calibration curve exceeded the percent relative standard deviation (%RSD) criteria and/or the associated multipoint calibration correlation coefficient was less than 0.995.

D-4.2.7 Surrogate Recoveries

No organic chemical results were qualified because of surrogate recovery.

D-4.2.8 IS Responses

No organic chemical results were qualified because of IS response.

D-4.2.9 Blanks

Three PCB results and two dioxin/furan results were qualified as estimated (J) because the sample concentration was greater than 5 times the amount in the method blank.

D-4.2.10 MS Samples

No organic chemical results were qualified because of MS analyses.

D-4.2.11 Laboratory Duplicate Samples

Laboratory duplicates collected for organic chemical analyses indicated acceptable precision for all samples.

D-4.2.12 LCS Recoveries

Three SVOC results were qualified as estimated not detected (UJ) because the LCS documentation is missing.

E-4.2.13 Rejected Data

No organic chemical results were qualified as rejected (R).

D-5.0 RADIONUCLIDE ANALYSES

Seven samples collected at SWMU 02-014 were analyzed for radionuclides. Three samples were analyzed for americium-241, seven samples were analyzed for gamma-emitting radionuclides, seven samples were analyzed for isotopic plutonium, seven samples were analyzed for isotopic uranium, three samples were analyzed for tritium, and seven samples were analyzed for strontium-90. The analytical methods used for radionuclides are listed in Table D-1.0-1.

Tables in the addendum to the investigation report summarize all samples collected at SWMU 02-014 and the analyses requested. All radionuclide results are provided on CD (Appendix E).

D-5.1 Radionuclide QA/QC Samples

To assess the accuracy and precision of radionuclide analyses, this investigation included analyses of LCSs, method blanks, MS samples, laboratory duplicate samples, and tracers. Each of these QA/QC sample types is described briefly in the paragraphs below.

The LCS serves as a monitor of the overall performance of each step during the analysis, including sample digestion. For radionuclides in soil or tuff, LCS %R should fall between the control limits of 80% and 120%.

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing; it is analyzed in the same manner as the corresponding environmental samples. Method blanks are used to assess the potential for sample contamination during analysis. All radionuclide results should be below the minimum detectable concentration (MDC).

MS samples assess the accuracy of radionuclide analyses. These samples are designed to provide information about the effect of the sample matrix on the sample preparation procedures and analytical technique. The MS acceptance criterion is 75% to 125% recovery.

Tracers are radioisotopes added to a sample for the purposes of monitoring losses of the target analytes. The tracer is assumed to behave in the same manner as the target analyte. The tracer recoveries should fall between the LAL and UAL.

Laboratory duplicate samples assess the precision of radionuclide analyses. All RPDs between the sample and laboratory duplicate should be ±35% for soil (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962).

D-5.2 Data-Quality Results for Radionuclides

Approximately one-third (22) of the analytical results for radionuclides were not assigned a qualifier. These data do not have any quality issues associated with the values presented.

The majority of results (51) were qualified as not detected (U) because the associated sample activity was less than or equal to the minimum detectable activity.

D-5.2.1 Maintenance of COC

SCL/COC forms were maintained properly for all samples (see Appendix E, on CD included with this document).

D-5.2.2 Sample Documentation

All samples were properly documented on the SCL/COC forms in the field (see Appendix E, on CD included with this document).

D-5.2.3 Sample Dilutions

Some samples were diluted for radionuclide analyses. No qualifiers were applied to any radionuclide sample results because of dilutions.

D-5.2.4 Sample Preservation

Preservation criteria were met for all samples analyzed for radionuclides.

D-5.2.5 Holding Times

Holding-time criteria were met for all samples analyzed for radionuclides.

D-5.2.6 Method Blanks

No radionuclide results were qualified because of method blank analyses.

D-5.2.7 MS Samples

No radionuclide results were qualified because of MS recovery.

D-5.2.8 Tracer Recoveries

No radionuclide results were qualified because of tracer recovery.

D-5.2.9 LCS Recoveries

No radionuclide results were qualified because of LCS recovery.

D-5.2.10 Laboratory Duplicate Sample Recoveries

No radionuclide results were qualified because of laboratory duplicate sample recovery.

D-5.2.11 Rejected Data

Two cesium-134 results and one cesium-137 result were qualified as rejected (R) because the minimum detectable activity and/or total propagated uncertainty documentation was missing.

D-6.0 REFERENCES

The following reference list includes documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned

by Newport News Nuclear BWXT-Los Alamos, LLC (N3B) (IDs 700000 and above). IDs are used to locate documents in N3B's Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

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LANL (Los Alamos National Laboratory), June 30, 2008. "Exhibit 'D' Scope of Work and Technical Specifications, Analytical Laboratory Services for General Inorganic, Organic, Radiochemical, Asbestos, Low-Level Tritium, Particle Analysis, Bioassay, Dissolved Organic Carbon Fractionation, and PCB Congeners," Los Alamos National Laboratory document RFP No. 63639-RFP-08, Los Alamos, New Mexico. (LANL 2008, 109962)

Table D-1.0-1
Inorganic Chemical, Organic Chemical, and
Radionuclide Analytical Methods for Samples Collected at SWMU 02-014

Analytical Method	Analytical Description	Analytical Suite
Inorganic Chemicals		
EPA 300.0	Ion chromatography	Anions (nitrate)
EPA SW-846: 6010/6010B	Inductively coupled plasma emission spectroscopy—atomic emission spectroscopy	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, uranium, vanadium, and zinc (TAL metals)
EPA SW-846:6020	Inductively coupled plasma mass spectrometry	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc (TAL metals)
EPA SW-846:9012A	Automated colorimetric/off-line distillation	Total cyanide
EPA SW-846:6850	Liquid chromatography–mass spectrometry/mass spectrometry	Perchlorate
EPA SW-846:7471A	Cold vapor atomic absorption	Mercury
Organic Chemicals		
EPA SW-846: 8082	Gas chromatography	PCBs
EPA SW-846:8260 EPA SW-846:8260B	Gas chromatography–mass spectrometry	VOCs
EPA SW-846:8270C	Gas chromatography–mass spectrometry	SVOCs
EPA SW-846:8290	High-resolution gas chromatography/high-resolution mass spectrometry	Dioxins/furans
Radionuclides		
EPA 901.1	Gamma spectroscopy	Cesium-134, cesium-137, cobalt-60, sodium-22
HASL Method 300:AM-241 HASL Method 300:ISOPU HASL Method 300:ISOU	Chemical separation alpha spectrometry	Americium-241 Isotopic plutonium Isotopic uranium
EPA 905.0	Gas proportional counting	Strontium-90
EPA 906.0	Liquid scintillation	Tritium

Appendix E

Analytical Suites and Results and Analytical Reports
(on CD included with this document)

Appendix F

Risk Assessments

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Attachments

F-1.0 INTRODUCTION

This appendix presents the results of the human health risk-screening evaluations conducted in support of the environmental characterization of Solid Waste Management Unit (SWMU) 02-014, located in the northern portion of Los Alamos National Laboratory (LANL or the Laboratory). The evaluations of potential risk at this SWMU are based on decision-level data from the 2007, 2010, 2017, and 2018 investigations.

F-2.0 BACKGROUND

A brief description of the Middle Los Alamos Canyon Aggregate Area site assessed for potential risks and dose in this addendum is presented below.

F-2.1 Site Description and Operational History

SWMU 02-014 is located within Technical Area 02 (TA-02) at the Laboratory. TA-02 was used to house a series of research reactors from 1943 to 2003 when decontamination and decommissioning (D&D) of the site occurred. The main reactor building (02-1) was constructed in 1943. It housed five separate nuclear reactors: three iterations of water boiler reactors located on the east side of the building, one plutonium-fueled reactor (the Clementine Reactor), and the Omega West Reactor (OWR). A number of facilities were constructed over the years to support the TA-02 research activities. TA-02 was active from 1943 to 1993 (WD-3 2003, 082646, pp. 1–2). Various remedial actions, such as soil removal and D&D, were conducted in the bottom of Los Alamos Canyon, including at TA-02, after the Cerro Grande fire. These actions were taken to reduce the risk of contaminants dispersing from post-fire floods. Approximately 54 yd^3 of soil contaminated with cesium-137 was removed in 2000, following an extensive field survey for gross-gamma radiation (LANL 2001, 070352). The OWR and associated structures underwent D&D in 2002 and 2003 (WD-3 2003, 082646). After all structures at TA-02 were removed, field radiological surveys were conducted to confirm that surface contamination release limits were not exceeded (WD-3 2003, 082646, pp. 18–19). The land was returned to its original contour and reseeded (WD-3 2003, 082646, pp. 1–2). The road accessing the reactor site is controlled by the Laboratory via a locked gate.

F-2.1.1 SWMU 02-014

SWMU 02-014 consists of three former electrical transformer stations (structures 02-31, 02-45, and 02-51) that served buildings in TA-02. This site was not identified as a SWMU or AOC in the 1990 SWMU report. (LANL 1990, 007511). This site was identified during efforts to discover the source of polychlorinated biphenyl (PCB) contamination identified during investigation sampling at storm drain area of concern (AOC) 02-011(a)(ii). Historical records, including engineering drawings and photographs, were reviewed and three potential sources of PCBs were identified. Former structure 02-31 was an electrical transformer station located 40 ft behind building 02-1. The transformer station was built in 1944 and was removed in 1950. Former structure 02-45 was built in 1954 to serve building 02-44. The transformer structure consisted of three transformers mounted across two telephone poles approximately 14 ft above the ground. The transformer station was replaced with another transformer station (structure 02-51). Former structure 02-51 was an electrical transformer station located approximately 20 ft southwest of former structure 02-31 and 20 ft southeast of former structure 02-45. Historical records indicated PCB-containing transformer oil had been used at this former transformer station. Structure 02-51 was constructed in 1961 and demolished in 2003. Soil at SWMU 02-014 was remediated in 2018.

F-2.2 Investigation Sampling

The final data set used to identify chemicals of potential concern (COPCs) for SWMU 02-014 and used in this appendix to evaluate the potential risks to human health and the environment are the qualified analytical results from the 2007–2018 investigations. Only those data determined to be of decision-level quality following the data-quality assessment (Appendix D) are included in the final data set evaluated in this appendix.

F-2.3 Determination of COPCs

Section 5.0 of the Phase II investigation report (Phase II IR) (N3B 2018, 700091) summarizes the COPC selection process. Only COPCs detected above background (inorganic chemicals and naturally occurring radionuclides); with detection limits greater than background values (BVs) (inorganic chemicals); and detected organic chemicals, inorganic chemicals with no BVs, and fallout radionuclides were retained. The industrial scenario and the recreational scenario used data for samples collected from 0.0 to 1.0 ft below ground surface (bgs). The residential scenario used data for samples collected from 0.0 to 10.0 ft bgs. However, sampling depths often overlapped because of multiple investigations; therefore, samples with a starting depth less than the lower bound of the interval were included in the risk-screening assessments for a given scenario as appropriate.

Tables F-2.3-1 and F-2.3-2 summarize the COPCs evaluated for potential risk at SWMU 02-014. Some of the COPCs identified in this addendum may not be evaluated for potential risk under one or more scenarios because they were not detected within the specified depth intervals associated with a given scenario.

F-3.0 CONCEPTUAL SITE MODEL

The primary mechanisms of release related to historical contaminant sources are described in detail in the approved investigation work plan for the Middle Los Alamos Canyon Aggregate Area (LANL 2006, 092571.12; NMED 2006, 095416). Releases from the sites at TA-02 may have occurred as a result of air emissions, surface releases, subsurface leaks, or effluent discharges. Previous sampling results indicated contamination from inorganic chemicals, organic chemicals, and radionuclides (LANL 2008, 101669.12).

F-3.1 Receptors and Exposure Pathways

The primary exposure pathway for human receptors is surface soil and subsurface soil/tuff that may be brought to the surface through intrusive activities. Migration of contamination to groundwater through the vadose zone is unlikely given the depth to regional groundwater (more than 500 ft bgs). Human receptors may be exposed through direct contact with soil or suspended particulates by ingestion, inhalation, dermal contact, and external irradiation pathways. Direct contact exposure pathways from subsurface contamination to human receptors are complete for the resident. The exposure pathways are the same as those for surface soil. Sources, exposure pathways, and receptors are shown in the conceptual site model (Figure F-3.1-1).

New Mexico Environment Department (NMED) guidance (NMED 2017, 602273) requires that sites larger than 2 acres be evaluated to determine if beef ingestion is a plausible and complete exposure pathway. SWMU 02-014 is smaller than 2 acres. In addition, grazing is not allowed on Laboratory property. Therefore, further evaluation of the beef ingestion pathway is not necessary.

The Middle Los Alamos Canyon Aggregate Area is primarily a former industrial area, and all sites are on Laboratory property. None of the sites are active and therefore they currently provide habitat for ecological receptors. Weathering of tuff is the only viable natural process that may result in the exposure of receptors to COPCs in tuff. However, because of the slow rate of weathering expected for tuff, exposure to COPCs in tuff is negligible, although it is included in the assessments. Exposure pathways to subsurface contamination below 10.0 ft (human health) are not complete and would be complete only if contaminated soil or tuff were excavated and brought to the surface.

F-3.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes affecting the persistence of chemicals in the environment, and the evaluation of transport addresses the physical processes affecting mobility along a migration pathway. Migration into soil and tuff depends on precipitation or snowmelt, soil moisture content, depth of soil, soil hydraulic properties, and properties of the COPCs. Migration into and through tuff also depends on the unsaturated flow properties of the tuff and the presence of joints and fractures.

The most important factor with respect to the potential for COPCs to migrate to groundwater is the presence of saturated conditions. Downward migration in the vadose zone is also limited by a lack of hydrostatic pressure as well as the lack of a source for the continued release of contamination. Without sufficient moisture and a source, there is little or no potential for migration of materials through the vadose zone to groundwater.

Contamination at depth is addressed in the discussion of nature and extent in the Phase II IR (N3B 2018, 700091). Results from the deepest samples collected at most sites showed either no detected concentrations of COPCs or low- to trace-level concentrations of only a few inorganic, radionuclide, and/or organic COPCs in tuff. The limited extent of contamination is related to the absence of the key factors that facilitate migration, as discussed above. Given how long the contamination has been present in the subsurface, the physical and chemical properties of the COPCs, and the lack of saturated conditions, the potential for contaminant migration to groundwater is very low.

NMED guidance (NMED 2017, 602273) contains screening levels that consider the potential for contaminants in soil to result in groundwater contamination. These screening levels consider equilibrium partitioning of contaminants among solid, aqueous, and vapor phases and account for dilution and attenuation in groundwater through the use of dilution attenuation factors (DAFs). These DAF soil screening levels (SSLs) may be used to identify chemical concentrations in soil that have the potential to contaminate groundwater (EPA 1996, 059902). Screening contaminant concentrations in soil against these DAF SSLs does not, however, provide an indication of the potential for contaminants to migrate to groundwater. The assumptions used in the development of these DAF SSLs include an assumption of uniform contaminant concentrations from the contaminant source to the water table (i.e., migration to groundwater is assumed to have already occurred). Furthermore, this assumption is inappropriate for cases such as SWMU 02-014, where sampling has shown that contamination is vertically bounded near the surface and the distance from the surface to the water table is large. For these reasons, screening of contaminant concentrations in soil against the DAF SSLs was not performed.

The relevant release and transport processes of the COPCs are a function of chemical-specific properties that include the relationship between the physical form of the constituents and the nature of the constituent transport processes in the environment. Specific properties include the degree of saturation and the potential for ion exchange (barium and other inorganic chemicals) or sorption and the potential for natural bioremediation. The transport of volatile organic compounds (VOCs) occurs primarily in the vapor phase by diffusion or advection in subsurface air.

Current potential transport mechanisms that may lead to exposure include

- dissolution and/or particulate transport of surface contaminants during precipitation and runoff events,
- airborne transport of contaminated surface soil,
- continued dissolution and advective/dispersive transport of chemical contaminants contained in subsurface soil and tuff as a result of past operations,
- disturbance of contaminants in shallow soil and subsurface tuff by Laboratory operations, and
- disturbance and uptake of contaminants in shallow soil by plants and animals.

Contaminant distributions indicate that after the initial deposition of contaminants from operational activities and historical remediation efforts, elevated levels of COPCs tend to remain concentrated in the vicinity of the original release points. The primary potential release and transport mechanisms identified for the site in the Middle Los Alamos Canyon Aggregate Area addendum include direct discharge; precipitation, sorption, and mechanical transport; dissolution and advective transport in water; and volatilization, diffusion, and dispersion. Less significant transport mechanisms include wind entrainment and, given the asphalt pavement covering most sites, dispersal of surface soil and uptake of contaminants from soil and water by biota.

Gas or vapor-phase contaminants such as VOCs are likely to volatilize to the atmosphere from near-surface soil and sediment and/or migrate by diffusion through air-filled pores in the vadose zone. Migration of vapor-phase contaminants from tuff into ambient air may occur by diffusion or advection driven by barometric pressure changes.

F-3.2.1 Inorganic Chemicals

In general, and particularly in a semiarid climate, inorganic chemicals are not highly soluble or mobile in the environment, although there are exceptions. The physical and chemical factors that determine the distribution of inorganic COPCs within the soil and tuff at SWMU 02-014 include the soil-water partition coefficient (K_d) of the inorganic chemicals, the pH of the soil, soil characteristics (such as sand or clay content), and the redox potential (Eh). The interaction of these factors is complex, but the K_d values provide a general assessment of the potential for migration through the subsurface; chemicals with higher K_d values are less likely to be mobile than those with lower ones. Chemicals with K_d values greater than 40 are very unlikely to migrate through soil towards the water table (Kincaid et al. 1998, 093270). Table F-3.2-1 presents the K_d values and water solubility for the inorganic COPCs at SWMU 02-014. Based on this criterion, the following COPCs have a low potential to mobilize and migrate through soil and the vadose zone: aluminum, barium, chromium, nickel, vanadium, and zinc. The K_d values for arsenic, iron, and selenium are less than 40 and may indicate a greater potential to mobilize and migrate through soil and the vadose zone beneath the sites. A K_d is not available for perchlorate.

It is important to note that other factors besides the K_d values (e.g., speciation in soil, oxidation-reduction potential, pH, and soil mineralogy) also play significant roles in the likelihood that inorganic chemicals will migrate. The COPCs with K_d values less than 40 are discussed further below. Information about the fate and transport properties of inorganic chemicals was obtained from individual chemical profiles published by the Agency for Toxic Substances and Disease Registry (ATSDR) (ATSDR 1997, 056531, and http://www.atsdr.cdc.gov/toxpro2).

Arsenic may undergo a variety of reactions, including oxidation-reduction reactions, ligand exchange, precipitation, and biotransformation. Arsenic forms insoluble complexes with iron, aluminum, and

magnesium oxides found in soil and in this form, arsenic is relatively immobile. However, under low pH and reducing conditions, arsenic can become soluble and may potentially leach into groundwater or result in runoff of arsenic into surface waters. Arsenic is expected to have low mobility under the environmental conditions (neutral to alkaline soil pH and oxidizing near-surface conditions) present in the Middle Los Alamos Canyon Aggregate Area.

Iron is naturally occurring in soil and tuff and may be relatively mobile under reducing conditions. Iron is sensitive to soil pH conditions, occurring in two oxidation states, iron(III), the insoluble oxidized form, and iron(II), the reduced soluble form. Most iron in well-drained neutral-to-alkaline soil is present as precipitates of iron(III) hydroxides and oxides. With time, these precipitates are mineralized and form various iron minerals, such as lepidcrocite, hematite, and goethite. Iron is not expected to be mobile in the neutral to slightly alkaline, well-drained soil at the Middle Los Alamos Canyon Aggregate Area.

Perchlorate is somewhat soluble in water and may migrate with water molecules in saturated soil. As noted above, the subsurface material beneath the sites has low moisture content, which inhibits the mobility of perchlorate as well as most other inorganic chemicals.

Selenium is not often found in the environment in its elemental form but is usually combined with sulfide minerals or with silver, copper, lead, and nickel minerals. In soil, pH and Eh are determining factors in the transport and partitioning of selenium. In soil with a pH of greater than 7.5, selenates, which have high solubility and a low tendency to adsorb onto soil particles, are the major selenium species and are very mobile. The soil pH at most sites in the Middle Los Alamos Canyon Aggregate Area is neutral to slightly alkaline, indicating that selenium is not likely to migrate.

F-3.2.2 Organic Chemicals

Table F-3.2-2 presents the physical and chemical properties (organic carbon-water partition coefficient [K_{oc}], logarithm to the base 10 octanol/water partition coefficient [log K_{ow}], solubility, and vapor pressure) of the organic COPCs identified at SWMU 02-014. The physical and chemical properties of organic chemicals are important when evaluating their fate and transport. The following physiochemical property information illustrates some aspects of the fate and transport of COPCs at SWMU 02-014. The information is summarized from Ney (1995, 058210).

Water solubility may be the most important chemical characteristic used to assess mobility of organic chemicals. The higher the water solubility of a chemical, the more likely it is to be mobile and the less likely it is to accumulate, bioaccumulate, volatilize, or persist in the environment. A highly soluble chemical (water solubility greater than 1000 mg/L) is prone to biodegradation and metabolism that may detoxify the parent chemical. No chemicals detected at SWMU 02-014 in the Middle Los Alamos Canyon Aggregate Area have water solubilities greater than 1000 mg/L.

The lower the water solubility of a chemical, especially below 10 mg/L, the more likely it will be immobilized by adsorption. Chemicals with lower water solubilities are more likely to accumulate or bioaccumulate and persist in the environment, are slightly prone to biodegradation, and are metabolized in plants and animals. The chemicals identified as having water solubilities less than 10 mg/L are the polycyclic aromatic hydrocarbons (PAHs), PCBs, and 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD).

Vapor pressure is a characteristic used to evaluate the tendency of organic chemicals to volatize. Chemicals with vapor pressure greater than 0.01 millimeters of mercury (mmHg) are likely to volatilize and, therefore, concentrations at the site are reduced over time; vapors of these chemicals are more likely to travel toward the atmosphere and not migrate towards groundwater. Toluene has vapor pressure greater than 0.01 mmHg.

Chemicals with vapor pressures less than 0.000001 mmHg are less likely to volatilize and, therefore, tend to remain immobile. Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and 2,3,7,8-TCDD have vapor pressures less than 0.000001 mmHg.

The K_{ow} is an indicator of a chemical's potential to bioaccumulate or bioconcentrate in the fatty tissues of living organisms. The unitless K_{ow} value is an indicator of water solubility, mobility, sorption, and bioaccumulation. The higher the K_{ow} above 1000, the greater the affinity the chemical has for bioaccumulation/bioconcentration in the food chain, the greater the potential for sorption in the soil, and the lower the mobility (Ney 1995, 058210).

No COPCs have a K_{ow} greater than 1000. A K_{ow} of less than 500 indicates high water solubility; mobility; little to no affinity for bioaccumulation; and degradability by microbes, plants, and animals. PAHs; PCBs; 2,3,7,8-TCDD; and toluene have a K_{ow} much less than 500.

The K_{oc} measures the tendency of a chemical to adsorb to organic carbon in soil. K_{oc} values above 500 L/kg indicate a strong tendency to adsorb to soil, leading to low mobility (NMED 2017, 602273). Most organic chemicals detected have K_{oc} values above 500 L/kg, indicating a very low potential to migrate toward groundwater. The only organic chemical with a K_{oc} value less than 500 L/kg is toluene.

The PAHs; PCBs; and 2,3,7,8-TCDD are the least mobile and the most likely to bioaccumulate. Toluene is more soluble and volatile and is more likely to travel toward the atmosphere and not migrate toward groundwater. Because the organic chemicals detected were at low concentrations and extent is defined, they are not likely to migrate to groundwater.

F-3.2.3 Radionuclides

No radionuclides were identified as COPCs at SWMU 02-014.

F-3.3 Exposure Point Concentration Calculations

The exposure point concentrations (EPCs) represent upper-bound concentrations of COPCs. For comparison with risk-screening levels, the upper confidence limit (UCL) of the arithmetic mean was calculated when possible and used as the EPC. The UCLs were calculated using all available decision-level data within the depth range of interest. If an appropriate UCL of the mean could not be calculated, the maximum detected concentration of the COPC was used as the EPC. The summary statistics, including the EPC for each COPC for the human health risk-screening assessments and the distribution used for the calculation, are presented in Tables F-2.3-1 and F-2.3-2.

The EPCs for the dioxin and furan congeners are the sums of the detected congeners weighted by the toxic equivalency factors (TEFs) (NMED 2017, 602273); the sum is expressed as the 2,3,7,8-TCDD- equivalent concentration. The toxic equivalency factors used are presented in Table F-3.3-1. The results of the TEF calculations for each site where dioxins/furans are COPCs are presented in Attachment F-1 and the 2,3,7,8-TCDD-equivalent concentrations (95% UCLs or maximum concentrations) are presented in the section F-4.2 tables.

The UCLs of the mean concentrations were calculated using the U.S. Environmental Protection Agency (EPA) ProUCL 5.1.002 software (EPA 2015, 601725), which is based on EPA guidance (EPA 2002, 085640). Consistent with the ProUCL v5.1 Technical Guide, a minimum of eight samples and five detections are needed to calculate UCLs (EPA 2015, 601724). The ProUCL program calculates 95%, 97.5%, and 99% UCLs and recommends a distribution and UCL. The 95% UCL for the recommended

calculation method was used as the EPC. The ProUCL software performs distributional tests on the data set for each COPC and calculates the most appropriate UCL based on the distribution of the data set. Environmental data may have a normal, lognormal, or gamma distribution but are often nonparametric (no definable shape to the distribution). The ProUCL documentation strongly recommends against using the maximum detected concentration for the EPC. The maximum detected concentration was used to represent the EPC for COPCs only when there were too few detections to calculate a UCL. Input and output data files for ProUCL calculations are provided on CD as Attachment F-2.

F-4.0 HUMAN HEALTH RISK-SCREENING EVALUATIONS

The human health risk-screening assessment for SWMU 02-014 evaluated residential, industrial, and recreational exposure scenarios. SWMU 02-014 was screened for the residential scenario using data from 0.0 to 10.0 ft bgs and screened for industrial and recreational scenarios using data from 0.0 to 1.0 ft bgs, where available. The human health risk-screening assessments compared either the 95% UCL of the mean concentration or the maximum detected concentration of each COPC with SSLs for chemicals.

F-4.1 Human Health SSLs

Human health risk-screening assessments were conducted using SSLs for the industrial and residential scenarios obtained from NMED guidance (NMED 2017, 602273). The NMED SSLs are based on a target hazard quotient (HQ) of 1 and a target cancer risk of 1×10^{-5} (NMED 2017, 602273). Recreational SSLs were obtained from Laboratory guidance (LANL 2017, 602581) and are based on the same target risk levels as the NMED SSLs. Surrogate chemicals were also used for some COPCs without an SSL based on structural similarity or because the COPC is a breakdown product (NMED 2003, 081172). Exposure parameters used to calculate the industrial, recreational, and residential SSLs are presented in Table F-4.1-1.

F-4.2 Results of Human Health Screening Evaluation

The EPC of each COPC was compared with the SSLs for the industrial, recreational, and residential scenarios, as appropriate. For carcinogenic chemicals, the EPCs were divided by the SSL and multiplied by 1×10^{-5}. The sum of the carcinogenic risks was compared with the NMED target cancer risk level of 1×10^{-5}. For noncarcinogenic chemicals, an HQ was generated for each COPC by dividing the EPC by the SSL. The HQs were summed to generate a hazard index (HI). The HI was compared with the NMED target HI of 1. No radionuclide COPCs were identified. The results are presented in Tables F-4.2-1 to F-4.2-7 and are described below for SWMU 02-014.

Sites posing no unacceptable risk under the residential scenario may be recommended for corrective action complete if the residential scenario is also protective of construction workers. For SWMU 02-014, the following COPCs have noncarcinogenic construction worker SSLs less than residential SSLs: aluminum, barium, chromium, and nickel. The residential EPC for each of these COPCs was compared with the construction worker noncarcinogenic SSL. The ratio of the residential EPC to the construction worker SSL (i.e., the maximum HQ) was 0.3 for aluminum, 0.01 for barium, 0.03 for chromium, and 0.004 for nickel. Although all COPCs had carcinogenic construction worker SSLs greater than carcinogenic residential SSLs, SWMU 02-014 potentially posed an unacceptable carcinogenic risk for the residential scenario, so the residential scenario may not be protective of construction workers. Therefore, carcinogenic risk was evaluated for the construction worker scenario. No radionuclides were COPCs at this site.

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The results of the risk-screening assessment for the industrial scenario are presented in Tables F-4.2-1 and F-4.2-2. The total excess cancer risk for the industrial scenario is 5×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The industrial HI is 0.07, which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–1.0 ft depth interval.

The results of the risk-screening assessment for the recreational scenario are presented in Tables F-4.2-3 and F-4.2-4. The total excess cancer risk for the recreational scenario is 6×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The recreational HI is 0.2, which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–1.0 ft depth interval.

The results of the risk-screening assessment for the residential scenario are presented in Tables F-4.2-5 and F-4.2-6. The total excess cancer risk for the residential scenario is 2×10^{-5}, which is greater than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The residential HI is 0.8, which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–10.0 ft depth interval.

The residential exposure scenario is also protective of construction workers for noncarcinogenic risk. The results of the carcinogenic risk-screening assessment for the construction worker scenario are presented in Table F-4.2-7. The total excess cancer risk for the construction worker scenario is 6×10^{-7}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–10.0 ft depth interval.

F-4.3 Vapor Intrusion Pathway

NMED guidance (NMED 2017, 602273) requires an evaluation of the vapor-intrusion pathway. The vapor intrusion pathway of VOCs into a building was evaluated where appropriate. The evaluation can be qualitative for a potentially complete pathway if the following criteria are met:

- Volatile and toxic compounds are minimally detected,
- Concentrations are below NMED's vapor-intrusion screening levels for soil-gas and/or groundwater. There is no suspected source(s) for volatile and toxic compounds, and
- Concentrations are decreasing with depth (for soil).

Because only bulk soil data are available for this site, the vapor-intrusion screening levels are not applicable for the evaluation. The vapor-intrusion pathway was qualitatively evaluated as part of the residential scenario. Among the factors considered for the vapor-intrusion pathway to be relevant to human health risk is the current extent of structures and their proximity to the VOC source. One may also consider if construction of buildings is possible or proposed in the reasonably foreseeable future.

F-4.3.1 SWMU 02-014

SWMU 02-014 consists of three former electrical transformer stations (structures 02-31, 02-45, and 02-51) that served buildings in TA-02. This site was not identified as a SWMU or AOC in the 1990 SWMU report. (LANL 1990, 007511). This site was identified during efforts to discover the source of PCB contamination identified during investigation sampling at storm drain AOC 02-011(a)(ii). Historical records, including engineering drawings and photographs, were reviewed and three potential sources of PCBs were

identified. Former structure 02-31 was an electrical transformer station located 40 ft behind building 02-1. The transformer station was built in 1944 and was removed in 1950. Former structure 02-45 was built in 1954 to serve building 02-44. The transformer structure consisted of three transformers mounted across two telephone poles approximately 14 ft above the ground. The transformer station was replaced with another transformer station (structure 02-51). Former structure 02-51 was an electrical transformer station located approximately 20 ft southwest of former structure 02-31 and 20 ft southeast of former structure 02-45. Historical records indicated PCB-containing transformer oil had been used at this former transformer station. Structure 02-51 was constructed in 1961 and demolished in 2003. Soil at SWMU 02-014 was remediated in 2018.

One VOC, toluene was minimally detected at this site (one detection in two samples) with a maximum concentration of 0.000465 mg/kg that was less than the nondetected concentration (0.00107 mg/kg) in the second sample. Furthermore, the site description does not indicate that solvents were used, so no sources of VOCs are present and VOCs were only detected minimally. In addition, the structures have been removed, soil has been remediated, and the site is inactive. The vapor-intrusion pathway is therefore potentially complete based on NMED guidance (NMED 2017, 602273) and no additional evaluation is necessary.

F-4.4 Essential Nutrients

NMED has SSLs for evaluation of essential nutrients (NMED 2017, 602273). Calcium and magnesium were identified as COPCs at SWMU 02-014 and the maximum detected concentrations of calcium and magnesium were compared with the appropriate NMED SSLs. The results of the comparisons found calcium and magnesium concentrations to be substantially less than the SSLs as presented in Table F-4.4-1. Further evaluation of calcium and magnesium at this site is not necessary.

F-4.5 Uncertainty Analysis

F-4.5.1 Data Evaluation and COPC Identification Process

A primary uncertainty associated with the COPC identification process is the possibility that a chemical may be inappropriately identified as a COPC when it is actually not a COPC or that a chemical may not be identified as a COPC when it actually should be identified as a COPC. Inorganic chemicals are appropriately identified as COPCs because only the chemicals detected or that have detection limits above background are retained for further analysis. There are no established BVs for organic chemicals, and all detected organic chemicals are identified as COPCs and are retained for further analysis unless shown to be from a source not related to the site. Other uncertainties may include errors in sampling, laboratory analysis, and data analysis. However, because concentrations used in the risk-screening evaluations include those detected below the estimated quantitation limits and nondetections above BVs, data evaluation uncertainties are expected to have little effect on the risk-screening results.

F-4.5.2 Exposure Evaluation

The current and reasonably foreseeable future land use is industrial. To the degree actual activity patterns are not represented by those activities assumed by the industrial scenario, uncertainties are introduced in the assessment, and the evaluation presented in this assessment overestimates potential risk. An individual may be subject to exposures in a different manner than the exposure assumptions used to derive the industrial SSLs. For the site evaluated, individuals might not be on-site at present or in the future for that frequency and duration. The industrial assumptions for the SSLs are that the potentially exposed individual is outside on-site for 8 hr/day, 225 days/yr, and 25 yr (NMED 2017, 602273). The

residential SSLs are based on exposure of 24 hr/day, 350 days/yr, and 30 yr (NMED 2017, 602273). As a result, the industrial and residential scenarios evaluated at SWMU 02-014 likely overestimate the exposure and risk.

A number of assumptions are made relative to exposure pathways, including input parameters, completeness of a given pathway, the contaminated media to which an individual may be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the exposure assumptions used were consistent with default values (NMED 2017, 602273). When several upper-bound values (as are found in NMED 2017, 602273) are combined to estimate exposure for any one pathway, the resulting risk estimate can exceed the 99th percentile, and therefore, can exceed the range of risk that may be reasonably expected. Also, the assumption that residual concentrations of chemicals in the tuff are available and result in exposure in the same manner as if they were in soil overestimates the potential exposure and risk to receptors.

Uncertainty is introduced in the concentration aggregation of data for estimating the EPCs at a site. Risk from a single location or area with relatively high COPC concentrations may be underestimated by using a representative sitewide value. The use of a UCL is intended to provide a protective upper-bound (i.e., conservative) COPC concentration and is assumed to be representative of the average exposure to a COPC across the entire site. Potential risk and exposure from a single location or area with relatively high COPC concentrations may be overestimated if a representative sitewide value is used. The use of the maximum detected concentration for the EPC overestimates the exposure to contamination because receptors are not consistently exposed to the maximum detected concentration across the site. The use of EPCs similar to BVs will overestimate risk due to site-related contamination since much of the risk will be associated with background concentrations.

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The residential total excess cancer risk at SWMU 02-014 was approximately 2×10^{-5}. Aroclor-1260 (1.01×10^{-5}), arsenic (3.37×10^{-6}), and 2,3,7,8-TCDD (1.35×10^{-6}), make up a majority of this risk. The residential EPCs for arsenic (2.38 mg/kg) and 2,3,7,8-TCDD (6.6E-06 mg/kg) are less than their respective SSLs of 7.07 mg/kg and 4.9E-05 mg/kg. The EPCs for arsenic and 2,3,7,8-TCDD are based on the maximum detected concentrations because there were too few samples to calculate UCLs. The Aroclor-1260 EPC (2.46 mg/kg) is basically equivalent to the SSL (2.43 mg/kg).

Arsenic was identified as a COPC based on detection above the Qbo BV (0.56 mg/kg) in one sample at 0.735 mg/kg. Arsenic was detected below the Qbo BV in one other Qbo sample (0.351 mg/kg) and was detected below the soil BV (8.17 mg/kg) in five soil samples (0.638 mg/kg to 2.38 mg/kg). Because there were too few samples to calculate a UCL, the maximum concentration (2.38 mg/kg) was used as the EPC. The EPC is less than the soil BV and sediment BV (3.98 mg/kg). Therefore, the risk from arsenic is not substantially different from risk due to background concentrations in the TA-02 core area.
SWMU 02-014 is located within the footprint of AOC 02-011(a)(i,ii,iii,iv,v,vi). Inorganic chemical results for AOC 02-011(a)(i,ii,iii,iv,v,vi) include target analyte list metal results from 54 samples and are representative of the area encompassing SWMU 02-014. Arsenic was not a COPC for the residential scenario at AOC 02-011(a)(i,ii,iii,iv,v,vi). Use of the maximum concentration at SWMU 02-014 as the EPC substantially overestimates the site risk due to arsenic. The total excess cancer risk for the residential scenario without arsenic is approximately 1×10^{-5}, which is equivalent to the NMED risk target level (NMED 2017, 602273).

F-4.5.3 Toxicity Evaluation

The primary uncertainty associated with the SSLs is related to the derivation of toxicity values used in their calculation. Toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the SSLs used in this risk-screening evaluation (NMED 2017, 602273). Uncertainties were identified in five areas with respect to the toxicity values: (1) extrapolation from other animals to humans, (2) interindividual variability in the human population, (3) the derivation of RfDs and SFs, (4) the chemical form of the COPC, and (5) the use of surrogate chemicals.

Extrapolation from Animals to Humans. The SFs and RfDs are often determined by extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic responses between animals and humans. Differences in body weight, surface area, and pharmacokinetic relationships between animals and humans are taken into account to address these uncertainties in the dose-response relationship. However, conservatism is usually incorporated in each of these steps, resulting in the overestimation of potential risk.

Individual Variability in the Human Population. For noncarcinogenic effects, the degree of variability in human physical characteristics is important both in determining the risks that can be expected at low exposures and in defining the no observed adverse effect level (NOAEL). The NOAEL uncertainty factor approach incorporates a 10-fold factor to reflect individual variability within the human population that can contribute to uncertainty in the risk evaluation; this factor of 10 is generally considered to result in a conservative estimate of risk to noncarcinogenic COPCs.

Derivation of RfDs and SFs. The RfDs and SFs for different chemicals are derived from experiments conducted by different laboratories that may have different accuracy and precision that could lead to an overestimation or underestimation of the risk. The uncertainty associated with the toxicity factors for noncarcinogens is measured by the uncertainty factor, the modifying factor, and the confidence level. For carcinogens, the weight of evidence classification indicates the likelihood that a contaminant is a human carcinogen. Toxicity values with high uncertainties may change as new information is evaluated.

Chemical Form of the COPC. COPCs may be bound to the environment matrix and not available for absorption into the human body. However, the COPCs are assumed to be bioavailable. This assumption can lead to an overestimation of the total risk.

*Use of Surrogate Chemicals***.** The use of surrogates for chemicals that do not have EPA-approved or provisional toxicity values also contributes to uncertainty in the risk assessment. A surrogate was used to provide an SSL for benzo(g,h,i)perylene based on structural similarity. The overall impact of surrogates on the risk assessment is minimal because these COPCs were detected infrequently and at low concentrations.

F-4.5.4 Additive Approach

For noncarcinogens, the effects of exposure to multiple chemicals are generally unknown, and possible interactions could be synergistic or antagonistic, resulting in either an overestimation or underestimation of the potential risk. Additionally, RfDs used in the risk calculations typically are not based on the same endpoints with respect to severity, effects, or target organs. Therefore, the potential for noncarcinogenic effects may be overestimated for individual COPCs that act by different mechanisms or by different modes of action but are addressed additively.

F-4.6 Interpretation of Human Health Risk Screening Results

F-4.6.1 SWMU 02-014

Industrial Scenario

The total excess cancer risk for the industrial scenario is 5×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The industrial HI is 0.07, which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–1.0 ft depth interval.

Recreational Scenario

The total excess cancer risk for the recreational scenario is 6×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The recreational HI is 0.2, which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–1.0 ft depth interval.

Residential Scenario

The total excess cancer risk for the residential scenario is 1×10^{-5}, which is equivalent to the NMED target risk level of 1×10^{-5} (NMED 2017, 602273). The residential HI is 0.8, which is less than the NMED target HI of 1 (NMED 2017, 602273). No radionuclide COPCs were identified in the 0.0–10.0 ft depth interval.

The residential exposure scenario is also protective of construction workers.

F-5.0 ECOLOGICAL RISK EVALUATION TA-02 CORE AREA

Ecological risk was evaluated collectively for sites within the TA-02 core area, including SWMU 02-014, in the “Phase II Investigation Report for Middle Los Alamos Canyon Aggregate Area, Revision 2” (N3B 2018, 700091). Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for threatened and endangered species), lowest observed adverse effect level analyses, the relationship of detected concentrations and screening levels to background concentrations, and results of site-specific ecological risk studies conducted within the TA-02 core area, the Phase II IR concluded that no potential ecological risks exist for the TA-02 core area, which includes SWMU 02-014. Therefore, further evaluation of ecological risk was not performed for this Phase II IR addendum.

F-6.0 CONCLUSIONS

F-6.1 Human Health Risk

The total excess cancer risks were less than the target risk level of 1×10^{-5} for the industrial and recreational scenarios at SWMU 02-014. The residential risks at SWMU 02-014 were greater than the target risk level of 1×10^{-5}. The carcinogenic risks were related to Aroclor-1260, arsenic, and 2,3,7,8-TCDD.

The HIs were less than the target HI of 1 for the industrial, recreational, and residential scenarios at SWMU 02-014.

No radionuclide COPCs were identified at SWMU 02-014.

Based on the COPCs at SWMU 02-014, the results for the resident are protective of the potential for risk to construction workers for noncarcinogenic COPCs. The total excess cancer risk was less than the target risk level of 1×10^{-5} for the construction worker scenario at SWMU 02-014.

F-7.0 REFERENCES

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by Newport News Nuclear BWXT-Los Alamos, LLC (N3B) (IDs 700000 and above). IDs are used to locate documents in N3B's Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

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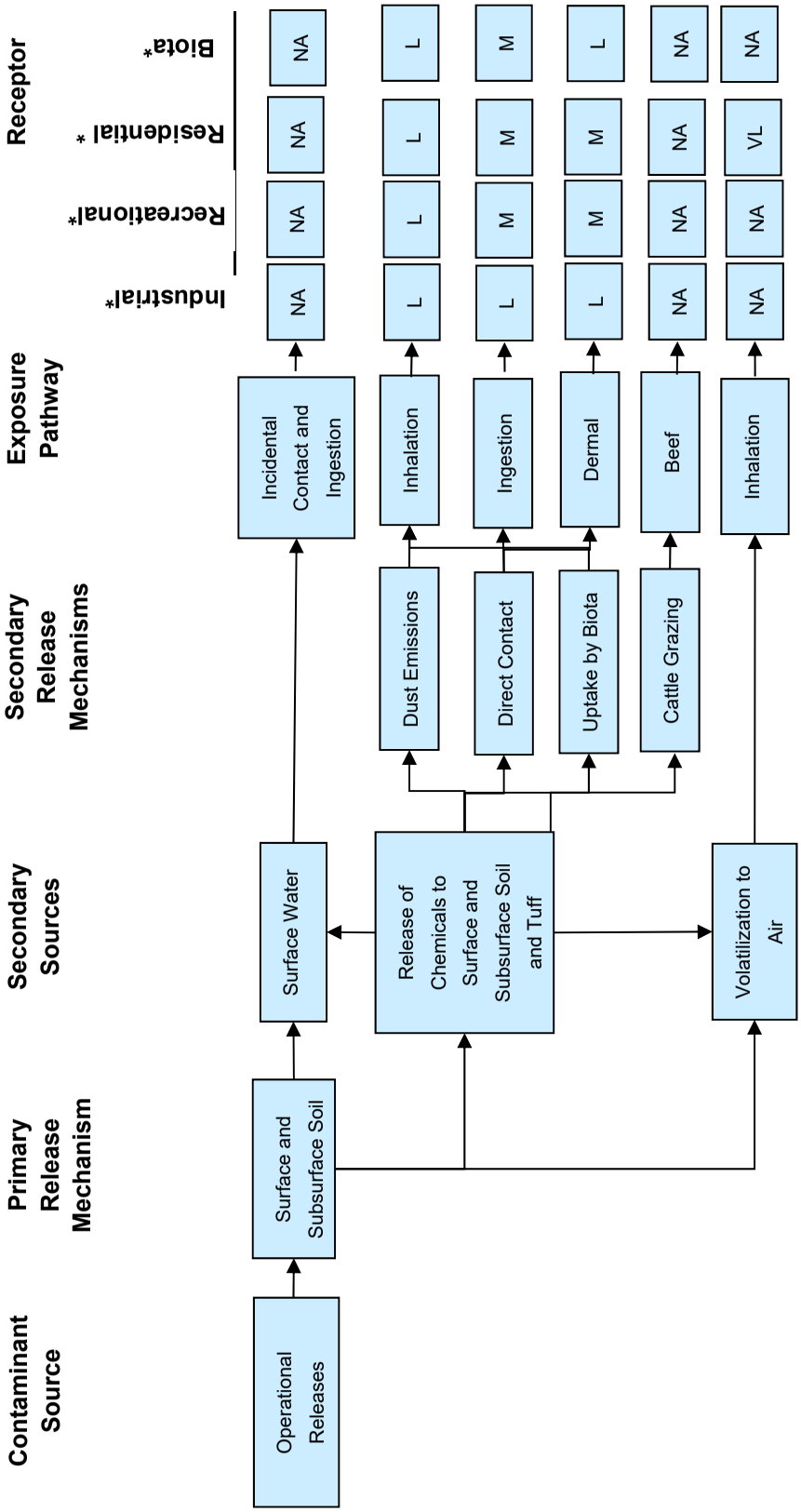

Notes: Very low (VL), low (L), and moderate (M) designations indicate the pathway is a potentially complete pathway and is evaluated in the risk assessments.
Not applicable (NA) indicates the pathway is incomplete and is not evaluated in the risk assessments.

Figure F-3.1-1 Conceptual site model for Solid Waste Management Unit 02-014

Table F-2.3-1
EPCs at SWMU 02-014 for the Industrial and Recreational Scenarios

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Zinc	1	1	78.2	78.2	n/a*	78.2	Maximum detected concentration
Organic Chemicals (mg/kg)							
Anthracene	1	1	0.00903	0.00903	n/a	0.00903	Maximum detected concentration
Aroclor-1254	22	6	0.00114 (U)	3.93	nonparametric	1.03	95% KM (Chebyshev)
Aroclor-1260	22	22	0.016	17.3	gamma	4.44	95% Adjusted Gamma
Benzo(a)anthracene	1	1	0.0516	0.0516	n/a	0.0516	Maximum detected concentration
Benzo(a)pyrene	1	1	0.0551	0.0551	n/a	0.0551	Maximum detected concentration
Benzo(b)fluoranthene	1	1	0.0702	0.0702	n/a	0.0702	Maximum detected concentration
Benzo(g,h,i)perylene	1	1	0.0271	0.0271	n/a	0.0271	Maximum detected concentration
Benzo(k)fluoranthene	1	1	0.041	0.041	n/a	0.041	Maximum detected concentration
Chrysene	1	1	0.0598	0.0598	n/a	0.0598	Maximum detected concentration
Fluoranthene	1	1	0.0984	0.0984	n/a	0.0984	Maximum detected concentration
Indeno(1,2,3-cd)pyrene	1	1	0.0252	0.0252	n/a	0.0252	Maximum detected concentration
Phenanthrene	1	1	0.0317	0.0317	n/a	0.0317	Maximum detected concentration
Pyrene	1	1	0.0771	0.0771	n/a	0.0771	Maximum detected concentration
Tetrachlorodibenzodioxin[2,3,7,8-]	1	1	0.0000066	0.0000066	n/a	0.0000066	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
* n/a = Not applicable.

Table F-2.3-2
EPCs at SWMU 02-014 for the Residential Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Aluminum	7	7	2170	10,800	n/a*	10,800	Maximum detected concentration
Arsenic	7	7	0.354	2.38	n/a	2.38	Maximum detected concentration
Barium	7	7	20.4	57.1	n/a	57.1	Maximum detected concentration
Calcium	7	7	544	7260	n/a	7260	Maximum detected concentration
Chromium	7	6	2.22	4.32	n/a	4.32	Maximum detected concentration
Iron	7	7	3240	7930	n/a	7930	Maximum detected concentration
Magnesium	7	7	360	1270	n/a	1270	Maximum detected concentration
Nickel	7	5	1.32	3.15 (U)	n/a	2.93	Maximum detected concentration
Perchlorate	3	1	0.000813	0.00214 (U)	n/a	0.000813	Maximum detected concentration
Selenium	7	4	0.21	1.33	n/a	1.33	Maximum detected concentration
Vanadium	7	7	3.45	7.18	n/a	7.18	Maximum detected concentration
Zinc	7	7	16.3	78.2	n/a	78.2	Maximum detected concentration
Organic Chemicals (mg/kg)							
Anthracene	3	2	0.00727	0.0356 (U)	n/a	0.00903	Maximum detected concentration
Aroclor-1254	226	24	0.00112 (U)	7.11	Lognormal	0.147	95% Percentile Bootstrap
Aroclor-1260	226	225	0.00123 (U)	23.9	Nonparametric	2.455	95% KM (Chebyshev)
Benzo(a)anthracene	3	2	0.032	0.0516	n/a	0.0516	Maximum detected concentration
Benzo(a)pyrene	3	2	0.0332	0.0551	n/a	0.0551	Maximum detected concentration
Benzo(b)fluoranthene	3	2	0.0356 (U)	0.0702	n/a	0.0702	Maximum detected concentration
Benzo(g,h,i)perylene	3	2	0.0222	0.0356 (U)	n/a	0.0271	Maximum detected concentration
Benzo(k)fluoranthene	3	2	0.0219	0.041	n/a	0.041	Maximum detected concentration
Chrysene	3	2	0.0356 (U)	0.0598	n/a	0.0598	Maximum detected concentration
Fluoranthene	3	2	0.0356 (U)	0.0984	n/a	0.0984	Maximum detected concentration
Indeno(1,2,3-cd)pyrene	3	2	0.0184	0.0356 (U)	n/a	0.0252	Maximum detected concentration

Table F-2.3-2 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Phenanthrene	3	2	0.0212	0.0356 (U)	n/a	0.0317	Maximum detected concentration
Pyrene	3	2	0.0356 (U)	0.0771	n/a	0.0771	Maximum detected concentration
Tetrachlorodibenzodioxin[2,3,7,8-]	3	3	0.00000418	0.0000066	n/a	0.0000066	Maximum detected concentration
Toluene	2	1	0.000465	0.00107 (U)	n/a	0.000465	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table F-3.2-1
Physical and Chemical Properties of
Inorganic COPCs at SWMU 02-014

COPC	K_d[a] (cm^3/g)	Water Solubility[a] (g/L)
Aluminum	1500	Insoluble
Arsenic	29	Insoluble
Barium	41	Insoluble
Chromium	850	Insoluble
Iron	25	Insoluble
Nickel	65	Insoluble
Perchlorate	na[b]	245
Selenium	5	Insoluble
Vanadium	1000	Insoluble
Zinc	62	Insoluble

[a] Information from http://rais.ornl.gov/cgi-bin/tools/TOX_search.

[b] na = Not available.

Table F-3.2-2
Physical and Chemical Properties of Organic
COPCs at SWMU 02-014

COPC	Water Solubility* (mg/L)	Organic Carbon Coefficient K_{oc}* (L/kg)	Log Octanol-Water Partition Coefficient K_{ow}*	Vapor Pressure* (mm Hg at 25°C)
Anthracene	4.34E-02	1.64E+04	4.45E+00	6.53E-06
Aroclor-1254	4.30E-02	1.30E+05	6.50E+00	7.71E-05
Aroclor-1260	1.44E-02	3.50E+05	7.55E+00	4.05E-05
Benzo(a)anthracene	9.40E-03	1.77E+05	5.76+00	2.1E-07
Benzo(a)pyrene	1.62E-03	5.87E+05	6.13E+00	5.49E-09
Benzo(b)fluoranthene	1.50E-03	5.99E+05	5.78E+00	5.00E-07
Benzo(g,h,i)perylene	2.60E-04	1.95E+06	6.63E+00	1.00E-10
Benzo(k)fluoranthene	8.00E-04	5.87E+05	6.11E+00	9.65E-10
Chrysene	2.00E-03	1.80E+05	5.81E+00	6.23E-09
Fluoranthene	2.60E-01	5.54E+04	5.16E+00	9.22E-06
Indeno(1,2,3-cd)pyrene	1.90E-04	1.95E+06	6.70E+00	1.25E-10
Phenanthrene	1.15E+00	1.67E+04	4.46E+00	1.21E-04
Pyrene	1.35E-01	5.43E+04	4.88E+00	4.50E-06
Tetrachlorodibenzodioxin[2,3,7,8-]	2.00E-04	2.49E+05	6.80E+00	1.50E-09
Toluene	5.26E+02	2.34E+02	2.73E+00	2.84E+01

* Information from http://rais.ornl.gov/cgi-bin/tools/TOX_search, unless noted otherwise.

Table F-3.3-1
TEFs Used for Calculating TCDD-Equivalent Concentrations

Dioxin and Furan Congeners	TEFs*
TCDD[2,3,7,8-]	1
Pentachlorodibenzodioxin[1,2,3,7,8-]	1
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	0.1
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	0.1
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	0.1
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	0.01
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	0.0003
Tetrachlorodibenzofuran[2,3,7,8-]	0.1
Pentachlorodibenzofuran[1,2,3,7,8-]	0.03
Pentachlorodibenzofuran[2,3,4,7,8-]	0.3
Hexachlorodibenzofuran[1,2,3,4,7,8-]	0.1
Hexachlorodibenzofuran[1,2,3,6,7,8-]	0.1
Hexachlorodibenzofuran[1,2,3,7,8,9-]	0.1
Hexachlorodibenzofuran[2,3,4,6,7,8-]	0.1
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	0.01
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	0.01
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	0.0003

*TEFs from NMED (2017, 602273).

Table F-4.1-1
Exposure Parameters Used to Calculate Chemical SSLs
for the Industrial, Recreational, and Residential Scenarios

Parameters	Industrial Values	Recreational Values	Residential Values
Target HQ	1	1	1
Target cancer risk	10^{-5}	10^{-5}	10^{-5}
Averaging time (carcinogen/mutagen)	70 yr × 365 days	70 yr × 365 days	70 yr × 365 days
Averaging time (noncarcinogen)	ED × 365 days	Exposure duration × 365 days	ED × 365 days
Skin absorption factor	SVOC[a] = 0.1	SVOC = 0.1	SVOC = 0.1
	Chemical-specific	Chemical-specific	Chemical-specific
Adherence factor–child	n/a[b]	0.2 mg/cm^2	0.2 mg/cm^2
Body weight–child	n/a	31 kg	15 kg (0–6 yr of age)
Cancer slope factor–oral (chemical-specific)	(mg/kg-day)$^{-1}$	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$
Inhalation unit risk (chemical-specific)	(µg/m^3)	(µg/m^3)	(µg/m^3)
Exposure frequency	225 days/yr	200 days/yr	350 days/yr

Table F-4.1-1 (continued)

Parameters	Industrial Values	Recreational Values	Residential Values
Exposure time	8 hr/day	1 hr/day	24 hr/day
Exposure duration–child	n/a	6 yr (6 to <12 yr of age)	6 yr[c]
Age-adjusted ingestion factor for carcinogens	n/a	n/a	36,750 mg/kg
Age-adjusted ingestion factor for mutagens	n/a	n/a	25,550 mg/kg
Soil ingestion rate–child	n/a	91 mg/d	200 mg/d
Particulate emission factor	6.61×10^9 m^3/kg	6.61×10^9 m^3/kg	6.61×10^9 m^3/kg
Reference dose–oral (chemical-specific)	(mg/kg-day)	(mg/kg-day)	(mg/kg-day)
Reference dose–inhalation (chemical-specific)	(mg/kg-day)	(mg/kg-day)	(mg/kg-day)
Exposed surface area–child	n/a	4030 cm^2	2690 cm^2/day
Age-adjusted skin contact factor for carcinogens	n/a	n/a	112,266 mg/kg
Age-adjusted skin contact factor for mutagens	n/a	n/a	166,833 mg/kg
Volatilization factor for soil (chemical-specific)	(m^3/kg)	(m^3/kg)	(m^3/kg)
Body weight–adult	80 kg	80 kg	80 kg
Exposure duration[d]	25 yr	26 yr (20 yr carcinogens)	30 yr[e]
Adherence factor–adult	0.12 mg/cm^2	0.07 mg/cm^2	0.07 mg/cm^2
Soil ingestion rate–adult	100 mg/day	30 mg/day	100 mg/day
Exposed surface area–adult	3470 cm^2/day	6032 cm^2	6032 cm^2/day

Note: Parameter values from NMED (2017, 602273) and LANL (2017, 602581).

[a] SVOC = Semivolatile organic compound.

[b] n/a = Not applicable.

[c] The child exposure duration for mutagens is subdivided into 0–2 yr and 2–6 yr.

[d] Exposure duration for lifetime resident is 26 yr. For carcinogens, the exposures are combined for child (6 yr) and adult (20 yr).

[e] The adult exposure duration for mutagens is subdivided into 6–16 yr and 16–30 yr.

Table F-4.2-1
Industrial Carcinogenic Screening Evaluation for SWMU 02-014

COPC	EPC (mg/kg)	Industrial SSL* (mg/kg)	Cancer Risk
Aroclor-1254	1.03	11	9.36E-07
Aroclor-1260	4.44	11.1	4.00E-06
Benzo(a)anthracene	0.0516	32.3	1.6E-08
Benzo(a)pyrene	0.0551	23.6	2.33E-08
Benzo(b)fluoranthene	0.0702	32.3	2.17E-08
Benzo(k)fluoranthene	0.041	323	1.27E-09
Chrysene	0.0598	3230	1.85E-10
Indeno(1,2,3-cd)pyrene	0.0252	32.3	7.8E-09
TCDD[2,3,7,8-]	0.0000066	0.00024	2.77E-07
Total Excess Cancer Risk			**5E-06**

* SSLs from NMED (2017, 602273).

Table F-4.2-2
Industrial Noncarcinogenic Screening Evaluation for SWMU 02-014

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Zinc	78.2	389,000	2.01E-04
Aroclor-1254	1.03	16.4	6.28E-02
Anthracene	0.00903	253,000	3.57E-08
Benzo(g,h,i)perylene	0.0271	25,300[b]	1.07E-06
Fluoranthene	0.0984	33,700	2.92E-06
Phenanthrene	0.0317	25,300	1.25E-06
Pyrene[b]	0.0771	25,300	3.05E-06
TCDD[2,3,7,8-]	0.0000066	0.000808	8.17E-03
HI			**0.07**

[a] SSLs from NMED (2017, 602273).

[b] Pyrene used as a surrogate based on structural similarity.

Table F-4.2-3
Recreational Carcinogenic Screening Evaluation for SWMU 02-014

COPC	EPC (mg/kg)	Recreational SSL* (mg/kg)	Cancer Risk
Aroclor-1254	1.03	10	1.03E-06
Aroclor-1260	4.44	10.3	4.31E-06
Benzo(a)anthracene	0.0516	88.8	5.81E-09
Benzo(a)pyrene	0.0551	8.88	6.2E-08
Benzo(b)fluoranthene	0.0702	88.8	7.91E-09
Benzo(k)fluoranthene	0.041	888	4.62E-10
Chrysene	0.0598	8880	6.73E-11
Indeno(1,2,3-cd)pyrene	0.0252	88.8	2.84E-09
TCDD[2,3,7,8-]	0.0000066	0.000297	2.22E-07
		Total Excess Cancer Risk	**6E-06**

* SSLs from LANL (2017, 602581).

Table F-4.2-4
Recreational Noncarcinogenic Screening Evaluation for SWMU 02-014

COPC	EPC (mg/kg)	Recreational SSL[a] (mg/kg)	HQ
Zinc	78.2	186,000	4.2E-04
Aroclor-1254	1.03	5.5	1.87E-01
Anthracene	0.00903	86,300	1.05E-07
Benzo(a)pyrene	0.0551	86	6.41E-04
Benzo(g,h,i)perylene	0.0271	8630[b]	3.14E-06
Fluoranthene	0.0984	11,500	8.56E-06
Phenanthrene	0.0317	8630	3.67E-06
Pyrene	0.0771	8630	8.93E-06
TCDD[2,3,7,8-]	0.0000066	0.00034	1.94E-02
		HI	**0.2**

[a] SSLs from LANL (2017, 602581).

[b] Pyrene used as a surrogate based on structural similarity

Table F-4.2-5
Residential Carcinogenic Screening Evaluation for SWMU 02-014

COPC	EPC (mg/kg)	Residential SSL* (mg/kg)	Cancer Risk
Arsenic	2.38	7.07	3.37E-06
Chromium	4.32	96.6	4.47E-07
Nickel	2.93	595,000	4.92E-11
Aroclor-1254	0.147	2.43	6.05E-07
Aroclor-1260	2.46	2.43	1.01E-05
Benzo(a)anthracene	0.0516	1.53	3.37E-07
Benzo(a)pyrene	0.0551	1.12	4.92E-07
Benzo(b)fluoranthene	0.0702	1.53	4.59E-07
Benzo(k)fluoranthene	0.041	15.3	2.68E-08
Chrysene	0.0598	153	3.91E-09
Indeno(1,2,3-cd)pyrene	0.0252	1.53	1.65E-07
TCDD[2,3,7,8-]	0.0000066	0.000049	1.35E-06
		Total Excess Cancer Risk	**2E-05**

* SSLs from NMED (2017, 602273).

Table F-4.2-6
Residential Noncarcinogenic Screening Evaluation for SWMU 02-014

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Aluminum	10,800	78,000	1.38E-01
Arsenic	2.38	13	1.83E-01
Barium	57.1	15,600	3.66E-03
Chromium	4.32	45,200	9.56E-05
Iron	7930	54,800	1.45E-01
Nickel	2.93	1560	1.88E-03
Perchlorate	0.000813	54.8	1.48E-05
Selenium	1.33	391	3.4E-03
Vanadium	7.18	394	1.82E-02
Zinc	78.2	23,500	3.33E-03
Aroclor-1254	0.147	1.14	1.29E-01
Anthracene	0.00903	17,400	5.19E-07
Benzo(g,h,i)perylene	0.0271	1740[b]	1.56E-05
Fluoranthene	0.0984	2320	4.24E-05
Phenanthrene	0.0317	1740	1.82E-05
Pyrene	0.0771	1740	4.43E-05
TCDD[2,3,7,8-]	0.0000066	0.000051	1.3E-01
Toluene	0.000465	5220	8.91E-08
		HI	**0.8**

[a] SSLs from NMED (2017, 602273).

[b] Pyrene used as a surrogate based on structural similarity.

Table F-4.2-7
Construction Worker Carcinogenic Screening Evaluation for SWMU 02-014

COPC	EPC (mg/kg)	Construction Worker SSL* (mg/kg)	Cancer Risk
Arsenic	2.38	216	1.10E-07
Chromium	4.32	468	9.23E-08
Nickel	2.93	25,000	1.17E-09
Aroclor-1254	0.147	85.3	1.72E-08
Aroclor-1260	2.46	85.3	2.88E-07
Benzo(a)anthracene	0.0516	240	2.15E-09
Benzo(a)pyrene	0.0551	173	3.18E-09
Benzo(b)fluoranthene	0.0702	240	2.93E-09
Benzo(k)fluoranthene	0.041	2310	1.77E-10
Chrysene	0.0598	23,100	2.59E-11
Indeno(1,2,3-cd)pyrene	0.0252	240	1.05E-09
TCDD[2,3,7,8-]	0.0000066	0.00172	3.84E-08
		Total Excess Cancer Risk	**6E-07**

* SSLs from NMED (2017, 602273).

Table F-4.4-1
Essential Nutrient Screening Assessment

SWMU / AOC	Scenario	COPC	Maximum Concentration (mg/kg)	SSL (mg/kg)*	Ratio
02-014	Residential	Calcium	7260	13,000,000	5.6E-04
02-014	Residential	Magnesium	1270	20,900,000	8.1E-05

* SSLs from NMED (2017, 602273).

Attachment F-1

Dioxin and Furan Toxicity Equivalency Factor Calculations
(on CD included with this document)

Attachment F-2

ProUCL Files
(on CD included with this document)