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Remedy Completion Report for Upper Los Alamos Canyon Aggregate Area, Former Technical Area 32, Revision 1

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

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February 2011

Responsible project manager:

Becky Coel-Roback		Project Manager	Environmental Programs	2/24/11
Printed Name	Signature	Title	Organization	Date

Responsible LANS representative:

Michael J. Graham	M. J. Graham	Associate Director	Environmental Programs	24 Feb 11
Printed Name	Signature	Title	Organization	Date

Responsible DOE representative:

George J. Rael	for	Manager	DOE-LASO	2-27-2011
Printed Name	Signature	Title	Organization	Date

Professional Engineer Certification

This certification was prepared in accordance with generally accepted engineering principles and practice pursuant to the requirements of Section VII.E.6 of the Compliance Order on Consent for a registered professional engineer's certification. These activities have been performed with the care and skill ordinarily exercised by members of the profession practicing under similar conditions in the same manner or in a similar locality. I make no other warranty either expressed or implied. The finding and certification are based on (1) review of the New Mexico Environment Department– (NMED-) approved work plan, (2) review of the remedy completion report and supporting records and documentation, and (3) review of the analytical results and supporting documentation.

With the signature and seal below, I certify that, except for the deviations presented in section 4.5, the investigation and/or remediation of these sites, Solid Waste Management Units 32-002(a) and 32-002(b) and Areas of Concern 32-003 and 32-004, was conducted in accordance with the "Accelerated Corrective Action Work Plan for Upper Los Alamos Canyon Aggregate Area, Technical Area 32," approved by NMED on January 22, 2010. The information presented in this report is, to the best of my knowledge and belief, true, accurate, and complete.

ALAN MACGREGOR
11709

Alan MacGregor
Professional Engineer
#11709 (New Mexico)

CERTIFICATION

CERTIFICATION BY THE ENVIRONMENTAL PROGRAMS – CORRECTIVE ACTION PROGRAM TECHNICAL REPRESENTATIVES

Document Title: **Remedy Completion Report for Upper Los Alamos Canyon Aggregate Area, Former Technical Area 32, Revision 1**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

Name: __________ Date: 2/~~24~~/11 24 DM
David McInroy, Program Director
Corrective Actions Program
Los Alamos National Laboratory

OR

Name: __________ Date: 24 Feb 2011
Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Name: __________ Date: 2-27-2011
David S. Rhodes, Project Director
Environmental Remediation
Los Alamos Site Office

OR

Name: __________ Date: __________
George J. Rael, Manager
Environmental Projects Office
Los Alamos Site Office

EXECUTIVE SUMMARY

This remedy completion report presents the results of the accelerated corrective action (ACA) activities at Solid Waste Management Units (SWMUs) 32-002(a) and 32-002(b) and Areas of Concern (AOCs) 32-003 and 32-004 at former Technical Area 32 (TA-32) in the Upper Los Alamos Canyon Aggregate Area at Los Alamos National Laboratory (the Laboratory). The ACA activities were conducted in 2010 in accordance with the ACA work plan approved by the New Mexico Environment Department in January 2010.

The objectives of the ACA were to (1) conduct limited soil removal to reduce potential risk at specific locations where residential soil screening levels were exceeded and (2) collect samples to finalize the determination of the extent of contamination.

The analytical data presented in this report indicate the nature and extent of contamination are defined at SWMU 32-002(b) and AOCs 32-003 and 32-004. All three sites have been determined to pose no potential unacceptable risk or dose to human health from Laboratory releases under the residential scenario. AOCs 32-003 and 32-004 also do not pose potential risk to ecological receptors. No further investigation or remediation activities are warranted at these two sites. However, elevated mercury concentrations were detected at SWMU 32-002(b) based on the 1996 samples, resulting in an elevated hazard index for the earthworm. This site requires further evaluation.

Sampling results show that the vertical extent of inorganic chemicals has not been defined for SWMU 32-002(a). Therefore, human health and ecological risk assessments were not performed. Additional sampling to determine the extent of contamination at SWMU 32-002(a) will be implemented as part of the Phase II investigation of the Upper Los Alamos Canyon Aggregate Area. Additional sampling has been proposed in the Phase II investigation work plan for Upper Los Alamos Canyon Aggregate Area to address the vertical extent of inorganic chemicals at SWMU 32-002(a).

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1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Los Alamos National Security, LLC. 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 40 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons that contain perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 to 7800 ft.

The Laboratory is participating in a national effort by DOE to clean up sites and facilities formerly involved in weapons research and development. The Laboratory’s goal is to ensure that past operations do not threaten human or environmental health and safety in and around Los Alamos County. To achieve this goal, the Laboratory is currently investigating sites potentially contaminated by past operations; the sites under investigation are designated as solid waste management units (SWMUs), areas of concern (AOCs), or consolidated units.

This remedy completion report describes the accelerated corrective action (ACA) activities conducted in 2010 to complete the investigation of two SWMUs and two AOCs associated with former Technical Area 32 (TA-32). The activities described in this report were conducted according to the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455). SWMUs 32-002(a) and 32-002(b) and AOCs 32-003 and 32-004 are part of the Upper Los Alamos Canyon Aggregate Area. Figure 1.0-1 shows the location of Upper Los Alamos Canyon Aggregate Area and former TA-32 with respect to the Laboratory.

The SWMUs and AOCs addressed in this remedy completion report are 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, and DOE Order 435.1, Radioactive Waste Management. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

1.1 Location of ACA Activities

Former TA-32 is located within the Upper Los Alamos Canyon Aggregate Area (Figure 1.0-1). It was a small medical research facility consisting of three laboratories, an office building, a warehouse, a valve house, and a transformer station. It is located within the townsite of Los Alamos, approximately 400 ft east of Knecht Street and 400 ft south of Trinity Drive. Various Los Alamos County buildings and operations now occupy the area, and DOE owns the land south of the mesa top.

1.2 Purpose of ACA Activities

The ACA activities were conducted because Los Alamos County plans to develop the area for commercial and residential use in the near future. The objectives of the ACA were to (1) conduct limited soil removal to reduce potential risk at specific locations where residential soil screening levels (SSLs) were exceeded and (2) collect samples to finalize the determination of the extent of contamination.

1.3 Document Organization

Section 2 of this report presents the site description and operational history for each site. Section 3 presents the regulatory criteria and target cleanup levels for the sites. The ACA activities conducted for each site in 2010 are presented in section 4, along with analytical results, risk-screening results, deviations from the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455), and final site conditions. Sections 5 and 6 present conclusions and recommendations, respectively, based on the results of this ACA and previous investigations. The references cited in this report and the map data sources are listed in section 7.

Appendix A contains a list of acronyms and abbreviations used in this report, a metric conversion table, and a data qualifier definition table. Appendix B summarizes the field methods used during the ACA. Appendix C provides the analytical results of the samples collected during current and previous investigations. Appendix D presents the analytical program implemented for chemical analysis and data quality control. Appendix E presents the box plots and the results of statistical texts. Appendix F presents risk assessments. Appendix G describes the storage and disposal of investigation-derived waste (IDW) and provides available waste documentation.

1.4 Data Review

Data discussed in this report are the analytical results from samples collected during previous and current investigations. Samples were shipped through the Sample Management Office (SMO) to off-site contract laboratories for analyses and are accompanied by full chain-of-custody and quality documentation. The resulting data are decision-level data and are used to determine nature and extent of contamination, calculate exposure point concentrations, and conduct risk-screening assessments. Data collected during this ACA were combined with data collected previously if the previous data met current data quality requirements. Complete data sets for all sites investigated are provided on the DVD included in Appendix C of this report. Analytical data packages, sample collection logs, and chain-of-custody forms are also provided in Appendix C. Analytical methods used and data-quality assessments, including assignment of data qualifiers, are presented in Appendix D. The data qualifiers used are defined in Appendix A.

1.4.1 Identification of Chemicals of Potential Concern

Inorganic chemicals of potential concern (COPCs) are identified by comparing site data with background values (BVs) (LANL 1998, 059730) or are based on detection status if no BVs are available. Organic chemicals are identified as COPCs based on detection status. Radionuclides are identified as COPCs based on comparisons to BVs or fallout values (FVs) or are based on detection status if no BVs or FVs are available.

Sample media encountered in this ACA include soil (all soil horizons, designated by the media code ALLH or SOIL); fill material (media code FILL); alluvial sediment (media code SED), and Bandelier Tuff (media codes QBT2, QBT3, and QBT4). Because no separate BVs are available for fill material, fill samples are evaluated by comparing them with soil BVs (LANL 1998, 059730). In this report, the discussions of site contamination in soil include fill samples with soil samples in sample counts and comparisons to background. Fill samples are not discussed separately from soil.

For inorganic chemicals, data are evaluated by sample media to facilitate the comparison with media-specific background data. Background data are generally available for soil, sediment, and tuff (LANL 1998, 059730). However, some analytes (e.g., nitrate, perchlorate, and hexavalent chromium) have no

BVs. A BV may be either a calculated value from the background data set (upper tolerance limit or the 95% upper confidence bound on the 95th quantile) or a detection limit (DL). When a BV is based on a DL, there is no corresponding background data set for that analyte/media combination.

To identify inorganic COPCs, the first step is to compare the sample result with the BV, if available. If sample results are above BVs and sufficient data are available (10 or more sample results), statistical tests are used to compare the site sample data with the background data set for the appropriate media, if available. If statistical tests cannot be performed because of insufficient data (less than 10 samples) or a high percentage of nondetects, the sample results are compared with the BV and/or the maximum background concentration of the chemical in the appropriate media. If sample results are above the BV and/or maximum background concentration, the chemical is identified as a COPC. The same evaluation is performed using sample DLs when a constituent is not detected but has DLs above the BV. If no BV is available, detected inorganic chemicals are identified as COPCs.

Radionuclides are identified as COPCs based on comparisons to BVs for naturally occurring radionuclides or to FVs for fallout radionuclides. Isotopic thorium and isotopic uranium are naturally occurring radionuclides. Americium-241, cesium-137, plutonium-238, plutonium-239/240, strontium-90, and tritium are fallout radionuclides. FVs apply only to surface soil and sediment samples (0 to 1 ft below ground surface [bgs]), so fallout radionuclides detected below 1 ft bgs are identified as COPCs. Fallout radionuclides in tuff are also identified as COPCs based on detection status.

The FV for tritium in surface soil (LANL 1998, 059730) is in units of picocuries per milliliter. When this FV is used, sample percent moisture must be used to convert sample tritium data from picocuries per gram, as provided by analytical laboratories, to the corresponding values in units of picocuries per milliliter. Because sample percent moisture historically has been determined using a variety of methods that were often undocumented, the Laboratory has adopted the conservative approach of identifying tritium in soil as a COPC based on detection status.

1.4.2 Overview of Statistical Methods

A variety of statistical methods may be applied to each of the data sets but generally include distributional comparisons and box plots comparing site data with background data. In cases where no background data are available, fewer than 10 samples were analyzed for a specific constituent, or more than 80% of the site samples and background samples are nondetects, statistical tests are not valid. In such cases, COPC identification is based on detection status, direct comparison to the BV or FV (if one is available), and subsequent comparison to the maximum background concentration if it is greater than the BV or FV. If no BV or FV is available, the constituent is identified as a COPC if it was detected in any samples at the site.

Comparisons between site (SWMU, AOC, or consolidated unit) data sets and the Laboratory background data sets are performed using statistical methods. All comparisons begin with a simple comparison of site-specific data to media-specific BVs or FVs (LANL 1998, 059730). BV/FV comparisons are followed, when appropriate, by statistical tests that evaluate potential differences between the distributions. These tests are used for testing hypotheses about data from two potentially different distributions (e.g., a test of the hypothesis that site concentrations are different from background levels).

Nonparametric tests that are most commonly performed include the two-sample Wilcoxon Rank Sum test (the Wilcoxon test), the Gehan test (modification of the Wilcoxon test), and the quantile test (Gehan 1965, 055611; Gilbert and Simpson 1990, 055612). The Gehan test is best suited for assessing complete shifts in distributions, and accounts for nondetected concentrations at multiple DLs in a statistically robust manner. If the data have no nondetected concentrations, the Gehan test is equivalent to the Wilcoxon test. The quantile test is better suited for assessing shifts of a subset of the data. Most types of differences between distributions can be identified. Occasionally, if the differences between two distributions appear to occur far into the tails, the slippage test might be performed. This test evaluates the potential for some of the site data to be greater than the maximum concentration in the background data set if, in fact, the site data and background data came from the same distribution.

Observed significance levels (p-values) are obtained from the Gehan, quantile, or slippage tests. If a p-value is less than a specified probability (e.g., 0.05, a nominal significance level), then there is some reason to suspect that a difference exists between the distributions. If the p-value is greater than 0.05, no difference is indicated. The standard set of tests is run whenever the detection rate for both the site data set and the Laboratory background data set is greater than 50%; if there are fewer than 50% detections in either set, then the Gehan test is not applicable. If all sample data are nondetects, statistical tests are not performed.

Paired tests are used to test whether site data are different from background. Specifically, the Gehan test (or the Wilcoxon Rank Sum test if all sample results are detects) is the preferred initial test. If the result of the Gehan test indicates that the site data are not different from background (i.e., $p > 0.05$), the quantile test is performed. Site data must pass (i.e., $p > 0.05$) both tests to eliminate an inorganic chemical as a COPC. If the p-value from either the Gehan (or Wilcoxon) or the quantile test is less than 0.05, the constituent is identified as a COPC for the specific medium tested. If the Gehan test is not applicable because either the site or background data set includes more than 50% nondetects, the quantile test is performed first. If the p-value from the quantile test is >0.05, the slippage test is performed next. Again, the p-value from both tests must be >0.05 to eliminate an inorganic chemical as a COPC. If the p-value from the first test is <0.05, indicating the site data are different from background, the second test does not need to be performed, and the inorganic chemical is identified as a COPC. Results of statistical tests are presented in Appendix E.

Box plots provide a visual representation of the data and may identify the presence of outliers or other anomalous data that might affect statistical results and interpretations. The plots allow a visual comparison between site and background concentration distributions. The plots are generally used in conjunction with the statistical tests (distributional comparisons) described above. A box plot consists of a box, a line across the box, whiskers (lines extended beyond the box and terminated with a short perpendicular line), and points outside the whiskers. The box area of the plot is the region between the 25th percentile and the 75th percentile of the data, which is the interquartile range or middle half of the data. The horizontal line within the box represents the median (50th percentile) of the data. The whiskers give an interval of 1.5 times the interquartile range, outside of which data may be evaluated for their potential to be outliers. The concentrations of individual samples are plotted as points overlaying the box plot. When a data set contains both detected and nondetected concentrations reported as DLs, the detected concentrations are plotted as Xs, and the nondetected concentrations are plotted as Os. The medium-specific BV is also illustrated by a dashed line in each box plot. All box plots are presented in Appendix E.

2.0 BACKGROUND

Former TA-32 was occupied by the medical research facility from 1944 to 1953 when operations were moved to TA-43 as the research group expanded. All the Laboratory structures at former TA-32 were removed after 1954. Currently, the mesa-top portion of former TA-32 is owned by Los Alamos County and is almost entirely covered by asphalt. The area was used to store equipment and materials for road work and maintenance, including asphalt, road salt, and other materials. Street sweepers and other vehicles were also emptied and cleaned at this location. However, the County recently removed all structures from the site in preparation for redevelopment.

Four sites are addressed in this report: two septic systems that served former buildings 32-01 and 32-02 [SWMUs 32-002(a) and 32-002(b)], a former transformer station (AOC 32-003), and the drainline and outfall that served former building 32-03 (AOC 32-004). These four sites are shown on Plate 1.

2.1 SWMU 32-002(a)

2.1.1 Site Description and Operational History

SWMU 32-002(a) is a former septic system that served former building 32-01 (Plate 1). The septic system was installed in 1944 south of building 32-01 on the edge of Los Alamos Canyon. The septic system consisted of a wood-frame tank (former structure 32-07) measuring 4 ft × 8 ft × 4 ft, an influent line from building 32-01 and an outlet drainline that discharged to the edge of Los Alamos Canyon. Former building 32-01 operated as a research laboratory from 1944 to 1954. Research activities involved plutonium-238, plutonium-239, americium-241, and carbon-14. Inorganic and organic chemicals also may have been used at the facility. Because no industrial waste line served former TA-32, it is possible chemical and radioactive wastes were disposed of in sinks and drains connected to the SWMU 32-002(a) septic system. Former TA-32 was decommissioned in 1954. The septic tank was removed before 1996 (LANL 1996, 059178), but no historical records are available documenting the removal date or disposition of the tank. The drainlines were removed during a 1996 VCA (LANL 1996, 059178).

2.1.2 Summary of Previous Investigations

During the 1993 Phase I Resource Conservation and Recovery Act facility investigation (RFI) conducted at TA-32, it was discovered that the previously identified location of SWMU 32-002(a) was incorrect and no samples were collected at SWMU 32-002(a) (LANL 1995, 048944). A Phase II investigation was recommended to determine how much of the influent drainline remained and whether any releases had occurred in the soil surrounding the drainline.

During the Phase II RFI and voluntary corrective action (VCA) conducted at SWMU 32-002(a) in 1996, inlet drainlines associated with the former SWMU 32-002(a) septic system were removed (LANL 1996, 059178). Confirmation samples were collected from nine locations beneath the former drainlines. The drainline samples were analyzed for target analyte list (TAL) metals, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, and tritium. In addition, samples were collected from nine locations and analyzed for TAL metals, SVOCs, isotopic plutonium, isotopic uranium, americium-241, and tritium to characterize the outfall area shared by SWMUs 32-002(a) and 32-002(b). Based on the results of the sampling, a small amount of soil (approximately 1 ft^3) was removed to reduce levels of Aroclor-1260 at the outfall.

During the 2008 Upper Los Alamos Canyon Aggregate Area investigation, 18 samples were collected from nine locations at depths ranging from 0 to 9.5 ft bgs (LANL 2010, 108528). All 18 samples were analyzed for TAL metals, perchlorate, nitrate, total cyanide, dioxins/furans, polychlorinated biphenyls (PCBs), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, and tritium.

Decision-level data from the Phase II RFI/VCA and 2008 investigation indicated the lateral and vertical extent of the inorganic, organic, and radionuclide COPCs were defined at SWMU 32-002(a), except for the vertical extent of barium, chromium, and nickel. In addition, concentrations of arsenic (maximum 13 mg/kg), mercury (maximum 43 mg/kg), and lead (maximum 530 mg/kg) above the residential SSLs were reported in one 1996 sample. Sampling results were presented in the investigation report, which recommended limited soil removal (LANL 2010, 108528).

2.2 SWMU 32-002(b)

2.2.1 Site Description and Operational History

SWMU 32-002(b) is a former septic system that served former buildings 32-01 and 32-02 (Plate 1). The septic system was installed directly northwest and slightly upgradient of the SWMU 32-002(a) septic tank, near the edge of Los Alamos Canyon. This system was installed when the SWMU 32-002(a) septic system could no longer meet the usage requirement of the laboratory (building 32-01), and it consisted of a reinforced concrete tank (former structure 32-08) measuring 9 ft × 5 ft × 6 ft with an outlet drainline that discharged to an outfall at the edge of Los Alamos Canyon. The influent line from the SWMU 32-002(a) septic system was diverted to the SWMU 32-002(b) septic system, which also received effluent from former building 32-02, the medical research annex. The outfall of SWMU 32-002(b) was located at the edge of Los Alamos Canyon, approximately 15 ft southwest of the SWMU 32-002(a) outfall. The septic tank was removed in 1988, and the influent drainline was removed in 1996.

Research activities in former building 32-01 involved radionuclides. Inorganic and organic chemicals may also have been used. Because no industrial waste line served former TA-32, it is possible chemical and radioactive wastes may have been disposed of in sinks and drains connected to the septic system at SWMU 32-002(b).

2.2.2 Summary of Previous Investigations

During the 1993 Phase I RFI conducted at SWMU 32-002(b), samples were collected from the former location of the septic tank (four samples), the outfall area (six samples), and the drainlines (eight samples) (LANL 1995, 048944). As a result of the findings of the 1993 RFI, further investigation was recommended; however, none of the 1993 data are decision-level quality.

During the Phase II RFI and VCA conducted at SWMU 32-002(b) in 1996, inlet drainlines associated with the former SWMU 32-002(b) septic system were removed (LANL 1996, 059178). Confirmation samples were collected from five locations beneath the former drainlines, and two samples were collected at the bottom of the former septic tank excavation. The drainline samples were analyzed for TAL metals, SVOCs, VOCs, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, and tritium; the septic tank footprint samples were analyzed for TAL metals, gamma-emitting radionuclides, isotopic plutonium, and isotopic uranium. In addition, samples were collected from nine locations and analyzed for TAL metals, SVOCs, isotopic plutonium, isotopic uranium, americium-241, and tritium to characterize the outfall area shared by SWMUs 32-002(a) and 32-002(b). Based on the results of the sampling, a small amount of soil (approximately 1 ft^3) was removed to reduce levels of Aroclor-1260 at the outfall.

During the 2008 Upper Los Alamos Canyon Aggregate Area investigation, 22 samples were collected from 11 locations at depths ranging from 0.0 to 8.5 ft bgs (LANL 2010, 108528). All 22 samples were analyzed for TAL metals, perchlorate, nitrate, total cyanide, dioxins/furans, PCBs, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, and tritium.

Decision-level data from the Phase II RFI/VCA and 2008 investigation indicated the lateral and vertical extent of the inorganic, organic, and radionuclide COPCs were defined at SWMU 32-002(b), except for the vertical extent of barium, chromium, and nickel. Sampling results are presented and discussed in the investigation report (LANL 2010, 108528).

2.3 AOC 32-003

2.3.1 Site Description and Operational History

AOC 32-003 is the former location of a transformer station (structure 32-10) (Plate 1), which consisted of three transformers on a wooden platform suspended on poles approximately 20 ft off the ground. AOC 32-003 was discovered northwest of the SWMU 32-002(b) septic tank and directly south of former building 32-01 during the 1993 Phase I RFI at former TA-32. The pile of wood debris at this location was initially thought to be the location of the SWMU 32-002(a) septic tank (LANL 1995, 048944).

2.3.2 Summary of Previous Investigations

The Phase I RFI analytical results from the samples collected in the immediate area of the transformer station indicated the presence of PCBs (LANL 1995, 048944, p. 34). As a result of the 1993 RFI findings, further investigation was recommended; however, none of the 1993 data are decision-level quality.

A Phase II RFI and VCA were conducted at AOC 32-003 in 1996 (LANL 1996, 059178). Remedial activities included excavation of contaminated soil at AOC 32-003. Confirmation samples were collected, and the results indicated the PCB cleanup goal of 10 mg/kg had been met (LANL 1996, 059178, p. 51). However, data from the 1996 RFI and VCA are screening-level data. The excavation was backfilled with clean fill material from the Los Alamos County landfill stockpile.

During the 2008 Upper Los Alamos Canyon Aggregate Area investigation, 24 samples were collected from 12 locations at depths ranging from 0 to 8 ft bgs. All 24 samples were analyzed for TAL metals, PCBs, SVOCs, and VOCs.

Decision-level data from the 2008 investigation indicated the lateral and vertical extent of the inorganic and organic COPCs were defined at AOC 32-003, except for the vertical extent of chromium and nickel, the lateral extent of Aroclor-1260 to the east, and the lateral extent of polycyclic aromatic hydrocarbons (PAHs) to the east, south, and west. In addition, concentrations of Aroclor-1260 (maximum 26 mg/kg) exceeded the residential SSL at one location, warranting limited soil removal. Sampling results are presented and discussed in the investigation report (LANL 2010, 108528).

2.4 AOC 32-004

2.4.1 Site Description and Operational History

AOC 32-004 consists of a former drainline and outfall that served former building 32-03 and discharged to Los Alamos Canyon. Building 32-03 was an office building and contained a vault room where a radioactive source was stored. The drainline at AOC 32-004 led directly to an outfall at the edge of the mesa without passing through a septic tank. Building 32-03 was removed when TA-32 was decommissioned in 1954 (LANL 1995, 048944).

2.4.2 Summary of Previous Investigations

During the 1993 Phase I RFI activities at former TA-32, the drainline and outfall were identified in engineering drawings (LANL 1995, 048944). A Phase II investigation was recommended to determine whether the drainline had been removed previously and whether any releases had occurred in the soil surrounding the drainline.

During the 1996 Phase II RFI and VCA conducted at AOC 32-004, the 37.5-ft section of the drainline located on Los Alamos County property was removed (LANL 1996, 059178). Because the drainline was found not to be contaminated, the portion of the drainline located on DOE property was left in place and grouted at both ends. A confirmation sample was collected at each of two locations beneath the removed section of drainline, one from a depth of 2.5 to 3.0 ft bgs and the other from a depth of 3.0 to 3.5 ft bgs. Additionally, seven samples were collected from five locations at depths ranging from 0 to 1 ft bgs, including four locations within and below the outfall area and one location upgradient of the outfall. The samples were analyzed for TAL metals, SVOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, and tritium; the sample collected at the upgradient location was analyzed for TAL metals and SVOCs.

During the 2008 Upper Los Alamos Canyon Aggregate Area investigation, three samples were collected from one location at depths ranging from 0 to 6 ft bgs. All three samples were analyzed for TAL metals, perchlorate, nitrate, total cyanide, PCBs, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, and tritium.

Decision-level data from the 1996 Phase II RFI/VCA and the 2008 investigation indicate the lateral and vertical extent of the inorganic, organic, and radionuclide COPCs are defined at AOC 32-004. No potential unacceptable risks or doses to human health exist under the construction worker scenario. However, potential unacceptable risks to human health exist under the industrial and residential scenarios. Most of the potential unacceptable risk was from benzo(a)pyrene detected above the SSLs in samples collected in 1996 from multiple locations; these locations are under pavement or received runoff from the adjacent pavement. Sampling results are presented and discussed in the investigation report (LANL 2010, 108528).

3.0 REGULATORY CRITERIA AND TARGET CLEANUP LEVELS

3.1 Current and Future Land Use

Former TA-32 is located within the Los Alamos townsite. Los Alamos County owns the mesa-top portion of former TA-32, which is almost entirely paved with asphalt. The area was used by Los Alamos County to store equipment and materials for road work and maintenance. Other activities at the site included emptying and cleaning of street sweepers and staging of asphalt, road salt, and other materials. Abundant staining can be seen on the ground. The County demolished all structures at the site in 2010 and plans to develop the area for commercial and residential use in the near future. DOE owns the land south of the mesa top.

3.2 Screening Levels and Cleanup Standards

The industrial, construction worker, and residential SSLs from NMED guidance (NMED 2009, 108070) were used for human health risk-screening levels for nonradionuclide COPCs. Recreational SSLs were obtained from Laboratory guidance (LANL 2010, 108613). The SSLs are based on a target hazard quotient (HQ) of 1.0 or a target cancer risk of 1×10^{-5} (NMED 2009, 108070). For COPCs for which no NMED value is available, U.S. Environmental Protection Agency (EPA) regional screening levels (available at http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) were used. The EPA screening levels for carcinogens were multiplied by 10 to adjust to the NMED target cancer risk of 1×10^{-5}. Exposure parameters used to calculate the SSLs are presented in Appendix F, Table F-4.1-1. Screening action levels (SALs) were derived using the RESRAD Model, Version 6.5 (LANL 2009, 107655) and were used for human health risk-screening levels for radionuclide COPCs. The radionuclide SALs are based on a 15 mrem/yr dose per DOE guidance (DOE 2000, 067489). Exposure parameters used to calculate the SALs are provided in Appendix F, Tables F-4.1-2 and F-4.1-3. The SSLs and SALs are included in the analytical data tables for each site.

3.3 Cleanup Goals

As specified in Section VIII.B.1 of the Consent Order, screening levels will be used as soil cleanup levels unless they are determined to be impracticable or values do not exist for the current and reasonably foreseeable future land use. Screening assessments compare COPC concentrations for each site with SSLs depending on the current and foreseeable future land use at each site.

The cleanup goals specified in Section VIII of the Consent Order are a target cancer risk of 1×10^{-5} and a hazard index (HI) of 1.0. For radionuclides, the target dose is 15 mrem/yr based on DOE guidance (DOE 2000, 067489).

4.0 ACCELERATED CORRECTIVE ACTION ACTIVITIES

The activities described in the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455) were conducted at former TA-32 from February to July 2010. During field screening, no organic vapors were detected above ambient air; no radiological screening results exceeded twice the daily site background levels. Field-screening results for samples collected at the four sites in 2010 were recorded in the sample collection logs (SCLs) and are presented in Table 4.0-1. No changes to sampling or other activities occurred based on field-screening results.

Appendix B summarizes the field methods used during the ACA. Analytical results, data reports, SCLs, and chain-of-custody forms are provided in Appendix C. The analytical program is summarized in Appendix D.

4.1 SWMU 32-002(a)

4.1.1 Remediation Activities

The concentrations of arsenic, mercury, and lead exceeded the residential SSLs in a 1996 surface sample (0 to 0.5 ft) at location 32-06373 at SWMU 32-002(a). Proposed cleanup at location 32-06373 included removing material from an area up to, but not including, the closest adjacent sampling locations. The remediated area was approximately 4 ft long × 4 ft wide × 2 ft deep (Plate 1). The total volume of excavated material was approximately 1.2 yd^3. However, upon review of the field log book from the 1996 VCA, it was found that the only sample from location 32-06373 (sample 0132-96-0631) was collected from within the pipe that was subsequently removed (ERM/Golder 1996, 063801, p. 90). This sample should have been marked as “excavated” in the Environmental Programs (EP) Directorate database and should not have been used to represent current site conditions. Therefore, the remediation and associated confirmation sampling proposed in the ACA work plan (LANL 2009, 108332; NMED 2010, 108455) were not necessary.

4.1.2 Sampling Activities

Fifteen samples were collected from 12 locations at SWMU 32-002(a) in 2010. The 15 samples were analyzed for TAL metals.

- Eleven deeper samples were collected from nine existing sampling locations to define the vertical extent of barium, chromium, and nickel at these locations.
- Four confirmation samples were collected from three locations within the excavated area of location 32-06373. Two samples were collected from the bottom of the excavation at depths of 2 to 3 ft and 4 to 5 ft bgs. One sample each was collected from the north and east sidewalls of the excavation at 1.5 to 2.0 ft bgs.

4.1.3 Sample Analytical Results

The samples collected in 1996, 2008, and 2010 and the analyses requested are presented in Table 4.1-1. The samples were collected from depths ranging from 0 to 11 ft bgs. Plate 1 shows the sampling locations. Upon review of the field log book from the 1996 VCA, it was found that five samples (0132-96-0604, 0132-96-0606, 0132-96-0608, 0132-96-0609, and 0132-96-0610) had incorrect depths in the VCA report (ERM/Golder 1996, 063801, pp. 86–90). The depths have been corrected in Table 4.1-1 and in appropriate data figures and tables throughout this report.

Inorganic Chemicals

Table 4.1-2 presents the results of inorganic chemicals above BVs and detected inorganic chemicals that have no BVs. Plate 2 shows the sampling locations and inorganic chemicals detected or detected above BVs.

All 15 samples collected in 2010 were analyzed for TAL metals. Aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, copper, lead, magnesium, nickel, selenium, sodium, and thallium were detected above BVs or had DLs above BVs in the samples collected in 2010.

Upon review of the field log book from the 1996 VCA, it was found that sample 0132-96-0631 at location 32-06373 had been excavated in 1996. However, this sample was not flagged as excavated in the EP database and was incorrectly retained as an investigation sample. Arsenic and iron were detected above BVs in only this sample at the site and were identified as COPCs (LANL 2010, 108528, pp. F-182–F-183). Arsenic and iron were not detected above BVs in the 2010 samples. Therefore, arsenic and iron are no longer COPCs.

Organic Chemicals

Table 4.1-3 presents the results of the detected organic chemicals. Plate 3 shows the sampling locations and the detected organic chemicals.

Because the nature and extent of organic chemicals are defined at SWMU 32-002(a) (LANL 2010, 108528), the samples collected in 2010 were not analyzed for organic chemicals.

Radionuclides

Table 4.1-4 presents the radionuclides detected or detected above BVs/FVs. Plate 4 shows the sampling locations and radionuclides detected or detected above BVs/FVs.

Because the nature and extent of radionuclides are defined at SWMU 32-002(a) (LANL 2010, 108528), the samples collected in 2010 were not analyzed for radionuclides.

Summary of COPCs at SWMU 32-002(a)

The inorganic COPCs are antimony, barium, beryllium, cadmium, chromium, copper, total cyanide, lead, mercury, nickel, nitrate, perchlorate, selenium, silver, sodium, thallium, and zinc. This list of inorganic COPCs is the same as that presented in the investigation report (LANL 2010, 108528, p. F-188), except for arsenic and iron, which were eliminated following the discovery that sample 0132-96-0631 at location 32-06373 had been excavated in 1996.

The organic COPCs are the same as those identified previously (LANL 2010, 108528, p. F-188) and include acenaphthene; acetone; anthracene; Aroclor-1260; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; bis(2-ethylhexyl)phthalate; butylbenzylphthalate; carbazole; chrysene; dibenz(a,h)anthracene; dibenzofuran; dichlorodifluoromethane; fluoranthene; fluorene; indeno(1,2,3-cd)pyrene; methylene chloride; naphthalene; phenanthrene; pyrene; trichlorofluoromethane; and dioxins and furans including 1,2,3,4,6,7,8-heptachlorodibenzodioxin; total heptachlorodibenzodioxins; 1,2,3,4,6,7,8-heptachlorodibenzofuran; 1,2,3,4,7,8,9-heptachlorodibenzofuran; total heptachlorodibenzofurans; 1,2,3,4,7,8-hexachlorodibenzodioxin; 1,2,3,6,7,8-hexachlorodibenzodioxin; 1,2,3,7,8,9-hexachlorodibenzodioxin; total hexachlorodibenzodioxins; 1,2,3,4,7,8-hexachlorodibenzofuran; 1,2,3,6,7,8-hexachlorodibenzofuran; 2,3,4,6,7,8-hexachlorodibenzofuran; total hexachlorodibenzofurans; 1,2,3,4,6,7,8,9-octachlorodibenzodioxin; 1,2,3,4,6,7,8,9-octachlorodibenzofuran; 1,2,3,7,8-pentachlorodibenzodioxin; total pentachlorodibenzodioxins; 1,2,3,7,8-pentachlorodibenzofuran; 2,3,4,7,8-pentachlorodibenzofuran; total pentachlorodibenzofurans; total tetrachlorodibenzodioxins; 2,3,7,8-tetrachlorodibenzofuran; and total tetrachlorodibenzofurans.

The radionuclide COPCs are the same those as identified previously in the investigation report (LANL 2010, 108528, p. F-188) and include cesium-137, plutonium-238, plutonium-239/240, tritium, and uranium-235/236.

4.1.4 Nature and Extent of Contamination

Inorganic Chemicals

Deeper samples were collected at nine existing locations (00-603580, 00-603581, 00-603582, 00-603583, 00-603585, 32-06367, 32-06368, 32-06370, and 32-06372) to evaluate the vertical extent of barium, chromium, and nickel.

Concentrations of barium decreased with depth, or barium was not detected above BV at seven of the nine locations. Concentrations of barium increased with depth at the other two locations (32-603582 and 32-603585). Therefore, the vertical extent of barium is not defined at locations 32-603582 and 32-603585.

Concentrations of chromium decreased with depth, or chromium was not detected above BV at six of the nine locations. The concentrations of chromium in the deepest samples at locations 00-603585 and 32-06368 were 12.9 mg/kg and 10.4 mg/kg, respectively, which are below the maximum tuff background concentration (13 mg/kg). Concentrations of chromium increased with depth at location 32-06372. Therefore, the vertical extent of chromium is not defined at location 32-06372.

Concentrations of nickel decreased with depth, or nickel was not detected above BV at six of the nine locations. Concentrations of nickel increased with depth at locations 00-603582, 00-603585, and 32-06372. Therefore, the vertical extent of nickel is not defined at locations 00-603582, 00-603585, and 32-06372.

In addition, aluminum, antimony, beryllium, cadmium, calcium, copper, lead, magnesium, selenium, sodium, and thallium were either detected above BVs or had DLs above BVs in the samples collected in 2010. The extent of these inorganic chemicals is discussed below.

Concentrations of aluminum decreased with depth, or aluminum was not detected above BV at seven of the nine locations. Concentrations of aluminum increased with depth at locations 00-603582 and 00-603585. Therefore, the vertical extent of aluminum is not defined at locations 00-603582 and 00-603585.

Antimony was not detected above BV or was not detected but had DLs above BV at eight of the nine locations. At location 32-06372, the concentration of antimony in the deeper sample was 0.569 mg/kg, which is similar to the maximum tuff background concentration (0.5 mg/kg). Antimony was not detected but had a DL of 12 mg/kg in the shallower sample collected at location 32-06372. Therefore, the vertical extent of antimony is defined at location 32-06372.

Concentrations of beryllium decreased with depth, or beryllium was not detected above BV at eight of the nine locations. Concentrations of beryllium increased with depth at location 00-603582. Therefore, the vertical extent of beryllium is not defined at location 00-603582.

Cadmium was not detected above BV at eight of the nine locations and was not detected but had a DL above BV in the deepest sample collected at location 32-06370. Therefore, the vertical extent of cadmium is defined.

Concentrations of calcium decreased with depth, or calcium was not detected above BV at all nine locations. Therefore, the vertical extent of calcium is defined.

Concentrations of copper decreased with depth, or copper was not detected above BV at seven of the nine locations. Concentrations of copper increased with depth at locations 00-603582 and 00-603585. Therefore, the vertical extent of copper is not defined at locations 00-603582 and 00-603585.

Concentrations of lead decreased with depth, or lead was not detected above BV at eight of the nine locations. Concentrations of lead increased with depth at location 00-603582. Therefore, the vertical extent of lead is not defined at location 00-603582.

Magnesium was not detected above BV at seven of the nine locations. Concentrations of magnesium increased with depth at locations 00-603582 and 00-603585. However, the concentrations of magnesium in the deepest samples are 2010 mg/kg and 2570 mg/kg, respectively, less than the maximum tuff background concentration (2820 mg/kg). Therefore, the vertical extent of magnesium is defined.

Selenium was detected above BV at only one location (00-603585) sampled in 2010 but had DLs above BVs at all other locations. The detection of selenium occurred in the shallower of the two samples collected in 2010. Therefore, the vertical extent of selenium is defined.

Concentrations of sodium decreased with depth, or sodium was not detected above maximum background concentration at all nine locations. Therefore, the vertical extent of sodium is defined.

Thallium was not detected above BV at eight of the nine locations and was not detected but had a DL above BV in the deepest sample at location 00-603585. Therefore, the vertical extent of thallium is defined.

At location 32-06373 where the excavation was conducted, the results of confirmation samples show arsenic and mercury were not detected above BVs, and the concentrations of lead decreased with depth. Arsenic, lead, and mercury were not detected above BVs in the two samples from the sidewalls of the excavation (locations 32-611241 and 32-611242). Therefore, the lateral and vertical extent of arsenic, lead, and mercury are defined at location 32-06373. The concentrations of all other inorganic chemicals decreased with depth at location 32-06373.

Organic Chemicals

The nature and extent of organic COPCs are defined at SWMU 32-002(a) (LANL 2010, 108528, p. F-190).

Radionuclides

The nature and extent of radionuclide COPCs are defined at SWMU 32-002(a) (LANL 2010, 108528, pp. F-190–F-191).

Summary of Nature and Extent for SWMU 32-002(a)

The lateral and vertical extent of organic and radionuclide COPCs as well as the lateral extent of inorganic COPCs are defined at SWMU 32-002(a). The vertical extent is not defined for

- aluminum, barium, beryllium, copper, lead, and nickel at location 00-603582;
- aluminum, barium, copper, and nickel at location 00-603585; and
- chromium and nickel at location 32-06372.

4.1.5 Summary of Human Health Risk Screening

Because the extent of contamination has not been defined at SWMU 32-002(a), human health risk-screening assessments were not conducted for the site.

4.1.6 Summary of Ecological Risk Screening

Because the extent of contamination has not been defined at SWMU 32-002(a), an ecological risk-screening assessments were not conducted for the site.

4.2 SWMU 32-002(b)

4.2.1 Sampling Activities

Eight deeper samples were collected from six existing sampling locations in 2010 to define the vertical extent of barium, chromium, and/or nickel at these locations. The eight samples were analyzed for TAL metals only.

4.2.2 Sample Analytical Results

The samples collected in 1996, 2008, and 2010 and the analyses requested are presented in Table 4.2-1. The samples were collected from depths ranging from 0 to 12.5 ft bgs. Plate 1 shows the sampling locations. Upon review of the field log book from the 1996 VCA, it was found that one sample (0132-96-0614 from location 32-06377) had an incorrect depth in the VCA report (ERM/Golder 1996, 063801, pp. 86–90). The depth has been corrected in Table 4.1-1 and in appropriate data figures and tables throughout this report.

Inorganic Chemicals

Table 4.2-2 presents the results of inorganic chemicals above BVs and the detected inorganic chemicals that have no BVs. Plate 5 shows the sampling locations and inorganic COPCs detected or detected above BVs.

Inorganic Chemicals in Soil

No additional soil samples were collected in 2010. The results of the soil samples collected in 1996 and 2008 are presented in Table 4.2-2 and are shown on Plate 5. Antimony, chromium, copper, lead, mercury, nitrate, silver, thallium, and zinc were identified as COPCs in soil (LANL 2010, 108528).

Inorganic Chemicals in Tuff

A total of 37 tuff samples were analyzed for TAL metals. Twenty-one samples were also analyzed for cyanide (total), nitrate, and perchlorate. The eight tuff samples collected in 2010 were analyzed for TAL metals only. Therefore, the results of total cyanide, nitrate, and perchlorate are the same as those previously reported (LANL 2010, 108528), and they are identified as COPCs in tuff.

Antimony was detected above the tuff BV (0.5 mg/kg) and above the maximum background concentration of antimony in tuff (0.4 mg/kg) in one tuff sample at a concentration of 3.72 mg/kg. Antimony was not detected but had DLs (0.51 to 12 mg/kg) above the BV and the maximum tuff background concentration in 22 tuff samples. Antimony is identified as a COPC in tuff.

Arsenic was detected above the tuff BV (2.79 mg/kg) in five tuff samples, with a maximum concentration of 7.91 mg/kg. Three of the five results also exceeded the maximum background concentration of arsenic in tuff (5 mg/kg). Statistical tests were performed to determine if the site data for arsenic are different from background. The statistical test results are presented in Appendix E, Table E-1. The result of the Gehan test indicates the site data are different from background. The box plot for arsenic in tuff is presented in Appendix E, Figure E-1. Arsenic is identified as a COPC in tuff.

Barium was detected above the tuff BV (46.0 mg/kg) in 13 tuff samples, with a maximum concentration of 220 mg/kg. Eleven of the 13 results also exceeded the maximum background concentration of barium in tuff (51.6 mg/kg). Statistical tests were performed to determine if the site data for barium are different from background. The statistical test results are presented in Appendix E, Table E-1. The result of the Gehan test indicates the site data are different from background. The box plot for barium in tuff is presented in Appendix E, Figure E-2. Barium is identified as a COPC in tuff.

Calcium was detected above the tuff BV (2200 mg/kg) and above the maximum background concentration of calcium in tuff (2230 mg/kg) in two tuff samples at concentrations of 4700 mg/kg and 2500 mg/kg. Statistical tests were performed to determine if the site data for calcium are different from background. The statistical test results are presented in Appendix E, Table E-1. The results of both the

Gehan test and the quantile test indicate the site data are not different from background. The box plot for calcium in tuff is presented in Appendix E, Figure E-3. Calcium is not identified as a COPC in tuff.

Chromium was detected above the tuff BV (7.14 mg/kg) in 28 tuff samples, with a maximum concentration of 167 mg/kg. Seventeen of the 28 results also exceeded the maximum background concentration of chromium in tuff (13 mg/kg). Chromium is interpreted as being substantially above background. Chromium is identified as a COPC in tuff.

Cobalt was detected above the tuff BV (3.14 mg/kg) and above the maximum background concentration of cobalt in tuff (also 3.14 mg/kg) in two tuff samples at concentrations of 3.6 mg/kg. Statistical tests were performed to determine if the site data for cobalt are different from background. The statistical test results are presented in Appendix E, Table E-1. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for cobalt in tuff is presented in Appendix E, Figure E-4. Cobalt is not identified as a COPC in tuff.

Copper was detected above the tuff BV (4.66 mg/kg) in 15 tuff samples, with a maximum concentration of 8.41 mg/kg. Six of the 16 results also exceeded the maximum background concentration of copper in tuff (6.2 mg/kg). Statistical tests were performed to determine if the site data for copper are different from background. The statistical test results are presented in Appendix E, Table E-1. The result of the Gehan test indicates the site data are different from background. The box plot for copper in tuff is presented in Appendix E, Figure E-5. Copper is identified as a COPC in tuff.

Lead was detected above the tuff BV (11.2 mg/kg) in 18 tuff samples, with a maximum concentration of 71 mg/kg. Fourteen of the 18 results also exceeded the maximum background concentration of lead in tuff (15.5 mg/kg). Lead is interpreted as being substantially above background. Lead is identified as a COPC in tuff.

Manganese was detected above the tuff BV (482 mg/kg) and above the maximum background concentration of manganese in tuff (752 mg/kg) in one tuff sample at a concentration of 830 mg/kg. Statistical tests were performed to determine if the site data for manganese are different from background. The statistical test results are presented in Appendix E, Table E-1. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for manganese in tuff is presented in Appendix E, Figure E-6. Manganese is not identified as a COPC in tuff.

Mercury was detected above the tuff BV (0.1 mg/kg) in 17 tuff samples, with a maximum concentration of 6.4 mg/kg. Mercury also had a DL (0.11 mg/kg) above the BV. Results were compared only with the BV because a background data set is not available for mercury in tuff. Mercury is identified as a COPC in tuff.

Nickel was detected above the tuff BV (6.58 mg/kg) and above the maximum background concentration of nickel in tuff (7 mg/kg) in 15 tuff samples, with a maximum concentration of 28.5 mg/kg. Statistical tests were performed to determine if the site data for nickel are different from background. The statistical test results are presented in Appendix E, Table E-1. The result of the quantile test indicates the site data are different from background. The box plot for nickel in tuff is presented in Appendix E, Figure E-7. Nickel is identified as a COPC in tuff.

Selenium was detected above the tuff BV (0.3 mg/kg) and above the maximum background concentration of selenium in tuff (0.105 mg/kg) in 15 tuff samples, with a maximum concentration of 0.762 mg/kg. Selenium also had DLs (0.56 mg/kg to 1.18 mg/kg) above the BV in 10 tuff samples. Statistical tests were not performed because the background data set for selenium in tuff consists of all nondetects. The box plot for selenium in tuff is presented in Appendix E, Figure E-8. Selenium is identified as a COPC in tuff.

Silver was detected above the tuff BV (1 mg/kg) in seven tuff samples, with a maximum concentration of 6.7 mg/kg. Six of the seven results also exceeded the maximum background concentration of silver in tuff (1.9 mg/kg). Statistical tests were performed to determine if the site data for silver are different from background. The statistical test results are presented in Appendix E, Table E-1. The result of the quantile test indicates the site data are not different from background, while the result of the slippage test indicates the site data are different from background. The box plot for silver in tuff is presented in Appendix E, Figure E-9. Silver is identified as a COPC in tuff.

Sodium was detected above the tuff BV (2770 mg/kg) in one tuff sample at a concentration of 2840 mg/kg. The result did not exceed the maximum background concentration of sodium in tuff (7700 mg/kg). Statistical tests were performed to determine if the site data for sodium are different from background. The statistical test results are presented in Appendix E, Table E-1. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for sodium in tuff is presented in Appendix E, Figure E-10. Sodium is not identified as a COPC in tuff.

Thallium was detected above the tuff BV (1.10 mg/kg) in one tuff sample at a concentration of 1.3 mg/kg. The result did not exceed the maximum background concentration of thallium in tuff (1.7 mg/kg). Thallium also had DLs (1.3 mg/kg to 2.1 mg/kg) above the BV in six tuff samples. Two of the six DLs exceeded the maximum background concentration. Statistical tests were performed to determine if the site data for thallium are different from background. The statistical test results are presented in Appendix E, Table E-1. The results of both the quantile test and the slippage test indicate the site data are not different from background. The box plot for thallium in tuff is presented in Appendix E, Figure E-11. Thallium is not identified as a COPC in tuff.

Zinc was detected above the tuff BV (63.5 mg/kg) and above the maximum background concentration of zinc in tuff (65.6 mg/kg) in four tuff samples, with a maximum concentration of 98.7 mg/kg. Statistical tests were performed to determine if the site data for zinc are different from background. The statistical test results are presented in Appendix E, Table E-1. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for zinc in tuff is presented in Appendix E, Figure E-12. Zinc is not identified as a COPC in tuff.

Organic Chemicals

Table 4.2-3 presents the results of the detected organic chemicals. Plate 6 shows the sampling locations and the detected organic chemicals.

Because the nature and extent of organic chemicals are defined at SWMU 32-002(b) (LANL 2010, 108528, pp. F-198), the samples collected in 2010 were not analyzed for organic chemicals.

Radionuclides

Table 4.2-4 presents the results of the radionuclides detected or detected above BVs/FVs. The sampling locations and the radionuclides detected or detected above BVs/FVs are shown on Plate 4.

Because the nature and extent of radionuclides are defined at SWMU 32-002(b) (LANL 2010, 108528, pp. F-198–F-199), the samples collected in 2010 were not analyzed for radionuclides.

Summary of COPCs at SWMU 32-002(b)

The inorganic COPCs are antimony, arsenic, barium, chromium, copper, total cyanide, lead, mercury, nickel, nitrate, perchlorate, selenium, silver, thallium, and zinc. This list is the same as that presented in the investigation report (LANL 2010, 108528, p. F-196), except for manganese, based on the statistical comparisons presented above.

The organic COPCs are Aroclor-1260; anthracene; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; benzoic acid; bis(2-ethylhexyl)phthalate; butylbenzylphthalate; chrysene; di-n-butylphthalate; dibenz(a,h)anthracene; fluoranthene; indeno(1,2,3-cd)pyrene; methylene chloride; phenanthrene; pyrene; tetrachloroethene; trichlorofluoromethane; and dioxins and furans (1,2,3,4,6,7,8-heptachlorodibenzodioxin; total heptachlorodibenzodioxins; 1,2,3,4,6,7,8-heptachlorodibenzofuran; 1,2,3,4,7,8,9-heptachlorodibenzofuran; total heptachlorodibenzofurans; 1,2,3,4,7,8-hexachlorodibenzodioxin; 1,2,3,6,7,8-hexachlorodibenzodioxin; 1,2,3,7,8,9-hexachlorodibenzodioxin; total hexachlorodibenzodioxins; 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; total hexachlorodibenzofurans; 1,2,3,4,6,7,8,9-octachlorodibenzodioxin; 1,2,3,4,6,7,8,9-octachlorodibenzofuran; 1,2,3,7,8-pentachlorodibenzodioxin; total pentachlorodibenzodioxins; 1,2,3,7,8-pentachlorodibenzofuran; 2,3,4,7,8-pentachlorodibenzofuran; total pentachlorodibenzofurans; total tetrachlorodibenzofurans). This is the same list of organic COPCs as reported previously (LANL 2010, 108528, pp. F-196–F-197), except for carbazole. Carbazole was detected in only one sample at a concentration of 0.38 mg/kg, which is equivalent to the quantitation limit. This result was reevaluated and determined to be a nondetect during the data-validation process for this report.

The radionuclide COPCs are the same as those identified previously in the investigation report (LANL 2010, 108528, p. F-197) and include americium-241, cesium-137, plutonium-239/240, strontium-90, tritium, uranium-234, uranium-235/236, and uranium-238.

4.2.3 Nature and Extent of Contamination

Inorganic Chemicals

Eight samples were collected from deeper sampling intervals at six existing locations (00-603589, 00-603590, 00-603591, 00-603592, 00-603594, and 00-603595) to evaluate the vertical extent of barium, chromium, and nickel.

Concentrations of barium decreased with depth, or barium was not detected above BV at all six locations. Therefore, the vertical extent of barium is defined.

Concentrations of chromium decreased with depth at all six locations. Therefore, the vertical extent of chromium is defined.

Concentrations of nickel decreased with depth at all six locations. Therefore, the vertical extent of nickel is defined.

Although the lateral and vertical extent of antimony, arsenic, copper, lead, mercury, selenium, silver, thallium, and zinc were defined following the 2008 investigation (LANL 2010, 108528), these analytes were detected above BVs in 2010 samples. The extent of these COPCs is discussed below. Samples collected in 2010 were not analyzed for total cyanide, nitrate, or perchlorate. Therefore, although they are identified as COPCs, the lateral and vertical extent of total cyanide, nitrate, and perchlorate are defined, as reported previously (LANL 2010, 108528), and are not discussed below.

Antimony had DLs above BV in several samples collected in 2010. Antimony was detected in only one sample (location 00-603595, 9 to 10 ft bgs) but was not detected in the deepest sample from the same location. Therefore, the vertical extent of antimony is defined.

Concentrations of arsenic decreased with depth, or arsenic was not detected above BV at all six 2010 locations. Therefore, the vertical extent of arsenic is defined.

Concentrations of copper decreased with depth, or copper was not detected above BV at all six 2010 locations. Therefore, the vertical extent of copper is defined.

Concentrations of lead decreased with depth, or lead was not detected above BV at all six locations. Therefore, the vertical extent of lead is defined.

Concentrations of mercury decreased with depth, or mercury was not detected above BV at all six locations. Therefore, the vertical extent of mercury is defined.

Selenium was not detected but had DLs above BV (0.3 mg/kg) in five of the eight samples collected in 2010 and was detected at estimated concentrations in two samples. The eighth sample (location 00-603595, 12 to 12.5 bgs) was analyzed for TAL metals to determine the vertical extent of chromium (see deviations from the ACA work plan discussed in section 4.5.2). However, the selenium results were rejected because of quality issues. At locations 00-603589 and 00-603591, selenium was detected above tuff BV in only the deepest samples at similar estimated concentrations (0.703 mg/kg at 7 to 8 ft bgs and 0.763 mg/kg at 9 to 10 ft bgs). Selenium was not detected at 9 to 10 ft bgs at location 00-603590, which is approximately 25 ft downslope of location 00-603589. Selenium was detected at lower concentrations in the deepest samples at two locations associated with SWMU 32-003 (00-603600 and 00-603607), within 20 ft of location 00-603591. Although the deepest samples at these locations are slightly shallower (6.75 to 7.25 and 7 to 8 ft bgs) than at location 00-603591, they are located downslope and are nearly equivalent in elevation. Selenium was detected at the BV at these two locations (0.32 mg/kg and 0.31 mg/kg, respectively). Selenium was not detected in the deepest downslope sample at location 00-603592 (7 to 8 ft bgs). Therefore, the vertical extent of selenium is defined.

Concentrations of silver decreased with depth, or silver was not detected above BV at all six locations. Therefore, the vertical extent of silver is defined.

Thallium was not detected above BV at all six locations. Therefore, the vertical extent of thallium is defined.

Concentrations of zinc decreased with depth, or zinc was not detected above BV at five of the six locations. The concentrations of zinc increased slightly with depth at location 00-603595, with a concentration of 69.2 mg/kg in the deepest sample (12 to 12.5 ft bgs) versus 66.4 mg/kg in the shallowest sample (1.2 to 2.2 ft bgs). The detected concentrations are similar to the maximum tuff background concentration (65.6 mg/kg). Zinc was not detected above BV in the three intermediate sampling intervals at location 00-603595 (3.2 to 4.2, 5 to 6, and 9 to 10 ft bgs) and does not appear to be the result of a release. Therefore, the vertical extent of zinc is defined.

Organic Chemicals

The nature and extent of organic COPCs are defined at SWMU 32-002(b) (LANL 2010, 108528, p. F-198).

Radionuclides

The nature and extent of radionuclide COPCs are defined at SWMU 32-002(b) (LANL 2010, 108528, pp. F-198–F-199).

4.2.4 Summary of Human Health Risk Screening

Human health risk-screening assessments for SWMU 32-002(b) are presented in Appendix F, section F-4.2.1.

The total excess cancer risk for the industrial scenario is 3×10^{-6}, below the NMED target risk level of 1×10^{-5}. The HI for the industrial scenario is 0.3, below the NMED target HI of 1.0. The total dose is 1 mrem/yr, below the DOE target dose limit of 15 mrem/yr.

The total excess cancer risk for the recreational scenario is 2×10^{-6}, below the NMED target risk level of 1×10^{-5}. The HI is 0.4, below the NMED target HI of 1.0. The total dose is 0.3 mrem/yr, below the DOE target dose limit of 15 mrem/yr.

The total excess cancer risk for the construction worker scenario is 3×10^{-7}, below the NMED target risk level of 1×10^{-5}. The HI is 0.3, below the NMED target HI of 1.0. The total dose is 1 mrem/yr, below the DOE target dose limit of 15 mrem/yr.

The total excess cancer risk for the residential scenario is 2×10^{-5}, slightly above the NMED target risk level of 1×10^{-5}. The total excess cancer risk for the residential vapor intrusion is approximately 5×10^{-8} and does not change the potential risk from soil. For the residential scenario, arsenic contributes to the cancer risk (6×10^{-6}). The arsenic exposure point concentration is within the ranges of background concentrations, the risk did not incrementally increase above that which would result from exposure to naturally occurring levels of arsenic, and the risk is overestimated. Without arsenic, the total excess cancer risk is approximately 1×10^{-5}, equivalent to the NMED target risk level. The HI is 0.8, below the NMED target HI of 1.0. The HI for the residential vapor intrusion is approximately 0.00003 and does not change the potential risk from soil. The total dose is 4 mrem/yr, below the DOE target dose limit of 15 mrem/yr.

The total dose for the industrial and construction worker scenarios are equivalent to a total risk of 1×10^{-5} and 6×10^{-6}, respectively, based on a comparison with EPA's outdoor worker preliminary remediation goals (PRGs) for radionuclides (available at http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls). The total dose for the residential scenario is equivalent to a total risk of 1×10^{-5}, based on a comparison with EPA's residential PRGs for radionuclides (available at http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls). The total dose for the recreational scenario is equivalent to a total risk of 6×10^{-7}, based on conversion from dose using RESRAD, Version 6.5.

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 32-002(b).

4.2.5 Summary of Ecological Risk Screening

Elevated mercury concentrations were detected at SWMU 32-002(b) based on the 1996 samples, resulting in an elevated HI for the earthworm. There are no potential risks to the other ecological receptors. Ecological risk-screening assessments are presented in Appendix F, section F-5.0.

4.3 AOC 32-003

4.3.1 Remediation Activities

The concentration of Aroclor-1260 exceeded the industrial and residential SSLs in a 2008 surface sample (0 to 1 ft) at location 00-603601. Cleanup at location 32-603601 included soil excavation and confirmatory sampling. The remediated area was approximately 12 × 5 × 2.5 ft (Figure 4.3-1). The total volume of excavated material was approximately 5.5 yd^3.

4.3.2 Sampling Activities

Nineteen samples were collected from 13 locations at AOC 32-003 in 2010.

- Five deeper samples were collected from five existing sampling locations to define the vertical extent of chromium and nickel at these locations. These samples were analyzed for TAL metals and hexavalent chromium. The samples were analyzed for hexavalent chromium to determine whether it is appropriate to assume that the total chromium concentrations in existing samples can be attributed to hexavalent chromium.
- Eight confirmation samples were collected from five locations at the excavated area at location 00-603601. Confirmation samples were collected from the north, south, and east walls of the excavation. All eight samples were analyzed only for PCBs. It was not necessary to collect a confirmation sample from the bottom of the excavation because Aroclor-1260 was detected at 26 mg/kg at 0 to 1 ft and at 0.088 mg/kg at 2 to 2.5 ft at location 00-603601 in 2008 (LANL 2010, 108528, p. 440). The results of these two 2010 samples are also listed in the AOC 32-003 “excavated” table included in the data DVD (Appendix C).
- Six samples were collected from three locations to define the lateral extent of PAHs and PCBs.

4.3.3 Sample Analytical Results

The samples collected and analyses requested from 2008 and 2010 are presented in Table 4.3-1. The samples were collected from depths ranging from 0 to 8.5 ft bgs. Figure 4.3-1 shows the sampling locations.

Inorganic Chemicals

Table 4.3-2 presents the results of inorganic chemicals above BVs and the detected inorganic chemicals that have no BVs. The sampling locations and inorganic COPCs detected or detected above BVs are shown in Figure 4.3-2.

Inorganic Chemicals in Soil

None of the soil samples collected in 2010 were analyzed for inorganic chemicals. The results of soil samples collected in 2008 are presented in Table 4.3-2 and shown in Figure 4.3-2. Sodium and zinc were identified as COPCs in soil.

Inorganic Chemicals in Tuff

A total of 24 tuff samples from AOC 32-003 were analyzed for TAL metals.

Aluminum was detected above the tuff BV (7340 mg/kg) and above the maximum background concentration of aluminum in tuff (8370 mg/kg) in two tuff samples at concentrations of 14,100 mg/kg and 8970 mg/kg. Statistical tests were performed to determine if the site data for aluminum are different from background. The statistical test results are presented in Appendix E, Table E-2. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for aluminum in tuff is presented in Appendix E, Figure E-13. Aluminum is not identified as a COPC in tuff.

Antimony was not detected but had DLs (0.52 mg/kg to 1.3 mg/kg) above the tuff BV (0.5 mg/kg) and above the maximum background concentration of antimony in tuff (0.4 mg/kg) in 16 tuff samples. Antimony is identified as a COPC in tuff.

Arsenic was detected above the tuff BV (2.79 mg/kg) in one tuff sample at a concentration of 4.5 mg/kg. The result did not exceed the maximum background concentration of arsenic in tuff (5 mg/kg). Statistical tests were performed to determine if the site data for arsenic are different from background. The statistical test results are presented in Appendix E, Table E-2. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for arsenic in tuff is presented in Appendix E, Figure E-14. Arsenic is not identified as a COPC in tuff.

Barium was detected above the tuff BV (46.0 mg/kg) in four tuff samples, with a maximum concentration of 144 mg/kg. Three of the four results also exceeded the maximum background concentration of barium in tuff (51.6 mg/kg). Statistical tests were performed to determine if the site data for barium are different from background. The statistical test results are presented in Appendix E, Table E-2. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for barium in tuff is presented in Appendix E, Figure E-15. Barium is not identified as a COPC in tuff.

Beryllium was detected above the tuff BV (1.21 mg/kg) and above the maximum background concentration of beryllium in tuff (1.8 mg/kg) in two tuff samples, at concentrations of 1.9 mg/kg and 1.71 mg/kg. Statistical tests were performed to determine if the site data for beryllium are different from background. The statistical test results are presented in Appendix E, Table E-2. The result of the Gehan test indicates the site data are different from background. The box plot for beryllium in tuff is presented in Appendix E, Figure E-16. Beryllium is identified as a COPC in tuff.

Chromium was detected above the tuff BV (7.14 mg/kg) in 20 tuff samples, with a maximum concentration of 65.9 mg/kg. Twelve of the 20 results also exceeded the maximum background concentration of chromium in tuff (13 mg/kg). Chromium is interpreted as being substantially different from background. Chromium is identified as a COPC in tuff.

Hexavalent chromium was also analyzed and detected in two 2010 samples at concentrations of 0.399 mg/kg and 0.541 mg/kg; the concentrations of total chromium in these two samples are 49.4 mg/kg and 17.2 mg/kg, respectively. Hexavalent chromium apparently contributes little to the concentration of total chromium. Therefore, contamination from chromium is evaluated as total chromium, which is identified as a COPC in tuff.

Cobalt was detected above the tuff BV (3.14 mg/kg) and above the maximum background concentration of cobalt in tuff (also 3.14 mg/kg) in one tuff sample at a concentration of 5 mg/kg. Statistical tests were performed to determine if the site data for cobalt are different from background. The statistical test results are presented in Appendix E, Table E-2. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for cobalt in tuff is presented in Appendix E, Figure E-17. Cobalt is not identified as a COPC in tuff.

Copper was detected above the tuff BV (4.66 mg/kg) in three tuff samples, with a maximum concentration of 8.2 mg/kg. Two of the three results also exceeded the maximum background concentration of copper in tuff (6.2 mg/kg). Statistical tests were performed to determine if the site data for copper are different from background. The statistical test results are presented in Appendix E, Table E-2. The result of the Gehan test indicates the site data are different from background. The box plot for copper in tuff is presented in Appendix E, Figure E-18. Copper is identified as a COPC in tuff.

Lead was detected above the tuff BV (11.2 mg/kg) in four tuff samples, with a maximum concentration of 26.2 mg/kg. One of the four results also exceeded the maximum background concentration of lead in tuff (15.5 mg/kg). Statistical tests were performed to determine if the site data for lead are different from background. The statistical test results are presented in Appendix E, Table E-2. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for lead in tuff is presented in Appendix E, Figure E-19. Lead is not identified as a COPC in tuff.

Magnesium was detected above the tuff BV (1690 mg/kg) in one tuff sample at a concentration of 2230 mg/kg. The result did not exceed the maximum background concentration of magnesium in tuff (2820 mg/kg). Statistical tests were performed to determine if the site data for magnesium are different from background. The statistical test results are presented in Appendix E, Table E-2. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for magnesium in tuff is presented in Appendix E, Figure E-20. Magnesium is not identified as a COPC in tuff.

Nickel was detected above the tuff BV (6.58 mg/kg) in 16 tuff samples, with a maximum concentration of 32.5 mg/kg. Twelve of the 16 results also exceeded the maximum background concentration of nickel in tuff (7 mg/kg). Statistical tests were performed to determine if the site data for nickel are different from background. The statistical test results are presented in Appendix E, Table E-2. The result of the quantile test indicates the site data are different from background. The box plot for nickel in tuff is presented in Appendix E, Figure E-21. Nickel is identified as a COPC in tuff.

Selenium was detected above the tuff BV (0.3 mg/kg) and above the maximum background concentration of selenium in tuff (0.105 mg/kg) in five tuff samples, with a maximum concentration of 0.36 mg/kg. Selenium also had DLs (0.58 mg/kg to 1.24 mg/kg) above the BV in nine tuff samples. Statistical tests were not performed because the background data of selenium in Qbt 2, Qbt 3, Qbt 4 tuff are all nondetects. The box plot for selenium in tuff is presented in Appendix E, Figure E-22. Selenium is identified as a COPC in tuff.

Vanadium was detected above the tuff BV (17.0 mg/kg) in one tuff sample at a concentration of 21 mg/kg. The result is equal to the maximum background concentration of vanadium in tuff (21 mg/kg). Statistical tests were performed to determine if the site data for vanadium are different from background. The statistical test results are presented in Appendix E, Table E-2. The results of both the Gehan test and the quantile test indicate the site data are not different from background. The box plot for vanadium in tuff is presented in Appendix E, Figure E-23. Vanadium is not identified as a COPC in tuff.

Organic Chemicals

Table 4.3-3 presents the results of the detected organic chemicals. The sampling locations and the detected organic chemicals are shown in Figure 4.3-3.

Organic Chemicals in Soil

Eleven soil samples from AOC 32-003 were analyzed for PAHs, PCBs, SVOCs, and VOCs.

Anthracene; Aroclor-1260; 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; methylene chloride; phenanthrene; and pyrene were detected in at least one soil sample and are identified as COPCs in soil.

Organic Chemicals in Tuff

Nineteen tuff samples were analyzed for PCBs, SVOCs, and VOCs; an additional six tuff samples were analyzed for PCBs only.

Aroclor-1260, bis(2-ethylhexyl)phthalate, fluoranthene, methylene chloride, and pyrene were detected in at least one tuff sample and are identified as COPCs in tuff.

Summary of COPCs at AOC 32-003

The inorganic COPCs are antimony, beryllium, chromium, copper, nickel, selenium, sodium, and zinc. This is the same list of inorganic COPCs as reported previously (LANL 2010, 108528, p. F-202).

The organic COPCs are anthracene; Aroclor-1260; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; bis(2-ethylhexyl)phthalate; chrysene; fluoranthene; indeno(1,2,3-cd)pyrene; methylene chloride; phenanthrene; and pyrene. This is the same list of organic COPCs as reported previously (LANL 2010, 108528, p. F-202) but includes anthracene. which was detected in a 2010 sample (Table 4.3-3).

4.3.4 Nature and Extent of Contamination

Inorganic Chemicals

Five deeper samples were collected at five existing locations (00-603601, 00-603605, 00-603606, 00-603609, and 00-603611) to evaluate the vertical extent of chromium and nickel.

Concentrations of chromium decreased with depth at locations 00-603606, 00-603609, and 00-603611. At location 00-603601, chromium was detected at a concentration of 9.77 mg/kg in the 2010 sample, the deepest sample collected at this location. Chromium was detected at a concentration of 44.3 mg/kg in a shallower sample collected in 2008 at location 00-603601 (LANL 2010, 108528, p. 439); however, this location was excavated during the 2010 ACA. The concentration in the 2010 sample represents a decrease with depth and is less than the maximum background concentration (13 mg/kg). Therefore, the vertical extent of chromium is defined at location 00-603601. At location 00-603605, the concentrations of chromium increased with depth, with a maximum concentration of 49.4 mg/kg in the deepest sample (5.5 to 6.5 ft bgs). At location 00-603591, which is associated with SWMU 32-002(b) and is approximately 10 ft north of location 00-603605, the concentration of chromium decreased to 12 mg/kg in the deepest sample (9 to 10 ft bgs) (Plate 5). This chromium detection is less than the maximum background concentration for tuff (13 mg/kg). Therefore, the vertical extent of chromium is defined.

Concentrations of nickel decreased with depth at locations 00-603605, 00-603606, and 00-603611. At location 00-603601, nickel was not detected above BV in the deepest sample (the location of the shallower sample was excavated during the 2010 ACA). At location 00-603609, the concentrations of nickel increased with depth, with a maximum concentration of 11.3 mg/kg in the deepest sample (4 to 5 ft bgs). At location 00-603592, which is associated with SWMU 32-002(b) and is approximately 15 ft northeast of location 00-603609, the concentrations of nickel decreased to below BV in the deepest sample (7 to 8 ft bgs) (Plate 5). Therefore, the vertical extent of nickel is defined.

Antimony, beryllium, copper, selenium, sodium, and zinc are also identified as COPCs at AOC 32-003. Although the lateral and vertical extent of beryllium and copper were defined following the 2008 investigation (LANL 2010, 108528), they were detected above BVs in 2010 samples. The extent of these COPCs is discussed below. Antimony, selenium, sodium, and zinc were not detected above BVs in samples collected in 2010. Therefore, the lateral and vertical extent of antimony, selenium, sodium, and zinc are defined as reported previously (LANL 2010, 108528) and are not discussed below.

Beryllium was not detected above BV at four of the five locations. At location 00-603609, the concentration of beryllium in the deepest sample is 1.71 mg/kg, which is below the maximum tuff background concentration (1.8 mg/kg). In addition, beryllium was not detected above BV at 5 to 6 ft at location 00-063611, which is approximately 15 ft to the east of location 00-603609. Therefore, the vertical extent of beryllium is defined.

Copper was not detected above BV at four of the five locations. At location 00-603609, the concentration of copper in the deepest sample is 6.47 mg/kg, which is similar to the maximum tuff background concentration (6.2 mg/kg). In addition, copper was not detected above BV at 5 to 6 ft at location 00-063611, which is approximately 15 ft to the east of location 00-603609. Therefore, the vertical extent of copper is defined.

Organic Chemicals

Location 00-603601 was excavated in 2010. Aroclor-1260 was detected at 26 mg/kg at 0 to 1 ft and at 0.088 mg/kg at 2 to 2.5 ft at location 00-603601 in 2008 (LANL 2010, 108528, p. 440). Because vertical extent has been defined and the deepest sample did not exceed cleanup levels, it was not necessary to collect a confirmation sample from the bottom of the excavation (although a deeper sample was collected at this location to define the vertical extent of inorganic chemicals, as described above). Eight confirmation samples were collected from five locations bounding the excavation to the south (location 32-611788), southeast (location 32-611789), northeast (location 32-611845), and north (locations 32-611846 and 32-611847). Confirmation samples were analyzed for PCBs, and only Aroclor-1260 was detected. The concentrations of Aroclor-1260 were more than an order of magnitude below the cleanup goal of 1 mg/kg in all confirmation samples, and the results decreased with depth and/or were at or below the estimated quantitation limits (EQLs). Therefore, removal activities at AOC 32-003 were successful, and the extent of PCBs is defined in the excavated area.

Six samples were collected from locations 32-611232, 32-611233, and 32-611234 to evaluate the lateral and vertical extent of PAHs and the lateral extent of Aroclor-1260. All concentrations of PAHs and Aroclor-1260 decreased laterally within the AOC boundary. Therefore, the lateral extent of PAHs and PCBs is defined. The concentrations of all PAHs decreased with depth at locations 32-611232 and 32-611234. At location 32-611233, the concentrations of PAHs in the deeper sample are all at or below EQLs. PAHs were not detected in any of the deeper samples from the site (greater than 32.5 ft). Therefore, the vertical extent of PAHs is defined.

In accordance with the approved work plan (LANL 2009, 108332; NMED 2010, 108455), a sample was collected at location 00-603608 at a depth of 4 to 4.5 ft bgs to define vertical extent of Aroclor-1260, which was detected in the 3 to 3.5 ft bgs sample from this location at a concentration of 0.26 mg/kg. The deeper sample was erroneously submitted for screening-level PCB analysis instead of level 4 analysis (see section 4.5.3). The screening-level data indicated that PCBs were not detected in the 4 to 4.5 ft bgs sample above a reporting limit of 0.01 mg/kg. In addition, a sample collected from 3.25 to 3.75 ft bgs at location 00-603609, less than 10 ft to the south, had no detected Aroclor-1260. No other PCBs were detected in samples from AOC 32-003. Therefore, the vertical extent of PCBs is defined.

4.3.5 Summary of Human Health Risk Screening

Human health risk-screening assessments for AOC 32-003 are presented in Appendix F, section F-4.2.2.

The total excess cancer risk for the industrial scenario is 3×10^{-6}, below the NMED target risk level of 1×10^{-5}. The HI for the industrial scenario is 0.005, below the NMED target HI of 1.0.

The total excess cancer risk for the recreational scenario is 2×10^{-6}, below the NMED target risk level of 1×10^{-5}. The HI is 0.01, below the NMED target HI of 1.0.

The total excess cancer risk for the construction worker scenario is 3×10^{-7}, below the NMED target risk level of 1×10^{-5}. The HI is 0.09, below the NMED target HI of 1.0.

The total excess cancer risk for the residential scenario is 1×10^{-5}, equivalent to the NMED target risk level of 1×10^{-5}. The total excess cancer risk for the residential vapor intrusion is approximately 7×10^{-8} and does not change the potential risk from soil. The HI is 0.2, below the NMED target HI of 1.0.

Based on the risk-screening assessment results, no potential unacceptable risks exist for the industrial, recreational, construction worker, and residential scenarios at AOC 32-003.

4.3.6 Summary of Ecological Risk Screening

No potential unacceptable risks to ecological receptors are present at AOC 32-003. Ecological risk-screening assessments are presented in Appendix F, section F-5.0.

4.4 AOC 32-004

4.4.1 Sampling Activities

Eight samples were collected in 2010 from four existing sampling locations and analyzed for PAHs only. Sampling was conducted at these locations to confirm the high concentrations of PAHs detected in 1996 samples.

4.4.2 Sample Analytical Results

The samples collected and analyses requested from 1996, 2008, and 2010 are presented in Table 4.4-1. The samples were collected from depths ranging from 0 to 6 ft bgs. Figure 4.4-1 shows the sampling locations. Upon review of the field log book from the 1996 VCA, it was found that two 1996 samples (0132-96-0621 at location 32-06363 and 0132-96-0622 at location 32-06364) had incorrect depths (ERM/Golder 1996, 063801, p. 76). Their depths have been corrected in Table 4.4-1 and in appropriate data figures and tables throughout this report.

Inorganic Chemicals

Table 4.4-2 presents the results of the inorganic chemicals above BVs and the detected inorganic chemicals that have no BVs. The sampling locations and inorganic COPCs detected or detected above BVs are shown in Figure 4.4-2.

Because the nature and extent of inorganic chemicals are defined at AOC 32-004 (LANL 2010, 108528, p. F-207), the samples collected in 2010 were not analyzed for inorganic chemicals.

Organic Chemicals

Table 4.4-3 presents the results of the detected organic chemicals. The sampling locations and the detected organic chemicals are shown in Figure 4.4-3.

The eight soil samples collected in 2010 were analyzed for PAHs only. Locations 32-06326, 32-06331, 32-06338, and 32-06340 were resampled at the same depths as the 1996 samples, and a deeper sample was collected at locations 32-06331 and 32-06340 because only surface samples had been collected in 1996. Concentrations of PAHs in 2010 samples were less than those in the 1996 samples at locations 32-06331, 32-06338, and 32-06340. Concentrations of PAHs in 2010 samples were similar to or higher than those in the 1996 samples collected at location 32-06326.

The 2010 PAH results replace the 1996 PAH results where samples were collected at the same depths as previous samples (Table 4.4-3). The replaced PAH results are for

- sample 0132-96-0354 at location 32-06326, replaced by sample RE32-10-11368;
- sample 0132-96-0356 at location 32-06331, replaced by sample RE32-10-11370;
- sample 0132-96-0352 at location 32 06338, replaced by sample RE32-10-11366; and
- sample 0132-96-0351 at location 32-06340, replaced by sample RE32-10-11364.

Organic Chemicals in Soil

Eight soil samples from 1996 were analyzed for SVOCs, and two samples were also analyzed for VOCs. The eight soil samples collected in 2010 were analyzed for PAHs.

Acetone; anthracene; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; bis(2-ethylhexyl)phthalate; butylbenzylphthalate; chrysene; di-n-octylphthalate; fluoranthene; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene were detected in at least one soil sample and are identified as COPCs in soil.

Organic Chemicals in Tuff

One tuff sample collected in 1996 was analyzed only for SVOCs. Three tuff samples collected in 2008 were analyzed for SVOCs and VOCs.

Bis(2-ethylhexyl)phthalate was detected in two tuff samples and is identified as a COPC in tuff.

Radionuclides

Table 4.4-4 presents the results of the radionuclides detected or detected above BVs/FVs. The sampling locations and radionuclides detected or detected above BVs/FVs are shown in Figure 4.4-4.

Because the nature and extent of radionuclides are defined at AOC 32-004 (LANL 2010, 108528, p. F-207), the samples collected in 2010 were not analyzed for radionuclides.

Summary of COPCs at AOC 32-004

The inorganic COPCs are the same as those identified previously (LANL 2010, 108528, p. F-207) and include antimony, chromium, copper, total cyanide, lead, mercury, nickel, nitrate, selenium, silver, thallium, and zinc.

The organic COPCs are acetone; anthracene; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; bis(2-ethylhexyl)phthalate; butylbenzylphthalate; chrysene; di-n-octylphthalate; fluoranthene; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene. This is the same list of organic COPCs as was reported previously (LANL 2010, 108528, p. F-207), except for acenaphthene, fluorene, and naphthalene. Acenaphthene, fluorene, and naphthalene are no longer COPCs because they were not detected in the 2010 samples that replace the 1996 samples.

The radionuclide COPC is the same as previously identified (LANL 2010, 108528, p. F-207) and includes americium-241.

4.4.3 Nature and Extent of Contamination

Inorganic Chemicals

The nature and extent of inorganic chemicals are defined at AOC 32-004 (LANL 2010, 108528, p. F-207).

Organic Chemicals

The investigation report concluded that the nature and extent of organic chemicals are defined at AOC 32-004 (LANL 2010, 108528, pp. F-207–F-208).

The PAHs detected in the 2010 samples include anthracene; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; fluoranthene; phenanthrene; and pyrene (Table 4.4-3). All the PAHs detected were previously identified as COPCs (LANL 2010, 108528, p. F-207), and all concentrations decreased with depth at the four locations resampled in 2010 (locations 32-06326, 32-06331, 32-06338, and 32-06340). Acenaphthene, fluorene, and naphthalene are no longer COPCs because they were not detected in the 2010 samples that replace the 1996 samples. Therefore, the nature and extent of organic chemicals are defined at AOC 32-004.

Radionuclides

The nature and extent of radionuclides are defined at AOC 32-004 (LANL 2010, 108528, p. F-207).

Summary of Nature and Extent for AOC 32-004

The lateral and vertical extent of all inorganic chemicals, organic chemicals, and radionuclides are defined at AOC 32-004.

4.4.4 Summary of Human Health Risk Screening

Human health risk-screening assessments for AOC 32-004 are presented in Appendix F, section F-4.2.3.

As described in the VCA report for former TA-32 (LANL 1996, 059178), another potential source of contamination, the industrial/commercial area situated northwest of AOC 32-004 along Knecht Street, was identified. The potential sources of contamination include two auto repair shops, a car wash, a paint and body shop, and a gas station. This area may have impacted the AOC 32-004 outfall area. Stormwater from the Knecht Street area is collected by a storm drain that discharges onto the hillslope near the outfall. The Knecht Street discharge area and the AOC outfall area converge into a common drainage channel. Contaminants that could result from the industries and businesses include organic chemicals (e.g., PAHs) and metals.

To address the potential contamination from the Knecht Street area, during the VCA, samples were collected from two locations upgradient of the outfall pipe (locations 32-06339 and 32-06340). These two locations were within the area affected by the Knecht Street drainage. Two samples were collected from location 32-06340, and one sample (0132-96-0069) was sent to a fixed laboratory for analysis of TAL metals and SVOCs following field screening. One sample was collected from location 32-06339 and field screened only.

No archival evidence was found to indicate PAHs were used or generated in former building 32-03, which was served by the AOC 32-004 septic system. Former building 32-03 was an office building that included a vault room where a radioactive source was stored. The radioactive source is the only documented source of contamination at AOC 32-004. Americium-241 was the only radionuclide detected at the site in only one sample, located below outfall, at a concentration of 0.091 pCi/g (Table 4.4-4). The mesa top where AOC 32-004 drainline was located is covered by asphalt and until recently was associated with the Los Alamos County Public Works Department Pavement Management Division. The asphalt pavement covers the mesa top from the former Public Works Department buildings, which were vacated and demolished in 2010, to the edge of Los Alamos Canyon. In addition, a storm drain located upgradient of AOC 32-004 drains directly onto the outfall area. Therefore, the PAHs detected in the outfall area are likely a result of runoff from the asphalt and storm drain.

While the PAHs detected at the site are not likely attributable to Laboratory activities, the initial risk estimates calculated include the PAH concentrations at location 32-06340. The results indicate no potential unacceptable cancer risks for the industrial, recreational, and construction worker scenarios and an approximately 2×10^{-5} (1.5×10^{-5}) cancer risk for the residential scenario. Because the PAHs detected at location 32-06340 are not site-related (i.e., upgradient of the outfall), the cancer risk has been recalculated without the PAHs at this location. The cancer risk is approximately 1×10^{-5} and the HI is 1, which are equivalent to the NMED target levels. These risk estimates are also overestimated because the calculations still include the PAHs, detected downgradient in the drainage, which are wholly or in part associated with the Knecht Street area runoff and not likely site related.

The total excess cancer risk for the industrial scenario is 1×10^{-5}, equivalent to the NMED target risk level of 1×10^{-5}. The HI for the industrial scenario is 0.3, below the NMED target HI of 1.0. The total dose is 0.01 mrem/yr, below the DOE target dose limit of 15 mrem/yr.

The total excess cancer risk for the recreational scenario is 9×10^{-6}, below the NMED target risk level of 1×10^{-5}. The HI is 0.4, below the NMED target HI of 1.0. The total dose is 0.005 mrem/yr, below the DOE target dose limit of 15 mrem/yr.

The total excess cancer risk for the construction worker scenario is 5×10^{-7}, below the NMED target risk level of 1×10^{-5}. The HI is 0.4, below the NMED target HI of 1.0. The total dose is 0.04 mrem/yr, below the DOE target dose limit of 15 mrem/yr.

The total excess cancer risk for the residential scenario is 2×10^{-5}, slightly above the NMED target cancer risk level of 1×10^{-5}. PAHs are the primary contributors to human health risks. The HI is 1, equivalent to the NMED target HI of 1.0. The residential HI is overestimated and reduced to 0.6 based on the uncertainty discussions associated with lead and antimony (Appendix F, section F-4.3.2). The HI for the residential vapor intrusion is approximately 1×10^{-9} and does not change the potential risk from soil. The total dose is 0.05 mrem/yr, below the DOE target dose limit of 15 mrem/yr.

As discussed above and in Appendix F, the runoff from the industrialized Knecht Street area upslope of the outfall flows into the drainage shared by the outfall, and elevated PAH concentrations have been detected on both the mesa top and the canyon slope. Because the building served by the drainline and outfall was an office building, which included a radiation source vault, and location 32-06340 is upslope from the outfall, the PAH results from samples at location 32-06340 should be excluded to from human health risk-screening assessments. As a result, the total excess cancer risk for the residential scenario is approximately 1×10^{-5}, equivalent to the NMED target risk level of 1×10^{-5}.

The total dose for the industrial and construction worker scenarios is equivalent to a total risk of 2×10^{-8}, based on a comparison with EPA's outdoor worker PRGs for radionuclides (available at http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls). The total dose for the residential scenario is equivalent to a total risk of 5×10^{-8}, based on a comparison with EPA's residential PRGs for radionuclides (available at http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls). The total dose for the recreational scenario is equivalent to a total risk of 1×10^{-9}, based on conversion from dose using RESRAD, Version 6.5.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial, recreational, construction worker, and residential scenarios resulting from releases from AOC 32-004.

4.4.5 Summary of Ecological Risk Screening

No potential unacceptable risks to ecological receptors are present at AOC 32-004. Ecological risk-screening assessments are presented in Appendix F, section F-5.0.

4.5 Deviations from the ACA Work Plan

4.5.1 SWMU 32-002(a)

The following deviations from the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455) occurred during sampling activities at SWMU 32-002(a).

- Two deeper depths (1 to 2 and 5 to 6 ft bgs) were sampled at location 32-06370 instead of the one deeper depth (5 to 6 ft bgs) proposed in the work plan.
- Samples collected at the north and east sidewalls at the excavation of location 32-06373 were collected from 1.5 to 2 ft bgs instead of the approximately 4 to 5 ft bgs as proposed in the work plan.

4.5.2 SWMU 32-002(b)

The following deviations from the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455) occurred during sampling activities at SWMU 32-002(b).

- Three deeper depths (5 to 6, 9 to 10, and 12 to 12.5 ft bgs) were sampled at location 00-603595 instead of the one deeper depth (5.0 to 6.0 ft bgs) proposed in the work plan. The additional depth intervals were sampled to determine the vertical extent of chromium.

4.5.3 AOC 32-003

The following deviations from the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455) occurred during sampling activities at AOC 32-003.

- Two confirmation samples (0.5 to 1 and 2 to 2.5 ft bgs) were collected at the north wall of the excavation, instead of the one depth (0.5 to 1 ft bgs) proposed in the work plan.
- Six confirmation samples were collected from three locations at depths ranging from 7 to 8.5 ft bgs to the north of the excavated area instead of the one depth (0.5 to 1 ft bgs) proposed in the work plan. Because of the depth of fill material to the north of the excavated area, the first depth sample was collected at the soil-tuff interface from 7 to 7.5 ft bgs.
- The deepest sample collected at location 00-603608 (4 to 4.5 ft bgs) to determine vertical extent of Aroclor-1260 was erroneously submitted for screening-level PCB analysis instead of level 4 PCB analysis. Therefore, the data associated with this sample are not included in figures and tables (see section 4.3.4).

4.5.4 AOC 32-004

No deviations from the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455) occurred at AOC 32-004.

4.6 Final Site Conditions

Soil was excavated at SWMU 32-002(a) and AOC 32-003. The excavation at 32-002(a) was backfilled with clean fill material and restored to the approximate original grade and condition. The excavation at AOC 32-003 has been stabilized and will undergo final stabilization and/or restoration following demolition of a fence and guardrail in the immediate area by Los Alamos County.

5.0 CONCLUSIONS

5.1 Summary of Nature and Extent of Contamination

The nature and extent of contamination are defined at SWMU 32-002(b) and AOCs 32-003 and 32-004.

The nature and extent of organic and radionuclide COPCs are defined at SWMU 32-002(a). The nature and the lateral extent of inorganic COPCs are also defined; however, the vertical extent of inorganic COPCs is not defined.

5.2 Summary of Risk-Screening Assessments

Risk-screening assessments were conducted for SWMU 32-002(b) and AOCs 32-003 and 32-004. No potential unacceptable risks or doses exist for the industrial, recreational, construction worker, and residential scenarios at SWMU 32-002(b) and AOCs 32-003 and 32-004. Also, no potential unacceptable risks to ecological receptors exist at AOCs 32-003 and 32-004. However, elevated mercury concentrations were detected at SWMU 32-002(b) based on the 1996 samples, resulting in an elevated HI for the earthworm.

The Laboratory’s as low as reasonably achievable (ALARA) program description states that quantitative ALARA evaluations are not necessary for Laboratory activities that have a potential for annual public exposure less than a 3-mrem total effective dose equivalent individual dose ("Los Alamos National Laboratory Environmental ALARA Program," PD410, p. 7, effective November 8, 2008). The calculated radiation dose(s) for the residential scenario ranged from 0.05 mrem/yr to 3.5 mrem/yr. The dose for SWMU 32-002(b) (3.5 mrem/yr) was background-corrected by subtracting the background dose from the total dose per Standard Operating Procedure 5254, Performing ALARA analysis for Public Exposures. The background corrected dose for SWMU 32-002(b) was 2.8 mrem/yr, which satisfies PD410 as noted above. Therefore, radiation exposures to the public at the three sites evaluated at former TA-32 are ALARA.

6.0 RECOMMENDATIONS

The determination of site status is based on the evaluation of nature and extent and the results of the risk-screening assessments. Depending on the decision scenario used, the sites are recommended as corrective actions complete either with or without controls or for additional action. The residential scenario is the only scenario under which corrective action complete without controls is applicable. The other scenarios (industrial, recreational, and construction worker) result in corrective action complete with controls. The decision scenario for former TA-32 is residential. All three sites do not pose a potential unacceptable risk or dose under the residential scenario. No further investigation or remediation activities are warranted.

The Laboratory recommends corrective actions complete without controls for the following two sites within former TA-32:

- AOC 32-003, former transformer site
- AOC 32-004, drainline and outfall

Further investigation is needed to define vertical extent of inorganic chemicals at SMWU 32-002(a) as follows:

- aluminum, barium, beryllium, copper, lead, and nickel at location 00-603582
- aluminum, barium, copper, and nickel at location 00-603585
- chromium and nickel at location 32-06372

In addition to sampling at these locations for the analytes listed above, chromium analysis will be conducted on samples from locations 00-603582 and 00-603585 to finalize the definition of extent at nearby locations. This additional sampling has been proposed in the Phase II investigation work plan for the Upper Los Alamos Canyon Aggregate Area (LANL 2010, 110860) and/or NMED's approval with modifications (NMED 2011, 111674) to address the vertical extent of inorganic chemicals at SWMU 32-002(a).

Further evaluation is needed at SWMU 32-002(b) because elevated mercury concentrations were detected in the 1996 samples, resulting in an elevated HI for the earthworm. These locations will be resampled to confirm the presence of mercury at elevated levels. Depending upon the results of the reanalysis, further evaluation might be necessary (e.g., testing the soil using the earthworm toxicity and growth test) to determine if a potential ecological impact is present.

7.0 REFERENCES AND MAP DATA SOURCES

7.1 References

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the EP Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

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

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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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NMED (New Mexico Environment Department), January 19, 2011. “Approval with Modifications, Phase II Investigation Work Plan for Upper Los Alamos Canyon Aggregate Area,” New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 111674)

7.2 Data Map Sources

Hypsography; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.

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Structures; County of Los Alamos, Information Services; as published 29 October 2007.

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Water Utility Distribution System Maintained by the County of Los Alamos; County of Los Alamos, Information Services; as published 04 March 2009.

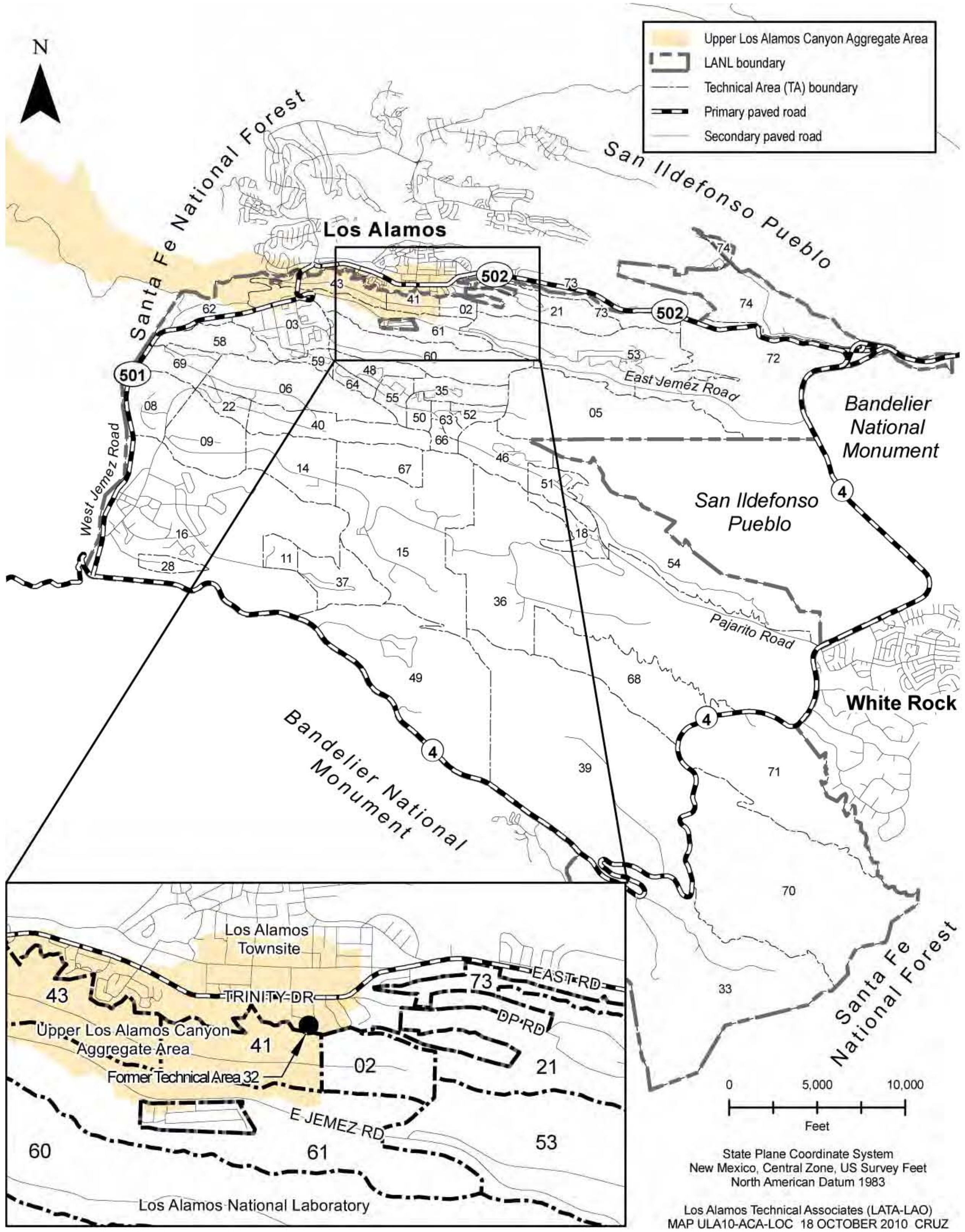


Figure 1.0-1 **Location of former TA-32 within the Upper Los Alamos Canyon Aggregate Area**

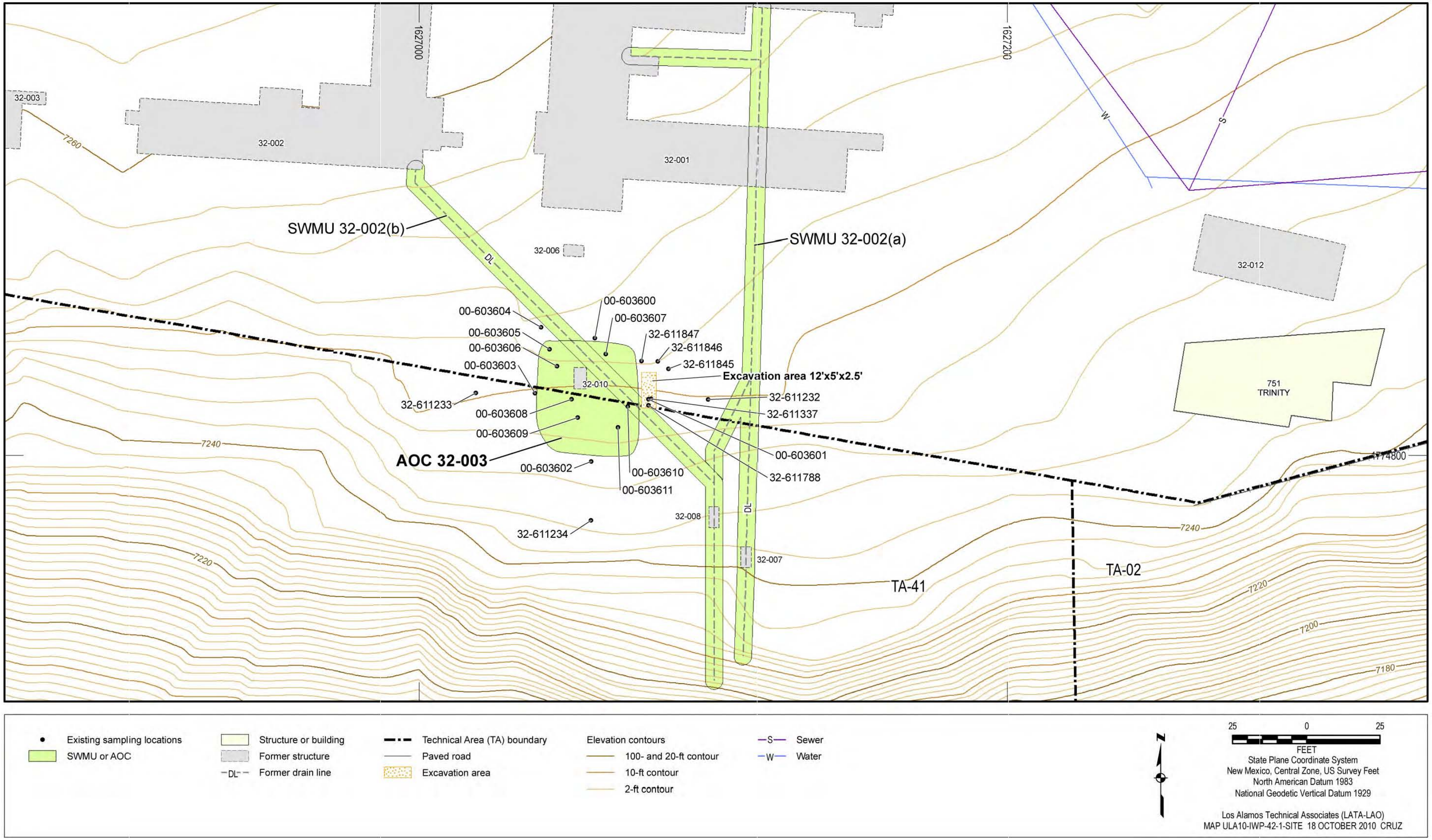


Figure 4.3-1 Site map of AOC 32-003 and sampling locations

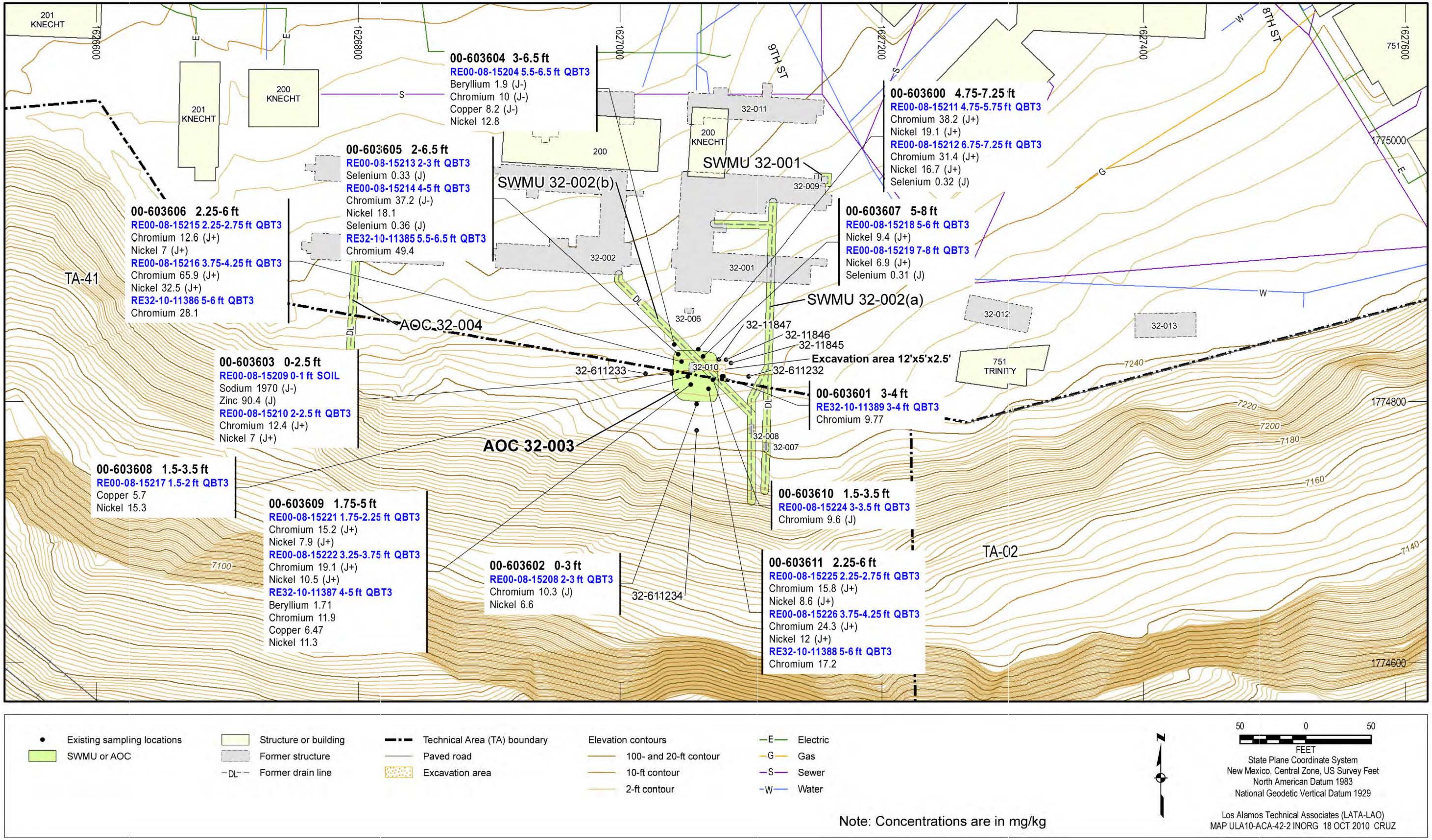


Figure 4.3-2 Inorganic COPCs detected or detected above BVs at AOC 32-003

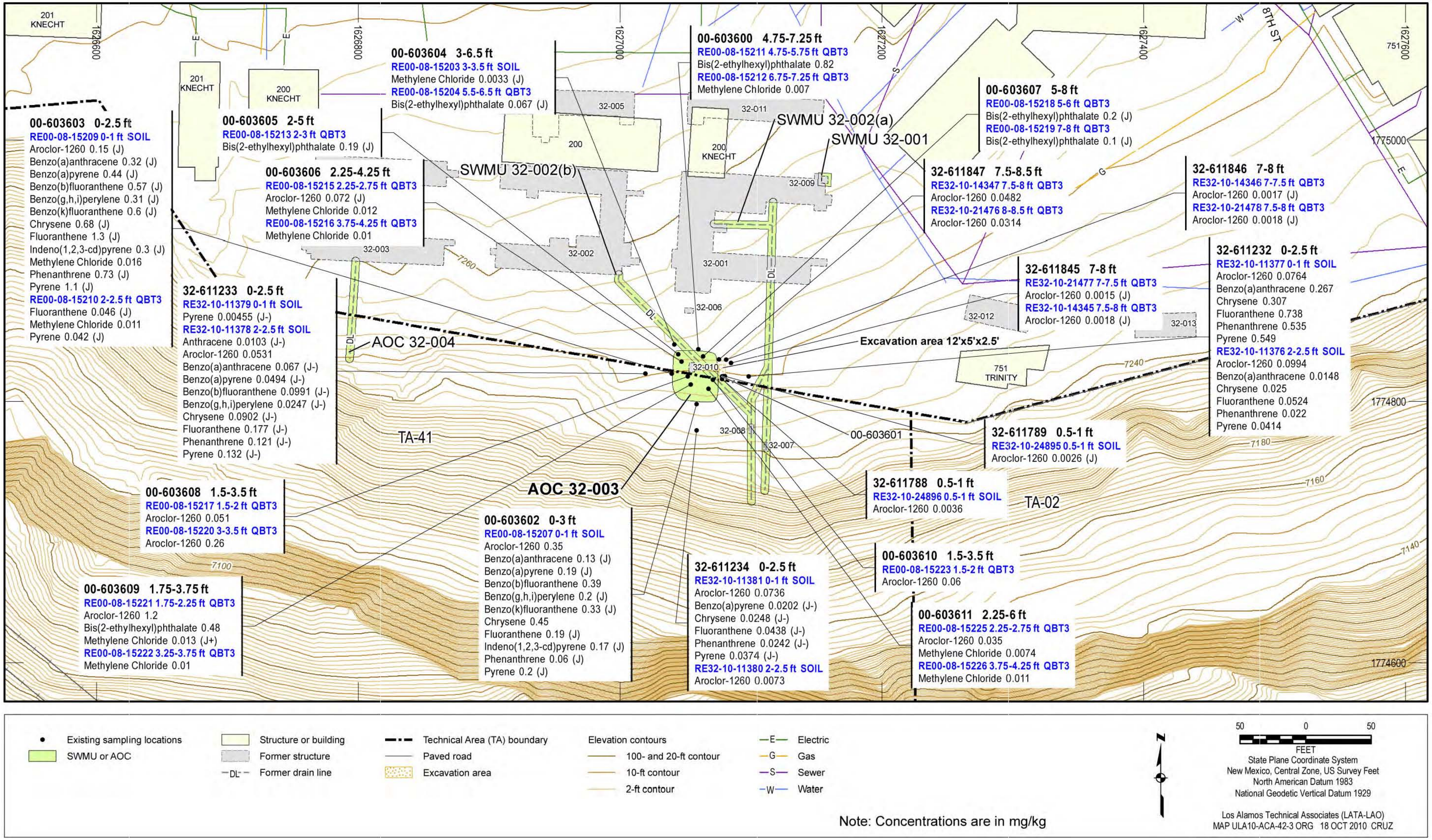


Figure 4.3-3 Organic COPCs detected at AOC 32-003

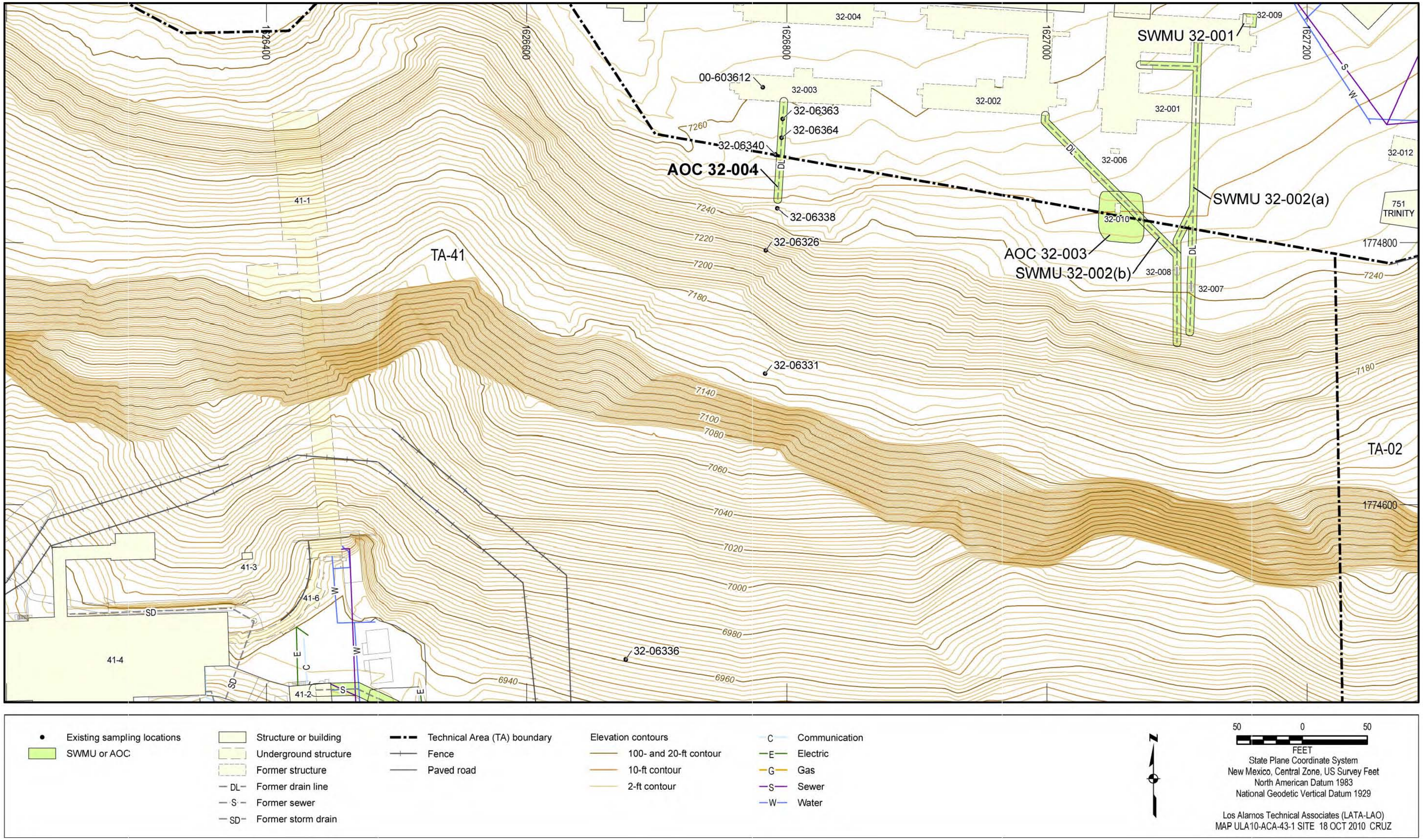


Figure 4.4-1 Site map of AOC 32-004 and sampling locations

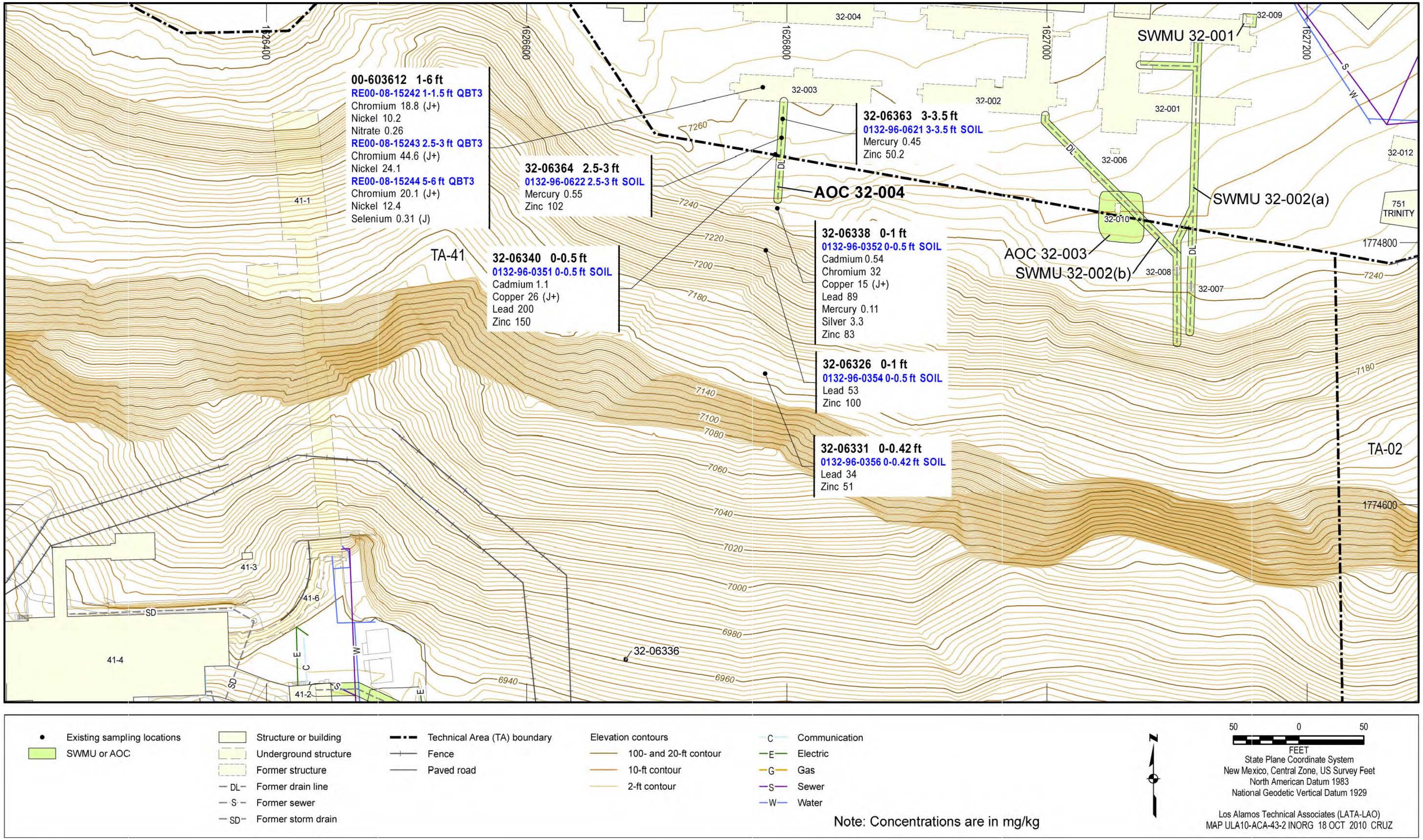
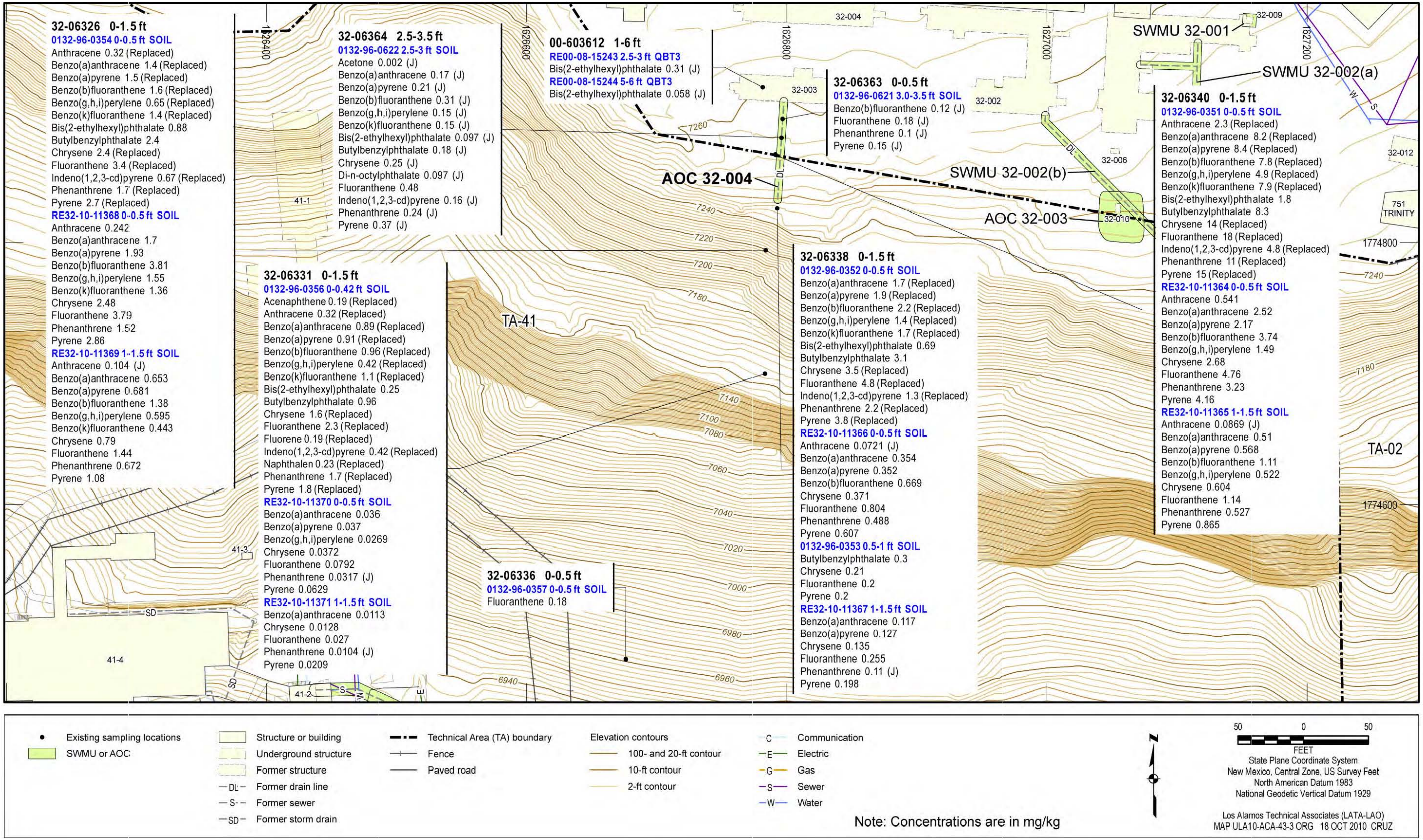


Figure 4.4-2 Inorganic COPCs detected or detected above BVs at AOC 32-004



32-06326 0-1.5 ft
0132-96-0354 0-0.5 ft SOIL
Anthracene 0.32 (Replaced)
Benzo(a)anthracene 1.4 (Replaced)
Benzo(a)pyrene 1.5 (Replaced)
Benzo(b)fluoranthene 1.6 (Replaced)
Benzo(g,h,i)perylene 0.65 (Replaced)
Benzo(k)fluoranthene 1.4 (Replaced)
Bis(2-ethylhexyl)phthalate 0.88
Butylbenzylphthalate 2.4
Chrysene 2.4 (Replaced)
Fluoranthene 3.4 (Replaced)
Indeno(1,2,3-cd)pyrene 0.67 (Replaced)
Phenanthrene 1.7 (Replaced)
Pyrene 2.7 (Replaced)
RE32-10-11368 0-0.5 ft SOIL
Anthracene 0.242
Benzo(a)anthracene 1.7
Benzo(a)pyrene 1.93
Benzo(b)fluoranthene 3.81
Benzo(g,h,i)perylene 1.55
Benzo(k)fluoranthene 1.36
Chrysene 2.48
Fluoranthene 3.79
Phenanthrene 1.52
Pyrene 2.86
RE32-10-11369 1-1.5 ft SOIL
Anthracene 0.104 (J)
Benzo(a)anthracene 0.653
Benzo(a)pyrene 0.681
Benzo(b)fluoranthene 1.38
Benzo(g,h,i)perylene 0.595
Benzo(k)fluoranthene 0.443
Chrysene 0.79
Fluoranthene 1.44
Phenanthrene 0.672
Pyrene 1.08

32-06364 2.5-3.5 ft
0132-96-0622 2.5-3 ft SOIL
Acetone 0.002 (J)
Benzo(a)anthracene 0.17 (J)
Benzo(a)pyrene 0.21 (J)
Benzo(b)fluoranthene 0.31 (J)
Benzo(g,h,i)perylene 0.15 (J)
Benzo(k)fluoranthene 0.15 (J)
Bis(2-ethylhexyl)phthalate 0.097 (J)
Butylbenzylphthalate 0.18 (J)
Chrysene 0.25 (J)
Di-n-octylphthalate 0.097 (J)
Fluoranthene 0.48
Indeno(1,2,3-cd)pyrene 0.16 (J)
Phenanthrene 0.24 (J)
Pyrene 0.37 (J)

00-603612 1-6 ft
RE00-08-15243 2.5-3 ft QBT3
Bis(2-ethylhexyl)phthalate 0.31 (J)
RE00-08-15244 5-6 ft QBT3
Bis(2-ethylhexyl)phthalate 0.058 (J)

32-06363 0-0.5 ft
0132-96-0621 3.0-3.5 ft SOIL
Benzo(b)fluoranthene 0.12 (J)
Fluoranthene 0.18 (J)
Phenanthrene 0.1 (J)
Pyrene 0.15 (J)

32-06340 0-1.5 ft
0132-96-0351 0-0.5 ft SOIL
Anthracene 2.3 (Replaced)
Benzo(a)anthracene 8.2 (Replaced)
Benzo(a)pyrene 8.4 (Replaced)
Benzo(b)fluoranthene 7.8 (Replaced)
Benzo(g,h,i)perylene 4.9 (Replaced)
Benzo(k)fluoranthene 7.9 (Replaced)
Bis(2-ethylhexyl)phthalate 1.8
Butylbenzylphthalate 8.3
Chrysene 14 (Replaced)
Fluoranthene 18 (Replaced)
Indeno(1,2,3-cd)pyrene 4.8 (Replaced)
Phenanthrene 11 (Replaced)
Pyrene 15 (Replaced)
RE32-10-11364 0-0.5 ft SOIL
Anthracene 0.541
Benzo(a)anthracene 2.52
Benzo(a)pyrene 2.17
Benzo(b)fluoranthene 3.74
Benzo(g,h,i)perylene 1.49
Chrysene 2.68
Fluoranthene 4.76
Phenanthrene 3.23
Pyrene 4.16
RE32-10-11365 1-1.5 ft SOIL
Anthracene 0.0869 (J)
Benzo(a)anthracene 0.51
Benzo(a)pyrene 0.568
Benzo(b)fluoranthene 1.11
Benzo(g,h,i)perylene 0.522
Chrysene 0.604
Fluoranthene 1.14
Phenanthrene 0.527
Pyrene 0.865

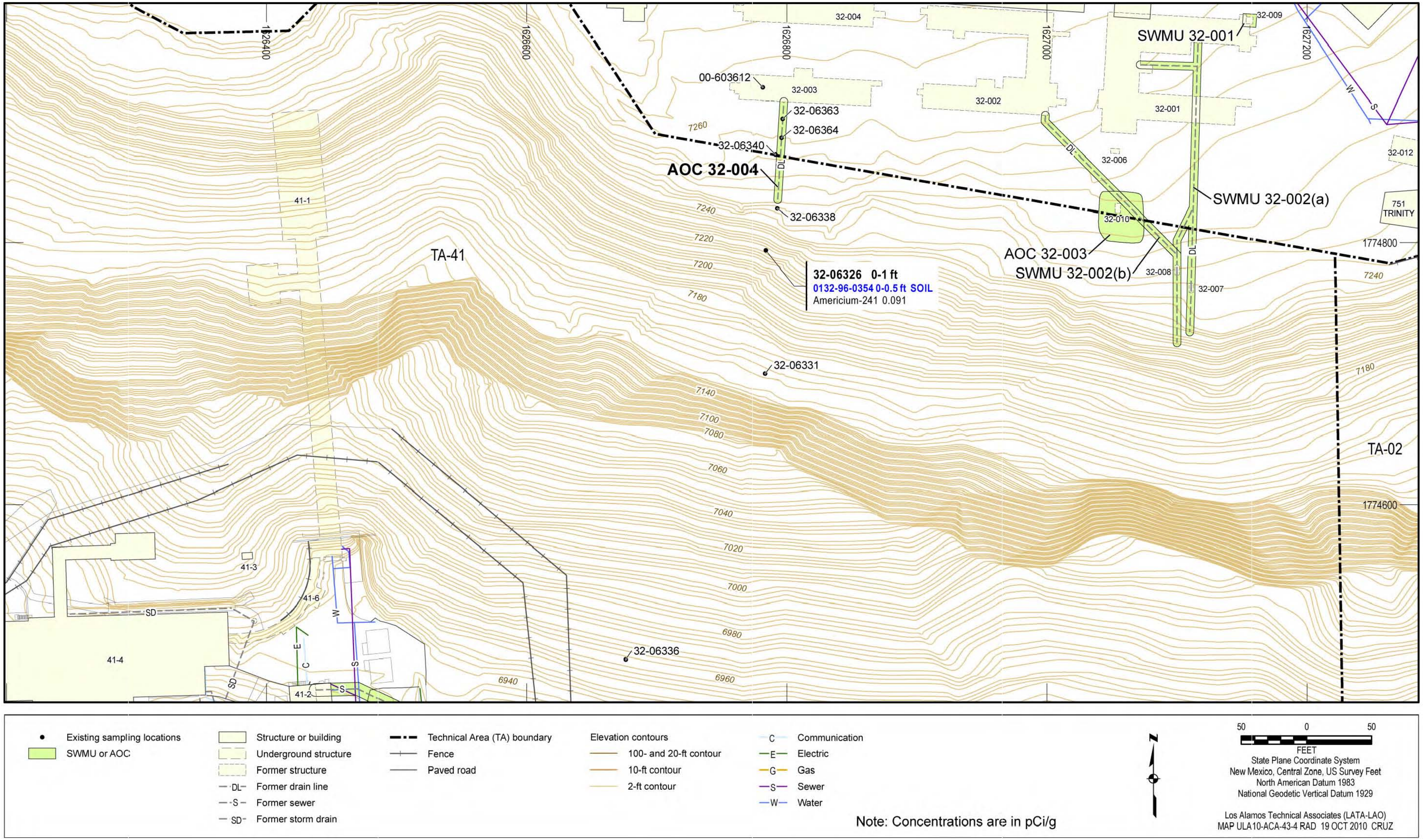
32-06331 0-1.5 ft
0132-96-0356 0-0.42 ft SOIL
Acenaphthene 0.19 (Replaced)
Anthracene 0.32 (Replaced)
Benzo(a)anthracene 0.89 (Replaced)
Benzo(a)pyrene 0.91 (Replaced)
Benzo(b)fluoranthene 0.96 (Replaced)
Benzo(g,h,i)perylene 0.42 (Replaced)
Benzo(k)fluoranthene 1.1 (Replaced)
Bis(2-ethylhexyl)phthalate 0.25
Butylbenzylphthalate 0.96
Chrysene 1.6 (Replaced)
Fluoranthene 2.3 (Replaced)
Fluorene 0.19 (Replaced)
Indeno(1,2,3-cd)pyrene 0.42 (Replaced)
Naphthalen 0.23 (Replaced)
Phenanthrene 1.7 (Replaced)
Pyrene 1.8 (Replaced)
RE32-10-11370 0-0.5 ft SOIL
Benzo(a)anthracene 0.036
Benzo(a)pyrene 0.037
Benzo(g,h,i)perylene 0.0269
Chrysene 0.0372
Fluoranthene 0.0792
Phenanthrene 0.0317 (J)
Pyrene 0.0629
RE32-10-11371 1-1.5 ft SOIL
Benzo(a)anthracene 0.0113
Chrysene 0.0128
Fluoranthene 0.027
Phenanthrene 0.0104 (J)
Pyrene 0.0209

32-06338 0-1.5 ft
0132-96-0352 0-0.5 ft SOIL
Benzo(a)anthracene 1.7 (Replaced)
Benzo(a)pyrene 1.9 (Replaced)
Benzo(b)fluoranthene 2.2 (Replaced)
Benzo(g,h,i)perylene 1.4 (Replaced)
Benzo(k)fluoranthene 1.7 (Replaced)
Bis(2-ethylhexyl)phthalate 0.69
Butylbenzylphthalate 3.1
Chrysene 3.5 (Replaced)
Fluoranthene 4.8 (Replaced)
Indeno(1,2,3-cd)pyrene 1.3 (Replaced)
Phenanthrene 2.2 (Replaced)
Pyrene 3.8 (Replaced)
RE32-10-11366 0-0.5 ft SOIL
Anthracene 0.0721 (J)
Benzo(a)anthracene 0.354
Benzo(a)pyrene 0.352
Benzo(b)fluoranthene 0.669
Chrysene 0.371
Fluoranthene 0.804
Phenanthrene 0.488
Pyrene 0.607
0132-96-0353 0.5-1 ft SOIL
Butylbenzylphthalate 0.3
Chrysene 0.21
Fluoranthene 0.2
Pyrene 0.2
RE32-10-11367 1-1.5 ft SOIL
Benzo(a)anthracene 0.117
Benzo(a)pyrene 0.127
Chrysene 0.135
Fluoranthene 0.255
Phenanthrene 0.11 (J)
Pyrene 0.198

32-06336 0-0.5 ft
0132-96-0357 0-0.5 ft SOIL
Fluoranthene 0.18

Note: Concentrations are in mg/kg

Figure 4.4-3 Organic COPCs detected at AOC 32-004



Note: Concentrations are in pCi/g

Figure 4.4-4 Radionuclide COPCs detected or detected above BVs/FVs at AOC 32-004

Table 4.0-1
Field-Screening Results for Samples Collected in 2010

SMWU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm*)	Beta/Gamma (dpm)
32-002(b)	00-603589	7–8	RE32-10-11437	0	32	987
32-002(b)	00-603591	9–10	RE32-10-11438	0	32	987
32-002(b)	00-603592	7–8	RE32-10-11439	0	7	1000
32-002(b)	00-603594	8–9	RE32-10-11440	0	7	1000
32-002(b)	00-603595	5–6	RE32-10-11441	0	7	1000
32-002(b)	00-603590	9–10	RE32-10-11442	0	7	1000
32-002(b)	00-603595	9–10	RE32-10-21512	0	10	1027
32-002(b)	00-603595	12–12.5	RE32-10-24894	0	10	1382
32-002(a)	32-06373	2–3	RE32-10-11445	0	45	1486
32-002(a)	32-06373	4–5	RE32-10-11446	0	45	1486
32-002(a)	32-611241	1.5–2	RE32-10-11449	0	45	1486
32-002(a)	32-611242	1.5–2	RE32-10-11450	0	45	1486
32-002(a)	32-06372	4–5	RE32-10-11451	0	32	987
32-002(a)	00-603580	6–7	RE32-10-11452	0	32	987
32-002(a)	32-06367	5–6	RE32-10-11453	0	32	987
32-002(a)	32-06370	1–2	RE32-10-11454	0	32	987
32-002(a)	00-603582	7–8	RE32-10-11455	0	20	2000
32-002(a)	32-06368	5–6	RE32-10-11456	0	20	2000
32-002(a)	00-603581	7–8	RE32-10-11457	0	20	2000
32-002(a)	00-603583	10–11	RE32-10-11458	0	20	2000
32-002(a)	00-603585	3–4	RE32-10-11459	0	7	1000
32-002(a)	00-603585	4–5	RE32-10-11460	0	7	1000
32-002(a)	32-06370	5–6	RE32-10-11461	0	8	1052
32-004	32-06340	0–0.5	RE32-10-11364	0	33	1083
32-004	32-06340	1–1.5	RE32-10-11365	0	33	1083
32-004	32-06338	0–0.5	RE32-10-11366	0	33	1083
32-004	32-06338	1–1.5	RE32-10-11367	0	33	1083
32-004	32-06326	0–0.5	RE32-10-11368	0	33	1083
32-004	32-06326	1–1.5	RE32-10-11369	0	33	1083
32-004	32-06331	0–0.5	RE32-10-11370	0	33	1083
32-004	32-06331	1–1.5	RE32-10-11371	0	33	1083
32-003	00-603608	4–4.5	RE32-10-11372	0	7	1000
32-003	32-611337	0.5–1	RE32-10-11373	0	45	1486
32-003	32-611335	0.5–1	RE32-10-11374	0	45	1486
32-003	32-611336	0.5–1	RE32-10-11375	0	45	1485
32-003	32-611232	2–2.5	RE32-10-11376	0	45	1485
32-003	32-611232	0–1	RE32-10-11377	0	45	1485

Table 4.0-1 (continued)

SMWU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm*)	Beta/Gamma (dpm)
32-003	32-611233	2–2.5	RE32-10-11378	0	45	1486
32-003	32-611233	0–1	RE32-10-11379	0	45	1486
32-003	32-611234	2–2.5	RE32-10-11380	0	45	1486
32-003	32-611234	0–1	RE32-10-11381	0	45	1486
32-003	00-603605	5.5–6.5	RE32-10-11385	0	7	1000
32-003	00-603606	5–6	RE32-10-11386	0	7	1000
32-003	00-603609	4–5	RE32-10-11387	0	7	1000
32-003	00-603611	5–6	RE32-10-11388	0	7	1000
32-003	00-603601	3–4	RE32-10-11389	0	7	1000
32-003	32-611335	1.5–2	RE32-10-14068	0	8	1052
32-003	32-611336	1.5–2	RE32-10-14069	0	8	1052
32-003	32-611337	1.5–2	RE32-10-14070	0	8	1052
32-003	32-611787	0.5–1	RE32-10-14071	0	10	1310
32-003	32-611788	0.5–1	RE32-10-14072	0	10	1310
32-003	32-611789	0.5–1	RE32-10-14073	0	10	1310
32-003	32-611842	0.5–1	RE32-10-14342	0	8	1366
32-003	32-611788	0.5–1	RE32-10-14343	0	10	1310
32-003	32-611789	0.5–1	RE32-10-14344	0	10	1310
32-003	32-611845	7.5–8	RE32-10-14345	0	10	1027
32-003	32-611846	7–7.5	RE32-10-14346	0	10	1027
32-003	32-611847	7.5–8	RE32-10-14347	0	10	1027
32-003	32-611913	0.5–1	RE32-10-15406	0	42	1346
32-003	32-611913	2–2.5	RE32-10-15407	0	42	1346
32-003	32-611915	0.5–1	RE32-10-15408	0	42	1346
32-003	32-611915	2–2.5	RE32-10-15409	0	42	1346
32-003	32-611917	0.5–1	RE32-10-15410	0	10	1036
32-003	32-611917	2–2.5	RE32-10-15411	0	10	1036
32-003	32-611847	8–8.5	RE32-10-21476	0	10	1027
32-003	32-611845	7–7.5	RE32-10-21477	0	10	1027
32-003	32-611846	7.5–8	RE32-10-21478	0	10	1027
32-003	32-611789	0.5–1	RE32-10-24895	0	10	1382
32-003	32-611788	0.5–1	RE32-10-24896	0	10	1382

Note: Readings are field measurements.

*dpm = Disintegrations per minute.

Table 4.1-1
Samples Collected and Analyses Requested at SWMU 32-002(a)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Dioxins/Furans	Gamma-Emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Cyanide (Total)
RE00-08-15140	00-603580	2–3	QBT3	08-1997	08-1997	08-1996	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997
RE00-08-15141	00-603580	4–5	QBT3	08-1997	08-1997	08-1996	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997	08-1997
RE32-10-11452	00-603580	6–7	QBT3	—*	—	—	—	—	—	—	10-1962	—	—	—	—	—	—
RE00-08-15142	00-603581	3–4	QBT3	08-2009	08-2008	08-2006	08-2009	08-2009	08-2009	08-2009	08-2008	08-2007	08-2008	08-2009	08-2007	08-2007	08-2008
RE00-08-15143	00-603581	5–6	QBT3	08-2009	08-2008	08-2006	08-2009	08-2009	08-2009	08-2009	08-2008	08-2007	08-2008	08-2009	08-2007	08-2007	08-2008
RE32-10-11457	00-603581	7–8	QBT3	—	—	—	—	—	—	—	10-1989	—	—	—	—	—	—
RE00-08-15144	00-603582	4–5	QBT3	08-2009	08-2008	08-2006	08-2009	08-2009	08-2009	08-2009	08-2008	08-2007	08-2008	08-2009	08-2007	08-2007	08-2008
RE00-08-15145	00-603582	6–7	QBT3	08-2009	08-2008	08-2006	08-2009	08-2009	08-2009	08-2009	08-2008	08-2007	08-2008	08-2009	08-2007	08-2007	08-2008
RE32-10-11455	00-603582	7–8	QBT3	—	—	—	—	—	—	—	10-1989	—	—	—	—	—	—
RE00-08-15146	00-603583	6.5–7.5	QBT3	08-2009	08-2008	08-2006	08-2009	08-2009	08-2009	08-2009	08-2008	08-2007	08-2008	08-2009	08-2007	08-2007	08-2008
RE00-08-15147	00-603583	8.5–9.5	QBT3	08-2009	08-2008	08-2006	08-2009	08-2009	08-2009	08-2009	08-2008	08-2007	08-2008	08-2009	08-2007	08-2007	08-2008
RE32-10-11458	00-603583	10–11	QBT3	—	—	—	—	—	—	—	10-1989	—	—	—	—	—	—
RE00-08-15148	00-603584	1.5–2.5	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15149	00-603584	3.5–4.5	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15150	00-603585	0–1	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15151	00-603585	2–3	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE32-10-11459	00-603585	3–4	QBT3	—	—	—	—	—	—	—	10-2112	—	—	—	—	—	—
RE32-10-11460	00-603585	4–5	QBT3	—	—	—	—	—	—	—	10-2112	—	—	—	—	—	—
RE00-08-15152	00-603586	0–1	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15153	00-603586	2–3	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15154	00-603587	0–1	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15155	00-603587	2–3	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15156	00-603588	0–1	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15157	00-603588	2–3	QBT3	09-15	09-14	09-12	09-15	09-15	09-15	09-15	09-14	09-13	09-14	09-15	09-13	09-13	09-14
RE00-08-15181	00-603596	1.25–2.25	QBT3	09-4	09-4	09-3	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4
RE00-08-15182	00-603596	3.25–4.25	QBT3	09-4	09-4	09-3	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4
0132-96-0751	32-06353	0–0.5	QBT3	—	—	—	2069	—	2069	2069	2068	—	—	—	—	—	—
0132-96-0610	32-06367	4–4.17	QBT4	—	—	—	2019	2019	2019	2019	2018	—	—	—	2017	2017	—
RE32-10-11453	32-06367	5–6	QBT3	—	—	—	—	—	—	—	10-1962	—	—	—	—	—	—
0132-96-0601	32-06368	4.5–4.67	QBT4	—	—	—	2019	2019	2019	2019	2018	—	—	—	2017	2017	—
RE32-10-11456	32-06368	5–6	QBT3	—	—	—	—	—	—	—	10-1989	—	—	—	—	—	—
0132-96-0602	32-06369	4.5–4.67	QBT4	—	—	—	2019	2019	2019	2019	2018	—	—	—	2017	2017	—
0132-96-0604	32-06370	5–5.25	QBT4	—	—	—	2023	2023	2023	2023	2022	—	—	—	2021	2021	—
RE32-10-11454	32-06370	1–2	SOIL	—	—	—	—	—	—	—	10-1962	—	—	—	—	—	—

Table 4.1-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Dioxins/Furans	Gamma-Emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Cyanide (Total)
RE32-10-11461	32-06370	5–6	SOIL	—	—	—	—	—	—	—	10-2382	—	—	—	—	—	—
0132-96-0606	32-06371	5–5.25	QBT4	—	—	—	2023	2023	2023	2023	2022	—	—	—	2021	2021	—
0132-96-0607	32-06372	3–3.25	QBT4	—	—	—	2027	2027	2027	2027	2026	—	—	—	2025	2025	—
RE32-10-11451	32-06372	4–5	QBT3	—	—	—	—	—	—	—	10-1962	—	—	—	—	—	—
RE32-10-11445	32-06373	2–3	SOIL	—	—	—	—	—	—	—	10-2252	—	—	—	—	—	—
RE32-10-11446	32-06373	4–5	SOIL	—	—	—	—	—	—	—	10-2252	—	—	—	—	—	—
0132-96-0608	32-06374	2–2.25	SOIL	—	—	—	2027	2027	2027	2027	2026	—	—	—	2025	2025	—
0132-96-0609	32-06375	3.5–4.5	SOIL	—	—	—	2038	2038	2038	2038	2037	—	—	—	2036	2036	—
0132-96-0616	32-06380	2.5–3	SOIL	—	—	—	2057	2057	2057	2057	2055	—	—	—	2054	2054	—
RE32-10-11449	32-611241	1.5–2	SOIL	—	—	—	—	—	—	—	10-2252	—	—	—	—	—	—
RE32-10-11450	32-611242	1.5–2	SOIL	—	—	—	—	—	—	—	10-2252	—	—	—	—	—	—

Note: Numbers in analyte columns are request numbers.

* — = Analysis not requested.

Table 4.1-2
Inorganic Chemicals above BVs at SWMU 32-002(a)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead	Magnesium	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Selenium	Silver	Sodium	Thallium	Zinc
Qbt 2, 3, 4 BV[a]				**7340**	**0.5**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**	**1690**	**482**	**0.1**	**6.58**	**na[b]**	**na**	**0.3**	**1**	**2770**	**1.1**	**63.5**
Soil BV[a]				**29200**	**0.83**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**na**	**22.3**	**4610**	**671**	**0.1**	**15.4**	**na**	**na**	**1.52**	**1**	**915**	**0.73**	**48.8**
Construction Worker SSL[c]				**40700**	**124**	**4350**	**144**	**309**	**na**	**449[d]**	**34.6[e]**	**12400**	**6190**	**800**	**na**	**463**	**92.9[e]**	**6190**	**496000**	**217**	**1550**	**1550**	**na**	**20.4**	**92900**
Industrial SSL[c]				**1130000**	**454**	**224000**	**2260**	**1120**	**na**	**2920[d]**	**300[f]**	**45400**	**22700**	**800**	**na**	**145000**	**310[f]**	**22700**	**1820000**	**795**	**5680**	**5680**	**na**	**74.9**	**341000**
Recreational SSL[g]				**791000**	**317**	**158000**	**1580**	**784**	**na**	**1910**	**238**	**31700**	**15800**	**560**	**na**	**110000**	**238**	**15800**	**1260000**	**555**	**3960**	**3960**	**na**	**52.3**	**238000**
Residential SSL[c]				**78100**	**31.3**	**15600**	**156**	**77.9**	**na**	**219[d]**	**23[f]**	**3130**	**1560**	**400**	**na**	**10700**	**23[f]**	**1560**	**125000**	**54.8**	**391**	**391**	**na**	**5.16**	**23500**
RE00-08-15140	00-603580	2–3	QBT3	—[h]	—	—	—	—	—	10.5 (J)	—	—	0.54 (UJ)	—	—	—	—	6.9 (J+)	0.89	—	0.54 (UJ)	—	—	—	—
RE00-08-15141	00-603580	4–5	QBT3	—	—	—	—	—	—	18.7 (J+)	—	—	0.54 (UJ)	—	—	—	—	10.2	1.2	—	0.39 (U)	—	—	—	—
RE32-10-11452	00-603580	6–7	QBT3	—	1.06 (U)	—	—	—	—	8.8 (J)	—	—	NA[i]	—	—	—	—	—	NA	NA	1.07 (U)	—	—	—	—
RE00-08-15142	00-603581	3–4	QBT3	—	—	—	—	—	—	11.2 (J)	—	—	0.59 (U)	—	—	—	—	8.6 (J)	2.5	—	—	—	—	—	—
RE00-08-15143	00-603581	5–6	QBT3	—	—	—	—	—	—	18 (J+)	—	—	0.54 (U)	—	—	—	—	10 (J)	1.7	—	—	—	—	—	—
RE32-10-11457	00-603581	7–8	QBT3	—	1.02 (UJ)	—	—	—	—	15.6	—	—	NA	—	—	—	—	—	NA	NA	1.06 (U)	—	—	—	—
RE00-08-15144	00-603582	4–5	QBT3	—	—	—	—	—	—	—	—	—	0.59 (U)	—	—	—	—	—	4.2	—	—	—	—	—	—
RE00-08-15145	00-603582	6–7	QBT3	—	—	138 (J)	—	—	—	9.2 (J)	—	4.7 (J)	0.58 (U)	18.4 (J)	—	—	—	7.1 (J)	6.6	—	—	—	—	—	—
RE32-10-11455	00-603582	7–8	QBT3	9230	1.16 (UJ)	409	2.14	—	—	8.74	—	7.34	NA	20.8	2010 (J+)	—	—	9.86	NA	NA	1.18 (U)	—	—	—	—
RE00-08-15146	00-603583	6.5–7.5	QBT3	—	—	—	—	—	—	18.4 (J)	—	5.3 (J)	—	—	—	—	—	11.3	0.32	—	—	—	—	—	—
RE00-08-15147	00-603583	8.5–9.5	QBT3	—	—	—	—	—	—	29.4 (J+)	—	—	0.52 (U)	—	—	—	—	14.6 (J)	—	—	—	—	—	—	—
RE32-10-11458	00-603583	10–11	QBT3	—	1.11 (UJ)	—	—	—	—	—	—	—	NA	—	—	—	—	—	NA	NA	1.09 (U)	—	—	—	—
RE00-08-15148	00-603584	1.5–2.5	QBT3	—	0.51 (U)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.0024	—	—	—	—	—
RE00-08-15149	00-603584	3.5–4.5	QBT3	—	0.51 (U)	—	—	—	—	10.5 (J)	—	—	—	—	—	—	—	7	0.14 (J)	0.0074	—	—	—	—	—
RE00-08-15150	00-603585	0–1	QBT3	—	0.88 (U)	55	—	—	—	—	—	—	—	21.6	—	—	0.169 (J)	—	0.57	—	—	—	—	—	102
RE00-08-15151	00-603585	2–3	QBT3	7450 (J)	—	73.1	1.4 (J)	—	3850 (J)	8.1 (U)	—	8.2 (J)	—	—	2140 (J)	—	—	11 (J)	—	0.0027	0.9	—	—	—	—
RE32-10-11459	00-603585	3–4	QBT3	—	1.01 (U)	71.1	—	—	—	7.63	—	5.59	NA	—	—	—	—	—	NA	NA	0.672 (J-)	—	—	—	—
RE32-10-11460	00-603585	4–5	QBT3	10300	1.1 (U)	110	1.3	—	2960	12.9	—	9.49	NA	—	2570 (J+)	—	—	9.23	NA	NA	1.13 (UJ)	—	—	1.13 (U)	—
RE00-08-15152	00-603586	0–1	QBT3	—	0.54 (U)	53	—	—	2350 (J)	—	—	5.2 (J)	—	14.5	—	—	0.114 (J)	6.6	0.71	0.0036	—	—	—	—	—
RE00-08-15153	00-603586	2–3	QBT3	—	0.51 (U)	—	—	—	—	10.8 (J)	—	—	—	—	—	—	—	8.4	—	0.0072	—	—	—	—	—
RE00-08-15154	00-603587	0–1	QBT3	—	—	48.8	—	—	2700	—	—	6.6	—	22.1	—	—	0.316 (J)	—	3.2	—	—	—	—	—	—
RE00-08-15155	00-603587	2–3	QBT3	—	0.51 (U)	—	—	—	—	—	—	—	—	—	—	—	—	—	0.43	0.0027	0.51 (U)	—	—	—	—
RE00-08-15156	00-603588	0–1	QBT3	—	—	—	—	—	—	—	—	—	—	25.6	—	—	0.241 (J)	—	0.89	0.0031	—	—	—	—	—
RE00-08-15157	00-603588	2–3	QBT3	—	0.51 (U)	—	—	—	—	10.8 (J)	—	—	—	—	—	—	—	7.6	0.15 (J)	0.0024	0.34 (J)	—	—	—	—
RE00-08-15181	00-603596	1.25–2.25	QBT3	—	—	55.1	—	—	—	10.3 (J)	—	5.6 (J)	—	13.6	—	—	0.546 (J)	6.9 (J)	0.16 (J)	—	0.34 (J)	—	—	—	—
RE00-08-15182	00-603596	3.25–4.25	QBT3	—	—	—	—	—	—	17.8 (J+)	—	—	—	—	—	—	—	9 (J+)	0.13 (J)	—	—	—	—	—	—
0132-96-0751	32-06353	0–0.5	QBT3	—	10 (UJ)	54	—	—	4700	—	—	7.1	NA	43 (J-)	—	830	0.17	—	NA	NA	1	2 (U)	—	1.3	—
0132-96-0610	32-06367	4–4.17	QBT4	—	11 (U)	61	—	—	—	—	—	—	NA	17	—	—	0.22 (UJ)	—	NA	NA	—	2.2 (U)	—	—	—

Table 4.1-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead	Magnesium	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Selenium	Silver	Sodium	Thallium	Zinc
Qbt 2, 3, 4 BV[a]				**7340**	**0.5**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**	**1690**	**482**	**0.1**	**6.58**	**na**	**na**	**0.3**	**1**	**2770**	**1.1**	**63.5**
Soil BV[a]				**29200**	**0.83**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**na**	**22.3**	**4610**	**671**	**0.1**	**15.4**	**na**	**na**	**1.52**	**1**	**915**	**0.73**	**48.8**
Construction Worker SSL[c]				**40700**	**124**	**4350**	**144**	**309**	**na**	**449**[d]	**34.6**[e]	**12400**	**6190**	**800**	**na**	**463**	**92.9**[e]	**6190**	**496000**	**217**	**1550**	**1550**	**na**	**20.4**	**92900**
Industrial SSL[c]				**1130000**	**454**	**224000**	**2260**	**1120**	**na**	**2920**[d]	**300**[f]	**45400**	**22700**	**800**	**na**	**145000**	**310**	**22700**	**1820000**	**795**	**5680**	**5680**	**na**	**74.9**	**341000**
Recreational SSL[g]				**791000**	**317**	**158000**	**1580**	**784**	**na**	**1910**[d]	**238**	**31700**	**15800**	**560**	**na**	**110000**	**238**	**15800**	**1260000**	**555**	**3960**	**3960**	**na**	**52.3**	**238000**
Residential SSL[c]				**78100**	**31.3**	**15600**	**156**	**77.9**	**na**	**219**[d]	**23**[f]	**3130**	**1560**	**400**	**na**	**10700**	**23**	**1560**	**125000**	**54.8**	**391**	**391**	**na**	**5.16**	**23500**
RE32-10-11453	32-06367	5–6	QBT3	—	1 (U)	—	—	—	—	—	—	—	NA	—	—	—	—	—	NA	NA	1.01 (U)	—	—	—	—
0132-96-0601	32-06368	4.5–4.67	QBT4	—	11 (U)	59	—	—	—	—	—	—	NA	26	—	—	0.23 (UJ)	—	NA	NA	—	2.3 (U)	—	—	—
RE32-10-11456	32-06368	5–6	QBT3	—	1.06 (UJ)	—	—	—	—	10.4	—	—	NA	—	—	—	—	—	NA	NA	1.09 (U)	—	—	—	—
0132-96-0602	32-06369	4.5–4.67	QBT4	—	11 (U)	71	—	—	—	—	3.3	—	NA	110	—	—	0.11 (UJ)	—	NA	NA	—	2.2 (U)	—	—	—
0132-96-0604	32-06370	5–5.25	QBT4	—	5.43 (U)	54.2	—	—	—	—	—	—	NA	19	—	—	—	—	NA	NA	—	—	—	—	—
RE32-10-11454	32-06370	1–2	SOIL	—	1.15 (U)	—	—	—	—	—	—	—	NA	—	—	—	—	—	NA	NA	—	—	987	—	—
RE32-10-11461	32-06370	5–6	SOIL	—	—	—	—	0.55 (U)	—	—	—	—	NA	—	—	—	—	—	NA	NA	—	—	—	—	—
0132-96-0606	32-06371	5–5.25	QBT4	—	5.12 (U)	—	—	—	—	—	—	—	NA	—	—	—	—	—	NA	NA	—	—	—	—	—
0132-96-0607	32-06372	3–3.25	QBT4	8100	12 (UJ)	140	—	—	2400	—	4.8	7.1	NA	26	—	—	0.12 (U)	—	NA	NA	—	2.4 (U)	4900	—	—
RE32-10-11451	32-06372	4–5	QBT3	—	0.569 (J)	—	—	—	—	15.5 (J)	—	—	NA	—	—	—	—	7.41 (J-)	NA	NA	1.12 (U)	—	—	—	—
RE32-10-11445	32-06373	2–3	SOIL	—	1.13 (UJ)	—	—	0.565 (U)	—	—	—	18.4 (J+)	NA	386 (J)	—	—	—	—	NA	NA	—	—	2940	—	—
RE32-10-11446	32-06373	4–5	SOIL	—	1.09 (UJ)	—	—	0.543 (U)	—	—	—	—	NA	50.6 (J)	—	—	—	—	NA	NA	—	—	2290	—	—
0132-96-0608	32-06374	2–2.25	SOIL	—	12 (UJ)	—	—	0.6 (U)	—	—	—	—	NA	24	—	—	1.2	—	NA	NA	—	2.4 (U)	1400	—	69
0132-96-0609	32-06375	3.5–4.5	SOIL	—	11	—	—	0.56 (U)	—	—	—	—	NA	65 (J-)	—	—	0.11 (U)	—	NA	NA	—	2.2 (U)	3500	1.4 (U)	49
0132-96-0616	32-06380	2.5–3	SOIL	—	6.8 (U)	—	—	0.9 (U)	—	—	—	—	NA	—	—	—	—	—	NA	NA	—	1.7 (U)	3210	—	—
RE32-10-11449	32-611241	1.5–2	SOIL	—	1.13 (UJ)	—	—	0.563 (U)	9540 (J)	—	—	—	NA	—	—	—	—	—	NA	NA	—	—	4030	—	—
RE32-10-11450	32-611242	1.5–2	SOIL	—	1.11 (UJ)	—	—	0.555 (U)	—	—	—	30.5 (J+)	NA	—	—	—	—	—	NA	NA	—	—	3060	—	—

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 (2009, 108070), unless otherwise noted.

[d] SSLs are for hexavalent chromium.

[e] Construction worker SSLs calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[f] SSLs are from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[g] Recreational SSLs are from LANL (2010, 108613).

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

[i] NA = Not analyzed.

Table 4.1-3
Organic Chemicals Detected at SWMU 32-002(a)

Sample ID	Location ID	Depth (ft)	Media	Acenaphthene	Acetone	Anthracene	Aroclor-1260	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Bis(2-ethylhexyl)phthalate	Butylbenzylphthalate	Carbazole	Chrysene	Dibenz(a,h)anthracene
Construction Worker SSL[a]				**18600**	**263000**	**66800**	**75.8**	**213**	**21.3**	**213**	**6680**[b]	**2060**	**4760**	**47600**	**10800**	**20600**	**21.3**
Industrial SSL[a]				**36700**	**851000**	**183000**	**8.26**	**23.4**	**2.34**	**23.4**	**18300**[b]	**234**	**1370**	**9100**	**960**	**2340**	**2.34**
Recreational SSL[c]				**20800**	**702000**	**104000**	**10.5**	**30.1**	**3.01**	**30.1**	**10400**[b]	**301**	**1830**	**13500**	**2830**	**3010**	**3.01**
Residential SSL[a]				**3440**	**67500**	**17200**	**2.22**	**6.21**	**0.621**	**6.21**	**1720**[b]	**62.1**	**347**	**2600**	**240**	**621**	**0.621**
RE00-08-15140	00-603580	2–3	QBT3	—[d]	0.0032 (J)	—	—	—	—	—	—	—	0.21 (J)	—	NA[e]	—	—
RE00-08-15141	00-603580	4–5	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15142	00-603581	3–4	QBT3	—	0.0053 (J)	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15143	00-603581	5–6	QBT3	—	0.0031 (J)	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15144	00-603582	4–5	QBT3	—	—	—	0.042	—	—	—	—	—	—	—	NA	—	—
RE00-08-15145	00-603582	6–7	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15146	00-603583	6.5–7.5	QBT3	—	0.0027 (J)	—	0.099	—	—	—	—	—	0.056 (J)	—	NA	—	—
RE00-08-15147	00-603583	8.5–9.5	QBT3	—	—	—	—	—	—	—	—	—	0.34	—	NA	—	—
RE00-08-15148	00-603584	1.5–2.5	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15149	00-603584	3.5–4.5	QBT3	—	—	—	—	—	—	—	—	—	—	0.055 (J)	NA	—	—
RE00-08-15150	00-603585	0–1	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15151	00-603585	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15152	00-603586	0–1	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15153	00-603586	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15154	00-603587	0–1	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	0.042 (J)	—
RE00-08-15155	00-603587	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	0.034 (J)	NA	—	—
RE00-08-15156	00-603588	0–1	QBT3	—	—	—	—	—	—	—	—	—	—	0.038 (J)	NA	—	—
RE00-08-15157	00-603588	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
RE00-08-15181	00-603596	1.25–2.25	QBT3	—	—	—	—	—	—	—	—	—	0.12 (J)	—	NA	—	—
RE00-08-15182	00-603596	3.25–4.25	QBT3	—	—	—	—	—	—	—	—	—	0.44	—	NA	—	—
0132-96-0610	32-06367	4–4.17	QBT4	—	—	0.064 (J)	NA	0.68	0.52	0.81	0.2 (J)	0.31 (J)	—	—	0.049 (J)	0.77	0.073 (J)
0132-96-0601	32-06368	4.5–4.67	QBT4	—	—	—	NA	0.17 (J)	0.14 (J)	0.2 (J)	0.074 (J)	0.075 (J)	—	—	0.06 (J)	0.19 (J)	—
0132-96-0602	32-06369	4.5–4.67	QBT4	—	—	0.11 (J)	NA	0.34 (J)	0.27 (J)	0.4	0.079 (J)	0.17 (J)	—	—	0.085 (J)	0.36 (J)	—
0132-96-0604	32-06370	5–5.25	QBT4	—	—	—	NA	0.053 (J)	—	0.07 (J)	—	—	—	—	—	0.065 (J)	—
0132-96-0606	32-06371	5–5.25	QBT4	0.3 (J)	—	1.5	NA	4.2	3.5	5.5	0.83	2.4	—	—	0.99	3.8	0.39 (J)
0132-96-0607	32-06372	3–3.25	QBT4	—	0.033 (J+)	—	NA	0.25	0.2	0.2	—	—	—	—	NA	0.29	—
0132-96-0608	32-06374	2–2.25	SOIL	—	—	—	NA	—	0.35	0.33	1.2	0.28	—	—	NA	0.34	—
0132-96-0609	32-06375	3.5–4.5	SOIL	—	0.022 (J+)	—	NA	—	—	—	—	—	—	—	NA	—	—
0132-96-0616	32-06380	2.5–3	SOIL	—	—	0.081 (J)	NA	0.73	0.58	0.59	0.33 (J)	0.58	—	—	NA	0.81	—

Table 4.1-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Dibenzofuran	Dichlorodifluoromethane	Fluoranthene	Fluorene	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-]	Heptachlorodibenzofurans (Total)	Hexachlorodibenzodioxin [1,2,3,4,7,8-]	Hexachlorodibenzodioxin [1,2,3,6,7,8-]
Construction Worker SSL[a]				**552**[f]	**1370**	**8910**	**8910**	**na**[g]	**na**	**na**	**na**	**na**	**na**	**na**
Industrial SSL[a]				**100**[h]	**1550**	**24400**	**24400**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
Recreational SSL[c]				**399**	**13000**	**13900**	**13900**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
Residential SSL[a]				**78**[h]	**481**	**2290**	**2290**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
RE00-08-15140	00-603580	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15141	00-603580	4–5	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15142	00-603581	3–4	QBT3	—	—	—	—	0.000000862 (J)	0.00000202	—	—	—	—	—
RE00-08-15143	00-603581	5–6	QBT3	—	—	—	—	0.000000566 (J)	0.00000129	—	—	—	—	—
RE00-08-15144	00-603582	4–5	QBT3	—	—	—	—	0.000000999 (J)	0.00000261	—	—	0.00000122 (J)	—	—
RE00-08-15145	00-603582	6–7	QBT3	—	—	—	—	0.000000543 (J)	0.00000124	—	—	—	—	—
RE00-08-15146	00-603583	6.5–7.5	QBT3	—	—	—	—	0.0000377	0.0000792	0.00001 (J)	0.000000877 (J)	0.0000337	0.000000407 (J)	0.00000122 (J)
RE00-08-15147	00-603583	8.5–9.5	QBT3	—	—	—	—	0.0000241	0.0000407	0.00000764 (J)	0.00000051 (J)	0.0000209	—	0.00000084 (J)
RE00-08-15148	00-603584	1.5–2.5	QBT3	—	—	—	—	—	0.000000532	—	—	—	—	—
RE00-08-15149	00-603584	3.5–4.5	QBT3	—	—	—	—	0.000000555 (J)	0.00000125	—	—	—	—	—
RE00-08-15150	00-603585	0–1	QBT3	—	—	0.036 (J)	—	0.000126	0.000255	0.0000428	0.00000168 (J)	0.000125	0.00000129 (J)	0.00000435
RE00-08-15151	00-603585	2–3	QBT3	—	—	—	—	0.00000333	0.00000625	0.000000885 (J)	—	0.00000262	—	—
RE00-08-15152	00-603586	0–1	QBT3	—	—	—	—	0.0000127	0.0000304	0.00000411	—	0.00000993	—	0.000000496 (J)
RE00-08-15153	00-603586	2–3	QBT3	—	—	—	—	—	0.00000026	—	—	—	—	—
RE00-08-15154	00-603587	0–1	QBT3	—	—	0.074 (J)	—	0.000038	0.0000857	0.0000104	0.000000476 (J)	0.0000253	0.000000552 (J)	0.00000135 (J)
RE00-08-15155	00-603587	2–3	QBT3	—	—	—	—	—	0.000000289	—	—	—	—	—
RE00-08-15156	00-603588	0–1	QBT3	—	—	—	—	0.0000348	0.0000719	0.0000115	0.000000352 (J)	0.0000273	0.000000388 (J)	0.00000131 (J)
RE00-08-15157	00-603588	2–3	QBT3	—	—	—	—	0.00000478	0.00000944	0.00000199 (J)	—	0.00000496	—	0.000000191 (J)
RE00-08-15181	00-603596	1.25–2.25	QBT3	—	—	—	—	0.000084	0.000163	0.0000238 (J)	0.0000012 (J)	0.0000749	0.000000763 (J)	0.00000222 (J)
RE00-08-15182	00-603596	3.25–4.25	QBT3	—	—	—	—	0.0000283	0.0000585	0.00000757 (J)	0.000000472 (J)	0.0000269	—	0.000000718 (J)
0132-96-0610	32-06367	4–4.17	QBT4	—	—	1.1	—	NA	NA	NA	NA	NA	NA	NA
0132-96-0601	32-06368	4.5–4.67	QBT4	—	—	0.36 (J)	—	NA	NA	NA	NA	NA	NA	NA
0132-96-0602	32-06369	4.5–4.67	QBT4	—	—	0.61	—	NA	NA	NA	NA	NA	NA	NA
0132-96-0604	32-06370	5–5.25	QBT4	—	—	0.097 (J)	—	NA	NA	NA	NA	NA	NA	NA
0132-96-0606	32-06371	5–5.25	QBT4	0.17 (J)	—	6.1	0.38 (J)	NA	NA	NA	NA	NA	NA	NA
0132-96-0607	32-06372	3–3.25	QBT4	—	NA	0.45	—	NA	NA	NA	NA	NA	NA	NA
0132-96-0608	32-06374	2–2.25	SOIL	—	—	0.2	—	NA	NA	NA	NA	NA	NA	NA
0132-96-0609	32-06375	3.5–4.5	SOIL	—	—	0.4	—	NA	NA	NA	NA	NA	NA	NA
0132-96-0616	32-06380	2.5–3	SOIL	—	0.001 (J)	1.3	—	NA	NA	NA	NA	NA	NA	NA

Table 4.1-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Hexachlorodibenzodioxin [1,2,3,7,8,9-]	Hexachlorodibenzodioxins (Total)	Hexachlorodibenzofuran [1,2,3,4,7,8-]	Hexachlorodibenzofuran [1,2,3,6,7,8-]	Hexachlorodibenzofuran [2,3,4,6,7,8-]	Hexachlorodibenzofurans (Total)	Indeno(1,2,3-cd)pyrene	Methylene Chloride	Naphthalene	Octachlorodibenzodioxin [1,2,3,4,6,7,8,9-]	Octachlorodibenzofuran [1,2,3,4,6,7,8,9-]
Construction Worker SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**213**	**10600**	**702**	**na**	**na**
Industrial SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**23.4**	**1090**	**252**	**na**	**na**
Recreational SSL[c]				**na**	**na**	**na**	**na**	**na**	**na**	**30.1**	**4520**	**1950**	**na**	**na**
Residential SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**6.21**	**199**	**45**	**na**	**na**
RE00-08-15140	00-603580	2–3	QBT3	—	—	—	—	—	—	—	—	—	0.00000075 (J)	—
RE00-08-15141	00-603580	4–5	QBT3	—	—	—	—	—	—	—	—	—	0.000000588 (J)	—
RE00-08-15142	00-603581	3–4	QBT3	—	—	—	—	—	—	—	0.0059	—	0.00000739	0.00000086 (J)
RE00-08-15143	00-603581	5–6	QBT3	—	—	—	—	—	—	—	0.0074	—	0.00000437 (J)	0.000000398 (J)
RE00-08-15144	00-603582	4–5	QBT3	—	—	0.00000016 (J)	—	—	0.000000545 (J)	—	0.0078	—	0.00000817	0.00000128 (J)
RE00-08-15145	00-603582	6–7	QBT3	—	—	0.000000148 (J)	—	—	—	—	0.0062	—	0.00000421 (J)	0.000000689 (J)
RE00-08-15146	00-603583	6.5–7.5	QBT3	0.00000096 (J)	0.00000694	0.00000062 (J)	—	0.000000432 (J)	0.0000101	—	0.0099	—	0.000337	0.0000386
RE00-08-15147	00-603583	8.5–9.5	QBT3	0.000000741 (J)	0.00000477	0.000000329 (J)	—	0.000000381 (J)	0.00000739	—	0.0049 (J)	—	0.000202	0.0000204
RE00-08-15148	00-603584	1.5–2.5	QBT3	—	—	—	—	—	—	—	—	—	0.00000289 (J)	—
RE00-08-15149	00-603584	3.5–4.5	QBT3	—	—	—	—	—	—	—	—	—	0.00000387 (J)	—
RE00-08-15150	00-603585	0–1	QBT3	0.0000025	0.0000248	0.00000106 (J)	0.000000921 (J)	0.0000013 (J)	0.0000313	—	0.0077	—	0.000985 (J)	0.000177
RE00-08-15151	00-603585	2–3	QBT3	—	0.000000139	—	—	—	0.000000361	—	—	—	0.0000252 (J)	0.00000325 (J)
RE00-08-15152	00-603586	0–1	QBT3	—	0.00000306	0.000000196 (J)	—	0.000000268 (J)	0.00000386	—	—	—	0.000101 (J)	0.00000929
RE00-08-15153	00-603586	2–3	QBT3	—	—	—	—	—	—	—	—	—	0.00000148 (J)	—
RE00-08-15154	00-603587	0–1	QBT3	0.000000924 (J)	0.000011	0.000000497 (J)	0.00000046 (J)	0.000000631 (J)	0.0000112	—	—	—	0.000291 (J)	0.0000211
RE00-08-15155	00-603587	2–3	QBT3	—	—	—	—	—	—	—	—	—	0.0000017 (J)	—
RE00-08-15156	00-603588	0–1	QBT3	0.000000797 (J)	0.00000896	0.000000342 (J)	0.00000036 (J)	0.000000544 (J)	0.0000105	—	0.0063	—	0.000253 (J)	0.0000259
RE00-08-15157	00-603588	2–3	QBT3	—	0.0000011	—	—	—	0.00000121	—	—	—	0.0000362 (J)	0.00000618
RE00-08-15181	00-603596	1.25–2.25	QBT3	0.00000167 (J)	0.0000127	0.000000569 (J)	0.000000386 (J)	0.000000584 (J)	0.0000167	—	—	—	0.00067	0.0000804
RE00-08-15182	00-603596	3.25–4.25	QBT3	0.00000045 (J)	0.00000368	—	—	—	0.00000486 (J)	—	—	—	0.000235	0.0000306
0132-96-0610	32-06367	4–4.17	QBT4	NA	NA	NA	NA	NA	NA	0.23 (J)	—	—	NA	NA
0132-96-0601	32-06368	4.5–4.67	QBT4	NA	NA	NA	NA	NA	NA	0.076 (J)	—	—	NA	NA
0132-96-0602	32-06369	4.5–4.67	QBT4	NA	NA	NA	NA	NA	NA	0.091 (J)	0.003 (J)	—	NA	NA
0132-96-0604	32-06370	5–5.25	QBT4	NA	NA	NA	NA	NA	NA	—	—	—	NA	NA
0132-96-0606	32-06371	5–5.25	QBT4	NA	NA	NA	NA	NA	NA	1	—	0.082 (J)	NA	NA
0132-96-0607	32-06372	3–3.25	QBT4	NA	NA	NA	NA	NA	NA	—	—	—	NA	NA
0132-96-0608	32-06374	2–2.25	SOIL	NA	NA	NA	NA	NA	NA	0.64	—	—	NA	NA
0132-96-0609	32-06375	3.5–4.5	SOIL	NA	NA	NA	NA	NA	NA	—	—	—	NA	NA
0132-96-0616	32-06380	2.5–3	SOIL	NA	NA	NA	NA	NA	NA	0.29 (J)	—	—	NA	NA

Table 4.1-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Pentachlorodibenzodioxin [1,2,3,7,8-]	Pentachlorodibenzodioxins (Total)	Pentachlorodibenzofuran [1,2,3,7,8-]	Pentachlorodibenzofuran [2,3,4,7,8-]	Pentachlorodibenzofurans (Totals)	Phenanthrene	Pyrene	Tetrachlorodibenzodioxins (Total)	Tetrachlorodibenzofuran [2,3,7,8-]	Tetrachlorodibenzofurans (Totals)	Trichlorofluoromethane
Construction Worker SSL[a]				**na**	**na**	**na**	**na**	**na**	**7150**	**6680**	**na**	**0.0127**	**na**	**5820**
Industrial SSL[a]				**na**	**na**	**na**	**na**	**na**	**20500**	**18300**	**na**	**0.00147**	**na**	**6760**
Recreational SSL[c]				**na**	**na**	**na**	**na**	**na**	**12000**	**10400**	**na**	**0.00197**	**na**	**49800**
Residential SSL[a]				**na**	**na**	**na**	**na**	**na**	**1830**	**1720**	**na**	**0.000374**	**na**	**2010**
RE00-08-15140	00-603580	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15141	00-603580	4–5	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15142	00-603581	3–4	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15143	00-603581	5–6	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15144	00-603582	4–5	QBT3	—	—	—	—	0.000000186	—	—	—	—	—	—
RE00-08-15145	00-603582	6–7	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15146	00-603583	6.5–7.5	QBT3	0.000000283 (J)	0.000000605	—	0.000000265 (J)	0.00000303	—	—	—	—	0.000000433	—
RE00-08-15147	00-603583	8.5–9.5	QBT3	0.000000183	0.000000183	—	—	0.00000147	—	—	—	—	0.000000221	—
RE00-08-15148	00-603584	1.5–2.5	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15149	00-603584	3.5–4.5	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15150	00-603585	0–1	QBT3	0.000000625 (J)	0.00000118	0.000000201 (J)	0.000000853 (J)	0.0000106	—	—	0.000000136	0.00000049 (J)	0.00000228	—
RE00-08-15151	00-603585	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15152	00-603586	0–1	QBT3	—	—	—	—	—	—	—	—	—	0.00000021	—
RE00-08-15153	00-603586	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15154	00-603587	0–1	QBT3	—	0.000000808	0.000000157 (J)	0.000000461 (J)	0.00000603	0.041 (J)	0.059 (J)	0.000000143	0.000000595	0.00000225	—
RE00-08-15155	00-603587	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15156	00-603588	0–1	QBT3	—	—	—	0.000000443 (J)	0.00000498	—	—	—	—	0.00000143	—
RE00-08-15157	00-603588	2–3	QBT3	—	—	—	—	0.000000406	—	—	—	—	—	—
RE00-08-15181	00-603596	1.25–2.25	QBT3	—	0.000000174	—	0.000000226 (J)	0.00000286	—	—	—	—	0.000000403	—
RE00-08-15182	00-603596	3.25–4.25	QBT3	—	—	—	—	0.000000398	—	—	—	—	—	—
0132-96-0610	32-06367	4–4.17	QBT4	NA	NA	NA	NA	NA	0.17 (J)	0.79	NA	NA	NA	—
0132-96-0601	32-06368	4.5–4.67	QBT4	NA	NA	NA	NA	NA	0.11 (J)	0.26 (J)	NA	NA	NA	—
0132-96-0602	32-06369	4.5–4.67	QBT4	NA	NA	NA	NA	NA	0.31 (J)	0.47	NA	NA	NA	0.006
0132-96-0604	32-06370	5–5.25	QBT4	NA	NA	NA	NA	NA	0.047 (J)	0.071 (J)	NA	NA	NA	—
0132-96-0606	32-06371	5–5.25	QBT4	NA	NA	NA	NA	NA	3.7	6.6	NA	NA	NA	—
0132-96-0607	32-06372	3–3.25	QBT4	NA	NA	NA	NA	NA	—	0.3	NA	NA	NA	—
0132-96-0608	32-06374	2–2.25	SOIL	NA	NA	NA	NA	NA	—	—	NA	NA	NA	—

Table 4.1-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Pentachlorodibenzodioxin [1,2,3,7,8-]	Pentachlorodibenzodioxins (Total)	Pentachlorodibenzofuran [1,2,3,7,8-]	Pentachlorodibenzofuran [2,3,4,7,8-]	Pentachlorodibenzofurans (Totals)	Phenanthrene	Pyrene	Tetrachlorodibenzodioxins (Total)	Tetrachlorodibenzofuran [2,3,7,8-]	Tetrachlorodibenzofurans (Totals)	Trichlorofluoromethane
Construction Worker SSL[a]				**na**	**na**	**na**	**na**	**na**	**7150**	**6680**	**na**	**0.0127**	**na**	**5820**
Industrial SSL[a]				**na**	**na**	**na**	**na**	**na**	**20500**	**18300**	**na**	**0.00147**	**na**	**6760**
Recreational SSL[c]				**na**	**na**	**na**	**na**	**na**	**12000**	**10400**	**na**	**0.00197**	**na**	**49800**
Residential SSL[a]				**na**	**na**	**na**	**na**	**na**	**1830**	**1720**	**na**	**0.000374**	**na**	**2010**
0132-96-0609	32-06375	3.5–4.5	SOIL	NA	NA	NA	NA	NA	—	0.22	NA	NA	NA	—
0132-96-0616	32-06380	2.5–3	SOIL	NA	NA	NA	NA	NA	0.28 (J)	1	NA	NA	NA	—

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

[a] SSLs are from NMED (2009, 108070), unless otherwise noted.

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

[c] Recreational SSLs are from LANL (2010, 108613).

[d] — = Not detected.

[e] NA = Not analyzed.

[f] Construction worker SSLs calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[g] na = Not available.

[h] SSLs are from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

Table 4.1-4
Radionuclides Detected or Detected above BVs/FVs at SWMU 32-002(a)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Plutonium-238	Plutonium-239/240	Tritium	Uranium-235/236
Qbt 2, 3, 4 BV[a]				**na[b]**	**na**	**na**	**na**	**0.09**
Soil BV[a,c]				**1.65**	**0.023**	**0.054**	**na**	**0.2**
Construction Worker SAL[d]				**18**	**40**	**36**	**320000**	**43**
Industrial SAL[d]				**23**	**240**	**210**	**440000**	**87**
Recreational SAL[d]				**210**	**330**	**300**	**5300000**	**520**
Residential SAL[d]				**5.6**	**37**	**33**	**750**	**17**
RE00-08-15150	00-603585	0–1	QBT3	0.246	—[e]	—	—	—
RE00-08-15152	00-603586	0–1	QBT3	—	—	0.409	—	—
RE00-08-15154	00-603587	0–1	QBT3	0.405	—	—	—	—
RE00-08-15156	00-603588	0–1	QBT3	0.217	—	—	—	—
0132-96-0751	32-06353	0–0.5	QBT3	1.7	—	0.091	NA[f]	—
0132-96-0602	32-06369	4.5–4.67	QBT4	—	—	0.681	—	—
0132-96-0604	32-06370	5–5.25	QBT4	—	—	0.027	—	—
0132-96-0606	32-06371	5–5.25	QBT4	—	—	2.7	—	—
0132-96-0607	32-06372	3–3.25	QBT4	—	—	—	—	0.126
0132-96-0608	32-06374	2–2.25	SOIL	—	0.079	0.109	—	—
0132-96-0609	32-06375	3.5–4.5	SOIL	—	—	—	0.0998875	—

Notes: Results are in pCi/g.

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

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs are from LANL (2009, 107655).

[e] — = Not detected or not detected above BV/FV.

[f] NA = Not analyzed.

Table 4.2-1
Samples Collected and Analyses Requested at SWMU 32-002(b)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Dioxins/Furans	Gamma-Emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Cyanide (Total)
RE00-08-15167	00-603589	3.5–4.5	QBT3	08-2011	08-2011	08-2010	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011
RE00-08-15168	00-603589	5.5–6.5	QBT3	08-2011	08-2011	08-2010	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011	08-2011
RE32-10-11437	00-603589	7–8	QBT3	—	—	—	—	—	—	—	10-1961	—	—	—	—	—	—
RE00-08-15169	00-603590	5.5–6.5	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE00-08-15170	00-603590	7.5–8.5	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE32-10-11442	00-603590	9–10	QBT3	—	—	—	—	—	—	—	10-2113	—	—	—	—	—	—
RE00-08-15171	00-603591	5.5–6.5	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE00-08-15172	00-603591	7.5–8.5	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE32-10-11438	00-603591	9–10	QBT3	—	—	—	—	—	—	—	10-1961	—	—	—	—	—	—
RE00-08-15173	00-603592	3.5–4.5	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE00-08-15174	00-603592	5.5–6.5	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE32-10-11439	00-603592	7–8	QBT3	—	—	—	—	—	—	—	10-2113	—	—	—	—	—	—
RE00-08-15175	00-603593	0–1	QBT3	09-37	09-36	09-34	09-37	09-37	09-37	09-37	09-36	09-35	09-36	09-37	09-35	09-35	09-36
RE00-08-15176	00-603593	2–3	QBT3	09-37	09-36	09-34	09-37	09-37	09-37	09-37	09-36	09-35	09-36	09-37	09-35	09-35	09-36
RE00-08-15177	00-603594	3.5–4.5	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE00-08-15178	00-603594	6.5–7.5	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE32-10-11440	00-603594	8–9	QBT3	—	—	—	—	—	—	—	10-2113	—	—	—	—	—	—
RE00-08-15179	00-603595	1.2–2.2	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE00-08-15180	00-603595	3.2–4.2	QBT3	08-2026	08-2025	08-2027	08-2026	08-2026	08-2026	08-2026	08-2025	08-2028	08-2025	08-2026	08-2028	08-2028	08-2025
RE32-10-11441	00-603595	5–6	QBT3	—	—	—	—	—	—	—	10-2113	—	—	—	—	—	—
RE32-10-21512	00-603595	9–10	QBT3	—	—	—	—	—	—	—	10-3429	—	—	—	—	—	—
RE32-10-24894	00-603595	12–12.5	QBT3	—	—	—	—	—	—	—	10-3962	—	—	—	—	—	—
RE00-08-15181	00-603596	1.25–2.25	QBT3	09-4	09-4	09-3	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4
RE00-08-15182	00-603596	3.25–4.25	QBT3	09-4	09-4	09-3	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4	09-4
RE00-08-15183	00-603597	0.75–1.75	QBT3	09-37	09-36	09-34	09-37	09-37	09-37	09-37	09-36	09-35	09-36	09-37	09-35	09-35	09-36
RE00-08-15184	00-603597	2.75–3.75	QBT3	09-37	09-36	09-34	09-37	09-37	09-37	09-37	09-36	09-35	09-36	09-37	09-35	09-35	09-36
RE00-08-15185	00-603598	1.25–2.25	QBT3	09-37	09-36	09-34	09-37	09-37	09-37	09-37	09-36	09-35	09-36	09-37	09-35	09-35	09-36
RE00-08-15186	00-603598	3.25–4.25	QBT3	09-37	09-36	09-34	09-37	09-37	09-37	09-37	09-36	09-35	09-36	09-37	09-35	09-35	09-36
RE00-08-15187	00-603599	0–0.5	SOIL	09-37	09-36	09-34	09-37	09-37	09-37	09-37	09-36	09-35	09-36	09-37	09-35	09-35	09-36
RE00-08-15188	00-603599	2.5–3.5	QBT2	09-37	09-36	09-34	09-37	09-37	09-37	09-37	09-36	09-35	09-36	09-37	09-35	09-35	09-36
0132-96-0325	32-06312	0–0.5	SOIL	1922	—	—	—	1922	1922	1922	1921	—	—	—	1920	—	—
0132-96-0326	32-06312	0.5–1	QBT3	1922	—	—	—	1922	1922	1922	1921	—	—	—	1920	—	—
0132-96-0323	32-06313	0–0.5	SOIL	1922	—	—	—	1922	1922	1922	1921	—	—	—	1920	—	—
0132-96-0324	32-06313	1.25–1.83	QBT3	1922	—	—	—	1922	1922	1922	1921	—	—	—	1920	—	—

Table 4.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Dioxins/Furans	Gamma-Emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Cyanide (Total)
0132-96-0755	32-06314	0–0.5	QBT3	—	—	—	2069	—	2069	2069	2068	—	—	—	—	—	—
0132-96-0327	32-06315	0–0.5	SOIL	1922	—	—	—	1922	1922	1922	1921	—	—	—	1920	—	—
0132-96-0322	32-06323	0–0.5	SOIL	1922	—	—	—	1922	1922	1922	1921	—	—	—	1920	—	—
0132-96-0321	32-06325	0–0.5	SOIL	1922	—	—	—	1922	1922	1922	1921	—	—	—	1920	—	—
0132-96-0802	32-06342	1.5–2	SOIL	—	—	—	2069	—	2069	2069	2068	—	—	—	2067	—	—
0132-96-0801	32-06344	1.5–2	SOIL	—	—	—	2069	—	2069	2069	2068	—	—	—	2067	—	—
0132-96-0751	32-06353	0–0.5	QBT3	—	—	—	2069	—	2069	2069	2068	—	—	—	—	—	—
0132-96-0752	32-06357	0–0.5	SOIL	—	—	—	2069	—	2069	2069	2068	—	—	—	—	—	—
0132-96-0753	32-06358	0–0.5	QBT3	—	—	—	2069	—	2069	2069	2068	—	—	—	—	—	—
0132-96-0611	32-06365	5–5.25	QBT4	—	—	—	2005	2005	2005	2005	2004	—	—	—	2003	2003	—
0132-96-0612	32-06366	4–4.25	QBT4	—	—	—	2005	2005	2005	2005	2004	—	—	—	2003	2003	—
0132-96-0614	32-06377	3.5–4.5	QBT4	—	—	—	2052	2052	2052	2052	2051	—	—	—	2049	2049	—

Note: Numbers in analyte columns are request numbers.

* — = Analysis not requested.

Table 4.2-2
Inorganic Chemicals above BVs at SWMU 32-002(b)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Selenium	Silver	Sodium	Thallium	Zinc
Qbt 2, 3, 4 BV[a]				**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**	**482**	**0.1**	**6.58**	**na[b]**	**na**	**0.3**	**1**	**2770**	**1.1**	**63.5**
Soil BV[a]				**0.83**	**8.17**	**295**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**	**671**	**0.1**	**15.4**	**na**	**na**	**1.52**	**1**	**915**	**0.73**	**48.8**
Construction Worker SSL[c]				**124**	**65.4**	**4350**	**309**	**na**	**449[d]**	**34.6[e]**	**12400**	**6190**	**800**	**463**	**92.9**	**6190**	**496000**	**217**	**1550**	**1550**	**na**	**20.4**	**92900**
Industrial SSL[c]				**454**	**17.7**	**224000**	**1120**	**na**	**2920[d]**	**300[f]**	**45400**	**22700**	**800**	**145000**	**310**	**22700**	**1820000**	**795**	**5680**	**5680**	**na**	**74.9**	**341000**
Recreational SSL[g]				**317**	**27.7**	**158000**	**784**	**na**	**1910[d]**	**238**	**31700**	**15800**	**560**	**110000**	**238**	**15800**	**1260000**	**555**	**3960**	**3960**	**na**	**52.3**	**238000**
Residential SSL[c]				**31.3**	**3.9**	**15600**	**77.9**	**na**	**219[d]**	**23[f]**	**3130**	**1560**	**400**	**10700**	**23**	**1560**	**125000**	**54.8**	**391**	**391**	**na**	**5.16**	**23500**
RE00-08-15167	00-603589	3.5–4.5	QBT3	—[h]	—	51.3	—	—	13.6 (J)	—	—	0.59 (U)	13.2	—	—	11.2 (J)	8.5	—	—	—	—	—	—
RE00-08-15168	00-603589	5.5–6.5	QBT3	—	—	60.3	—	—	14.7 (J)	—	—	0.58 (U)	—	—	—	11.3 (J)	2.4	—	—	—	—	—	—
RE32-10-11437	00-603589	7–8	QBT3	1.11 (U)	—	—	—	—	9.4	—	—	NA[i]	—	—	—	—	NA	NA	0.703 (J)	—	—	—	—
RE00-08-15169	00-603590	5.5–6.5	QBT3	—	—	77.2 (J-)	—	—	22.2 (J-)	—	5.4 (J-)	—	51.1	—	—	14.5	3.5	—	—	—	—	—	—
RE00-08-15170	00-603590	7.5–8.5	QBT3	—	—	—	—	—	45.6 (J-)	—	—	—	31.7	—	—	22.2	1.3	—	0.31 (J)	—	—	—	98.7 (J-)
RE32-10-11442	00-603590	9–10	QBT3	1.23 (U)	—	—	—	—	7.62	—	—	NA	—	—	—	—	NA	NA	1.18 (UJ)	—	2840	—	—
RE00-08-15171	00-603591	5.5–6.5	QBT3	—	—	166 (J-)	—	—	45.1 (J-)	—	4.8 (J-)	—	—	—	—	23.2	0.92	—	0.39 (J)	—	—	—	—
RE00-08-15172	00-603591	7.5–8.5	QBT3	—	—	—	—	—	60.7 (J-)	—	—	—	—	—	—	28.5	0.39	—	0.33 (J)	—	—	—	—
RE32-10-11438	00-603591	9–10	QBT3	1.14 (U)	—	—	—	—	12	—	—	NA	—	—	—	—	NA	NA	0.762 (J)	—	—	—	—
RE00-08-15173	00-603592	3.5–4.5	QBT3	0.78 (U)	—	—	—	—	44 (J-)	—	—	—	—	—	—	21.6	—	—	—	—	—	—	—
RE00-08-15174	00-603592	5.5–6.5	QBT3	—	—	—	—	—	48.3 (J-)	—	—	—	—	—	—	23.5	—	—	0.32 (J)	—	—	—	—
RE32-10-11439	00-603592	7–8	QBT3	1.08 (U)	—	—	—	—	—	—	—	NA	—	—	—	—	NA	NA	1.08 (UJ)	—	—	—	—
RE00-08-15175	00-603593	0–1	QBT3	—	6.8 (J)	—	—	—	22.2	—	8.4	—	71	—	5.35	—	0.55	—	0.33 (J)	6.7 (J+)	—	—	—
RE00-08-15176	00-603593	2–3	QBT3	0.51 (U)	—	—	—	—	10.5 (J)	—	—	0.51 (U)	17.7	—	0.406	—	—	—	0.5 (J)	1.2 (J+)	—	—	—
RE00-08-15177	00-603594	3.5–4.5	QBT3	—	—	—	—	—	13.4 (J-)	—	—	—	16.3	—	0.86	7.3	—	—	0.34 (J)	—	—	—	—
RE00-08-15178	00-603594	6.5–7.5	QBT3	—	—	—	—	—	22.6 (J-)	—	—	—	—	—	0.166	12.2	—	—	0.33 (J)	—	—	—	—
RE32-10-11440	00-603594	8–9	QBT3	1.01 (U)	—	—	—	—	15.4	—	—	NA	—	—	—	—	NA	NA	0.997 (UJ)	—	—	—	—
RE00-08-15179	00-603595	1.2–2.2	QBT3	0.79 (U)	7.5 (J+)	57.5 (J-)	—	—	—	—	6.1 (J-)	—	22	—	1.92	—	0.88	—	—	—	—	—	66.4 (J)
RE00-08-15180	00-603595	3.2–4.2	QBT3	—	—	220 (J-)	—	—	38.4 (J-)	—	6.3 (J-)	—	13	—	2	22.6	0.36	—	0.45 (J)	—	—	—	—
RE32-10-11441	00-603595	5–6	QBT3	—	7.91	—	—	—	67.8	—	8.41	NA	67.3	—	10.1	—	NA	NA	1.04 (UJ)	2.38	—	—	—
RE32-10-21512	00-603595	9–10	QBT3	3.72	—	56.8	—	—	167 (J+)	—	7.96	NA	—	—	—	14.4	NA	NA	1.08 (U)	—	—	—	—
RE32-10-24894	00-603595	12–12.5	QBT3	0.54 (U)	—	49.7	—	—	8.1 (J)	—	5.9 (J)	NA	51	—	1.67	—	NA	NA	—	—	—	—	69.2
RE00-08-15181	00-603596	1.25–2.25	QBT3	—	—	55.1	—	—	10.3 (J)	—	5.6 (J)	—	13.6	—	0.546 (J)	6.9 (J)	0.16 (J)	—	0.34 (J)	—	—	—	—
RE00-08-15182	00-603596	3.25–4.25	QBT3	—	—	—	—	—	17.8 (J+)	—	—	—	—	—	—	9 (J+)	0.13 (J)	—	—	—	—	—	—
RE00-08-15183	00-603597	0.75–1.75	QBT3	0.54 (U)	2.8 (J)	53.2	—	—	15.2	—	6.5	0.52 (U)	45.9	—	2.18	7.8	—	0.006 (J)	—	4.8 (J+)	—	—	—
RE00-08-15184	00-603597	2.75–3.75	QBT3	0.52 (U)	—	—	—	—	8 (J)	—	—	—	20.8	—	0.65	—	—	0.0056 (J)	—	5.1 (J+)	—	—	—
RE00-08-15185	00-603598	1.25–2.25	QBT3	0.53 (U)	—	—	—	—	7.2 (J)	—	—	—	14.4	—	2.12	—	—	—	—	—	—	—	—
RE00-08-15186	00-603598	3.25–4.25	QBT3	0.53 (U)	—	—	—	—	10.9 (J)	—	—	—	—	—	0.205	—	—	0.0021 (J)	—	—	—	—	—

Table 4.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Selenium	Silver	Sodium	Thallium	Zinc
Qbt 2, 3, 4 BV[a]				**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**	**482**	**0.1**	**6.58**	**na[b]**	**na**	**0.3**	**1**	**2770**	**1.1**	**63.5**
Soil BV[a]				**0.83**	**8.17**	**295**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**	**671**	**0.1**	**15.4**	**na**	**na**	**1.52**	**1**	**915**	**0.73**	**48.8**
Construction Worker SSL[c]				**124**	**65.4**	**4350**	**309**	**na**	**449[d]**	**34.6[e]**	**12400**	**6190**	**800**	**463**	**92.9**	**6190**	**496000**	**217**	**1550**	**1550**	**na**	**20.4**	**92900**
Industrial SSL[c]				**454**	**17.7**	**224000**	**1120**	**na**	**2920[d]**	**300[f]**	**45400**	**22700**	**800**	**145000**	**310**	**22700**	**1820000**	**795**	**5680**	**5680**	**na**	**74.9**	**341000**
Recreational SSL[g]				**317**	**27.7**	**158000**	**784**	**na**	**1910[d]**	**238**	**31700**	**15800**	**560**	**110000**	**238**	**15800**	**1260000**	**555**	**3960**	**3960**	**na**	**52.3**	**238000**
Residential SSL[c]				**31.3**	**3.9**	**15600**	**77.9**	**na**	**219[d]**	**23[f]**	**3130**	**1560**	**400**	**10700**	**23**	**1560**	**125000**	**54.8**	**391**	**391**	**na**	**5.16**	**23500**
RE00-08-15187	00-603599	0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—
RE00-08-15188	00-603599	2.5–3.5	QBT2	0.56 (U)	—	—	—	—	—	—	—	0.56 (U)	—	—	—	—	0.56	—	0.56 (U)	—	—	—	—
0132-96-0325	32-06312	0–0.5	SOIL	11 (UJ)	—	—	1.9	—	77	—	27 (J+)	NA	220	—	48	—	NA	NA	—	21	—	2.1 (U)	110
0132-96-0326	32-06312	0.5–1	QBT3	10 (UJ)	4.1 (J-)	—	—	—	7.2	—	6.2 (J+)	NA	37	—	6.4	—	NA	NA	1 (U)	3.1	—	2.1 (U)	—
0132-96-0323	32-06313	0–0.5	SOIL	10 (UJ)	—	—	1	—	84	—	31 (J+)	NA	200	—	42	—	NA	NA	—	19	—	2.1 (U)	190
0132-96-0324	32-06313	1.25–1.83	QBT3	10 (UJ)	—	—	—	—	9.1	—	—	NA	—	—	NA	—	NA	NA	1 (U)	4	—	2 (U)	—
0132-96-0755	32-06314	0–0.5	QBT3	10 (UJ)	—	—	—	—	—	—	—	NA	—	—	0.2	—	NA	NA	1 (U)	2 (U)	—	1.3 (U)	—
0132-96-0327	32-06315	0–0.5	SOIL	11 (UJ)	—	—	0.53 (U)	—	—	—	—	NA	58	—	4.3	—	NA	NA	—	2.1	—	2.1 (U)	—
0132-96-0322	32-06323	0–0.5	SOIL	12 (UJ)	—	—	0.59 (U)	—	—	—	—	NA	—	—	0.12 (U)	—	NA	NA	—	2.4 (U)	—	2.4 (U)	—
0132-96-0321	32-06325	0–0.5	SOIL	10 (UJ)	—	—	0.52 (U)	—	22	—	—	NA	82	—	12	—	NA	NA	—	5.2	—	2.1 (U)	52
0132-96-0802	32-06342	1.5–2	SOIL	11 (UJ)	—	—	0.54 (U)	—	—	—	—	NA	32 (J-)	—	5.9	—	NA	NA	—	2.2 (U)	—	1.3 (U)	—
0132-96-0801	32-06344	1.5–2	SOIL	11 (U)	—	—	2.1	—	—	—	—	NA	61	—	9.4	—	NA	NA	—	2.1 (U)	—	1.3 (U)	67
0132-96-0751	32-06353	0–0.5	QBT3	10 (UJ)	—	54	—	4700	—	—	7.1	NA	43 (J-)	830	0.17	—	NA	NA	1	2 (U)	—	1.3	—
0132-96-0752	32-06357	0–0.5	SOIL	10 (UJ)	—	—	0.51 (U)	—	—	—	—	NA	38 (J-)	—	1.4	—	NA	NA	—	2 (U)	—	1.3 (U)	—
0132-96-0753	32-06358	0–0.5	QBT3	10 (UJ)	—	—	—	—	—	—	—	NA	—	—	—	—	NA	NA	1 (U)	2 (U)	—	1.3 (U)	—
0132-96-0611	32-06365	5–5.25	QBT4	12 (UJ)	—	76	—	—	—	3.6	4.8	NA	33	—	5	—	NA	NA	—	2.4 (U)	—	1.5 (U)	68 (J-)
0132-96-0612	32-06366	4–4.25	QBT4	11 (UJ)	—	—	—	2500	—	—	5.3	NA	—	—	0.11 (U)	—	NA	NA	—	2.1 (U)	—	1.3 (U)	—
0132-96-0614	32-06377	3.5–4.5	QBT4	6.5 (U)	—	78.7	—	—	—	3.6 (J)	5.8	NA	23.6	—	—	—	NA	NA	0.65 (J)	1.6 (U)	—	—	—

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 (2009, 108070), unless otherwise noted.

[d] SSLs are for hexavalent chromium.

[e] Construction worker SSLs calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[f] SSLs are from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[g] Recreational SSLs are from LANL (2010, 108613).

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

[i] NA = Not analyzed.

Table 4.2-3
Organic Chemicals Detected at SWMU 32-002(b)

Sample ID	Location ID	Depth (ft)	Media	Anthracene	Aroclor-1260	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic Acid	Bis(2-ethylhexyl)phthalate	Butylbenzylphthalate	Chrysene	Dibenz(a,h)anthracene	Di-n-butylphthalate	Fluoranthene	Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	Heptachlorodibenzodioxins (Total)	Heptachlorodibenzofuran[1,2,3,4,6,7,8-]
Construction Worker SSL[a]				**66800**	**75.8**	**213**	**21.3**	**213**	**6680**[b]	**2060**	**952000**[c]	**4760**	**47600**[c]	**20600**	**21.3**	**23800**	**8910**	**na**[d]	**na**	**na**
Industrial SSL[a]				**183000**	**8.26**	**23.4**	**2.34**	**23.4**	**18300**[b]	**234**	**2500000**[e]	**1370**	**9100**[e]	**2340**	**2.34**	**68400**	**24400**	**na**	**na**	**na**
Recreational SSL[f]				**104000**	**10.5**	**30.1**	**3.01**	**30.1**	**10400**	**301**	**1590000**	**1830**	**13500**	**3010**	**3.01**	**39900**	**13900**	**na**	**na**	**na**
Residential SSL[a]				**17200**	**2.22**	**6.21**	**0.621**	**6.21**	**1720**[b]	**62.1**	**240000**[e]	**347**	**2600**[e]	**621**	**0.621**	**6110**	**2290**	**na**	**na**	**na**
RE00-08-15167	00-603589	3.5–4.5	QBT3	—[g]	—	—	—	—	—	—	—	0.23 (J)	—	—	—	—	—	0.00000052 (J)	0.00000128 (J)	—
RE00-08-15168	00-603589	5.5–6.5	QBT3	—	—	—	—	—	—	—	—	0.098 (J)	—	—	—	—	—	0.00000215 (J)	0.00000449 (J)	—
RE00-08-15169	00-603590	5.5–6.5	QBT3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00000128 (J)	0.00000323 (J)	—
RE00-08-15170	00-603590	7.5–8.5	QBT3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.000000373 (J)	0.00000085 (J)	—
RE00-08-15171	00-603591	5.5–6.5	QBT3	—	—	—	—	—	—	—	—	0.7	0.085 (J)	—	—	—	—	0.0000195 (J)	0.0000468 (J)	0.00000428 (J)
RE00-08-15172	00-603591	7.5–8.5	QBT3	—	—	—	—	—	—	—	—	0.69	0.051 (J)	—	—	—	—	0.0000101	0.0000218	0.00000318 (J)
RE00-08-15173	00-603592	3.5–4.5	QBT3	—	0.4	—	—	—	—	—	—	—	—	—	—	—	—	0.0000047	0.00000824	—
RE00-08-15174	00-603592	5.5–6.5	QBT3	—	0.078	—	—	—	—	—	—	—	—	—	—	—	—	0.00000174 (J)	0.00000323	—
RE00-08-15175	00-603593	0–1	QBT3	—	0.041	—	—	—	—	—	—	—	—	0.038 (J)	—	—	0.05 (J)	0.0000738	0.000215	0.0000163
RE00-08-15176	00-603593	2–3	QBT3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00000391	0.00000942	0.000000838 (J)
RE00-08-15177	00-603594	3.5–4.5	QBT3	—	—	—	—	—	—	—	—	0.32 (J)	—	—	—	—	—	0.00000604	0.0000147	—
RE00-08-15178	00-603594	6.5–7.5	QBT3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00000166 (J)	0.00000443	—
RE00-08-15179	00-603595	1.2–2.2	QBT3	—	0.088	0.14 (J)	0.41	0.69	0.3 (J)	0.52	—	—	—	0.48	0.09 (J)	—	0.11 (J)	0.000102	0.000329	0.0000392
RE00-08-15180	00-603595	3.2–4.2	QBT3	—	0.059	—	—	—	—	—	—	—	—	—	—	—	—	0.0000401	0.000124	0.0000165 (J)
RE00-08-15181	00-603596	1.25–2.25	QBT3	—	—	—	—	—	—	—	—	0.12 (J)	—	—	—	—	—	0.000084	0.000163	0.0000238 (J)
RE00-08-15182	00-603596	3.25–4.25	QBT3	—	—	—	—	—	—	—	—	0.44	—	—	—	—	—	0.0000283	0.0000585	0.00000757 (J)
RE00-08-15183	00-603597	0.75–1.75	QBT3	—	0.031 (J)	—	—	0.039 (J)	—	—	—	—	—	0.041 (J)	—	—	0.044 (J)	0.00032	0.000555	0.0000789
RE00-08-15184	00-603597	2.75–3.75	QBT3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.0000139	0.0000241	0.00000329
RE00-08-15185	00-603598	1.25–2.25	QBT3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00000161 (J)	0.00000161	0.000000396 (J)
RE00-08-15186	00-603598	3.25–4.25	QBT3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.000000607 (J)	0.00000115	—
RE00-08-15187	00-603599	0–0.5	SOIL	—	—	0.039 (J)	0.061 (J)	0.091 (J)	—	0.072 (J)	—	—	—	0.091 (J)	—	—	0.14 (J)	0.0000422	0.000107	0.00000566
RE00-08-15188	00-603599	2.5–3.5	QBT2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00000167 (J)	0.00000407	—
0132-96-0611	32-06365	5–5.25	QBT4	—	NA[h]	—	—	—	—	—	—	—	—	—	—	0.054 (J)	—	NA	NA	NA
0132-96-0612	32-06366	4–4.25	QBT4	0.085 (J)	NA	0.27 (J)	0.3 (J)	0.61 (J)	0.13 (J)	0.24 (J)	—	—	—	0.48 (J)	—	0.77	0.99	NA	NA	NA
0132-96-0614	32-06377	3.5–4.5	QBT4	—	NA	0.023 (J)	0.03 (J)	0.048 (J)	0.045 (J)	0.036 (J)	0.076 (J)	0.059 (J)	—	0.075 (J)	—	—	0.074 (J)	NA	NA	NA

Table 4.2-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	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
Construction Worker SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**213**
Industrial SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**23.4**
Recreational SSL[f]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**30.1**
Residential SSL[a]				**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**6.21**
RE00-08-15167	00-603589	3.5–4.5	QBT3	—	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15168	00-603589	5.5–6.5	QBT3	—	—	—	—	—	0.000000178 (J)	—	—	—	—	—	—
RE00-08-15169	00-603590	5.5–6.5	QBT3	—	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15170	00-603590	7.5–8.5	QBT3	—	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15171	00-603591	5.5–6.5	QBT3	—	0.0000122 (J)	0.000000307 (J)	0.00000083 (J)	0.000000656 (J)	0.00000515 (J)	0.000000285 (J)	0.000000183 (J)	—	0.000000304 (J)	0.00000488 (J)	—
RE00-08-15172	00-603591	7.5–8.5	QBT3	0.000000195 (J)	0.00000868 (J)	—	0.000000406 (J)	0.000000286 (J)	0.00000212	0.00000027 (J)	—	—	0.000000161 (J)	0.00000278 (J)	—
RE00-08-15173	00-603592	3.5–4.5	QBT3	0.000000318 (J)	0.00000434 (J)	—	—	—	0.000000318	0.000000411 (J)	0.000000167 (J)	—	0.000000215 (J)	0.00000294 (J)	—
RE00-08-15174	00-603592	5.5–6.5	QBT3	—	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15175	00-603593	0–1	QBT3	0.00000143 (J)	0.0000458	0.000000769 (J)	0.00000218 (J)	0.00000146 (J)	0.0000225	0.0000014 (J)	0.000000737 (J)	0.000000267 (J)	0.00000114 (J)	0.0000235	—
RE00-08-15176	00-603593	2–3	QBT3	—	0.00000217	—	—	—	—	—	—	—	—	0.0000005	—
RE00-08-15177	00-603594	3.5–4.5	QBT3	—	0.00000569 (J)	—	—	—	0.00000106	0.000000182 (J)	—	—	—	0.00000207 (J)	—
RE00-08-15178	00-603594	6.5–7.5	QBT3	—	—	—	—	—	0.000000184	—	—	—	—	—	—
RE00-08-15179	00-603595	1.2–2.2	QBT3	0.0000018 (J)	0.000123	0.000000668 (J)	0.00000272	0.00000125 (J)	0.0000215	0.00000179 (J)	0.000000826 (J)	0.000000341 (J)	0.0000013 (J)	0.0000358	0.26 (J)
RE00-08-15180	00-603595	3.2–4.2	QBT3	0.000000873 (J)	0.0000578	0.000000302 (J)	0.0000012 (J)	0.000000594 (J)	0.0000075	0.000000565 (J)	0.000000268 (J)	—	0.000000383 (J)	0.0000135	—
RE00-08-15181	00-603596	1.25–2.25	QBT3	0.0000012 (J)	0.0000749	0.000000763 (J)	0.00000222 (J)	0.00000167 (J)	0.0000127	0.000000569 (J)	0.000000386 (J)	—	0.000000584 (J)	0.0000167	—
RE00-08-15182	00-603596	3.25–4.25	QBT3	0.000000472 (J)	0.0000269	—	0.000000718 (J)	0.00000045 (J)	0.00000368	—	—	—	—	0.00000486 (J)	—
RE00-08-15183	00-603597	0.75–1.75	QBT3	0.00000602	0.000245	0.00000313	0.00000859	0.00000672	0.0000498	0.00000201 (J)	0.00000155 (J)	0.000000485 (J)	0.00000299	0.00007	—
RE00-08-15184	00-603597	2.75–3.75	QBT3	—	0.0000097	—	0.000000422 (J)	—	0.00000202	—	—	—	—	0.00000232	—
RE00-08-15185	00-603598	1.25–2.25	QBT3	—	0.000000969	—	—	—	—	—	—	—	—	0.000000427	—
RE00-08-15186	00-603598	3.25–4.25	QBT3	—	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15187	00-603599	0–0.5	SOIL	0.000000523 (J)	0.0000151	0.000000491 (J)	0.00000134 (J)	0.000000839 (J)	0.0000126	0.000000606 (J)	0.000000323 (J)	—	0.000000444 (J)	0.00000875	—
RE00-08-15188	00-603599	2.5–3.5	QBT2	—	0.000000321	—	—	—	—	—	—	—	—	—	—
0132-96-0611	32-06365	5–5.25	QBT4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	—
0132-96-0612	32-06366	4–4.25	QBT4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.14 (J)
0132-96-0614	32-06377	3.5–4.5	QBT4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.026 (J)

Table 4.2-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Methylene Chloride	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	Tetrachlorodibenzofurans (Totals)	Tetrachloroethene	Trichlorofluoromethane
Construction Worker SSL[a]				**10600**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**7150**	**6680**	**na**	**338**	**5820**
Industrial SSL[a]				**1090**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**20500**	**18300**	**na**	**36.4**	**6760**
Recreational SSL[f]				**4520**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**12000**	**10400**	**na**	**91.7**	**49800**
Residential SSL[a]				**199**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**1830**	**1720**	**na**	**6.99**	**2010**
RE00-08-15167	00-603589	3.5–4.5	QBT3	—	0.00000464 (J)	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15168	00-603589	5.5–6.5	QBT3	—	0.000018 (J)	—	—	—	—	—	0.000000365 (J)	—	—	0.00000019 (J)	—	—
RE00-08-15169	00-603590	5.5–6.5	QBT3	—	0.0000127 (J)	—	—	—	—	0.000000103 (J)	0.000000103 (J)	—	—	—	—	—
RE00-08-15170	00-603590	7.5–8.5	QBT3	—	0.00000321 (J)	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15171	00-603591	5.5–6.5	QBT3	—	0.00018 (J)	0.0000118 (J)	—	—	—	0.000000294 (J)	0.00000296 (J)	—	—	0.000000223 (J)	—	—
RE00-08-15172	00-603591	7.5–8.5	QBT3	—	0.0000899	0.00000799 (J)	—	—	—	—	0.00000118	—	—	—	—	—
RE00-08-15173	00-603592	3.5–4.5	QBT3	—	0.0000414	0.00000481 (J)	—	—	—	0.000000375 (J)	0.00000266	—	—	0.000000477	—	—
RE00-08-15174	00-603592	5.5–6.5	QBT3	—	0.0000153	0.00000161 (J)	—	—	—	—	—	—	—	—	—	—
RE00-08-15175	00-603593	0–1	QBT3	—	0.000569 (J)	0.000043	0.000000358 (J)	0.000000945	0.000000212 (J)	0.00000093 (J)	0.00000823	—	0.052 (J)	0.00000227	0.00053 (J)	—
RE00-08-15176	00-603593	2–3	QBT3	—	0.0000256 (J)	0.00000159 (J)	—	—	—	—	0.000000228	—	—	—	—	—
RE00-08-15177	00-603594	3.5–4.5	QBT3	—	0.0000438	0.00000441 (J)	—	—	—	—	0.000000768	—	—	—	—	—
RE00-08-15178	00-603594	6.5–7.5	QBT3	0.0084 (J+)	0.0000124	0.00000188 (J)	—	—	—	—	0.000000271	—	—	—	—	—
RE00-08-15179	00-603595	1.2–2.2	QBT3	—	0.000948	0.0000969	0.000000285 (J)	0.00000109	0.00000023 (J)	0.00000116 (J)	0.000012	—	0.13 (J)	0.00000302	—	—
RE00-08-15180	00-603595	3.2–4.2	QBT3	—	0.000342	0.0000466	—	—	—	0.000000345 (J)	0.00000308	—	—	0.000000422	—	—
RE00-08-15181	00-603596	1.25–2.25	QBT3	—	0.00067	0.0000804	—	0.000000174	—	0.000000226 (J)	0.00000286	—	—	0.000000403	—	—
RE00-08-15182	00-603596	3.25–4.25	QBT3	—	0.000235	0.0000306	—	—	—	—	0.000000398	—	—	—	—	—
RE00-08-15183	00-603597	0.75–1.75	QBT3	—	0.00246 (J)	0.000285	0.00000109 (J)	0.00000299	—	0.000000743 (J)	0.00000955	—	0.041 (J)	0.00000213	—	—
RE00-08-15184	00-603597	2.75–3.75	QBT3	—	0.000101 (J)	0.0000124	—	—	—	—	0.000000283	—	—	0.000000176	—	—
RE00-08-15185	00-603598	1.25–2.25	QBT3	—	0.0000112 (J)	0.000000844 (J)	—	—	—	—	—	—	—	—	—	—
RE00-08-15186	00-603598	3.25–4.25	QBT3	—	0.0000033 (J)	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15187	00-603599	0–0.5	SOIL	—	0.000411 (J)	0.000013	—	0.000000396	0.000000151 (J)	0.00000037 (J)	0.0000029	0.072 (J)	0.12 (J)	0.000000937	—	—
RE00-08-15188	00-603599	2.5–3.5	QBT2	0.004 (J)	0.000013 (J)	—	—	—	—	—	—	—	—	—	—	—

Table 4.2-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Methylene Chloride	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	Tetrachlorodibenzofurans (Totals)	Tetrachloroethene	Trichlorofluoromethane
Construction Worker SSL[a]				**10600**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**7150**	**6680**	**na**	**338**	**5820**
Industrial SSL[a]				**1090**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**20500**	**18300**	**na**	**36.4**	**6760**
Recreational SSL[f]				**4520**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**12000**	**10400**	**na**	**91.7**	**49800**
Residential SSL[a]				**199**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**1830**	**1720**	**na**	**6.99**	**2010**
0132-96-0611	32-06365	5–5.25	QBT4	0.003 (J)	NA	NA	NA	NA	NA	NA	NA	—	0.041 (J)	NA	—	0.006
0132-96-0612	32-06366	4–4.25	QBT4	—	NA	NA	NA	NA	NA	NA	NA	0.45 (J)	1	NA	—	0.003 (J)
0132-96-0614	32-06377	3.5–4.5	QBT4	0.014 (J+)	NA	NA	NA	NA	NA	NA	NA	—	0.074 (J)	NA	—	—

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

[a] SSLs are from NMED (2009, 108070), unless otherwise noted.

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

[c] Construction worker SSLs calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[d] na = Not available.

[e] SSLs are from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[f] Recreational SSLs are from LANL (2010, 108613).

[g] — = Not detected.

[h] NA = Not analyzed.

Table 4.2-4
Radionuclides Detected or Detected above BVs/FVs at SWMU 32-002(b)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-239/240	Strontium-90	Tritium	Uranium-234	Uranium-235/236	Uranium-238
Qbt 2, 3, 4 BV[a]				**na[b]**	**na**	**na**	**na**	**na**	**1.98**	**0.09**	**1.93**
Soil BV[a,c]				**0.013**	**1.65**	**0.054**	**1.31**	**na**	**2.59**	**0.2**	**2.29**
Construction Worker SAL[d]				**34**	**18**	**36**	**800**	**320000**	**220**	**43**	**160**
Industrial SAL[d]				**180**	**23**	**210**	**1900**	**440000**	**1500**	**87**	**430**
Recreational SAL[d]				**280**	**210**	**300**	**5600**	**5300000**	**3200**	**520**	**2100**
Residential SAL[d]				**30**	**5.6**	**33**	**5.7**	**750**	**170**	**17**	**87**
RE00-08-15175	00-603593	0–1	QBT3	—[e]	0.32	0.242	—	—	—	0.102	—
RE00-08-15176	00-603593	2–3	QBT3	—	—	—	—	—	—	0.119	—
RE00-08-15179	00-603595	1.2–2.2	QBT3	—	—	—	0.45	—	—	—	—
RE00-08-15183	00-603597	0.75–1.75	QBT3	—	—	0.171	—	—	—	—	—
RE00-08-15184	00-603597	2.75–3.75	QBT3	—	—	0.1	—	—	—	—	—
RE00-08-15188	00-603599	2.5–3.5	QBT2	—	—	—	—	—	—	0.104	—
0132-96-0325	32-06312	0–0.5	SOIL	0.929	NA[f]	5	NA	—	—	—	—
0132-96-0326	32-06312	0.5–1	QBT3	—	NA	0.356	NA	—	—	—	—
0132-96-0323	32-06313	0–0.5	SOIL	1.07	NA	3.76	NA	—	3.55	—	3.04
0132-96-0324	32-06313	1.25–1.83	QBT3	—	NA	0.11	NA	—	—	—	—
0132-96-0755	32-06314	0–0.5	QBT3	NA	0.58	0.099	NA	NA	—	—	—
0132-96-0327	32-06315	0–0.5	SOIL	—	NA	0.613	NA	—	—	—	—
0132-96-0322	32-06323	0–0.5	SOIL	—	NA	0.389	NA	—	—	—	—
0132-96-0321	32-06325	0–0.5	SOIL	0.146	NA	1.64	NA	—	—	—	—
0132-96-0802	32-06342	1.5–2	SOIL	NA	—	0.134	NA	NA	—	—	—
0132-96-0801	32-06344	1.5–2	SOIL	NA	—	0.495	NA	NA	—	—	—
0132-96-0751	32-06353	0–0.5	QBT3	NA	1.7	0.091	NA	NA	—	—	—
0132-96-0752	32-06357	0–0.5	SOIL	NA	2.56	0.916	NA	NA	—	—	—
0132-96-0753	32-06358	0–0.5	QBT3	NA	0.29	—	NA	NA	—	—	—
0132-96-0611	32-06365	5–5.25	QBT4	NA	—	0.039	NA	—	—	—	—
0132-96-0614	32-06377	3.5–4.5	QBT4	NA	—	0.016	NA	0.09	—	—	—

Notes: Results are in pCi/g.

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

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs are from LANL (2009, 107655).

[e] — = Not detected or not detected above BV/FV.

[f] NA = Not analyzed.

Table 4.3-1
Samples Collected and Analyses Requested at AOC 32-003

Sample ID	Location ID	Depth (ft)	Media	Hexavalent Chromium	TAL Metals	PAHs	PCBs	SVOCs	VOCs
RE00-08-15211	00-603600	4.75–5.75	QBT3	—*	09-6	—	09-5	09-5	09-5
RE00-08-15212	00-603600	6.75–7.25	QBT3	—	09-6	—	09-5	09-5	09-5
RE32-10-11389	00-603601	3–4	QBT3	10-2114	10-2114	—	—	—	—
RE00-08-15207	00-603602	0–1	SOIL	—	09-39	—	09-38	09-38	09-38
RE00-08-15208	00-603602	2–3	QBT3	—	09-39	—	09-38	09-38	09-38
RE00-08-15209	00-603603	0–1	SOIL	—	09-6	—	09-5	09-5	09-5
RE00-08-15210	00-603603	2–2.5	QBT3	—	09-6	—	09-5	09-5	09-5
RE00-08-15203	00-603604	3–3.5	SOIL	—	08-2015	—	08-2015	08-2015	08-2015
RE00-08-15204	00-603604	5.5–6.5	QBT3	—	08-2015	—	08-2015	08-2015	08-2015
RE00-08-15213	00-603605	2–3	QBT3	—	08-2015	—	08-2015	08-2015	08-2015
RE00-08-15214	00-603605	4–5	QBT3	—	08-2015	—	08-2015	08-2015	08-2015
RE32-10-11385	00-603605	5.5–6.5	QBT3	10-2114	10-2114	—	—	—	—
RE00-08-15215	00-603606	2.25–2.75	QBT3	—	09-6	—	09-5	09-5	09-5
RE00-08-15216	00-603606	3.75–4.25	QBT3	—	09-6	—	09-5	09-5	09-5
RE32-10-11386	00-603606	5–6	QBT3	10-2114	10-2114	—	—	—	—
RE00-08-15218	00-603607	5–6	QBT3	—	09-6	—	09-5	09-5	09-5
RE00-08-15219	00-603607	7–8	QBT3	—	09-6	—	09-5	09-5	09-5
RE00-08-15217	00-603608	1.5–2	QBT3	—	09-39	—	09-38	09-38	09-38
RE00-08-15220	00-603608	3–3.5	QBT3	—	09-39	—	09-38	09-38	09-38
RE00-08-15221	00-603609	1.75–2.25	QBT3	—	09-6	—	09-5	09-5	09-5
RE00-08-15222	00-603609	3.25–3.75	QBT3	—	09-6	—	09-5	09-5	09-5
RE32-10-11387	00-603609	4–5	QBT3	10-2114	10-2114	—	—	—	—
RE00-08-15223	00-603610	1.5–2	QBT3	—	09-39	—	09-38	09-38	09-38
RE00-08-15224	00-603610	3–3.5	QBT3	—	09-39	—	09-38	09-38	09-38
RE00-08-15225	00-603611	2.25–2.75	QBT3	—	09-6	—	09-5	09-5	09-5
RE00-08-15226	00-603611	3.75–4.25	QBT3	—	09-6	—	09-5	09-5	09-5
RE32-10-11388	00-603611	5–6	QBT3	10-2114	10-2114	—	—	—	—
RE32-10-11377	32-611232	0–1	SOIL	—	—	10-2279	10-2279	—	—
RE32-10-11376	32-611232	2–2.5	SOIL	—	—	10-2279	10-2279	—	—
RE32-10-11379	32-611233	0–1	SOIL	—	—	10-2279	10-2279	—	—
RE32-10-11378	32-611233	2–2.5	SOIL	—	—	10-2279	10-2279	—	—
RE32-10-11381	32-611234	0–1	SOIL	—	—	10-2279	10-2279	—	—
RE32-10-11380	32-611234	2–2.5	SOIL	—	—	10-2279	10-2279	—	—

Table 4.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Hexavalent Chromium	TAL Metals	PAHs	PCBs	SVOCs	VOCs
RE32-10-24896	32-611788	0.5–1	SOIL	—	—	—	10-3963	—	—
RE32-10-24895	32-611789	0.5–1	SOIL	—	—	—	10-3963	—	—
RE32-10-21477	32-611845	7–7.5	QBT3	—	—	—	10-3430	—	—
RE32-10-14345	32-611845	7.5–8	QBT3	—	—	—	10-3430	—	—
RE32-10-14346	32-611846	7–7.5	QBT3	—	—	—	10-3430	—	—
RE32-10-21478	32-611846	7.5–8	QBT3	—	—	—	10-3430	—	—
RE32-10-14347	32-611847	7.5–8	QBT3	—	—	—	10-3430	—	—
RE32-10-21476	32-611847	8–8.5	QBT3	—	—	—	10-3430	—	—

Note: Numbers in analyte columns are request numbers.

* — = Analysis not requested.

Table 4.3-2
Inorganic Chemicals above BVs at AOC 32-003

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Chromium	Hexavalent Chromium	Cobalt	Copper	Lead	Magnesium	Nickel	Selenium	Sodium	Vanadium	Zinc
Qbt 2, 3, 4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**7.14**	**na**[b]	**3.14**	**4.66**	**11.2**	**1690**	**6.58**	**0.3**	**2770**	**17**	**63.5**
Soil BV[a]				**29200**	**0.83**	**8.17**	**295**	**1.83**	**19.3**	**na**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**915**	**39.6**	**48.8**
Construction Worker SSL[c]				**40700**	**124**	**65.4**	**4350**	**144**	**449**[d]	**449**	**34.6**[e]	**12400**	**800**	**na**	**6190**	**1550**	**na**	**1550**	**92900**
Industrial SSL[c]				**1130000**	**454**	**17.7**	**224000**	**2260**	**2920**[d]	**2920**	**300**[f]	**45400**	**800**	**na**	**22700**	**5680**	**na**	**5680**	**341000**
Recreational SSL[g]				**791000**	**317**	**27.7**	**158000**	**1580**	**1910**[d]	**1910**	**238**	**31700**	**560**	**na**	**15800**	**3960**	**na**	**3960**	**238000**
Residential SSL[c]				**78100**	**31.3**	**3.9**	**15600**	**156**	**219**[d]	**219**	**23**[f]	**3130**	**400**	**na**	**1560**	**391**	**na**	**391**	**23500**
RE00-08-15211	00-603600	4.75–5.75	QBT3	—[h]	—	—	—	—	38.2 (J+)	NA[i]	—	—	—	—	19.1 (J+)	—	—	—	—
RE00-08-15212	00-603600	6.75–7.25	QBT3	—	—	—	—	—	31.4 (J+)	NA	—	—	—	—	16.7 (J+)	0.32 (J)	—	—	—
RE32-10-11389	00-603601	3–4	QBT3	—	1.04 (U)	—	—	—	9.77	—	—	—	—	—	—	1.04 (UJ)	—	—	—
RE00-08-15208	00-603602	2–3	QBT3	—	0.55 (U)	—	—	—	10.3 (J)	NA	—	—	—	—	6.6	—	—	—	—
RE00-08-15209	00-603603	0–1	SOIL	—	—	—	—	—	—	NA	—	—	24.1	—	—	—	1970 (J-)	—	90.4 (J)
RE00-08-15210	00-603603	2–2.5	QBT3	—	—	—	—	—	12.4 (J+)	NA	—	—	12.7	—	7 (J+)	0.61 (U)	—	—	—
RE00-08-15204	00-603604	5.5–6.5	QBT3	14100 (J)	0.55 (U)	4.5	144 (J-)	1.9 (J-)	10 (J-)	NA	5 (J)	8.2 (J-)	26.2	2230 (J-)	12.8	0.63 (U)	—	21 (J-)	—
RE00-08-15213	00-603605	2–3	QBT3	—	1.3 (U)	—	—	—	—	NA	—	—	12.7	—	—	0.33 (J)	—	—	—
RE00-08-15214	00-603605	4–5	QBT3	—	—	—	—	—	37.2 (J-)	NA	—	—	—	—	18.1	0.36 (J)	—	—	—
RE32-10-11385	00-603605	5.5–6.5	QBT3	—	1.12 (U)	—	—	—	49.4	0.399 (J)	—	—	—	—	—	1.17 (UJ)	—	—	—
RE00-08-15215	00-603606	2.25–2.75	QBT3	—	—	—	—	—	12.6 (J+)	NA	—	—	—	—	7 (J+)	0.61 (U)	—	—	—
RE00-08-15216	00-603606	3.75–4.25	QBT3	—	0.57 (U)	—	—	—	65.9 (J+)	NA	—	—	—	—	32.5 (J+)	—	—	—	—
RE32-10-11386	00-603606	5–6	QBT3	—	1.07 (U)	—	—	—	28.1	—	—	—	—	—	—	1.1 (UJ)	—	—	—
RE00-08-15218	00-603607	5–6	QBT3	—	0.6 (U)	—	—	—	18.7 (U)	NA	—	—	—	—	9.4 (J+)	—	—	—	—
RE00-08-15219	00-603607	7–8	QBT3	—	—	—	103	—	12.3 (U)	NA	—	—	—	—	6.9 (J+)	0.31 (J)	—	—	—
RE00-08-15217	00-603608	1.5–2	QBT3	—	—	—	48.5	—	—	NA	—	5.7	—	—	15.3	—	—	—	—
RE00-08-15220	00-603608	3–3.5	QBT3	—	0.6 (U)	—	—	—	—	NA	—	—	—	—	—	—	—	—	—
RE00-08-15221	00-603609	1.75–2.25	QBT3	—	—	—	—	—	15.2 (J+)	NA	—	—	—	—	7.9 (J+)	0.58 (U)	—	—	—
RE00-08-15222	00-603609	3.25–3.75	QBT3	—	0.61 (U)	—	—	—	19.1 (J+)	NA	—	—	—	—	10.5 (J+)	—	—	—	—
RE32-10-11387	00-603609	4–5	QBT3	8970	1.27 (U)	—	52.4	1.71	11.9	—	—	6.47	—	—	11.3	1.24 (UJ)	—	—	—
RE00-08-15223	00-603610	1.5–2	QBT3	—	0.54 (U)	—	—	—	—	NA	—	—	—	—	—	—	—	—	—
RE00-08-15224	00-603610	3–3.5	QBT3	—	0.54 (U)	—	—	—	9.6 (J)	NA	—	—	—	—	—	—	—	—	—
RE00-08-15225	00-603611	2.25–2.75	QBT3	—	0.52 (U)	—	—	—	15.8 (J+)	NA	—	—	—	—	8.6 (J+)	—	—	—	—

Table 4.3-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Chromium	Hexavalent Chromium	Cobalt	Copper	Lead	Magnesium	Nickel	Selenium	Sodium	Vanadium	Zinc
Qbt 2, 3, 4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**7.14**	**na**	**3.14**	**4.66**	**11.2**	**1690**	**6.58**	**0.3**	**2770**	**17**	**63.5**
Soil BV[a]				**29200**	**0.83**	**8.17**	**295**	**1.83**	**19.3**	**na**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**915**	**39.6**	**48.8**
Construction Worker SSL[c]				**40700**	**124**	**65.4**	**4350**	**144**	**449[d]**	**449**	**34.6[e]**	**12400**	**800**	**na**	**6190**	**1550**	**na**	**1550**	**92900**
Industrial SSL[c]				**1130000**	**454**	**17.7**	**224000**	**2260**	**2920[d]**	**2920**	**300[f]**	**45400**	**800**	**na**	**22700**	**5680**	**na**	**5680**	**341000**
Recreational SSL[g]				**791000**	**317**	**27.7**	**158000**	**1580**	**1910[d]**	**1910**	**238**	**31700**	**560**	**na**	**15800**	**3960**	**na**	**3960**	**238000**
Residential SSL[c]				**78100**	**31.3**	**3.9**	**15600**	**156**	**219[d]**	**219**	**23[f]**	**3130**	**400**	**na**	**1560**	**391**	**na**	**391**	**23500**
RE00-08-15226	00-603611	3.75–4.25	QBT3	—	0.52 (U)	—	—	—	24.3 (J+)	NA	—	—	—	—	12 (J+)	—	—	—	—
RE32-10-11388	00-603611	5–6	QBT3	—	1.03 (U)	—	—	—	17.2	0.541	—	—	—	—	—	1.03 (UJ)	—	—	—

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 (2009, 108070), unless otherwise noted.

[d] SSLs are for hexavalent chromium.

[e] Construction worker SSLs calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[f] SSLs are from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[g] Recreational SSLs are from LANL (2010, 108613).

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

[i] NA = Not analyzed.

Table 4.3-3
Organic Chemicals Detected at AOC 32-003

Sample ID	Location ID	Depth (ft)	Media	Anthracene	Aroclor-1260	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Bis(2-ethylhexyl)phthalate	Chrysene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Methylene Chloride	Phenanthrene	Pyrene
Construction Worker SSL[a]				**66800**	**75.8**	**213**	**21.3**	**213**	**6680**[b]	**2060**	**4760**	**20600**	**8910**	**213**	**10600**	**7150**	**6680**
Industrial SSL[a]				**183000**	**8.26**	**23.4**	**2.34**	**23.4**	**18300**[b]	**234**	**1370**	**2340**	**24400**	**23.4**	**1090**	**20500**	**18300**
Recreational SSL[c]				**104000**	**10.5**	**30.1**	**3.01**	**30.1**	**10400**[b]	**301**	**1830**	**3010**	**13900**	**30.1**	**4520**	**12000**	**10400**
Residential SSL[a]				**17200**	**2.22**	**6.21**	**0.621**	**6.21**	**1720**[b]	**62.1**	**347**	**621**	**2290**	**6.21**	**199**	**1830**	**1720**
RE00-08-15211	00-603600	4.75–5.75	QBT3	—[d]	—	—	—	—	—	—	0.82	—	—	—	—	—	—
RE00-08-15212	00-603600	6.75–7.25	QBT3	—	—	—	—	—	—	—	—	—	—	—	0.007	—	—
RE00-08-15207	00-603602	0–1	SOIL	—	0.35	0.13 (J)	0.19 (J)	0.39	0.2 (J)	0.33 (J)	—	0.45	0.19 (J)	0.17 (J)	—	0.06 (J)	0.2 (J)
RE00-08-15209	00-603603	0–1	SOIL	—	0.15 (J)	0.32 (J)	0.44 (J)	0.57 (J)	0.31 (J)	0.6 (J)	—	0.68 (J)	1.3 (J)	0.3 (J)	0.016	0.73 (J)	1.1 (J)
RE00-08-15210	00-603603	2–2.5	QBT3	—	—	—	—	—	—	—	—	—	0.046 (J)	—	0.011	—	0.042 (J)
RE00-08-15203	00-603604	3–3.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.0033 (J)	—	—
RE00-08-15204	00-603604	5.5–6.5	QBT3	—	—	—	—	—	—	—	0.067 (J)	—	—	—	—	—	—
RE00-08-15213	00-603605	2–3	QBT3	—	—	—	—	—	—	—	0.19 (J)	—	—	—	—	—	—
RE00-08-15215	00-603606	2.25–2.75	QBT3	—	0.072 (J)	—	—	—	—	—	—	—	—	—	0.012	—	—
RE00-08-15216	00-603606	3.75–4.25	QBT3	—	—	—	—	—	—	—	—	—	—	—	0.01	—	—
RE00-08-15218	00-603607	5–6	QBT3	—	—	—	—	—	—	—	0.2 (J)	—	—	—	—	—	—
RE00-08-15219	00-603607	7–8	QBT3	—	—	—	—	—	—	—	0.1 (J)	—	—	—	—	—	—
RE00-08-15217	00-603608	1.5–2	QBT3	—	0.051	—	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15220	00-603608	3–3.5	QBT3	—	0.26	—	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15221	00-603609	1.75–2.25	QBT3	—	1.2	—	—	—	—	—	0.48	—	—	—	0.013 (J+)	—	—
RE00-08-15222	00-603609	3.25–3.75	QBT3	—	—	—	—	—	—	—	—	—	—	—	0.01	—	—
RE00-08-15223	00-603610	1.5–2	QBT3	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—
RE00-08-15225	00-603611	2.25–2.75	QBT3	—	0.035	—	—	—	—	—	—	—	—	—	0.0074	—	—
RE00-08-15226	00-603611	3.75–4.25	QBT3	—	—	—	—	—	—	—	—	—	—	—	0.011	—	—
RE32-10-11377	32-611232	0–1	SOIL	—	0.0764	0.267	—	—	—	—	NA[e]	0.307	0.738	—	NA	0.535	0.549
RE32-10-11376	32-611232	2–2.5	SOIL	—	0.0994	0.0148	—	—	—	—	NA	0.025	0.0524	—	NA	0.022	0.0414
RE32-10-11379	32-611233	0–1	SOIL	—	—	—	—	—	—	—	NA	—	—	—	NA	—	0.00455 (J-)
RE32-10-11378	32-611233	2–2.5	SOIL	0.0103 (J-)	0.0531	0.067 (J-)	0.0494 (J-)	0.0991 (J-)	0.0247 (J-)	—	NA	0.0902 (J-)	0.177 (J-)	—	NA	0.121 (J-)	0.132 (J-)
RE32-10-11381	32-611234	0–1	SOIL	—	0.0736	—	0.0202 (J-)	—	—	—	NA	0.0248 (J-)	0.0438 (J-)	—	NA	0.0242 (J-)	0.0374 (J-)
RE32-10-11380	32-611234	2–2.5	SOIL	—	0.0073	—	—	—	—	—	NA	—	—	—	NA	—	—
RE32-10-24896	32-611788	0.5–1	SOIL	NA	0.0036	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RE32-10-24895	32-611789	0.5–1	SOIL	NA	0.0026 (J)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RE32-10-21477	32-611845	7–7.5	QBT3	NA	0.0015 (J)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4.3-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Anthracene	Aroclor-1260	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Bis(2-ethylhexyl)phthalate	Chrysene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Methylene Chloride	Phenanthrene	Pyrene
Construction Worker SSL[a]				**66800**	**7.58**	**213**	**21.3**	**213**	**6680**[b]	**2060**	**4760**	**20600**	**8910**	**213**	**10600**	**7150**	**6680**
Industrial SSL[a]				**183000**	**8.26**	**23.4**	**2.34**	**23.4**	**18300**[b]	**234**	**1370**	**2340**	**24400**	**23.4**	**1090**	**20500**	**18300**
Recreational SSL[c]				**104000**	**10.5**	**30.1**	**3.01**	**30.1**	**10400**[b]	**301**	**1830**	**3010**	**13900**	**30.1**	**4520**	**12000**	**10400**
Residential SSL[a]				**17200**	**2.22**	**6.21**	**0.621**	**6.21**	**1720**[b]	**62.1**	**347**	**621**	**2290**	**6.21**	**199**	**1830**	**1720**
RE32-10-14345	32-611845	7.5–8	QBT3	NA	0.0018 (J)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RE32-10-14346	32-611846	7–7.5	QBT3	NA	0.0017 (J)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RE32-10-21478	32-611846	7.5–8	QBT3	NA	0.0018 (J)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RE32-10-14347	32-611847	7.5–8	QBT3	NA	0.0482	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RE32-10-21476	32-611847	8–8.5	QBT3	NA	0.0314	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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

[a] SSLs are from NMED (2009, 108070), unless otherwise noted.

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

[c] Recreational SSLs are from LANL (2010, 108613).

[d] — = Not detected.

[e] NA = Not analyzed.

Table 4.4-1
Samples Collected and Analyses Requested at AOC 32-004

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Nitrate	Gamma-Emitting Radionuclides	Tritium	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PAHs	PCBs	Perchlorate	Strontium-90	SVOCs	VOCs	Cyanide (Total)
RE00-08-15242	00-603612	1–1.5	QBT3	08-2018	08-2017	08-2018	08-2018	08-2018	08-2018	08-2017	—*	08-2016	08-2017	08-2018	08-2016	08-2016	08-2017
RE00-08-15243	00-603612	2.5–3	QBT3	08-2018	08-2017	08-2018	08-2018	08-2018	08-2018	08-2017	—	08-2016	08-2017	08-2018	08-2016	08-2016	08-2017
RE00-08-15244	00-603612	5–6	QBT3	08-2018	08-2017	08-2018	08-2018	08-2018	08-2018	08-2017	—	08-2016	08-2017	08-2018	08-2016	08-2016	08-2017
0132-96-0354	32-06326	0–0.5	SOIL	1929	—	—	1929	1929	1929	1928	—	—	—	—	1927	—	—
RE32-10-11368	32-06326	0–0.5	SOIL	—	—	—	—	—	—	—	10-2221	—	—	—	—	—	—
0132-96-0355	32-06326	0.5–1	QBT3	1929	—	—	1929	1929	1929	1928	—	—	—	—	1927	—	—
RE32-10-11369	32-06326	1–1.5	SOIL	—	—	—	—	—	—	—	10-2221	—	—	—	—	—	—
0132-96-0356	32-06331	0–0.42	SOIL	1929	—	—	1929	1929	1929	1928	—	—	—	—	1927	—	—
RE32-10-11370	32-06331	0–0.5	SOIL	—	—	—	—	—	—	—	10-2221	—	—	—	—	—	—
RE32-10-11371	32-06331	1–1.5	SOIL	—	—	—	—	—	—	—	10-2221	—	—	—	—	—	—
0132-96-0357	32-06336	0–0.5	SOIL	1929	—	—	1929	1929	1929	1928	—	—	—	—	1927	—	—
0132-96-0352	32-06338	0–0.5	SOIL	1929	—	—	1929	1929	1929	1928	—	—	—	—	1927	—	—
RE32-10-11366	32-06338	0–0.5	SOIL	—	—	—	—	—	—	—	10-2221	—	—	—	—	—	—
0132-96-0353	32-06338	0.5–1	SOIL	1929	—	—	1929	1929	1929	1928	—	—	—	—	1927	—	—
RE32-10-11367	32-06338	1–1.5	SOIL	—	—	—	—	—	—	—	10-2221	—	—	—	—	—	—
0132-96-0351	32-06340	0–0.5	SOIL	—	—	—	—	—	—	1928	—	—	—	—	1927	—	—
RE32-10-11364	32-06340	0–0.5	SOIL	—	—	—	—	—	—	—	10-2221	—	—	—	—	—	—
RE32-10-11365	32-06340	1–1.5	SOIL	—	—	—	—	—	—	—	10-2221	—	—	—	—	—	—
0132-96-0621	32-06363	3–3.5	SOIL	—	—	1996	1996	1996	1996	1995	—	—	—	—	1994	1994	—
0132-96-0622	32-06364	2.5–3	SOIL	—	—	1996	1996	1996	1996	1995	—	—	—	—	1994	1994	—

Note: Numbers in analyte columns are request numbers.

* — = Analysis not requested.

Table 4.4-2
Inorganic Chemicals above BVs at AOC 32-004

Sample ID	Location ID	Depth (ft)	Media	Antimony	Cadmium	Chromium	Copper	Cyanide (Total)	Lead	Mercury	Nickel	Nitrate	Selenium	Silver	Thallium	Zinc
Qbt 2, 3, 4 BV[a]				**0.5**	**1.63**	**7.14**	**4.66**	**0.5**	**11.2**	**0.1**	**6.58**	**na[b]**	**0.3**	**1**	**1.1**	**63.5**
Soil BV[a]				**0.83**	**0.4**	**19.3**	**14.7**	**na**	**22.3**	**0.1**	**15.4**	**na**	**1.52**	**1**	**0.73**	**48.8**
Construction Worker SSL[c]				**124**	**309**	**449[d]**	**12400**	**6190**	**800**	**92.9[e]**	**6190**	**496000**	**1550**	**1550**	**20.4**	**92900**
Industrial SSL[c]				**454**	**1120**	**2920[d]**	**45400**	**22700**	**800**	**310[f]**	**22700**	**1820000**	**5680**	**5680**	**74.9**	**341000**
Recreational SSL[g]				**317**	**784**	**1910[d]**	**31700**	**15800**	**560**	**238**	**15800**	**1260000**	**3960**	**3960**	**52.3**	**238000**
Residential SSL[c]				**31.3**	**77.9**	**219[d]**	**3130**	**1560**	**400**	**23**	**1560**	**125000**	**391**	**391**	**5.16**	**23500**
RE00-08-15242	00-603612	1–1.5	QBT3	—[h]	—	18.8 (J+)	—	—	—	—	10.2	0.26	—	—	—	—
RE00-08-15243	00-603612	2.5–3	QBT3	0.52 (U)	—	44.6 (J+)	—	—	—	—	24.1	—	—	—	—	—
RE00-08-15244	00-603612	5–6	QBT3	—	—	20.1 (J+)	—	0.55 (U)	—	—	12.4	—	0.31 (J)	—	—	—
0132-96-0354	32-06326	0–0.5	SOIL	11 (UJ)	0.55 (U)	—	—	NA[i]	53	0.11 (U)	—	NA	—	2.2 (U)	2.2 (U)	100
0132-96-0355	32-06326	0.5–1	QBT3	12 (UJ)	—	—	—	NA	—	0.12 (U)	—	NA	1.2 (U)	2.4 (U)	2.4 (U)	—
0132-96-0356	32-06331	0–0.42	SOIL	10 (UJ)	0.51 (U)	—	—	NA	34	—	—	NA	—	2 (U)	2 (U)	51
0132-96-0357	32-06336	0–0.5	SOIL	10 (UJ)	0.52 (U)	—	—	NA	—	—	—	NA	—	2.1 (U)	2.1 (U)	—
0132-96-0352	32-06338	0–0.5	SOIL	11 (UJ)	0.54	32	15 (J+)	NA	89	0.11	—	NA	—	3.3	2.2 (U)	83
0132-96-0353	32-06338	0.5–1	SOIL	11 (UJ)	0.56 (U)	—	—	NA	—	0.11 (U)	—	NA	—	2.2 (U)	2.2 (U)	—
0132-96-0351	32-06340	0–0.5	SOIL	11 (UJ)	1.1	—	26 (J+)	NA	200	0.11 (U)	—	NA	—	2.1 (U)	2.1 (U)	150
0132-96-0621	32-06363	3–3.5	SOIL	5.8 (U)	0.58 (U)	—	—	NA	—	0.45	—	NA	—	—	—	50.2
0132-96-0622	32-06364	2.5–3	SOIL	5.8 (U)	0.58 (U)	—	—	NA	—	0.55	—	NA	—	—	—	102

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 (2009, 108070), unless otherwise noted.

[d] SSLs are for hexavalent chromium.

[e] Construction worker SSLs calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[f] SSLs are from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[g] Recreational SSLs are from LANL (2010, 108613).

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

[i] NA = Not analyzed.

Table 4.4-3
Organic Chemicals Detected at AOC 32-004

Sample ID	Location ID	Depth (ft)	Media	Acenaphthene	Acetone	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Bis(2-ethylhexyl)phthalate	Butylbenzylphthalate	Chrysene	Di-n-octylphthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
Construction Worker SSL[a]				**18600**	**263000**	**66800**	**213**	**21.3**	**213**	**6680**[b]	**2060**	**4760**	**47600**[c]	**20600**	**4760**[c]	**8910**	**8910**	**213**	**702**	**7150**	**6680**
Industrial SSL[a]				**36700**	**851000**	**183000**	**23.4**	**2.34**	**23.4**	**18300**[b]	**234**	**1370**	**9100**[d]	**2340**	**25000**[e]	**24400**	**24400**	**23.4**	**252**	**20500**	**18300**
Recreational SSL[f]				**20800**	**702000**	**104000**	**30.1**	**3.01**	**30.1**	**10400**[b]	**301**	**1830**	**13500**	**3010**	**7970**	**13900**	**13900**	**30.1**	**1950**	**12000**	**10400**
Residential SSL[a]				**3440**	**67500**	**17200**	**6.21**	**0.621**	**6.21**	**1720**[b]	**62.1**	**347**	**2600**[d]	**621**	**2400**[e]	**2290**	**2290**	**6.21**	**45**	**1830**	**1720**
RE00-08-15243	00-603612	2.5–3	QBT3	—[g]	—	—	—	—	—	—	—	0.31 (J)	—	—	—	—	—	—	—	—	—
RE00-08-15244	00-603612	5–6	QBT3	—	—	—	—	—	—	—	—	0.058 (J)	—	—	—	—	—	—	—	—	—
0132-96-0354	32-06326	0–0.5	SOIL	—	NA[h]	0.32	1.4	1.5	1.6	0.65	1.4	0.88	2.4	2.4	—	3.4	—	0.67	—	1.7	2.7
RE32-10-11368	32-06326	0–0.5	SOIL	—	NA	0.242	1.7	1.93	3.81	1.55	1.36	NA	NA	2.48	NA	3.79	—	—	—	1.52	2.86
RE32-10-11369	32-06326	1–1.5	SOIL	—	NA	0.104 (J)	0.653	0.681	1.38	0.595	0.443	NA	NA	0.79	NA	1.44	—	—	—	0.672	1.08
0132-96-0356	32-06331	0–0.42	SOIL	0.19	NA	0.32	0.89	0.91	0.96	0.42	1.1	0.25	0.96	1.6	—	2.3	0.19	0.42	0.23	1.7	1.8
RE32-10-11370	32-06331	0–0.5	SOIL	—	NA	—	0.036	0.037	—	0.0269	—	NA	NA	0.0372	NA	0.0792	—	—	—	0.0317 (J)	0.0629
RE32-10-11371	32-06331	1–1.5	SOIL	—	NA	—	0.0113	—	—	—	—	NA	NA	0.0128	NA	0.027	—	—	—	0.0104 (J)	0.0209
0132-96-0357	32-06336	0–0.5	SOIL	—	NA	—	—	—	—	—	—	—	—	—	—	0.18	—	—	—	—	—
0132-96-0352	32-06338	0–0.5	SOIL	—	NA	—	1.7	1.9	2.2	1.4	1.7	0.69	3.1	3.5	—	4.8	—	1.3	—	2.2	3.8
RE32-10-11366	32-06338	0–0.5	SOIL	—	NA	0.0721 (J)	0.354	0.352	0.669	—	—	NA	NA	0.371	NA	0.804	—	—	—	0.488	0.607
0132-96-0353	32-06338	0.5–1	SOIL	—	NA	—	—	—	—	—	—	—	0.3	0.21	—	0.2	—	—	—	—	0.2
RE32-10-11367	32-06338	1–1.5	SOIL	—	NA	—	0.117	0.127	—	—	—	NA	NA	0.135	NA	0.255	—	—	—	0.11 (J)	0.198
0132-96-0351	32-06340	0–0.5	SOIL	—	NA	2.3	8.2	8.4	7.8	4.9	7.9	1.8	8.3	14	—	18	—	4.8	—	11	15
RE32-10-11364	32-06340	0–0.5	SOIL	—	NA	0.541	2.52	2.17	3.74	1.49	—	NA	NA	2.68	NA	4.76	—	—	—	3.23	4.16
RE32-10-11365	32-06340	1–1.5	SOIL	—	NA	0.0869 (J)	0.51	0.568	1.11	0.522	—	NA	NA	0.604	NA	1.14	—	—	—	0.527	0.865
0132-96-0621	32-06363	3–3.5	SOIL	—	—	—	—	—	0.12 (J)	—	—	—	—	—	—	0.18 (J)	—	—	—	0.1 (J)	0.15 (J)
0132-96-0622	32-06364	2.5–3	SOIL	—	0.002 (J)	—	0.17 (J)	0.21 (J)	0.31 (J)	0.15 (J)	0.15 (J)	0.097 (J)	0.18 (J)	0.25 (J)	0.097 (J)	0.48	—	0.16 (J)	—	0.24 (J)	0.37 (J)

Notes: Results are in mg/kg. Data qualifiers are defined in Appendix A. Shading denotes results are replaced by corresponding 2010 sample results at same depths.

[a] SSLs are from NMED (2009, 108070), unless otherwise noted.

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

[c] Construction worker SSLs calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[d] SSLs are from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[e] SSLs are from EPA (2007, 099314).

[f] Recreational SSLs are from LANL (2010, 108613).

[g] — = Not detected.

[h] NA = Not analyzed.

Table 4.4-4
Radionuclides Detected or Detected above BVs/FVs at AOC 32-004

Sample ID	Location ID	Depth (ft)	Media	Americium-241
Soil BV[a,b]				**0.013**
Construction Worker SAL[c]				**34**
Industrial SAL[c]				**180**
Recreational SAL[c]				**280**
Residential SAL[c]				**30**
0132-96-0354	32-06326	0–0.5	SOIL	0.091

Note: Results are in pCi/g.

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

[b] FV applies to soil samples collected from 0–1 ft only.

[c] SALs are from LANL (2009, 107655).

Appendix A

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

A-1.0 ACRONYMS AND ABBREVIATIONS

%R	percent recovery
ACA	accelerated corrective action
AI	adequate intake
AK	acceptable knowledge
ALARA	as low as reasonably achievable
AOC	area of concern
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	area use factor
BCG	Biota Concentration Guide (DOE)
bgs	below ground surface
BV	background value
CCB	continuing calibration blank
CCV	continuing calibration verification
Consent Order	Compliance Order on Consent
COC	chain of custody
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CVAA	cold vapor atomic absorption
DAF	dilution attenuation factor
DOE	Department of Energy (U.S.)
DGPS	differential global positioning system
DL	detection limit
Eh	oxidation-reduction potential
EP	Environmental Programs Directorate
EPA	Environmental Protection Agency (U.S.)
EPC	exposure point concentration
EQL	estimated quantitation limit
ER ID	ER record identification number
ESL	ecological screening level
FV	fallout value
GCMS	gas chromatography mass spectrometry
GFAA	graphite furnace atomic absorption

HI	hazard index
HQ	hazard quotient
HR	home range
ICB	initial calibration blank
ICPES	Inductively coupled plasma emission spectroscopy
ICS	interference check sample
ICV	initial calibration verification
IDW	investigation-derived waste
IS	internal standard
K_d	soil-water partition coefficient
K_{oc}	organic carbon-water partition coefficient
K_{ow}	octanol-water partition coefficient
LAL	lower acceptance limit
LANL	Los Alamos National Laboratory (the Laboratory)
LCS	laboratory control sample
LLW	low-level waste
LOAEL	lowest observed adverse effect level
LOEC	lowest observed effect concentration
MDC	minimum detectable concentration
MDL	method detection limit
mm Hg	millimeter of mercury
MS	matrix spike
NMED	New Mexico Environment Department
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
PAH	polycyclic aromatic hydrocarbon
PAUF	population area use factor
PCB	polychlorinated biphenyl
PID	photoionization detector
PPE	personal protective equipment
PRG	preliminary remediation goal
QA	quality assurance
QC	quality control
QP	quality procedure

RCT	radiation control technician
RME	reasonable maximum exposure
RESRAD	residual radioactive (model)
RfD	reference dose
RFI	Resource Conservation and Recovery Act facility investigation
RL	reporting limit
RPD	relative percent difference
RPF	Records Processing Facility
SAL	screening action level
SCL	sample collection log
SF	slope factor
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
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	tetrachlorordibenzodioxin
TCLP	toxicity characteristic leaching procedure
TEF	toxicity equivalency factor
TPU	total propagated uncertainty
TRV	toxicity reference value
TSD	treatment, storage, and disposal
UAL	upper acceptance limit
UCL	upper confidence limit
VCA	voluntary corrective action
VOC	volatile organic compound
WCSF	waste characterization strategy form

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. 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 (QA/QC) parameters.

Appendix B

Field Methods

B-1.0 INTRODUCTION

This appendix summarizes field methods used during the 2010 accelerated corrective action (ACA) activities at former Technical Area 32 (TA-32) in the Upper Los Alamos Canyon Aggregate Area at the Los Alamos National Laboratory (LANL or the Laboratory). The ACA investigation was conducted according to the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455). Table B-1.0-1 provides a general summary of methods used, and the following sections provide more detailed descriptions of the field methods. All activities were conducted in accordance with the applicable Environmental Programs (EP) Directorate standard operating procedures (SOPs) and quality procedures (QPs), which are listed in Table B-1.0-2 and are available at http://www.lanl.gov/environment/all/qa.shtml.

B-2.0 EXPLORATORY DRILLING CHARACTERIZATION

No exploratory drilling characterization was conducted. All drilling was conducted for the purpose of collecting investigation samples.

B-3.0 FIELD SCREENING

This section summarizes the field-screening methods used during the investigation activities. Field screening for organic vapors and radioactivity was performed on each sample. The field-screening results are presented in Table 3.0-1 of the remedy completion report.

B-3.1 Field Screening for Organic Vapors

All samples collected were field screened for organic vapors using a MiniRAE 2000 photoionization detector (PID) equipped with an 11.7-electron volt lamp. Screening was performed in accordance with SOP-06.33, Headspace Vapor Screening with a Photo Ionization Detector. Screening was performed on each sample collected and screening measurements were recorded on the field sample collection log (SCL). The SCLs are provided in Appendix E. The field-screening results are presented in Table 3.0-1 of the remedy completion report.

B-3.2 Field Screening for Radioactivity

During sampling of soil, fill, tuff, or sediment, each sample was screened for radioactivity immediately at collection, targeting alpha and beta/gamma emitters. Screening was conducted by a Laboratory radiation control technician (RCT) using an Eberline E-600 radiation meter with an SHP-380AB alpha and beta/gamma scintillation detector. The Eberline E-600 with attachment SHP-380AB consists of a dual phosphor plate covered by two Mylar windows housed in a light-excluding metal body. The phosphor plate is a plastic scintillator for the detection of beta and gamma emissions and is thinly coated with zinc sulfide for the detection of alpha emissions. The operational range varies from trace emissions to 1 million disintegrations per minute. Screening was performed on each sample collected and screening measurements were recorded on the field SCLs. The field-screening results are presented in Table 3.0-1 of the remedy completion report.

B-3.3 Field Instrument Calibration

All instruments were calibrated before use. Calibration of the MiniRAE 2000 PID was conducted at least daily by the site crew. Calibration of the Eberline E-600 was conducted by the RCT. All calibrations were performed according to the manufacturer's specifications and requirements.

B-3.3.1 MiniRAE 2000 Instrument Calibration

The MiniRAE 2000 PID was calibrated both to ambient air and a standard reference gas (100 ppm isobutylene). The ambient-air calibration determined the zero point of the instrument sensor calibration curve in ambient air. Calibration with the standard reference gas determined a second point of the sensor calibration curve. Each calibration was within 3% of 100 ppm isobutylene, qualifying the instrument for use.

The following calibration information was recorded daily on operational calibration logs:

- instrument identification number
- final span settings
- date and time
- concentration and type of calibration gas used (isobutylene at 100 ppm)
- name of the personnel performing the calibration

All daily calibration procedures for the MiniRAE 2000 PID met the manufacturer's specifications for standard reference gas calibration and the requirements.

B-3.3.2 Eberline E-600 Instrument Calibration

The Eberline E-600 was calibrated daily by the RCT before local background levels for radioactivity were measured. The instrument was calibrated using plutonium-239 and chloride-36 sources for alpha and beta emissions, respectively. The following five checks were performed as part of the calibration procedures:

- calibration date
- physical damage
- battery
- response to a source of radioactivity
- background

All calibrations performed for the Eberline E-600 met the manufacturer's specifications and the applicable radiation detection instrument manual.

B-4.0 EXCAVATION

Excavation was completed using a backhoe. Excavations were visually logged for evidence of nonnative materials, disturbed bedding horizons, and areas of visible staining. Elevated radiological or organic vapor field-screening results were documented. Excavation advanced from the ground surface to remove material in lifts until the specified depth was reached. Excavations were backfilled with clean fill material obtained from an off-site source. All affected surfaces were restored to the approximate original grade and condition and were reseeded with a native seed mix as appropriate for unpaved areas. Any paved areas were patched as appropriate after backfilling.

B-5.0 GEODETIC SURVEY

Geodetic surveys of all sample locations were performed by a certified surveyor using a Trimble RTK 5700 differential global-positioning system (DGPS) referenced from published and monumented external Laboratory survey control points in the vicinity. All sample locations were surveyed in accordance with SOP-5028, Coordinating and Evaluating Geodetic Surveys. Horizontal accuracy of the monumented control points is within 0.1 ft. The DGPS instrument referenced from Laboratory control points is accurate within 0.2 ft.

B-6.0 SURFACE AND SUBSURFACE SAMPLING

This section summarizes the methods used for collecting surface and subsurface samples, including soil, fill, tuff, and sediment samples, according to the approved ACA work plan (LANL 2009, 108332; NMED 2010, 108455).

B-6.1 Surface Sampling Methods

Surface samples were collected at four sites within former TA-32 using either hand-auger or spade-and-scoop methods. Surface samples were collected in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler, or SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. Samples were placed in a stainless-steel bowl and were transferred using a stainless-steel spoon to sterile sample collection jars or bags for transport to the Sample Management Office (SMO).

A hand auger or spade and scoop was used to collect material in approximately 6-in. increments. Samples were preserved using coolers to maintain the required temperature and by using chemical preservatives such as nitric acid, as required by SOP-5056, Sample Containers and Preservation.

Samples were appropriately labeled, sealed with custody seals, and documented before transporting to the SMO. Samples were managed according to SOP-5057, Handling, Packaging, and Transporting Field Samples, and SOP-5058 Sample Control and Field Documentation.

Sample collection tools were decontaminated (section B-6.7) immediately before collection of each sample in accordance with SOP-5061, Field Decontamination of Equipment.

B-6.2 Subsurface Tuff Sampling Methods

Subsurface samples were collected using a hand auger in accordance with SOP-06.10, or using a drill rig in accordance with SOP-06.26, Core Barrel Sampling for Subsurface Earth Materials. Borehole samples were collected in a stainless-steel split-spoon core-barrel sampler that retrieved core in 2.5-ft intervals. Core retrieved from the subsurface was field screened for organic vapors and 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. The material was crushed, if necessary, with a decontaminated rock hammer and stainless-steel spoon to allow core material to fit into sample containers.

Samples for volatile organic compound (VOC) analysis were collected immediately to minimize loss of subsurface VOCs during the sample-collection process. After collection of the VOC samples, a stainless-steel scoop and bowl were used to homogenize the samples for the remaining analytical suites, which were then transferred to sterile sample collection jars or bags for transport to the SMO. The tools used to collect samples were decontaminated immediately before each sample was collected in accordance with SOP-5061.

B-6.3 Quality Control Samples

Quality control (QC) samples were collected in accordance with SOP-5059, Field Quality Control Samples. QC samples included field duplicates, field rinsate blanks, and field trip 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.

Field rinsate blanks were collected to evaluate field decontamination procedures. Rinsate blanks were collected by rinsing sampling equipment (i.e., sampling bowls and spoons) after it was decontaminated with deionized water. The rinsate water was collected in a sample container and submitted to the SMO. Field rinsate blank samples were analyzed for inorganic chemicals (metals, perchlorate, and total cyanide) and were collected from sampling equipment at a frequency of at least 1 rinsate sample for every 10 solid samples.

Field trip blanks also were collected at a frequency of 1 per 10 samples when samples were collected for VOC analysis. Trip blanks consisted of containers of certified clean sand opened and kept with the other sample containers during the sampling process.

B-6.4 Sample Documentation and Handling

Field personnel completed SCL and chain-of-custody (COC) forms for each sample. Sample containers were sealed with signed custody seals and placed in coolers at approximately 4°C. Samples were handled in accordance with SOP-5057, Handling, Packaging, and Transporting Field Samples, and with SOP-5056, Sample Containers and Preservation. Samples were transported to the SMO for processing and shipment to off-site contract analytical laboratories. The SMO personnel reviewed and approved the SCL/COC forms and accepted custody of the samples.

B-6.5 Borehole Abandonment

All boreholes were abandoned in accordance with SOP-5034, Monitor Well and RFI Borehole Abandonment, by placing bentonite chips, then hydrating the chips, in the hole up to 2–3 ft from the ground surface. Clean soil was placed on top. Pavement was patched as necessary depending on existing site conditions.

B-6.6 Decontamination of Sampling Equipment

The split-spoon core barrels and all other sampling equipment that made (or could have made) contact with sample material were decontaminated after each core was retrieved and logged. Decontamination included wiping the equipment with Fantastik and paper towels. Decontamination of the drilling equipment was conducted 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 SOP-5061, Field Decontamination of Equipment, and field rinsate blank samples were collected in accordance with SOP-5059, Field Quality Control Samples.

B-7.0 INVESTIGATION-DERIVED WASTE STORAGE AND DISPOSAL

All investigation-derived waste (IDW) generated during the field investigation was managed in accordance with SOP-5238, Characterization and Management of Environmental Program Waste. This procedure incorporates the requirements of all applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy orders, and Laboratory implementation requirements. Details of IDW management for the Upper Los Alamos Canyon Aggregate Area ACA activities are presented in Appendix G.

B-8.0 DEVIATIONS

B-8.1 SWMU 32-002(a)

The following deviations occurred during sampling activities at Solid Waste Management Unit (SWMU) 32-002(a).

- Two deeper depths (1.0–2.0 ft and 5.0–6.0 ft below ground surface [bgs]) were sampled at location 32-06370 instead of one deeper depth (5.0–6.0 ft bgs) proposed in the work plan.
- Samples collected at the north and east sidewalls at the excavation of location 32-06373 were collected from 1.5-2.0 ft bgs instead of the approximately 4–5 ft bgs proposed in the work plan.

B-8.2 SWMU 32-002(b)

The following deviations occurred during sampling activities at SWMU 32-002(b).

- Three deeper depths (5.0–6.0 ft, 9.0–10.0 ft, and 12.0–12.5 ft bgs) were sampled at location 00-603595 instead of one deeper depth (5.0–6.0 ft bgs) proposed in the work plan.

B-8.3 AOC 32-003

The following deviations occurred during sampling activities at Area of Concern (AOC) 32-003.

- Two confirmation samples (0.5–1.0 ft and 2.0–2.5 ft bgs) were collected at the north wall of the excavation instead of one depth (0.5–1.0 ft bgs) proposed in the work plan.
- Six confirmatory samples were collected from three locations at depths ranging from 7.0–8.5 ft bgs to the north of the excavated area instead of one depth (0.5–1.0 ft bgs) proposed in the work plan. Because of the depth of fill material to the north of the excavated area, the first depth sample was collected at the soil-tuff interface from 7.0–7.5 ft bgs.
- The deepest sample collected at location 00-603608 (4 to 4.5 ft bgs) to determine vertical extent of Aroclor-1260 was erroneously submitted for screening-level PCB analysis instead of level 4 PCB analysis.

B-8.4 AOC 32-004

No deviations occurred at AOC 32-004.

B-9.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the EP Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

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

LANL (Los Alamos National Laboratory), December 2009. "Accelerated Corrective Action Work Plan for Upper Los Alamos Canyon Aggregate Area, Former Technical Area 32," Los Alamos National Laboratory document LA-UR-09-8056, Los Alamos, New Mexico. (LANL 2009, 108332)

NMED (New Mexico Environment Department), January 22, 2010. "Notice of Approval, Accelerated Corrective Action Work Plan, Upper Los Alamos Canyon Aggregate Area, Former Technical Area 32," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 108455)

Table B-1.0-1
Summary of Field Investigation Methods

Method	Summary
Spade and Scoop Collection of Soil Samples	This method is typically used to collect shallow (i.e., approximately 0-12 in.) soil or sediment samples. The spade-and-scoop method involves digging a hole to the desired depth, as prescribed in the work plan, and collecting a discrete grab sample. The sample is typically placed in a clean stainless-steel bowl for transfer into various sample containers.
Hand Auger Sampling	This method is typically used for sampling soil or sediment at depths of less than 10–15 ft but may in some cases be used for collecting samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in. inside diameter [I.D.]), creating a vertical hole that can be advanced to the desired sampling depth. When the desired depth was reached during the investigation, the auger was decontaminated before the hole was advanced 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	In this method, a stainless-steel core barrel (typically 4 in. I.D., 2.5 ft long) is advanced using a powered drilling rig. The core barrel extracts a continuous length of soil and/or rock that can be examined as a unit. The split-spoon core barrel is a cylindrical barrel split lengthwise so that the two halves can be separated to expose the core sample. Once extracted, the section of core was screened for radioactivity and organic vapors and described in a geologic log. A portion of the core was then collected as a discrete sample from the desired depth.
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 for shipping the samples to 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, COC forms, 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. COC forms were completed and signed to verify the samples had not been 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 sampling equipment with deionized water, which was collected in a sample container and submitted for laboratory analysis. *Trip blanks*: Required for all field events, including collecting samples for VOC analysis. Trip blanks containers of certified clean sand were opened and kept with the other sample containers during the sampling process.
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination was used to minimize the generation of liquid waste. Dry decontamination included using a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by using a commercial cleaning agent (nonacid, waxless cleaners) and paper wipes.

Table B-1.0-1 (continued)

Method	Summary
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on EPA guidance for environmental sampling, preservation, and quality assurance. Specific requirements for each sample were printed in the SCLs 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.
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 a Trimble 5700 DGPS. The survey data conformed to Laboratory Information Architecture project standards IA-CB02, GIS Horizontal Spatial Reference System, and IA-D802, Geospatial Positioning Accuracy Standard for A/E/C/ and Facility Management. All coordinates were expressed as State Plain Coordinate System 83, NM Central, U.S. feet coordinates. All elevation data were reported relative to the National Geodetic Vertical Datum of 1983.
Management of Environmental Restoration Project Waste, Waste Characterization	IDW is managed, characterized, and stored in accordance with an approved waste characterization strategy form that documents site history, field activities, and the 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 the waste classification and item identification number and as radioactive (if applicable), immediately following containerization. All waste was segregated by classification and compatibility to prevent cross-contamination. Management of IDW is discussed in Appendix G.

Table B-1.0-2
SOPs Used for ACA Activities Conducted at Former TA-32

EP-DIR-QAP-0001, Quality Assurance Plan for the Environmental Programs
SOP-5028, Coordinating and Evaluating Geodetic Surveys
SOP-5034, Monitor Well and RFI Borehole Abandonment
SOP-5055, General Instructions for Field Investigations
SOP-5056, Sample Containers and Preservation
SOP-5057, Handling, Packaging, and Transporting Field Samples
SOP-5058, Sample Control and Field Documentation
SOP-5059, Field Quality Control Samples
SOP-5061, Field Decontamination of Equipment
SOP-5181, Notebook and Logbook Documentation for Environmental Directorate Technical and Field Activities
SOP-5238, Characterization and Management of Environmental Program Waste
SOP-01.12, Field Site Closeout Checklist
SOP-06.09, Spade and Scoop Method for Collection of Soil Samples
SOP-06.10, Hand Auger and Thin-Wall Tube Sampler
SOP-06.26, Core Barrel Sampling for Subsurface Earth Materials
SOP-06.33, Headspace Vapor Screening with a Photoionization Detector
SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials

Note: These procedures are available at http://www.lanl.gov/environment/all/qa/adep.shtml.

Appendix C

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

Appendix D

Analytical Program

D-1.0 INTRODUCTION

This appendix presents the analytical methods used and the review of the data quality of the analytical results for the former Technical Area 32 (TA-32) accelerated corrective action (ACA) in the Upper Los Alamos Canyon Aggregate Area at Los Alamos National Laboratory (LANL or the Laboratory).

The analytical program for this investigation includes submission of samples to approved contract laboratories, with specific requirements for analytical methods, data quality, and reporting. Quality assurance (QA), quality control (QC), and data validation procedures were implemented in accordance with the requirements of the Quality Assurance Project Plan Requirements for Sampling and Analysis (LANL 1996, 054609), and the analytical services statement of works (SOWs) for contract laboratories (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962). The results of the QA/QC activities were used to estimate accuracy, bias, and precision of the analytical measurements. The QC samples included preparation blanks, spikes, matrix spikes (MSs), and laboratory control samples (LCSs) to assess accuracy and bias. Internal standards (ISs), external standards, surrogates, and tracers were also used to assess accuracy.

The type and frequency of QC analyses are described in the analytical service SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962), along with the applicable analytical methods. 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. Evaluating these QC indicators allows estimates to be made of the accuracy, bias, and precision of the analytical suites. A focused data validation was also performed for all the data packages (also referred to as request numbers).

The following SOPs were used for data validation:

- SOP-5161, Routine Validation of Volatile Organic Data
- SOP-5162, Routine Validation of Semivolatile Organic Compound (SVOC) Analytical Data
- SOP-5163, Routine Validation of Organochlorine Pesticide and 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-5168, Routine Validation of LC/MS/MS High Explosive Analytical Data
- SOP-5191, Routine Validation of LC/MS/MS Perchlorate Analytical Data (SW-846 EPA Method 6850)

The focused validation included a more detailed review of the data generated by the analytical laboratory. The analytical data and instrument printouts used during focused validation and the validation reports are provided in Appendix C.

Analytical data were reviewed and evaluated based on U.S. Environmental Protection Agency (EPA) National Functional Guidelines for inorganic and organic chemical data review where applicable (EPA 1994, 048639; EPA 1999, 066649). As a result of the data validation and assessment efforts, qualifiers may be assigned to the analytical records as appropriate. The data qualifiers used in the data validation procedures are defined in Appendix A.

D-2.0 ANALYTICAL DATA ORGANIZATION

The data sets evaluated for the former TA-32 sites include analytical results for samples collected in the 2010 ACA and historical data collected during previous investigations in 1996–2008. All historical analytical data included in the report were reviewed and revalidated to current data-quality standards. Only analytical data for which complete data packages and sample documentation are available are appropriate for decision-making purposes and included in the data set(s). All other data are screening-level data only and are not included in the report.

D-3.0 INORGANIC CHEMICAL ANALYSES

Samples collected during historical investigations as well as the 2010 ACA were analyzed for one or more of the following inorganic chemicals: target analyte list (TAL) metals, nitrate, perchlorate, hexavalent chromium, and total cyanide. Samples were analyzed for nitrate using EPA Method 300.0. Samples were analyzed for TAL metals using EPA SW-846 Methods 6010, 6010B, 6020, 7470A, 7471A, and 7841. Other analytical methods included EPA SW-846 Method 9012A for total cyanide, and EPA SW-846 Method 6850 for perchlorate. Hexavalent chromium was analyzed using EPA SW-846 Method 7196A. The analytical methods used for inorganic chemicals are listed in Table D-3.0-1.

A total of 127 samples (plus 7 field duplicates) were submitted for analysis of TAL metals; 43 samples were submitted for analysis of nitrate, perchlorate, and total cyanide; and 5 samples were submitted for analysis of hexavalent chromium.

All decision-level analytical data are included in Appendix C.

D-3.1 Inorganic Chemical Analyses

The use of QA/QC samples is designed to produce quantitative measures of the reliability of specific parts of an analytical procedure. 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, LCSs, preparation blanks, MS samples, laboratory duplicate samples, interference check samples (ICSs), and serial dilution samples were analyzed. Each of these QA/QC sample types is defined in the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962) and is described briefly in the sections 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 lower acceptance limit (LAL) and upper acceptance limit (UAL).

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 and which 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 between the LAL and UAL, inclusive for all spiked analytes.

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 between the LAL and UAL.

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%.

Details regarding the quality of the inorganic chemical analytical data included in the data set are summarized in the following sections.

D-3.2 Data Quality Results for Inorganic Chemicals

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

A total of 201 inorganic chemical results were qualified as estimated (J) on the basis of the initial qualifier assigned by the analytical laboratories. These data do not have any quality issues associated with the values presented.

D-3.2.1 Maintenance of Chain of Custody

Chain-of-custody forms were maintained properly for all samples analyzed for inorganic chemicals (Appendix C).

D-3.2.2 Sample Documentation

All samples analyzed for inorganic chemicals were properly documented in the field in sample collection logs (Appendix C).

D-3.2.3 Sample Dilutions

Some samples were diluted for inorganic chemical analyses. No qualifiers were applied to any inorganic chemical analytical 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 ICV and CCV

A total of 51 TAL metal and three perchlorate results were qualified as estimated (J) because the initial calibration verification (ICV) or continuing calibration verification (CCV) was not analyzed at the appropriate method frequency.

A total of 74 TAL metal and 5 cyanide (total) results were qualified as not detected (U) because the sample result was less than or equal to the 5 times the concentration of the related analyte in the initial calibration blank (ICB) or continuing calibration blank (CCB).

Five perchlorate results were qualified as estimated not detected (UJ) because the ICV or CCV were not analyzed at the appropriate method frequency.

D-3.2.7 ICS and/or Serial Dilutions

Eight TAL metal results were qualified as estimated (J) because the serial dilution sample RPD was greater than 10%, and the sample result was greater than 50 times the MDL (greater than the 100 times MDL for inductively coupled plasma mass spectroscopy).

A total of 78 TAL metal results were qualified as estimated (J) the IS area count for the quantitating IS was greater than the 125% in relation to the TAL metals calibration blank.

D-3.2.8 Laboratory Duplicate Samples

A total of 65 TAL metal results were qualified as estimated (J) because the sample and duplicates were greater than or equal to 5 times the reporting limit (RL) and the duplicated RPD was greater than 35%

D-3.2.9 Preparation Blanks

A total of 158 TAL metal results were qualified as estimated (J) because the results were less than 5 times the amount in the preparation blank.

Six TAL metal results were qualified as not detected (U) because the results were less than 5 times the amount in the preparation blank.

A total of 110 TAL metal and 26 cyanide (total) results were qualified as not detected (U) because the sample result was less than or equal to the 5 times the concentration of the related analyte in the method blank.

D-3.2.10 MS Samples

A total of 24 TAL metal results were qualified as estimated and potentially biased low (J-) because the analyte was recovered below the LAL but above 30% in the associated MS sample.

A total of 157 TAL metal results were qualified as estimated and potentially biased low (J-) because the analyte was recovered below the LAL but above 10% in the associated MS sample.

Thirteen TAL metal results were qualified as estimated and potentially biased high (J+) because the analyte was recovered above the UAL but below 150% in the associated MS sample.

A total of 146 TAL metal results were qualified as estimated and potentially biased high (J+) because the associated MS recovery was above the UAL.

A total of 38 TAL metal results were qualified as estimated not detected (UJ) because the analyte was recovered below the LAL but above 30% in the associated MS sample.

Ten TAL metal and two cyanide (total) results were qualified as estimated not detected (UJ) because the analyte was recovered below the LAL but above 10% in the associated MS sample.

One TAL metal result was qualified as estimated not detected (UJ) because the associated MS recovery was above the UAL.

D-3.2.11 LCS Recoveries

Eight TAL metal results were qualified as estimated not detected (UJ) because the LCS %R was less than 10%.

D-3.2.12 Detection Limits

A total of 23 TAL metal results were qualified as estimated (J) because the sample results were reported as detected between the instrument detection limit and estimated detection limit.

D-3.2.13 Trip Blanks, Equipment Blanks, and Rinsate Blanks

One nitrate result was qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration in the trip blank or equipment rinsate blank.

Fourteen TAL metal results were qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the trip blank or equipment rinsate blank.

D-3.2.14 Rejected Results

No inorganic results were rejected for data quality reasons.

D-4.0 ORGANIC CHEMICAL ANALYSES

Soil, tuff, and sediment samples collected during the investigation were analyzed for one or more of the following organic chemicals: polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), dioxins and furans, and pesticides. Samples were analyzed for PAHs using SW-846 Method 9310; for PCBs using SW-846 Method 8082; for pesticides using SW-846 Method 8081; for SVOCs using SW-846 Method 8270C; for VOCs using SW-846 Method 8260B; and for dioxins and furans using SW-846 Method 8310. All QC procedures were followed as required by the analytical laboratory SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962). The analytical methods used for organic chemicals are listed in Table D-4.0-1.

A total of 79 samples were submitted for analysis of PCBs; 40 samples were submitted for analysis of dioxins/furans; 14 samples (plus 1 field duplicate) were submitted for analysis of PAHs; 95 samples were submitted for analysis of SVOCs, and 79 samples were submitted for analysis of VOCs.

All organic chemical analytical results are included in Appendix C.

D-4.1 Organic Chemical QA/QC Samples

The use of QA/QC samples is designed to produce quantitative measures of the reliability of specific parts of an analytical procedure. 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. Calibration verifications, LCSs, method blanks, MS samples, surrogates, and ISs were analyzed to assess the accuracy and precision of organic chemical analyses. Each of these QA/QC sample types is defined in the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962) and described briefly 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 the initial calibration is still holding and is 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 fall between the LAL and UAL.

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 and which 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 (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962).

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 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 normally is not 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.

The 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. Internal standards are used as the basis for quantitation of target analytes. The %R for ISs should be within the range of 50% to 200%.

Details regarding the quality of the organic chemical analytical data included in the data sets are summarized in the following sections.

D-4.2 Data Quality Results for Organic Chemicals

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

A total of 171 organic chemical results were qualified as estimated (J) on the basis of the initial qualifier assigned by the analytical laboratories. These data do not have any quality issues associated with the values presented.

D-4.2.1 Maintenance of Chain of Custody

Chain-of-custody forms were maintained properly for all samples analyzed for organic chemicals (Appendix C)

D-4.2.2 Sample Documentation

All samples analyzed for organic chemicals were properly documented on sample collection logs in the field (Appendix C)

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

Eighteen dioxin/furan results were qualified as estimated (J) because the ICV and/or CCV were recovered outside the method specific limits.

A total of 31 dioxin/furan results were qualified as estimated (J) because the ICV and/or CCV were not analyzed at the appropriate method frequency.

A total of 84 dioxin/furan results were qualified as estimated not detected (UJ) because the ICV and/or CCV were not analyzed at the appropriate method frequency.

A total of 49 PCB, 112 SVOC, and 216 VOC results were qualified as estimated not detected (UJ) because the ICV and/or CCV was recovered outside the method specific limits.

Seven SVOC results were qualified as estimated not detected (UJ) because the associated %R standard deviation/percent difference exceeded the criteria in the initial or continuing calibration standards.

D-4.2.7 Surrogate Recoveries

One PAH result was qualified as estimated and potentially biased low (J-) because the surrogate recovery was less than 10%.

Fourteen PAH results were qualified as estimated and potentially biased low (J-) because the surrogate recovery was less than the LAL but greater than or equal to 10%.

Twelve PAH results were qualified as estimated not detected (UJ) because the surrogate recovery was less than the LAL but greater than or equal to 10%.

Four VOC results were qualified as estimated and potentially biased high (J+) because the surrogate recovery was greater than the UAL.

One VOC result was qualified as estimated not detected (UJ) because at least one surrogate was above the UAL and one surrogate was below the LAL.

D-4.2.8 Internal Standard Responses

One VOC result was qualified as estimated (J) because the IS area count for the quantitating IS was below 50% but above 10% in relation to the previous continuing calibration.

A total of 468 VOC results were qualified as estimated not detected (UJ) because the IS area count for the quantitating IS was below 50% but above 10% in relation to the previous continuing calibration.

D-4.2.9 Method Blanks

A total of 26 dioxin/furan results were qualified as estimated (J) because the sample result was less than or equal to 5 times the concentration of the related analyte in the method blank.

A total of 24 dioxin/furan and 11 SVOC results were qualified not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the method blank.

Fourteen VOC results were qualified at not detected (U) because the associated sample concentration was less than 5 times or 10 times the amount in the method blank.

D-4.2.10 Laboratory Duplicate Samples

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

D-4.2.11 Laboratory Control Sample Recoveries

One VOC result was qualified as estimated and potentially biased high (J+) because the LCS%R was greater than the UAL.

Sixteen VOC results were qualified as estimated not detected (UJ) because the LCS%R was less than the LAL but greater than 10%.

D-4.2.12 Quantitation and MDLs

Ten dioxin/furan results were qualified as not detected (U) because the analyte was detected in a sample, and the result was not confirmed on a second column with successful analysis of the gas chromatography (GC) column performance mix.

One VOC and 33 PAH results were qualified as not detected (U) because the associated mass spectrum did not meet method specifications.

D-4.2.13 MS Samples

The MS samples were within acceptable limits for all samples analyzed for organic chemicals.

D-4.2.14 Trip Blanks, Equipment Blanks, and Rinsate Blanks

Twelve VOC results were qualified at not detected (U) because the sample result was less than or equal to the concentration of the related analyte in the trip blank or equipment rinsate blank.

D-4.2.15 Rejected Results

Fifteen PAH results (Area of Concern [AOC] 32-003) were rejected (R) because the surrogate recovery was below 10%.

Two PAH results (AOC 32-004) and one SVOC result [Solid Waste Management Unit (SWMU) 32-002(b)] were rejected (R) because the results were not analyzed with a valid 5-point calibration curve and/or a standard at the RL.

D-5.0 RADIONUCLIDE ANALYSES

Samples were analyzed for radionuclides by gamma spectroscopy using EPA Method 901.1 or generic gamma spectroscopy (historical samples only); for americium-241, isotopic plutonium, and isotopic uranium by alpha spectroscopy (HASL-300 Methods); for tritium by liquid scintillation using EPA Method 906.0; and for strontium-90 by alpha/beta counting EPA Method 905.0. All QC procedures were followed as required by the analytical laboratories SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962). The methods used for analyzing radionuclides are listed in Table D-5.0-1.

A total of 63 samples were submitted for analyses by gamma spectroscopy; 56 samples were submitted for analysis of americium-241; 76 samples were submitted for analysis of isotopic plutonium, 69 samples were submitted for analysis of isotopic uranium; 70 samples were submitted for analysis of tritium; and 43 samples were submitted for analysis of strontium-90.

All radionuclide results are included in Appendix C.

D-5.1 Radionuclide QA/QC Samples

All procedures were followed as required by the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962). Some sample results were qualified as not detected (U) because the associated sample concentration was less than or equal to the minimum detectable concentration (MDC). Some sample results were qualified as not detected (U) because the associated sample concentration was less than or equal to 3 times the total propagated uncertainty (TPU). This data qualification is related to detection status only not to data quality issues.

To assess the accuracy and precision of radionuclide analyses, LCSs, method blanks, MS samples, laboratory duplicate samples, and tracers were analyzed. Each of these QA/QC sample types is defined in the analytical services SOWs LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962) and is described briefly 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 %Rs should fall between the LAL and UAL.

Method blanks are an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing and which 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 MDC.

MS samples assess the accuracy of inorganic chemical analyses and 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 between the LAL and UAL.

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

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

Details regarding the quality of the radionuclide analytical data included in the data set are summarized in the following sections.

D-5.2 Data Quality Results for Radionuclides

The majority of the analytical results are 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-5.2.1 Maintenance of Chain of Custody

Chain-of-custody forms were maintained properly for all samples (Appendix C).

D-5.2.2 Sample Documentation

All samples were properly documented on sample collection logs in the field (Appendix C).

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

Five tritium and 7 isotopic uranium results were qualified as not detected (U) because the analyte was identified in the method blank but was greater than 5 times the concentration in the method blank.

One isotopic plutonium and 11 isotopic uranium results was qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the method blank.

Fifteen isotopic uranium results were qualified as estimated (J) because the analyte was identified in the method blank but was greater than 5 times the concentration in the method blank.

D-5.2.7 MS Samples

Three strontium-90 results were qualified as estimated not detected (UJ) because the associated MS recovery was less than 10%.

D-5.2.8 Tracer Recoveries

The tracer recoveries were within acceptable limits for all samples analyzed for radionuclides.

D-5.2.9 LCS Recoveries

The LCS recoveries were within acceptable limits for all samples analyzed for radionuclides.

D-5.2.10 Laboratory Duplicate Sample Recoveries

The LDS recoveries were within acceptable limits for all samples analyzed for radionuclides.

D-5.2.11 Rejected Results

A total of 26 isotopic uranium results [8 from SWMU 32-002(a) and 18 from SWMU 32-002(b)] were qualified as rejected (R) because the MDC and/or TPU documentation was missing.

D-6.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

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

EPA (U.S. Environmental Protection Agency), February 1994. “USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,” EPA-540/R-94/013, Office of Emergency and Remedial Response, Washington, D.C. (EPA 1994, 048639)

EPA (U.S. Environmental Protection Agency), October 1999. “USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review,” EPA540/R-99/008, Office of Emergency and Remedial Response, Washington, D.C. (EPA 1999, 066649)

LANL (Los Alamos National Laboratory), July 1995. “Statement of Work (Formerly Called "Requirements Document") - Analytical Support, (RFP number 9-XS1-Q4257), (Revision 2 - July, 1995),” Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1995, 049738)

LANL (Los Alamos National Laboratory), March 1996. “Quality Assurance Project Plan Requirements for Sampling and Analysis,” Los Alamos National Laboratory document LA-UR-96-441, Los Alamos, New Mexico. (LANL 1996, 054609)

LANL (Los Alamos National Laboratory), December 2000. “University of California, Los Alamos National Laboratory (LANL), I8980SOW0-8S, Statement of Work for Analytical Laboratories,” Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2000, 071233)

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-3.0-1
Inorganic Chemical Analytical Methods for Samples Collected at Former TA-32

Analytical Method	Analytical Description	Analytical Suite
EPA Method 300.0	Ion chromatography	Nitrate
SW-846:6850	High-performance liquid chromatography mass spectrometry	Perchlorate
SW-846: 6010/6010B	Inductively coupled plasma emission spectroscopy (ICPES)—atomic emission spectroscopy	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc (TAL metals)
SW-846:6020	ICPES	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc (TAL metals)
SW-846:9012a	Colorimetric method	Cyanide (total)
SW-846:7470	Cold vapor atomic absorption (CVAA)	Mercury
SW-846:7471A	Graphite furnace atomic absorption (GFAA)	Mercury (TAL metal)
SW-846:7196A	Colorimetric method	Chromium hexavalent ion
SW-846:7060A	GFAA	Arsenic
SW-846:7421	GFAA	Lead
SW-846:7740	GFAA	Selenium
SW-846:7841	GFAA	Thallium

Table D-4.0-1
Organic Chemical Analytical Methods for Samples Collected at Former TA-32

Analytical Method	Analytical Description	Target Compound List
EPA SW-846:8270C	SVOCs by gas chromatography mass spectrometry (GCMS)	Analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962)
EPA SW-846:8260B	VOCs by GC/MS	Analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962)
EPA SW-846:8082–Analysis	PCBs by gas chromatography	Analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233; LANL 2008, 109962)
SW-846:8290	Dioxins and furans by high-resolution gas chromatography/high-resolution mass spectrometry	Analytical services SOW (LANL 2008, 109962)
SW-846:8310	PAHs by high performance liquid chromatography	Analytical services SOW (LANL 2008, 109962)

Table D-5.0-1
Radionuclide Analytical Methods for Samples Collected at Former TA-32

Analytical Method	Analytical Description	Target Compound List
HASL-300: Am-241	Alpha spectroscopy	Americium-241
EPA Method: 901.1 Generic: Gamma Spec	Gamma spectroscopy	Americium-241, cesium-137, cesium-134, cobalt-60, europium-152, ruthenium-106, sodium-22, uranium-235
EPA Method: 906.0	Liquid scintillation	Tritium
HASL-300: ISOPU	Alpha spectroscopy	Isotopic plutonium
HASL-300: ISOU	Alpha spectroscopy	Isotopic uranium
EPA Method: 905.0	Alpha/beta counting	Strontium-90

Appendix E

Box Plots and Statistical Test Results

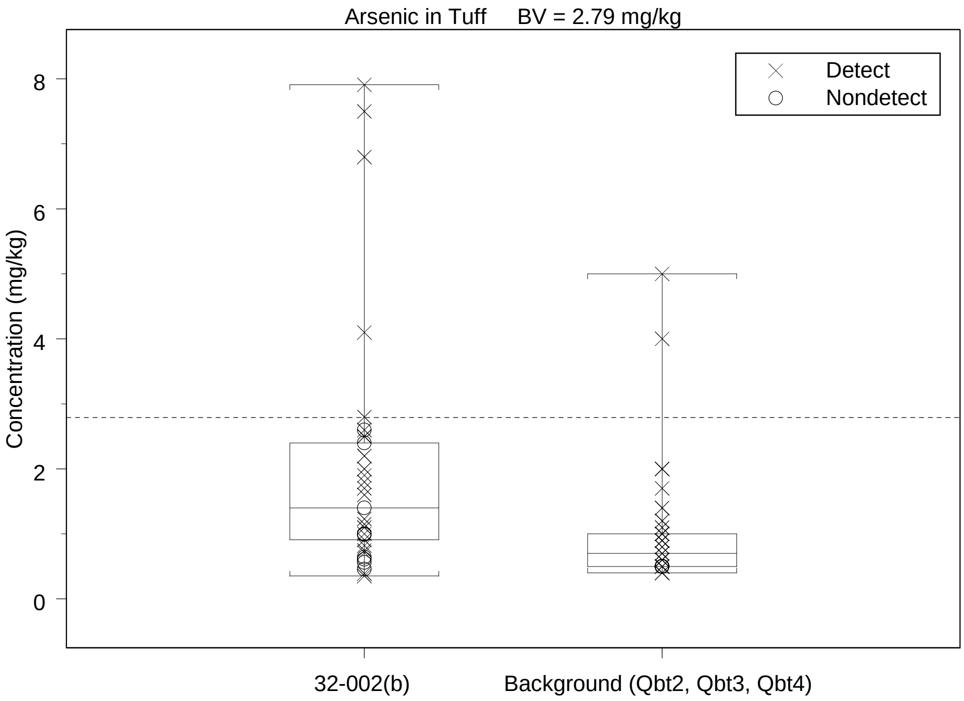


Figure E-1 Site concentrations of arsenic in tuff at SWMU 32-002(b) compared to background

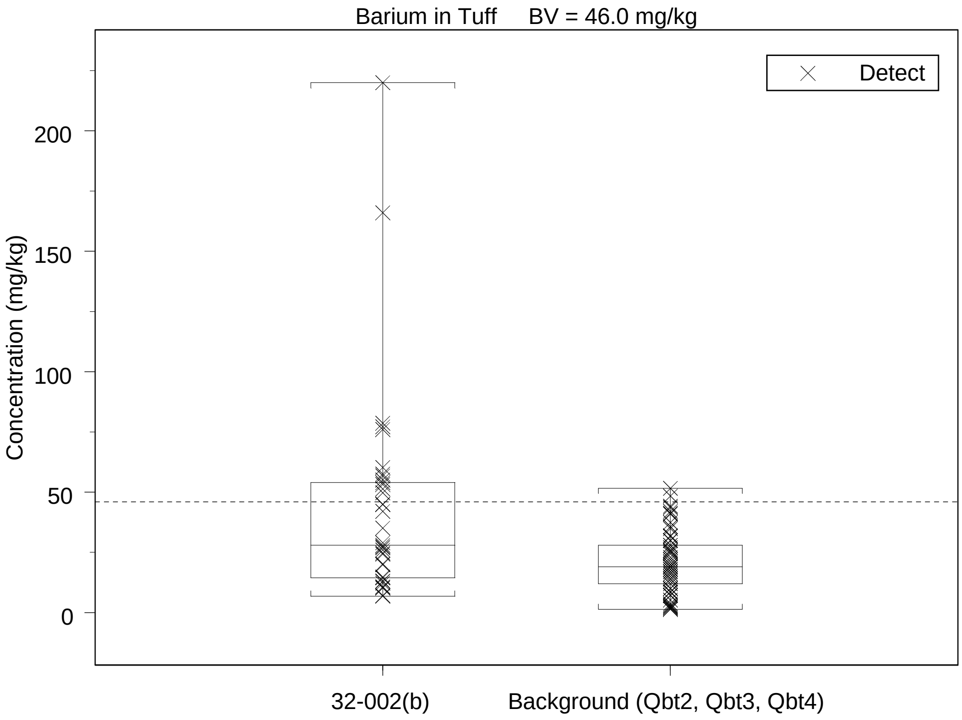


Figure E-2 Site concentrations of barium in tuff at SWMU 32-002(b) compared to background

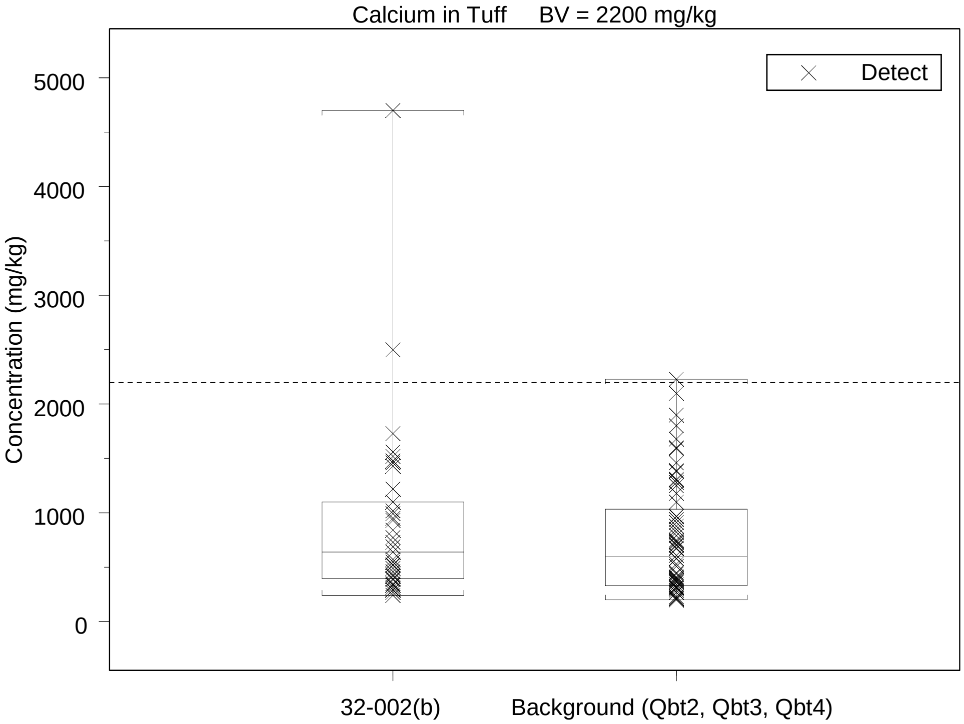


Figure E-3 **Site concentrations of calcium in tuff at SWMU 32-002(b) compared to background**

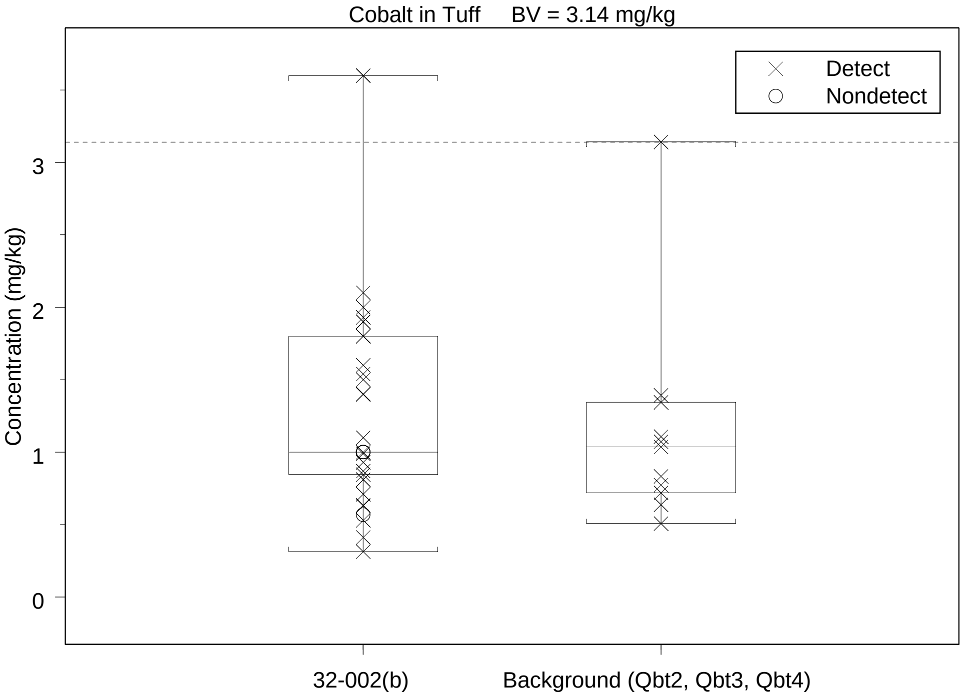


Figure E-4 **Site concentrations of cobalt in tuff at SWMU 32-002(b) compared to background**

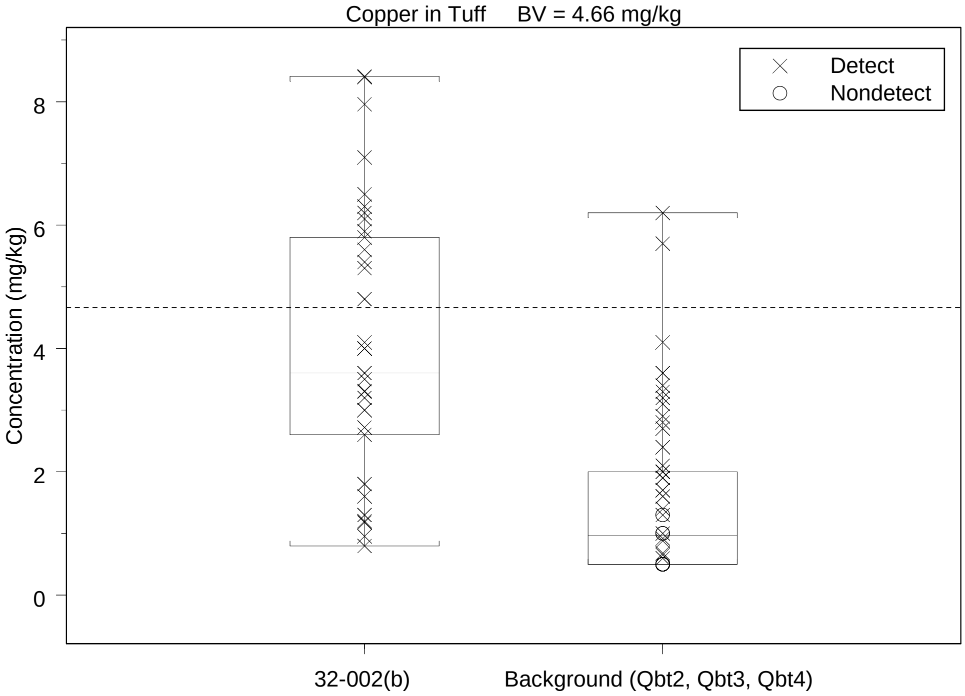


Figure E-5 Site concentrations of copper in tuff at SWMU 32-002(b) compared to background

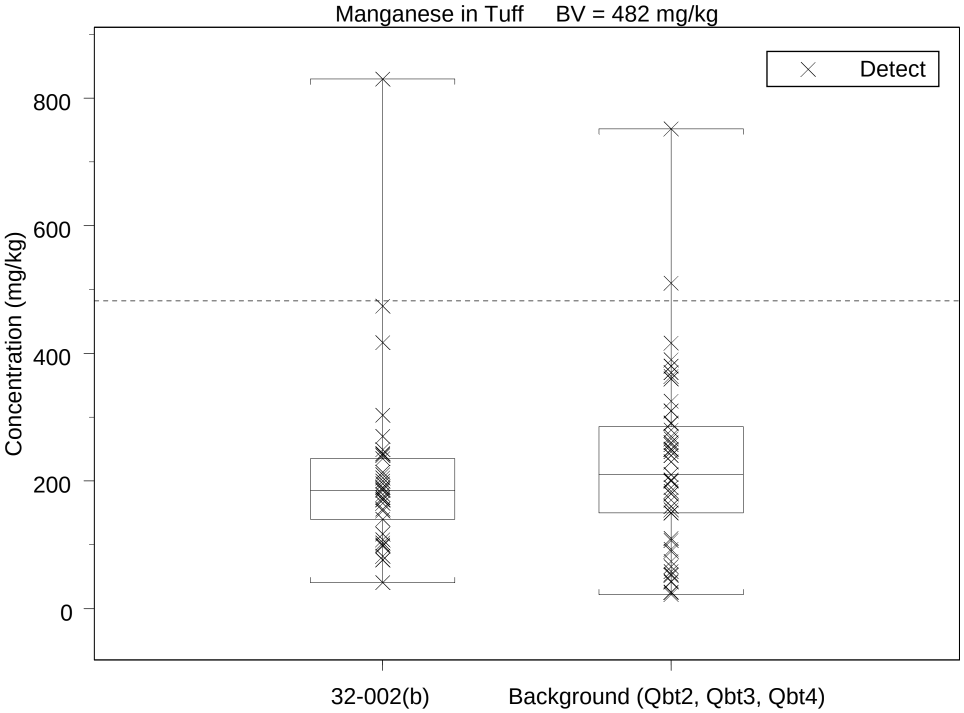


Figure E-6 Site concentrations of manganese in tuff at SWMU 32-002(b) compared to background

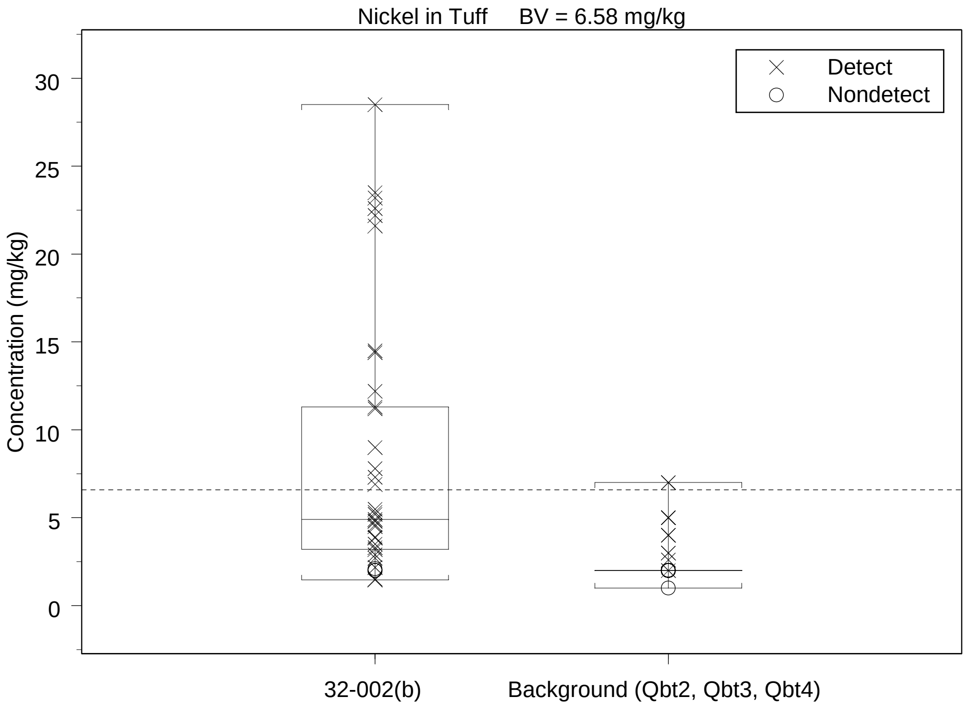


Figure E-7 Site concentrations of nickel in tuff at SWMU 32-002(b) compared to background

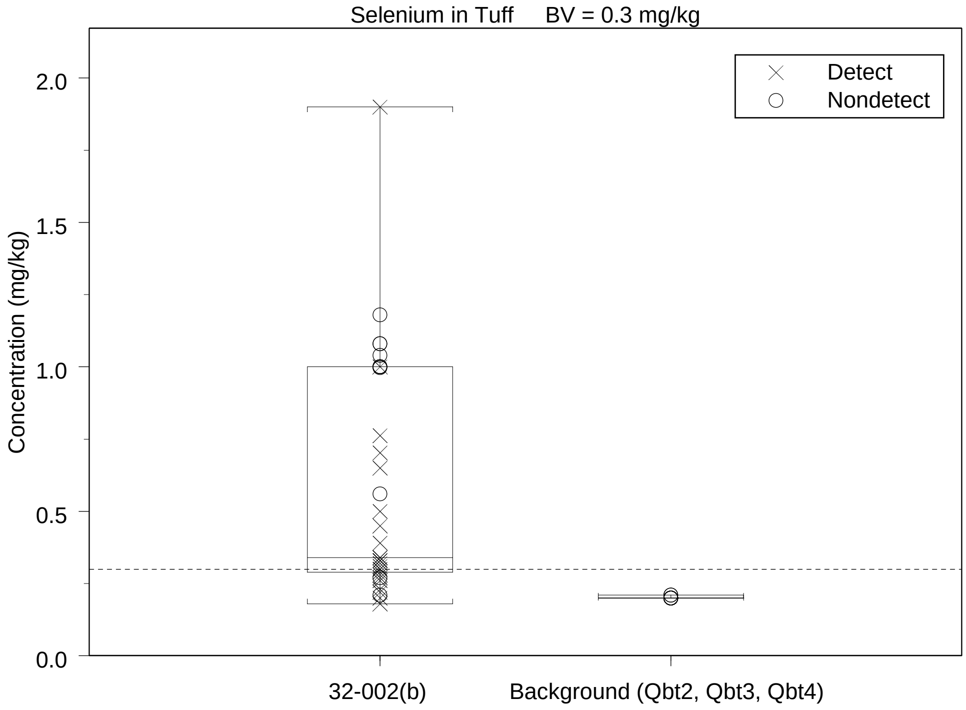


Figure E-8 Site concentrations of selenium in tuff at SWMU 32-002(b) compared to background

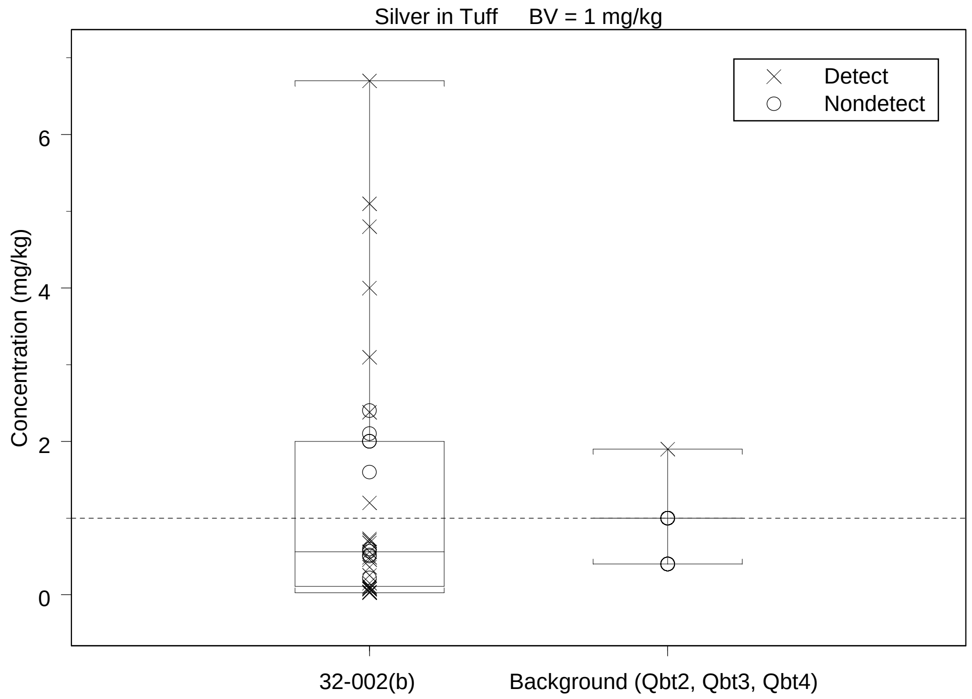


Figure E-9 Site concentrations of silver in tuff at SWMU 32-002(b) compared to background

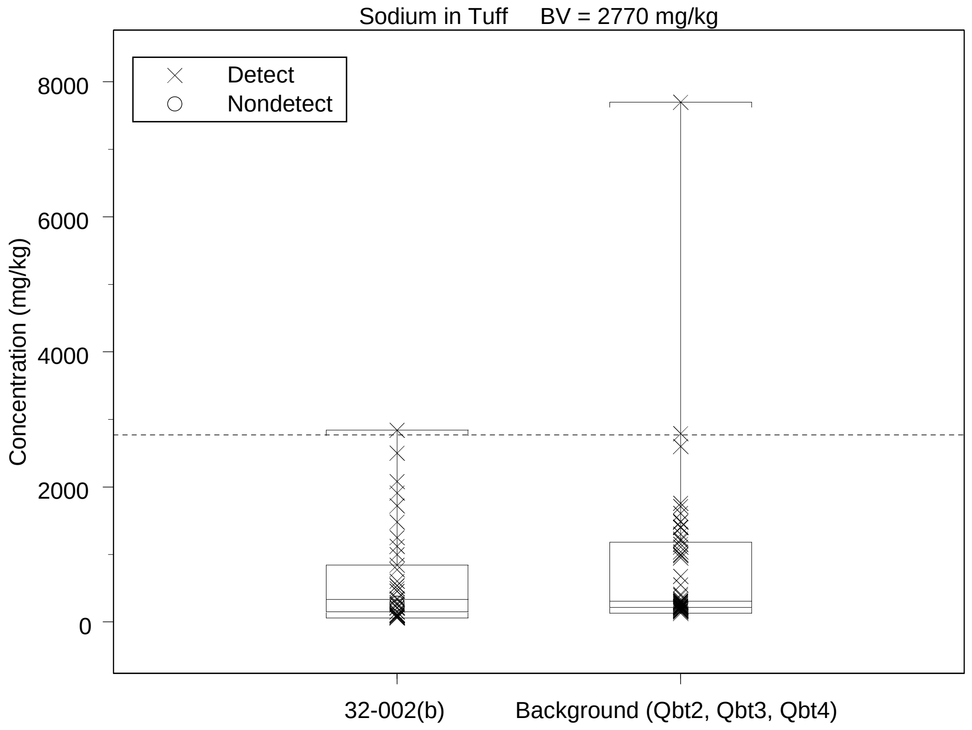


Figure E-10 Site concentrations of sodium in tuff at SWMU 32-002(b) compared to background

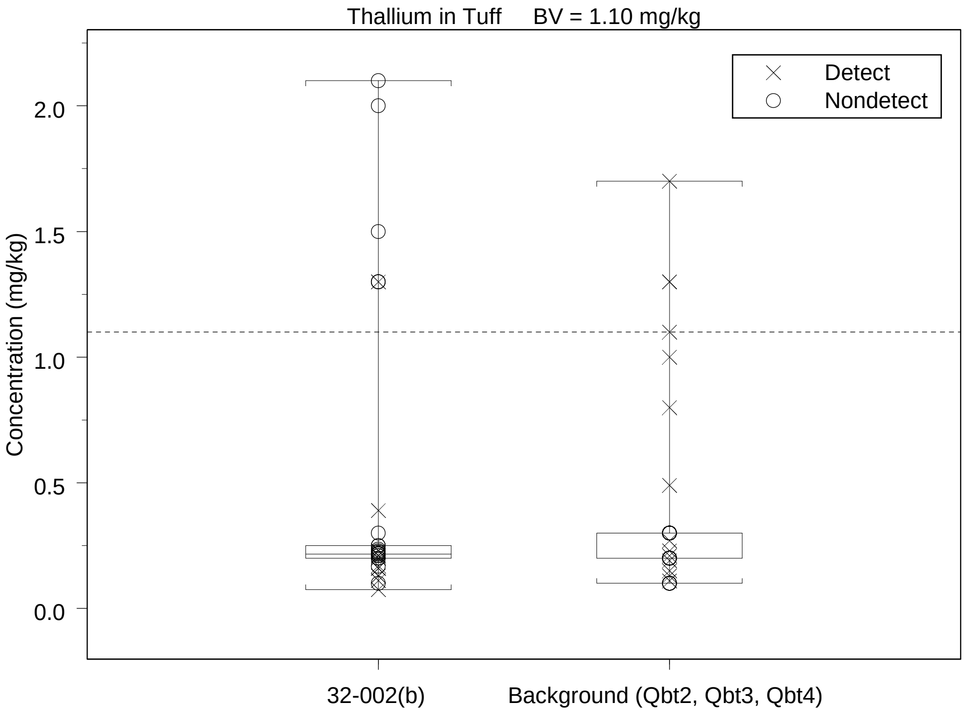


Figure E-11 Site concentrations of thallium in tuff at SWMU 32-002(b) compared to background

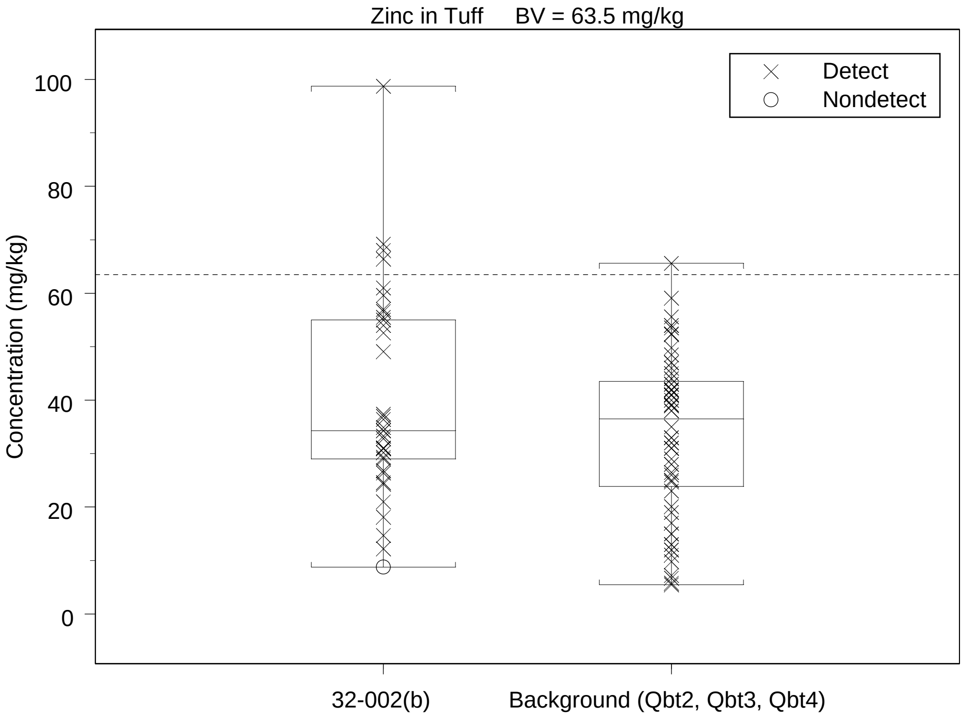


Figure E-12 Site concentrations of zinc in tuff at SWMU 32-002(b) compared to background

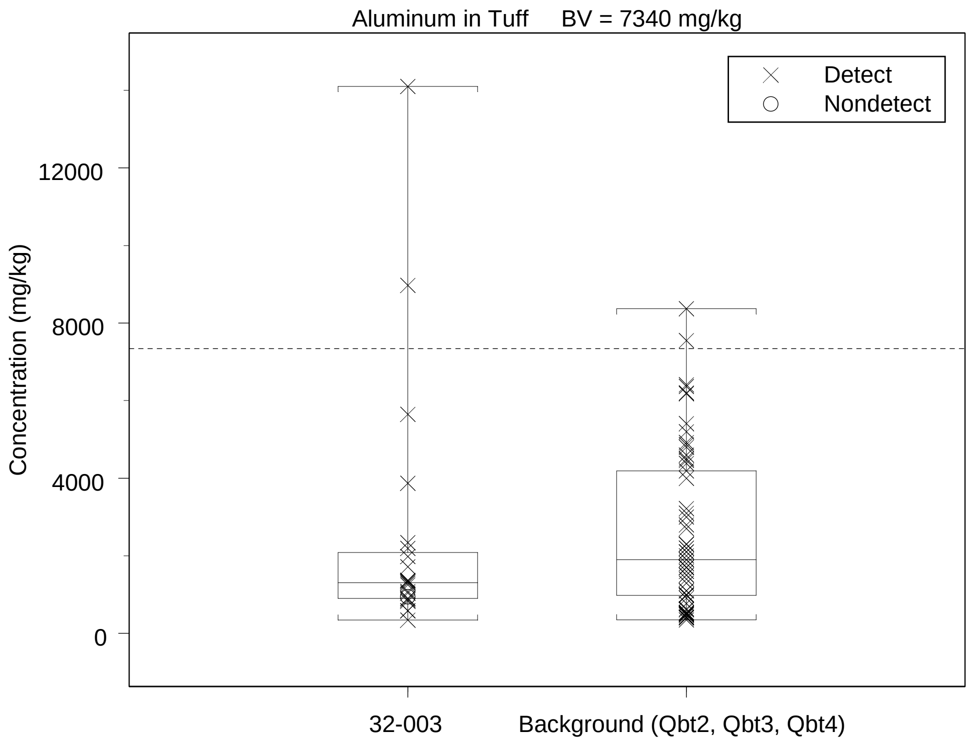


Figure E-13 Site concentrations of aluminum in tuff at AOC 32-003 compared to background

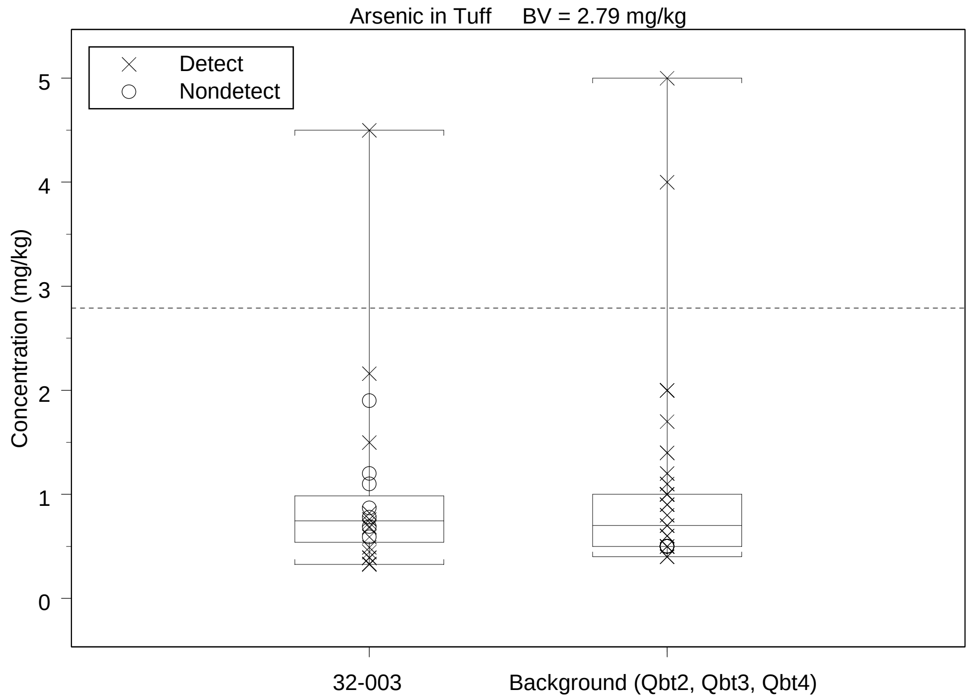


Figure E-14 Site concentrations of arsenic in tuff at AOC 32-003 compared to background

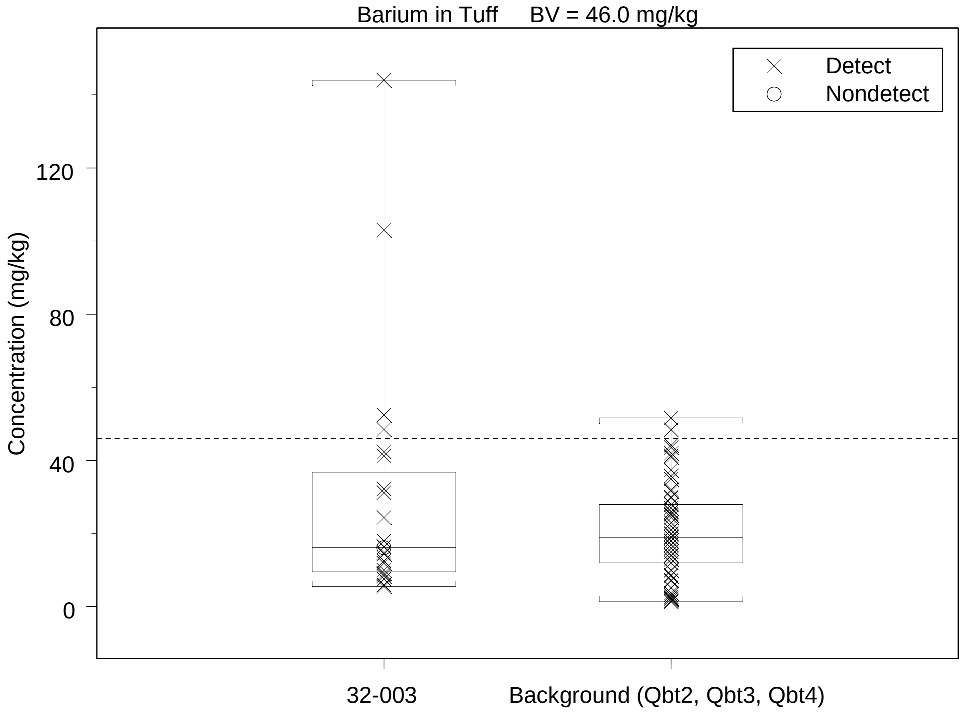


Figure E-15 **Site concentrations of barium in tuff at AOC 32-003 compared to background**

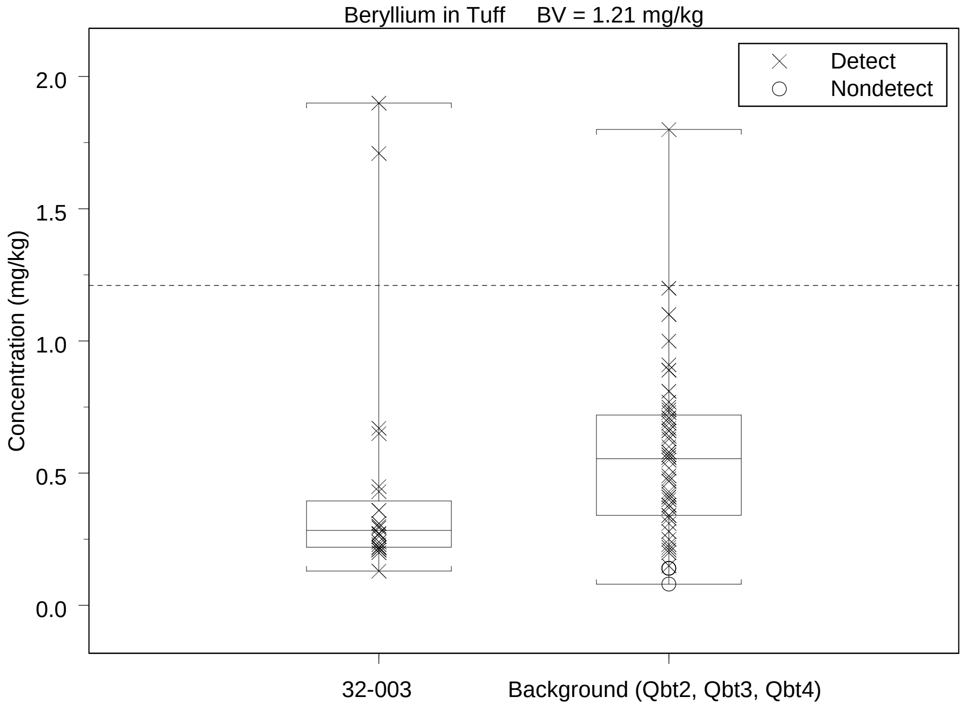


Figure E-16 **Site concentrations of beryllium in tuff at AOC 32-003 compared to background**

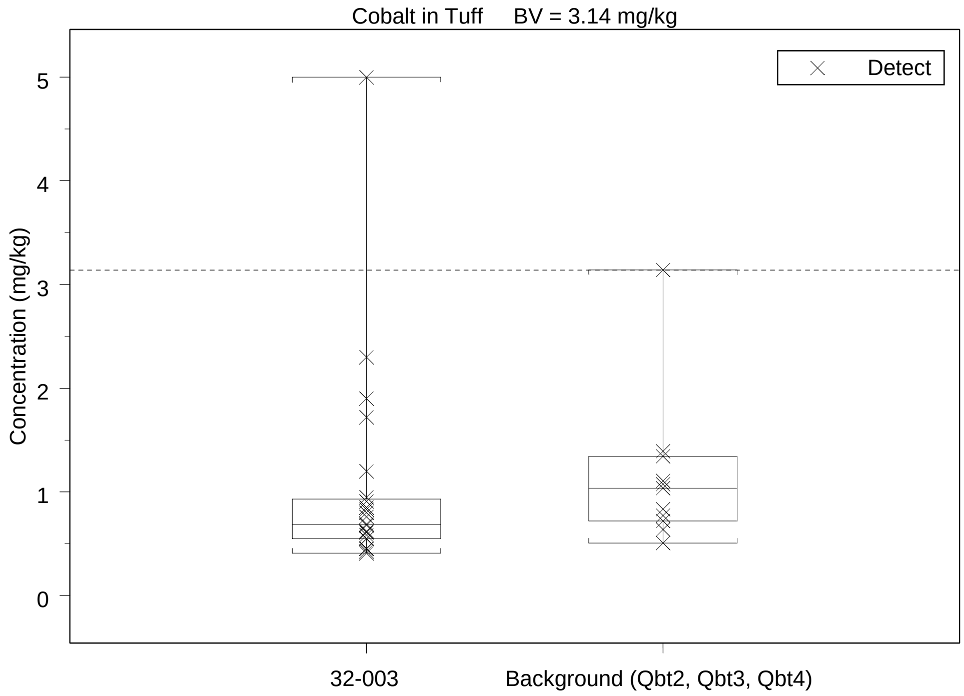


Figure E-17 Site concentrations of cobalt in tuff at AOC 32-003 compared to background

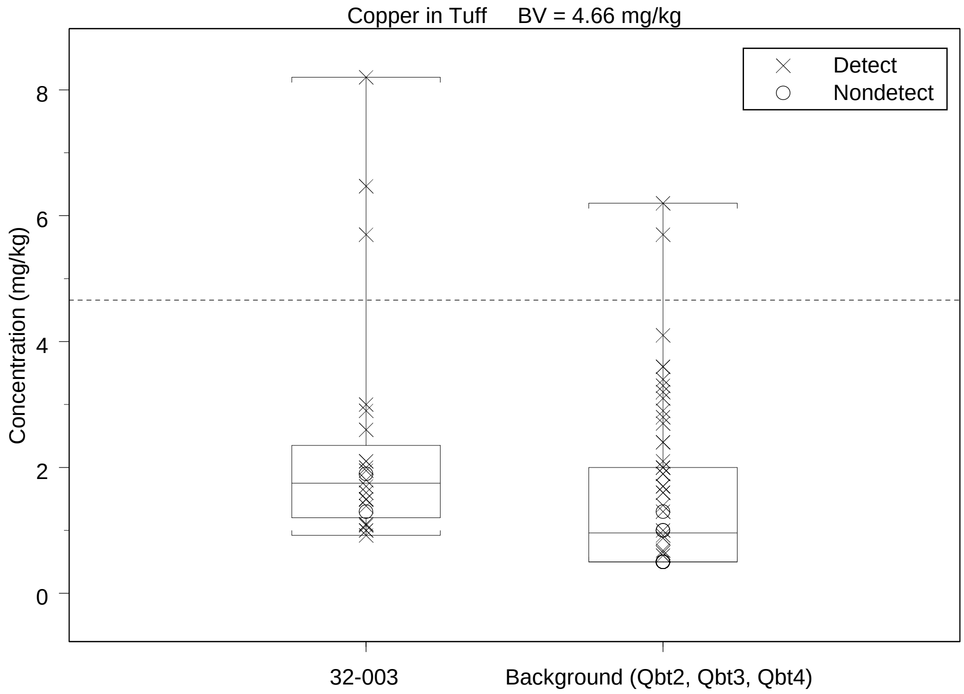


Figure E-18 Site concentrations of copper in tuff at AOC 32-003 compared to background

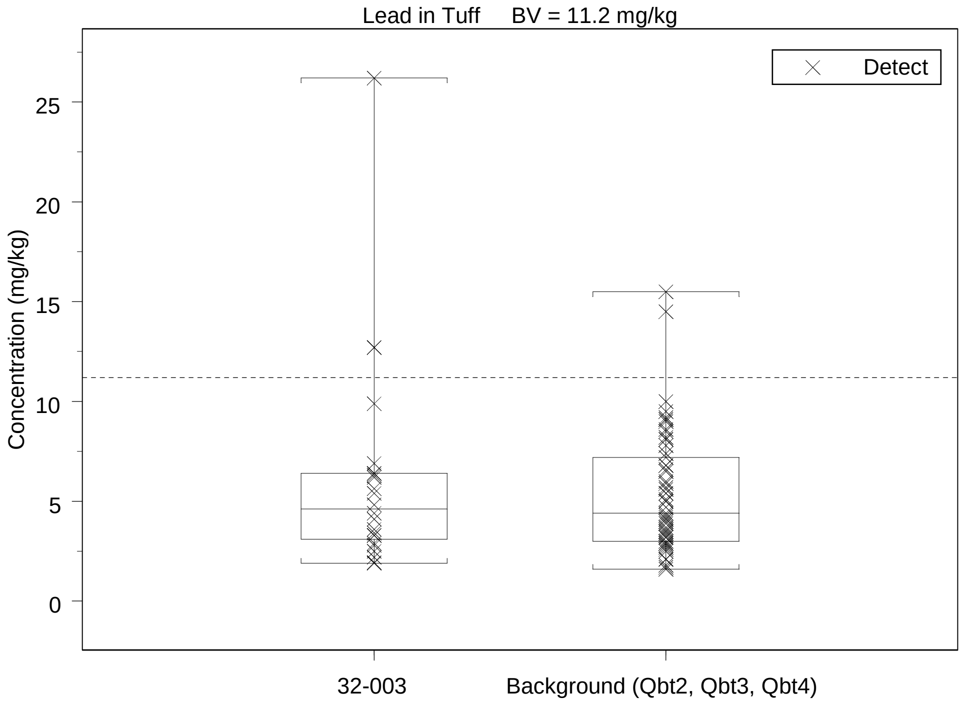


Figure E-19 **Site concentrations of lead in tuff at AOC 32-003 compared to background**

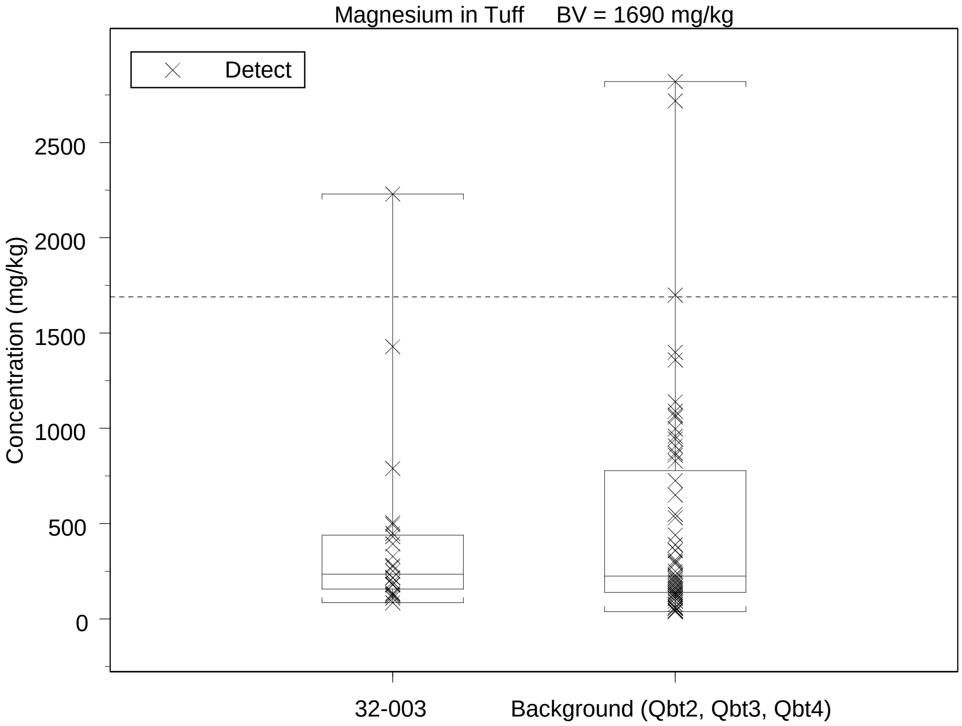


Figure E-20 **Site concentrations of magnesium in tuff at AOC 32-003 compared to background**

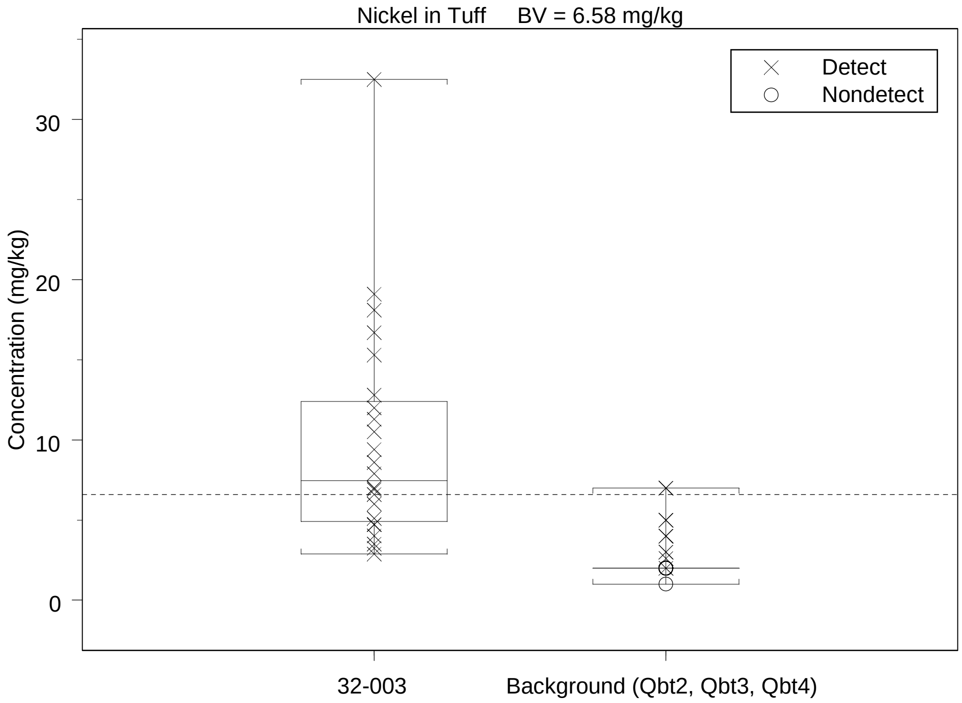


Figure E-21 Site concentrations of nickel in tuff at AOC 32-003 compared to background

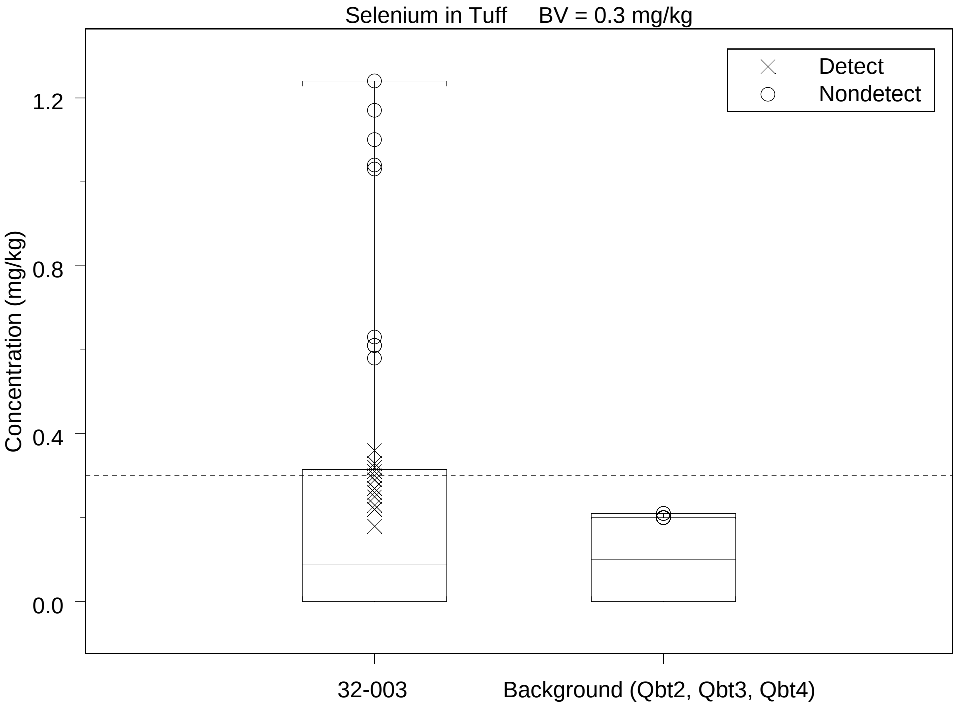


Figure E-22 Site concentrations of selenium in tuff at AOC 32-003 compared to background

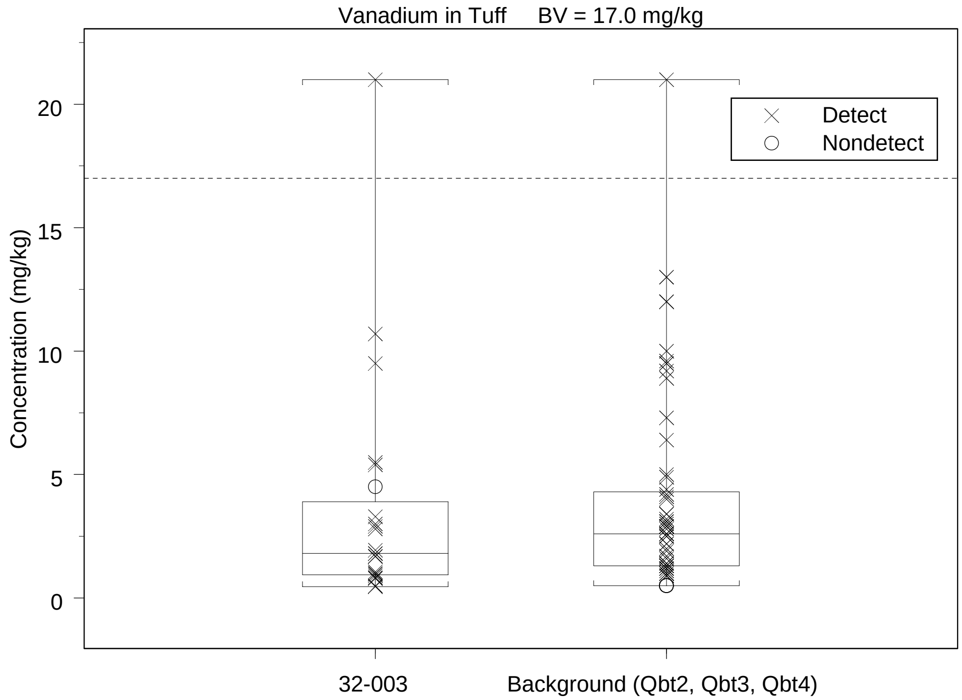


Figure E-23 Site concentrations of vanadium in tuff at AOC 32-003 compared to background

Table E-1
Results of Statistical Tests for Inorganic Chemicals in Tuff at SWMU 32-002(b)

Analyte	Gehan p-value	Quantile p-value	Slippage p-value	COPC?
Arsenic	0.0108	—[a]	—	Yes
Barium	0.00189	—	—	Yes
Calcium	0.412	0.470	n/a[b]	No
Cobalt	0.506	0.753	n/a	No
Copper	2.26×10^{-9}	—	—	Yes
Manganese	0.168	0.989	—	No
Nickel	n/a	6.61×10^{-10}	—	Yes
Silver	n/a	1.00	0.00183	Yes
Sodium	0.207	0.530	n/a	No
Thallium	n/a	0.943	0.132	No
Zinc	0.299	0.773	n/a	No

[a] — = Test not performed because the first test indicated site samples are significantly different from background.

[b] n/a = Not applicable.

Table E-2
Results of Statistical Tests for Inorganic Chemicals in Tuff at AOC 32-003

Analyte	Gehan p-value	Quantile p-value	Slippage p-value	COPC?
Aluminum	0.180	0.967	n/a[a]	No
Arsenic	0.060	0.356	n/a	No
Barium	0.721	0.960	n/a	No
Beryllium	0.002	—[b]	—	Yes
Cobalt	0.095	0.943	n/a	No
Copper	0.015	—	—	Yes
Lead	0.973	0.569	n/a	No
Magnesium	0.974	0.594	n/a	No
Nickel	n/a	1.47×10^{-11}	—	Yes
Vanadium	0.110	0.884	n/a	No

[a] n/a = Not applicable.

[b] — = Test not performed because the first test indicated site samples are significantly different from background.

Appendix F

Risk Assessments

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F-1.0 INTRODUCTION

This appendix presents the results of the human health and ecological risk-screening assessments for the 2010 accelerated corrective action (ACA) activities at three sites located at former Technical Area 32 (TA-32) in the Upper Los Alamos Canyon Aggregate Area at Los Alamos National Laboratory (LANL or the Laboratory). The sites for which extent is defined are Solid Waste Management Unit (SWMU) 32-002(b) and Areas of Concern (AOCs) 32-003 and 32-004.

F-2.0 BACKGROUND

Former TA-32 was occupied by the medical research facility from 1944 to 1953 when operations were moved to TA-43 as the research group expanded. All the structures at former TA-32 were removed after 1954. Currently, the mesa-top portion of TA-32 is owned by Los Alamos County and is almost entirely covered by asphalt. The area is used to store equipment and materials for roadwork and maintenance. Maintenance activities include using solvents, lubricants, and fuels; emptying of street sweeper contents until they are moved to a disposal facility; staging of asphalt, road salt, and other materials; and cleaning vehicles.

Four sites are addressed in the remedy completion report: two septic systems that served former buildings 32-01 and 32-02 [SWMUs 32-002(a) and 32-002(b)], a former transformer station (AOC 32-003), and a drainline and outfall that served former building 32-03 (AOC 32-004). These four sites are shown on Plate 1 of the remedy completion report. However, extent is defined for only three of the sites; extent has not been defined at SWMU 32-002(a).

F-2.1 Site Descriptions and Operational History

F-2.1.1 SWMU 32-002(b)

The septic system (former structure 32-08) [SWMU 32-002(b)] was installed when the SWMU 32-002(a) septic tank could no longer meet the usage requirement of the laboratory (former building 32-01). The influent line of SWMU 32-002(a) was diverted to the new septic tank, which also received effluent from former building 32-02, the medical research annex. The outfall of SWMU 32-002(b) was at the edge of Los Alamos Canyon.

Research activities at former building 32-01 involved radionuclides. Inorganic and organic chemicals may also have been used. Because no industrial waste line served former TA-32, it is possible chemical and radioactive wastes may have been disposed of in sinks and drains connected to the septic system at SWMU 32-002(b). The septic tank was removed in 1988, and the drainline was removed in 1996.

F-2.1.2 AOC 32-003

The location of the former transformer station (former structure 32-10) (AOC 32-003) was discovered during the 1993 Phase I Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) at former TA-32 (LANL 1995, 048944). Three transformers sat on a wooden platform on poles, approximately 20 ft aboveground. The Phase I RFI analytical results from the samples collected in the immediate area indicated PCB contamination (LANL 1995, 048944, p. 34). However, data from the 1993 RFI are screening-level data.

F-2.1.3 AOC 32-004

The drainline and outfall of AOC 32-004 were discovered during the 1993 RFI at former TA-32 (LANL 1995, 048944). The drainline and outfall served former building 32-03, an office building, and discharged directly to Los Alamos Canyon. Former building 32-03 included a vault room where a radioactive source was stored. The drainline led directly to an outfall at the edge of the mesa without passing through a septic tank.

F-2.2 Sampling Results and Determination of Chemicals of Potential Concern

The data used to identify chemicals of potential concern (COPCs) and to evaluate potential risks to human health and the environment for these four sites at former TA-32 consisted of all qualified analytical results compiled from both historical sampling activities and the 2010 ACA activities. Only those data determined to be of decision-level quality following the data-quality assessment (Appendix D) are included in the data sets evaluated in this risk appendix. The data are present in Appendix C (on DVD).

Section 1.4 in the remedy completion report summarizes the COPC identification process.

F-3.0 CONCEPTUAL SITE MODEL

The three sites for which extent is defined are of three types. The first type of site is a septic tank [SWMU 32-002(b)]. The second type is potentially contaminated soil (AOC 32-003). The third type is outfalls to the hillsides [SWMU 32-002(b) and AOC 32-004].

The first type of site is a subsurface structure (septic tank). The COPCs may occur in the subsurface surrounding the structure, particularly at the junctions between tank and piping or connections in the associated piping structure. The septic tank has been excavated.

The second type of site is potential surface soil contamination at AOC 32-003. COPCs may be found in surface material and may also have migrated into the subsurface.

The third type of site is outfalls to the hillsides from the septic tank drainlines or direct drainline. The effluents from these outfalls could contribute to COPCs on the surface and in the subsurface on hillsides.

F-3.1 Receptors and Exposure Pathways

The primary exposure pathway for human receptors is from surface and subsurface soil or tuff that may be brought to the surface through intrusive activities*.* Migration of contamination to groundwater through the vadose zone is not likely given the depth to groundwater (greater than 1000 ft below ground surface [bgs]) at the site. 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 resident and construction worker. The exposure pathways are the same as those for surface soil. In addition, the vapor-intrusion pathway from subsurface volatile organic compounds (VOCs) in soil was evaluated for the residential scenario. The sources, exposure pathways, and receptors are shown in the conceptual site model in Figure F-3.1-1.

The sites at former TA-32 provide minimal potential habitat for ecological receptors because the area is highly developed. Exposure pathways are complete to surface soil and tuff for ecological receptors to a depth of 0–5 ft. 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 5 ft are not complete unless contaminated soil or tuff were excavated and brought to the surface. The potential pathways are root uptake by plants, inhalation of vapors, inhalation of dust, dermal contact, incidental ingestion of soil, external irradiation, and food-web transport. Pathways from subsurface releases may be complete for plants. Surface water was not evaluated because of the lack of surface water features.

F-3.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes affecting the persistence of a chemical in the environment; the evaluation of transport addresses the physical processes affecting mobility of a contaminant along a migration pathway. Migration through soil and tuff depends on properties such as soil pH, rate of precipitation or snowmelt, soil moisture content, soil-tuff 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 limited also by a lack of hydrostatic pressure as well as lack of a source for the continued release of contamination. Without sufficient moisture and a source, little or no potential migration of materials through the vadose zone to groundwater occurs.

Contamination at depth is addressed in the discussion of nature and extent in section 3 of the remedy completion report. Results from the deepest samples collected showed either no detected concentrations of COPCs or low/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, physical and chemical properties of the COPCs, and the lack of saturated conditions, the potential for contaminant migration to groundwater is very low.

The New Mexico Environment Department (NMED) guidance (NMED 2009, 108070) 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) can be used to identify chemical concentrations in soil that have the potential to contaminate groundwater (EPA 1996, 059902). However, screening contaminant concentrations in soil against these DAF SSLs do not 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., it is assumed that migration to groundwater has already occurred). Furthermore, this assumption is inappropriate for cases such as former TA-32 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 best indication of the potential for future contaminant migration to groundwater is the current vertical distribution of contaminants in the subsurface. The releases from the four sites at former TA-32 occurred decades ago. The regional aquifer beneath the aggregate area is greater than 1000 ft bgs. Therefore, for migration of contaminants to occur from shallow soil to the regional aquifer in a meaningful time frame (e.g., 100 to 1000 yr), significant vertical migration should have already occurred. Sampling has shown that this migration has not occurred, indicating a very low potential for future contaminant migration to groundwater.

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, the potential for ion exchange or sorption, and the potential for natural bioremediation. The transport of VOCs occurs primarily in the vapor phase by diffusion or advection in subsurface air. The chemical and physical properties of the COPCs at the four sites are presented in Tables F-3.2-1, F-3.2-2, and F-3.2-3.

The primary release and transport mechanisms that may lead to the potential exposure of receptors from the four sites at former TA-32 include

- dissolution and/or particulate transport of surface contaminants from precipitation and runoff,
- airborne transport of contaminated surface soil or particulates,
- continued dissolution and advective/dispersive transport of chemical and radiological contaminants contained in subsurface soil and bedrock,
- biotic perturbation and/or translocation of contaminants in subsurface contaminated media, and
- uptake of contaminants from soil and water by biota.

Contaminant distributions at the sites indicate that after the initial deposition of contaminants from operational activities and historical remediation efforts, elevated levels of contaminants tend to remain concentrated near the original release points.

F-3.2.1 Inorganic Chemicals

Table F-3.2-1 presents the physical and chemical properties (soil-water partition coefficient [K_d] and solubility) of the inorganic COPCs identified. In general, and particularly in a semiarid climate such as that found at former TA-32, inorganic chemicals are not highly soluble or mobile in the environment. The primary physical and chemical factors that determine and describe the distribution of inorganic COPCs within the soil and tuff are the water solubility of the inorganic chemical and K_d. Other factors besides the K_d values, such as speciation in soil and oxidation-reduction potential (Eh) and pH, also play a role in the likelihood that inorganic chemicals will migrate. 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 K_d values. Inorganic chemicals with K_d values greater than 40 are very unlikely to migrate through soil towards the water table (Kincaid et al. 1998, 093270). Based on this criterion, antimony, barium, beryllium, cadmium, chromium, lead, mercury, nickel, thallium, vanadium, and zinc have a very low potential to mobilize and migrate through soil and the vadose zone.

The K_d values for arsenic, copper, cyanide, nitrate, perchlorate, selenium, and silver are less than 40 and may indicate that these inorganic chemicals have a greater potential to mobilize and migrate through soil and the vadose zone. These COPCs are discussed further in the following sections. 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). Information for these inorganic chemicals is also available from the ATSDR website at http://www.atsdr.cdc.gov/toxpro2.html.

- 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 commonly 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 (average pH is 7.8) present at the four sites at former TA-32.
- Copper movement in soil is determined by physical and chemical interactions with the soil components. The K_d value for copper is 35 cm^3/g (Table F-3.2-1), indicating it is not highly mobile. Most copper deposited in soil is strongly adsorbed and remains in the upper few centimeters. Copper will adsorb to organic matter, carbonate minerals, clay minerals, hydrous iron, and manganese oxides. In most temperate soil, pH, organic matter, and ionic strength of the soil solutions are the key factors affecting adsorption. Copper binds to soil much more strongly than other divalent cations, and the distribution of copper in the soil solution is less affected by pH than other metals. Copper is expected to be bound to the soil and move in the system by way of transport of soil particles by water as opposed to movement as dissolved species. Because the average pH is 7.8 at the four sites at former TA-32, leaching of copper is unlikely.
- Cyanide tends to adsorb onto various natural media, including clay and sediment; however, sorption is insignificant relative to the potential for cyanide to volatilize and/or biodegrade. At soil surfaces, volatilization of hydrogen cyanide is a significant mechanism for cyanide loss. Cyanide occurring at low concentrations in subsurface soil is likely to biodegrade under both aerobic and anaerobic conditions.
- Nitrate is highly soluble in water and may migrate with water molecules in saturated soil. As noted above, the subsurface material beneath former TA-32 has low moisture content, which would inhibit the mobility of nitrate as well as most other inorganic chemicals.
- Perchlorate is soluble in water and may migrate with water molecules in saturated soil. As noted above, the subsurface material beneath former TA-32 has low moisture content, which would inhibit 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 average pH at the four sites at former TA-32 is 7.8, which indicates that selenium does not have a high potential to migrate.
- Silver sorbs onto soil and sediment and tends to form complexes with inorganic chemicals and humic substances in soil. Organic matter complexes with silver and reduces its mobility. Silver compounds tend to leach from well-drained soil so that it may potentially migrate into the subsurface.

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. Physical and chemical properties of organic chemicals are important when evaluating their fate and transport. The following information illustrates some aspects of the fate and transport tendencies of these COPCs. 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. The following organic COPCs have water solubilities greater than 1000 mg/L: acetone, benzoic acid, methylene chloride, and trichlorofluoromethane.

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, to be slightly prone to biodegradation, and to be metabolized in plants and animals. The following organic COPCs have water solubilities less than 10 mg/L: acenaphthene, anthracene, Aroclor-1260, benzo(a)anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, bis[2-ethylhexyl]phthalate, butylbenzylphthalate, chrysene, dibenz[a,h]anthracene, dibenzofuran, di-n-octylphthalate, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene.

Vapor pressure is a chemical characteristic used to evaluate the tendency of organic chemicals to volatize. Chemicals with vapor pressure greater than 0.01 millimeters of mercury (mm Hg) 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 toward groundwater. The following organic COCPs have vapor pressures greater than 0.01 mm Hg: acetone, methylene chloride, tetrachloroethene, and trichlorofluoromethane.

Chemicals with vapor pressures less than 0.000001 mm Hg are less likely to volatilize and, therefore, tend to remain immobile. The following organic COPCs have vapor pressures less than 0.000001 mm Hg: benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, bis[2-ethylhexyl]phthalate, chrysene, dibenz[a,h]anthracene, di-n-octylphthalate, and indeno[1,2,3-cd]pyrene.

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}, the greater the affinity the chemical has for bioaccumulation in the food chain, the greater its potential for sorption in the soil, and the lower its mobility (Ney 1995, 058210). The following organic COPCs have K_{ow} values greater than 1000: acenaphthene, anthracene, Aroclor-1260, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, bis[2-ethylhexyl]phthalate, chrysene, dibenz[a,h]anthracene, di-n-butylphthalate, di-n-octylphthalate, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, pyrene, and tetrachloroethene.

A K_{ow} of less than 500 indicates high water solubility, high mobility, little to no affinity for bioaccumulation, and degradability by microbes, plants, and animals. The following organic COPCs have K_{ow} values less than 500: acetone, benzoic acid, methylene chloride, and trichlorofluoromethane.

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 2006, 092513). The following organic COPCs have K_{oc} values above 500 L/kg, indicating a very low potential to migrate toward groundwater: acenaphthene, anthracene, Aroclor-1260, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, bis[2-ethylhexyl]phthalate, chrysene, dibenz[a,h]anthracene, di-n-butylphthalate, di-n-octylphthalate, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene. The following organic COPCs have K_{oc} values less than 500 L/kg: acetone, benzoic acid, dichlorodifluoromethane, methylene chloride, tetrachloroethene, and trichlorofluoromethane.

In summary, the following organic COPCs are the least mobile and the most likely to bioaccumulate: acenaphthene, anthracene, Aroclor-1260, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, bis[2-ethylhexyl]phthalate, chrysene, dibenz[a,h]anthracene, di-n-octylphthalate, fluoranthene, fluorene, phenanthrene, and pyrene. The more soluble and volatile COPCs are more mobile but are also more likely to travel toward the atmosphere and not migrate toward groundwater. They include acetone, benzoic acid, methylene chloride, tetrachloroethene, and trichlorofluoromethane. Because the organic COPCs were detected at low concentrations and the extent is defined, they are not likely to migrate to groundwater.

F-3.2.3 Radionuclides

Table F-3.2-3 gives physical and chemical properties (K_d and solubility) of the radionuclide COPCs identified. Radionuclides are generally not highly soluble or mobile in the environment, particularly in the semiarid climate of the Laboratory. The physical and chemical factors that determine the distribution of radionuclides within soil and tuff are the K_d, the pH of the soil and other soil characteristics (e.g., sand or clay content), and the Eh. The interaction of these factors is complex, but 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 values. Radionuclides with K_d values greater than 40 are very unlikely to migrate through soil towards the water table (Kincaid et al. 1998, 093270).

Based on K_d values, americium-241, cesium 137, plutonium-238, and plutonium 239/240 have a very low potential to migrate towards groundwater. The K_d values for strontium-90, tritium, uranium-234, uranium-235/236, and uranium-238 are less than 40 and indicate a potential to migrate towards groundwater.

- A major portion of stable and radioactive strontium in soil dissolves in water, so it might move deeper into the subsurface. However, the K_d value of 35 indicates that strontium-90 is relatively immobile in the subsurface.
- Uranium is a natural and commonly occurring radioactive element present in nearly all rock and soil. The mobility of uranium in soil and its vertical transport to groundwater depend on properties of the soil such as pH, Eh, concentration of complexing anions, porosity of the soil, soil-particle size, and sorption properties as well as the amount of water available. In general, the actinide nuclides form comparatively insoluble compounds in the environment and are therefore not considered biologically mobile. The actinides are transported in ecosystems mainly by physical and sometimes chemical processes. They tend to attach, sometimes strongly, to surfaces; and tend to accumulate in soil and sediment, which ultimately serve as strong reservoirs. Retention of uranium by soil may be due to adsorption, chemisorption, ion exchange, or a combination of these mechanisms. The sorption of uranium in most soil is such that it may not leach readily from soil surface to groundwater, particularly in soil containing clay and iron oxide.

- Tritium's initial behavior in the environment is determined by the source. If it is released as a gas or vapor to the atmosphere, substantial dispersion can be expected, and the rapidity of deposition is dependent on climatic factors. If tritium is released in liquid form, it is diluted in surface water and is subject to physical dispersion, percolation, and evaporation (Whicker and Schultz 1982, 058209, p. 147). Tritium concentrations are low (<0.1 pCi/g), indicating that the area of elevated radioactivity is not a significant source of tritium, although this radionuclide is relatively mobile. Because tritium migrates in association with moisture, the low moisture content of the subsurface limits the potential for tritium to migrate to groundwater.

F-3.3 Exposure Point Concentration Calculations

The exposure point concentrations (EPCs) represent upper bound concentrations of COPCs. For comparison to risk-screening levels, the upper confidence limit (UCL) of the arithmetic mean of a set of concentrations was calculated when possible and used as the EPC. If an appropriate UCL of the mean could not be calculated or if the UCL exceeded the maximum concentration, the maximum detected concentration of the COPC was used as the EPC.

Calculation of the UCLs of the mean concentration was done using the U.S. Environmental Protection Agency (EPA) ProUCL 4.00.05 software (EPA 2010, 109944), which is based on EPA guidance (EPA 2002, 085640). 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. The ProUCL program calculates 95%, 97.5%, and 99% UCLs and recommends a distribution and a value for UCL. The UCL calculated via the recommended distribution was used as the EPC. Environmental data may have a normal, lognormal, or gamma distribution but are often nonparametric (no definable shape to the distribution). The input and output data files for ProUCL calculations for each site are provided on CD as Attachment F-1.

For SWMU 32-002(b), the summary statistics, including the EPC for each COPC for the industrial, recreational, ecological, residential, and construction worker risk-screening assessments and the distributions used for the calculations, are presented in Tables F-3.3-1, F-3.3-2, and F-3.3-3. The dioxin and furan congener toxicity equivalency factor (TEF) calculations, which yield a 2,3,7,8-tetrachlorodibenzodioxin (TCDD) equivalent EPC for the dioxin and furan congeners, are presented in Tables F-3.3-4, F-3.3-5, and F-3.3-6.

For AOC 32-003, the summary statistics, including the EPC for each COPC for the industrial, recreational, ecological, residential, and construction worker risk-screening assessments and the distributions used for the calculations, are presented in Tables F-3.3-7, F-3.3-8, and F-3.3-9.

At AOC 32-004, the 2010 samples were analyzed only for polycyclic aromatic hydrocarbons (PAHs) and these PAH results replaced the 1996 PAH results where samples were collected at the same depths and locations as previous samples. Also, two samples (sample IDs 0132-96-0621 and 0132-96-0622) had depths changed from 0–0.5 ft to 2.5–3.5 ft per the 1996 Phase II and voluntary corrective action (VCA) report (LANL 1996, 059178). The summary statistics, including the EPC for each COPC for the industrial, recreational, ecological, residential, and construction worker risk-screening assessments and the distributions used for the calculations, are presented in Tables F-3.3-10, F-3.3-11, and F-3.3-12.

The 2010 PAH results confirmed elevated PAH concentrations as a result of runoff from the Knecht Street area. Because location 32-06340 is upslope from the outfall and is unrelated to potential releases from AOC 32-004, the potential human health risks for the residential and construction worker scenarios were reevaluated without the PAH results from samples at location 32-06340. The summary statistics and the distribution used for the calculation are presented in Table F-3.3-13.

F-4.0 HUMAN HEALTH RISK-SCREENING ASSESSMENTS

Human health and ecological risk assessments were conducted for SWMU 32-002(b), AOC 32-003, and AOC 32-004. All three sites were screened using the industrial, recreational, construction worker, and residential scenarios.

The risk-screening assessment(s) for a site included all COPCs detected within the depth interval relevant for each exposure scenario. The depth intervals are

- 0–10 ft bgs for the residential and construction worker scenarios,
- 0–5 ft bgs for ecological risk, and
- 0–1 ft bgs for the industrial and recreational scenarios.

The COPCs evaluated for each scenario may differ depending on the depth at which the COPC was detected. Because sampling depths often overlapped during multiple investigations, all samples with a starting depth less than the lower bound of the interval for each scenario were included in the risk assessment. Some COPCs 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-4.1 Soil Screening Levels and Screening Action Levels

Human health risk-screening assessments were conducted for inorganic and organic COPCs using the residential, industrial, and construction worker SSLs from NMED guidance (NMED 2009, 108070) or EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm). The EPA SSLs for carcinogens were multiplied by 10 to adjust from a 10^{-6} cancer risk level to the NMED target cancer risk level of 10^{-5}. The SSLs for the recreational scenario were obtained from Laboratory guidance (LANL 2010, 108613). Exposure parameters used to calculate the SSLs for all four scenarios are presented in Table F-4.1-1. Surrogate chemicals were used for some COPCs without a screening value based on structural similarity or because the surrogate is a parent compound (NMED 2003, 081172).

Radionuclide screening action levels (SALs) are used for comparison with radionuclide COPC concentrations and were derived using the residual radioactive (RESRAD) model, Version 6.5 (LANL 2009, 107655). The SALs are based on a 15-mrem/yr dose (DOE 2000, 067489). Exposure parameters used to calculate the SALs for all four scenarios are presented in Tables F-4.1-2 and F-4.1-3.

In addition, vapor intrusion of VOCs into a building was evaluated for the residential scenario. The potential risk was assessed using the Johnson and Ettinger model (http://www.epa.gov/swerrims/riskassessment/airmodel/johnson_ettinger.htm) for subsurface vapor intrusion into buildings (EPA 2002, 094114). Because only soil data are available, the advanced soil model (SL-ADV-Feb04.xls) was used to calculate risk-based soil concentrations for VOCs at sites, where appropriate. The maximum detected concentration of each VOC was compared with the risk-based concentration generated by the model for each site. The model inputs and risk-based concentrations generated are provided in Attachment F-2. The hazard quotients (HQs) and hazard indexes (HIs) were calculated for noncarcinogenic COPCs and total excess cancer risks for carcinogenic COPCs. The NMED target cancer risk level of 1×10^{-5} and a target HI of 1.0 were applied.

F-4.2 Results of the Human Health Risk-Screening Assessments

The EPC of each COPC was compared with the SSL for the appropriate scenario.

- For a carcinogenic COPC, the EPC was divided by the SSL and then multiplied by 1 $\times 10^{-5}$. The cancer risks were summed for a site, and the sum was compared with the NMED target cancer risk level of 1 × 10^{-5} (NMED 2009, 108070).
- For a noncarcinogenic COPC, a HQ was calculated by dividing the EPC by the SSL. The HQs were summed for a site to obtain a HI. The HI was compared with the NMED target HI of 1.0 (NMED 2009, 108070).
- For a radionuclide, the EPC was divided by the SAL and then multiplied by 15 mrem/yr. The doses were summed for a site, and the sum was compared with the DOE target dose level of 15 mrem/yr (DOE 2000, 067489).

F-4.2.1 SWMU 32-002(b)

The results of the risk-screening assessments for the industrial scenario are presented in Tables F-4.2-1, F-4.2-2, and F-4.2-3. The total excess cancer risk is approximately 3 × 10^{-6}, which is less than the NMED target cancer risk level of 1 × 10^{-5}. The HI is approximately 0.3, which is less than the NMED target HI of 1.0. The total dose is approximately 1 mrem/yr, which is less than the DOE target dose limit of 15 mrem/yr.

The results of the risk-screening assessments for the recreational scenario are presented in Tables F-4.2-4, F-4.2-5, and F-4.2-6. The total excess cancer risk is approximately 2 × 10^{-6}, which is less than the NMED target cancer risk level of 1 × 10^{-5}. The HI is approximately 0.4, which is less than the NMED target HI of 1.0. The total dose is 0.3 mrem/yr, which is less than the DOE target dose limit of 15 mrem/yr.

The results of the risk-screening assessments for the construction worker scenario are presented in Tables F-4.2-7, F-4.2-8, and F-4.2-9. The total excess cancer risk is approximately 3 × 10^{-7}, which is less than the NMED target cancer risk level of 1 × 10^{-5}. The HI is approximately 0.3, which is less than the NMED target HI of 1.0. The total dose is approximately 1 mrem/yr, which is less than the DOE target dose limit of 15 mrem/yr.

The results of the risk-screening assessments for the residential scenario are presented in Tables F-4.2-10, F-4.2-11, and F-4.2-12. The total excess cancer risk is approximately 2 × 10^{-5}, which is slightly above the NMED target cancer risk level of 1 × 10^{-5}. The HI is approximately 0.8, which is less than the NMED target HI of 1.0. The total dose is approximately 4 mrem/yr, which is less than the DOE target dose limit of 15 mrem/yr.

The results of the residential vapor intrusion screening assessment are presented in Tables F-4.2-13 and F-4.2-14. The total excess cancer risk is approximately 5 × 10^{-8}, which is less than the NMED target cancer risk level of 1 × 10^{-5}. The HI is approximately 0.00003, which is less than the NMED target HI of 1.0.

F-4.2.2 AOC 32-003

Sodium was identified as a COPC but does not have a published toxicity value. It is among those elements identified in section 5.9.4 of EPA’s Risk Assessment Guidance for Superfund (EPA 1989, 008021) as an essential macronutrient. As an essential nutrient, sodium may be compared to the adequate intake (AI) for younger and older adults. The AI is 1500 mg/d of sodium for a younger adult and 1300 mg/d for an older adult (Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate 2005, http://www.nap.edu/catalog.php?record_id=10925#toc). If all the daily incidental ingestion of soil were to occur at the location of the maximum concentration detected at AOC 32-003 of 1970 mg/kg, at the EPA default child soil-ingestion rate of 200 mg/d of soil, a younger adult would ingest approximately 0.7 mg/d of sodium, which is far less than the AI of 1500 mg/d. At the EPA default older adult soil-ingestion rate of 100 mg/d of soil, an older adult would ingest approximately 0.3 mg/d of sodium, which is far less than the AI of 1300 mg/d. Therefore, no adverse health effects are expected from sodium at 1970 mg/kg at AOC 32-003, and sodium is eliminated in human health risk assessments.

The results of the risk-screening assessments for the industrial scenario are presented in Tables F-4.2-15 and F-4.2-16. The total excess cancer risk is approximately 3×10^{-6}, which is less than the NMED target cancer risk level of 1×10^{-5}. The HI is approximately 0.005, which is less than the NMED target HI of 1.0.

The results of the risk-screening assessments for the recreational scenario are presented in Tables F-4.2-17 and F-4.2-18. The total excess cancer risk is approximately 2×10^{-6}, which is less than the NMED target cancer risk level of 1×10^{-5}. The HI is approximately 0.01, which is less than the NMED target HI of 1.0.

The results of the risk-screening assessments for the construction worker scenario are presented in Tables F-4.2-19 and F-4.2-20. The total excess cancer risk is approximately 3×10^{-7}, which is less than the NMED target cancer risk level of 1×10^{-5}. The HI is approximately 0.09, which is less than the NMED target HI of 1.0.

The results of the risk-screening assessments for the residential scenario are presented in Tables F-4.2-21 and F-4.2-22. The total excess cancer risk is approximately 1×10^{-5}, which is equivalent to the NMED target cancer risk level of 1×10^{-5}. The HI is approximately 0.2, which is less than the NMED target HI of 1.0.

The results of the residential vapor-intrusion screening assessment are presented in Table F-4.2-23. The total excess cancer risk is approximately 7×10^{-8}, which is less than the NMED target cancer risk level of 1×10^{-5}.

F-4.2.3 AOC 32-004

The results of the risk-screening assessments for the industrial scenario are presented in Tables F-4.2-24, F-4.2-25, and F-4.2-26. The total excess cancer risk is 1×10^{-5}, which is equivalent to the NMED target cancer risk level of 1×10^{-5}. The HI is 0.3, which is less than the NMED target HI of 1.0. The total dose is 0.01 mrem/yr, which is less than the DOE target dose limit of 15 mrem/yr.

The results of the risk-screening assessments for the recreational scenario are presented in Tables F-4.2-27, F-4.2-28, and F-4.2-29. The total excess cancer risk is approximately 9×10^{-6}, which is less than the NMED target cancer risk level of 1×10^{-5}. The HI is approximately 0.4, which is less than the NMED target HI of 1.0. The total dose is 0.005 mrem/yr, which is less than the DOE target dose limit of 15 mrem/yr.

The results of the risk-screening assessments for the construction worker scenario are presented in Tables F-4.2-30, F-4.2-31, and F-4.2-32. The total excess cancer risk is 5×10^{-7}, which is less than the NMED target cancer risk level of 1×10^{-5}. The HI is 0.4, which is less than the NMED target HI of 1.0. The total dose is 0.04 mrem/yr, which is less than the DOE target dose limit of 15 mrem/yr.

The results of the risk-screening assessments for the residential scenario are presented in Tables F-4.2-33, F-4.2-34, and F-4.2-35. The total excess cancer risk is 2×10^{-5}, which is slightly above the NMED target cancer risk level of 1×10^{-5}. The HI is 1, which is equivalent to the NMED target HI of 1.0. The total dose is 0.05 mrem/yr, which is less than the DOE target dose limit of 15 mrem/yr.

The results of the residential vapor-intrusion screening assessment are presented in Table F-4.2-36. The HI is approximately 0.000000001, which is less than the NMED target HI of 1.0.

F-4.3 Uncertainty Analysis

The human health risk-screening assessments are subject to varying degrees and types of uncertainty. Aspects of data evaluation and COPC identification, exposure assessment, toxicity assessment, and the additive approach all contribute to uncertainties in the risk assessment process. Each or all of these uncertainties may affect the evaluation results.

F-4.3.1 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 those chemicals either detected or with detection limits above background are retained for further analysis. However, established BVs may not accurately represent certain subunits of the Bandelier Tuff (e.g., fractured, clay-rich material) that may be encountered during sampling because such data are not included in the background data set. Some inorganic chemicals and radionuclides may also have been retained as COPCs that are not site-related. All detected organic chemicals are identified as COPCs and are retained for further analysis.

Other uncertainties may include errors in sampling, laboratory analysis, and data analysis. However, because some concentrations used in the risk-screening assessments are less than detection or quantitation limits, data evaluation uncertainties are expected to have little effect on the risk-screening results.

F-4.3.2 Exposure Assessment

The following exposure assessment uncertainties were identified for the risk assessment: (1) the applicability of the standard scenarios, (2) the assumptions underlying the exposure pathways, and (3) the derivation of EPCs.

An individual may be subject to exposures in a different manner than the exposure assumptions used to derive the SSLs/SALs. For the sites 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 h/d, 225 d/yr, and 25 yr (NMED 2009, 108070), while the construction worker SSLs are based on exposure of 8 h/d, 250 d/yr, and 1 yr (NMED 2009, 108070). The recreational scenario assumes that the receptor is exposed for 1 h for 200 events per yr. The residential SSLs are based on exposure of 24 h/d, 350 d/yr, and 30 yr (NMED 2009, 108070). As a result, the industrial, recreational, construction worker, and residential scenarios evaluated at these sites likely overestimate the exposure and risk.

A number of assumptions are made relative to exposure pathways, including input parameters, whether or not a given pathway is complete, 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 2009, 108070). When several upper-bound values (as are found in NMED 2009, 108070) are combined to estimate exposure for any one pathway, the resulting risk 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 overestimates the potential risk to receptors.

Uncertainty is introduced in the concentration aggregation of data for estimating the EPCs at a site. The use of a UCL is intended to provide a protective upper-bound estimate of the COPC concentration and is assumed to be representative of 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.

Several sites have potential risks that exceeded NMED target levels. The potential risks were overestimated because of uncertainties associated with the EPCs and/or the COPCs at these sites.

Lead at SWMU 32-002(b) and AOC 32-004

Lead was a COPC at SWMU 32-002(b) and AOC 32-004, with HQs less than 1 for both sites. Lead was generally not a major contributor, with HQs ranging from 0.05 to 0.2 at SWMU 32-002(b) and 0.1 to 0.3 at AOC 32-004 for the industrial, recreational, construction worker, and resident scenarios. The HIs were less than 1 without lead included, indicating no potential risks to receptors from lead or other noncarcinogenic COPCs exist.

Antimony at AOC 32-004

The residential antimony HQ of 0.4 is overestimated based on a 1996 elevated detection limit (12 mg/kg). More recent data from 2008 have lower detection limits (0.52 mg/kg maximum detection limit), and antimony is not detected above the BV in the 2008 samples. Using 0.52 mg/kg for antimony as the EPC results in an HQ of 0.02, and the residential HI is further reduced (including the lead discussed above) to approximately 0.6, which is below the NMED target level.

Arsenic at SWMU 32-002(b)

The potential total excess cancer risk (approximately 2×10^{-5}) for the residential scenario is slightly above the NMED target risk level in part from arsenic. However, exposure to arsenic across the site is similar to that at background locations. Although concentrations of arsenic were detected above background, the upper confidence level (UCL) of the mean concentration (2.42 mg/kg) is within the ranges of arsenic background concentrations, indicating no difference in potential risk from exposure across the site whether from the site EPC or the ranges of background concentrations. Given the infrequent and isolated occurrence of arsenic concentrations above the maximum background concentrations at SWMU 32-002(b) (only three sample results at two locations are above the maximum tuff background concentration), the potential exposure to and risk from arsenic are substantially overestimated by the screening-level comparison.

The UCL is intended to represent the average concentration of a contaminant and the reasonable maximum exposure (RME) over time for a receptor at a site. The RME is the maximum exposure that is reasonably expected to occur at a site and represents the average concentration during the exposure period. Although this concentration does not reflect the maximum concentration that a receptor could be exposed to at any one time (i.e., the worst case), it is a reasonable estimate of the exposure concentration over time. This is because an assumption of long-term contact with the maximum concentration is generally not reasonable. If the EPC is within the ranges of background concentrations, then the receptor is exposed to an average concentration indistinguishable from naturally occurring levels.

Because the arsenic EPC of 2.42 mg/kg falls within the ranges of arsenic background concentrations (0.3 mg/kg to 9.3 mg/kg for soil and 0.25 mg/kg to 5 mg/kg for Qbt 2, Qbt 3, Qbt 4), the EPC is not a true reflection of an incremental cancer risk and indicates site risk is not substantially different from the risk from background concentrations. Although statistically the arsenic site data set is different from the arsenic background data set(s), it does not necessarily indicate an unacceptable incremental risk, especially when the residential SSL is also within the ranges of background concentrations (residential SSL of 3.9 mg/kg and range of arsenic background concentrations of 0.3 mg/kg to 9.3 mg/kg for soil and 0.25 mg/kg to 5 mg/kg for Qbt 2, Qbt 3, Qbt 4). Therefore, the arsenic does not contribute to the potential risk at the RME concentration, which overestimates the potential incremental risk.

The arsenic EPC is indistinguishable from exposure to naturally occurring levels of arsenic across the site, i.e., the mean exposure across the site is similar to background. Because the calculated risk represents the total excess cancer risk to a receptor above what he/she is typically exposed to, the risk from arsenic is not included as it is not incrementally above the risk that would result from exposure to naturally occurring levels of arsenic. Therefore, the risk is overestimated and the contribution from arsenic is not included in the total risk estimate.

Without arsenic, the total excess cancer risk for the residential scenario is approximately 1×10^{-5}, which is equivalent to the NMED target risk level.

PAHs at SWMU 32-002(b)

Additional overestimation of the risk at SWMU 32-002(b) is a result of using the maximum detected concentrations of benzo(a) pyrene and dibenz(a,h)anthracene as the EPCs (risk contribution of these COPCs is approximately 8×10^{-5}). In the case of benzo(a)pyrene, the EPC is the maximum of four detected concentrations, while the dibenz(a,h)anthracene EPC is the only detected concentration. EPA guidance strongly advises against using the maximum concentration as an EPC, so using a calculated value is deemed better than using the maximum (EPA 1989, 008021). EPA points out that the EPC term represents an individual's average exposure from an exposure area during a long period of time; therefore, the EPC term should be estimated using an average value (such as a 95% UCL of the mean) and not the maximum detected concentration. It is unlikely that an individual will visit the location of the maximum detected concentration all of the time, and the use of this value results in a conservative (higher) estimate of the EPC term and associated risk. The maximum detected concentration is therefore not an accurate estimate of the EPC term, and the risk is further overestimated for the residential scenario. Given this uncertainty, the total excess cancer risk for the residential scenario likely does not exceed the NMED target level of 1×10^{-5}.

PAHs at AOC 32-004

AOC 32-004 has potential residential risk that exceeds the NMED target risk level. The potential risk is overestimated because of uncertainties associated with the COPCs and their EPCs.

The Phase II and VCA report for former TA-32 (LANL 1996, 059178) identified potential sources of contamination from the industrial/commercial area situated northwest of AOC 32-004 along Knecht Street. The sources included two auto repair shops, a car wash, a paint and body shop, and a gas station. This area may have impacted the AOC 32-004 outfall area. Stormwater from the Knecht Street area is collected by a storm drain that discharges onto the hill slope near the outfall. The Knecht Street discharge area and the AOC outfall area converge into a common drainage channel. Contaminants that could result from the industries and businesses include organic chemicals (e.g., PAHs) and metals.

To address the potential contamination from the Knecht Street area, samples were collected from two locations upgradient of the outfall pipe (locations 32-06339 and 32-06340) during the VCA. These two locations were within the area affected by the Knecht Street drainage. Two samples were collected from location 32-06340, and one sample (0132-96-0069) was sent to a fixed laboratory for analysis of TAL metals and semivolatile organic compounds (SVOCs) following field screening. One sample was collected from location 32-06339 and field screened only.

No archival evidence indicates PAHs were used or generated in former building 32-03 that AOC 32-004 served. Former building 32-03 was an office building, which included a vault room where a radioactive source was stored. Americium-241 was the only radionuclide detected at the site in only one sample, located below outfall, at a concentration of 0.091 pCi/g (Table 4.3-4 of the remedy completion report). The mesa top where the AOC 32-004 drainline was located is covered with asphalt and is associated with the Los Alamos County Public Works Department Pavement Management Division. The asphalt pavement covers the mesa top from the Public Works Department buildings to the edge of Los Alamos Canyon. In addition, a storm drain is located upgradient of AOC 32-004 that drains directly onto the outfall area. Therefore, the PAHs detected in the outfall area are likely a result of runoff from the asphalt and storm drain.

While the PAHs detected at the site are not likely attributable to Laboratory activities, the initial risk estimates calculated include the PAH concentrations at location 32-06340 (section F-4.2-3). The results indicated no potential unacceptable cancer risks for the industrial, recreational, and construction worker scenarios and an approximately 2×10^{-5} (1.5×10^{-5}) cancer risk for the residential scenario. Because the PAHs detected at location 32-06340 are not site related (i.e., upgradient of the outfall), the cancer risk was recalculated without the PAHs at this location. The recalculated EPCs without the PAH results from samples at location 32-06340 are presented in Table F-3.3-13 and the results of risk-screening assessment for the residential scenario are presented in Tables F-4.2-37 and F-4.2-38. The cancer risk is approximately 1×10^{-5} and the HI is 1, which are equivalent to the NMED target levels. These risk estimates are also overestimated because the calculations still include the PAHs detected downgradient in the drainage, which are wholly or in part associated with the Knecht Street area runoff and not likely related to the site.

F-4.3.3 Toxicity Assessment

The primary uncertainty associated with the screening values is related to the derivation of toxicity values used in their calculation. Toxicity values (slope factors [SFs] and reference doses [RfDs]) were used to derive the screening values used in this screening evaluation (NMED 2009, 108070). Uncertainties were identified in five areas with respect to the toxicity values: (1) extrapolation from animals to humans, (2) interindividual variability in the human population, (3) the derivation of SFs and RfDs, (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 between other animals and humans in chemical absorption, metabolism, excretion, and toxic response. 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 into each of these steps, resulting in the overestimation of potential risk.

Individual Variability in the Human Population

For noncarcinogenic effects, the degree of human variability in physical characteristics is important in determining the risks that can be expected at low exposures and in determining the no observed adverse effect level (NOAEL). The NOAEL uncertainty factor approach incorporates a factor of 10 to reflect the possible interindividual variability in 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 SFs and RfDs

The SFs and RfDs for different chemicals are derived from experiments conducted by different laboratories that may have different accuracy and precision that could lead to an over- 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 environmental matrix and not available for absorption into the human body. However, the exposure scenarios default to the assumption that the COPCs are 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 risk assessment. A surrogate was used to establish toxicity values for benzo[g,h,i]perylene based on structural similarity (NMED 2003, 081172). The overall impact of surrogate on the risk assessment is minimal because benzo[g,h,i]perylene was detected at low concentrations and the HQs were less than 0.1.

F-4.3.4 Additive Approach

For noncarcinogens, the effects of exposure to multiple chemicals are generally not known, 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 and on different target organs but are addressed additively.

F-4.4 Interpretation

F-4.4.1 SWMU 32-002(b)

The total excess cancer risks for the industrial, recreational, construction worker, and residential scenarios are 3×10^{-6}, 2×10^{-6}, 3×10^{-7}, and 2×10^{-5}, respectively. The residential cancer risk includes the contribution from the vapor-intrusion pathway. For the residential scenario, arsenic contributes to the cancer risk at this site. As discussed in the uncertainty analysis (section F-4.3.2), the arsenic EPC is within the ranges of background concentrations, the risk did not incrementally increase above that which would result from exposure to naturally occurring levels of arsenic, and the risk is overestimated. Without arsenic, the total excess cancer risk is approximately 1×10^{-5}, which is equivalent to the NMED target risk level.

The HIs are 0.3, 0.4, 0.3, and 0.8, respectively, for the industrial, recreational, construction worker, and residential scenarios and are below the NMED target HI of 1.0. The residential HI includes the contribution from the vapor-intrusion pathway.

The total doses are approximately 1 mrem/yr, 0.3 mrem/yr, 1 mrem/yr, and 4 mrem/yr for the industrial, recreational, construction worker, and residential scenarios, respectively, and are below the DOE target dose limit of 15 mrem/yr. The total doses for the industrial and construction worker scenarios are equivalent to a total risk of 1×10^{-5} and 6×10^{-6}, respectively, based on a comparison with EPA's outdoor worker preliminary remediation goals (PRGs) for radionuclides (available at http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls). The total dose for the residential scenario is equivalent to a total risk of 1×10^{-5}, based on a comparison with EPA's residential PRGs for radionuclides (available at http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls). The total dose for the recreational scenario is equivalent to a total risk of 6×10^{-7}, based on conversion from dose using RESRAD, Version 6.5.

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 32-002(b).

F-4.4.2 AOC 32-003

The total excess cancer risks for the industrial, recreational, construction worker, and residential scenarios are 3×10^{-6}, 2×10^{-6}, 3×10^{-7}, and 1×10^{-5}, respectively, which are below or equivalent to the NMED target risk level of 1×10^{-5}. The residential cancer risk includes the contribution from the vapor-intrusion pathway. The HIs are 0.005, 0.01, 0.09, and 0.2, respectively, which are below the NMED target HI of 1.0.

Based on the risk-screening assessment results, there are no potential unacceptable risks for the industrial, recreational, construction worker, and residential scenarios at AOC 32-003.

F-4.4.3 AOC 32-004

The total excess cancer risks for the industrial, recreational, construction worker, and residential scenarios are 1×10^{-5}, 9×10^{-6}, 5×10^{-7}, and 2×10^{-5}, respectively. PAHs are the primary contributors to potential human health risks. As discussed in the uncertainty section (section F-4.3.2), runoff from the industrialized Knecht Street area upslope of the outfall flows into the drainage shared by the outfall, and elevated PAH concentrations are detected on both the mesa top and canyon slope. Because the site is a drainline and outfall from an office building containing a radiation source vault, and location 32-06340 is upslope from the outfall, the PAH results from samples at location 32-06340 are not related to site activities and should be excluded from the risk-screening assessment. As a result, the total excess cancer risk for the residential scenario is approximately 1×10^{-5}. Therefore, the potential risks for the industrial, recreational, construction worker, and residential scenarios are below or equivalent to the NMED target risk level of 1×10^{-5}.

The HIs are 0.3, 0.4, 0.4, and 1, respectively, for the industrial, recreational, construction worker, and residential scenarios, which are below or equivalent to the NMED target HI of 1.0. The residential HI includes the contribution from the vapor-intrusion pathway. The residential HI is overestimated and reduced to 0.6 based on the uncertainty discussions associated with lead and antimony (section F-4.3.2).

The total doses are 0.01 mrem/yr, 0.005 mrem/yr, 0.04 mrem/yr, and 0.05 mrem/yr for the industrial, recreational, construction worker, and residential scenarios, respectively, and are below the DOE target dose limit of 15 mrem/yr. The total doses for the industrial and construction worker scenarios are equivalent to a total risk of 2×10^{-8} for both scenarios, based on a comparison with EPA's outdoor worker PRGs for radionuclides (available at http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls). The total dose for the residential scenario is equivalent to a total risk of 5×10^{-8}, based on a comparison with EPA's residential PRGs for radionuclides (available at http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls). The total dose for the recreational scenario is equivalent to a total risk of 1×10^{-9}, based on conversion from dose using RESRAD, Version 6.5.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist from COPCs for the industrial, recreational, construction worker, and residential scenarios at AOC 32-004.

F-5.0 ECOLOGICAL RISK-SCREENING ASSESSMENT

The approach for conducting ecological risk-screening assessments is described in the "Screening Level Ecological Risk Assessment Methods, Revision 2" (LANL 2004, 087630). The assessment consists of the following four parts: (1) a scoping evaluation, (2) a screening evaluation, (3) an uncertainty analysis, and (4) an interpretation of the results.

F-5.1 Scoping Evaluation

The scoping evaluation establishes the breadth and focus of the screening assessment. The ecological scoping checklists for SWMU 32-002(b) and AOCs 32-003, and 32-004 are useful tools for organizing existing ecological information (Attachment F-3). The information in the scoping checklists is used to determine whether ecological receptors may be affected, identify the types of receptors that may be present, and develop the ecological conceptual site model for each site. Portions of the sites at former TA-32 are developed, with pavement overlying the site, and those areas are inaccessible to ecological receptors. The portions on the hillsides provide some habitat for ecological receptors. However, because of the presence of business and county facilities, the quality of the habitat varies.

The scoping portion of the assessment indicated that terrestrial receptors were appropriate for evaluating the concentrations of contaminants in soil and tuff samples. Aquatic receptors were not evaluated because no aquatic communities and no aquatic habitat or perennial source of water exist at any of the three sites at former TA-32. The depth of the regional aquifer (greater than 1000 ft bgs) and the semiarid climate limit transport to groundwater. The potential exposure pathways for terrestrial receptors in soil and tuff are root uptake, inhalation, soil ingestion, dermal contact, external irradiation, and food-web transport

(Figure F-3.1-1). The weathering of tuff is the only viable natural process that may result in the exposure of receptors to contaminants in tuff. Because of the slow rate of weathering expected for tuff, exposure in tuff is negligible, although it is included in the assessment. Plant exposure in tuff is largely limited to fractures near the surface, which does not produce sufficient biomass to support an herbivore population. Consequently, the contaminants in tuff are unavailable to receptors.

Potential risk was evaluated in the risk-screening assessments for the following ecological receptors representing several trophic levels:

- a plant,
- soil-dwelling invertebrates (represented by the earthworm),
- the deer mouse (mammalian omnivore),
- the Montane shrew (mammalian insectivore),
- the desert cottontail (mammalian herbivore),
- the red fox (mammalian carnivore),
- the American robin (avian insectivore, avian omnivore, and avian herbivore), and
- the American kestrel [avian intermediate carnivore and avian carnivore, surrogate for threatened and endangered (T&E) species].

The rationale for these receptors is presented in “Screening Level Ecological Risk Assessment Methods, Revision 2.4” (LANL 2004, 087630). The ecological screening levels (ESLs) are derived for each of these receptors where information is available. The ESLs are based on similar species and are derived from experimentally determined NOAELs, lowest observed-adverse effect levels (LOAELs), or doses determined lethal to 50% of the test population. Information relevant to the calculate ESLs, including concentration equations, dose equations, bioconcentration factors, transfer factors, and toxicity reference values (TRVs) are presented in the ECORISK Database, Version 2.5 (LANL 2010, 110846).

F-5.2 Assessment Endpoints

An assessment endpoint is an explicit expression of the environmental value to be protected. These endpoints are ecologically relevant and help sustain the natural structure, function, and biodiversity of an ecosystem or its components (EPA 1998, 062809). In a screening-level assessment, assessment endpoints are attributes of ecological receptors that may be adversely affected by exposure to hazardous wastes from past operations (EPA 1997, 059370), wherein receptors are populations and communities (EPA 1999, 070086).

The ecological screening assessment is designed to protect populations and communities of biota rather than individual organisms, except for listed or candidate T&E species or treaty-protected species (EPA 1999, 070086). The protection of individual organisms within these designated protected species could also be achieved at the population level; the populations of these species tend to be small, and the loss of an individual adversely affects the species.

In accordance with this guidance, the Laboratory developed generic assessment endpoints to ensure that values at all levels of the food chain are considered in the ecological screening process (LANL 1999, 064137). These general assessment endpoints can be measured using impacts on reproduction, growth, and survival to represent categories of effects that may adversely impact populations. In addition, specific receptor species were chosen to represent each functional group. The receptor species were chosen because of their presence at the site, their sensitivity to the COPCs, and their potential for exposure to those COPCs. These categories of effects and the chosen receptor species were used to select the types of effects seen in toxicity studies considered in the development of the TRVs. Toxicity studies used in the development of TRVs included only those in which the evaluated adverse effect affected reproduction, survival, and/or growth.

The selection of receptors and assessment endpoints are designed to be protective of both the representative species used as screening receptors and the other species within their feeding guilds and the overall food web for the terrestrial and aquatic ecosystems. Focusing the assessment endpoints on the general characteristics of species that affect populations (rather than the biochemical and behavioral changes that may affect only the studied species) also ensures applicability to the ecosystem of concern.

F-5.3 Screening Evaluation

The ecological risk-screening assessments identify chemicals of potential ecological concern (COPECs) from 0–5 ft bgs based on the comparison of EPCs with ESLs in accordance with Laboratory guidance (LANL 2004, 087630). The ESLs were obtained from the ECORISK Database, Version 2.5 (LANL 2010, 110846) and are presented in Table F-5.3-1 for all COPCs and receptors evaluated.

The risk-screening assessments involve the following steps (LANL 2004, 087630).

- The HQs are calculated as the ratios of the EPCs (UCLs, maximum detected concentrations, or maximum detection limits) to the ESLs. The minimum ESL for each COPC is used in the initial screening, and HQs greater than 0.3 are identified as COPECs.
- The COPECs are evaluated by receptor with individual HQs for a receptor summed to produce an HI. An HI greater than 1.0 requires further assessment to determine if exposure to multiple COPECs results in potential adverse impacts to a given receptor population.
- COPCs without ESLs are retained as COPECs and evaluated further in the uncertainty section.

For the purposes of the ecological screening, it is assumed nonradionuclides have common toxicological effects. The HQ and HI analysis is a conservative indication of potential adverse effects and is designed to minimize the potential of overlooking possible COPECs at the site.

F-5.3.1 SWMU 32-002(b)

The results of the minimum ESL comparisons are presented in Table F-5.3-2. Antimony, arsenic, barium, chromium, copper, cyanide (total), lead, mercury, nickel, selenium, silver, thallium, zinc, Aroclor-1260, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and 2,3,7,8-TCDD equivalent are retained as COPECs because the HQs are greater than 0.3.

Table F-5.3-3 presents the HQs and HIs for each receptor/COPEC at SWMU 32-002(b). The HI analysis indicates that all receptors have HIs greater than 1. The COPECs and receptors are discussed in the uncertainty section.

Nitrate and perchlorate do not have ESLs. They are retained as COPECs and discussed in the uncertainty section.

F-5.3.2 AOC 32-003

The results of the minimum ESL comparisons are presented in Table F-5.3-4. Antimony, chromium, nickel, selenium, zinc, Aroclor-1260, and bis(2-ethylhexyl)phthalate are retained as COPECs because the HQs are greater than 0.3.

Table F-5.3-5 presents the HQs and HIs for each receptor/COPEC at AOC 32-003. The HI analysis indicates that all receptors, except the robin (herbivore) and cottontail, have HIs greater than 1. The COPECs and receptors are discussed in the uncertainty section.

Sodium does not have ESLs. It is retained as a COPEC and discussed in the uncertainty section.

F-5.3.3 AOC 32-004

The results of the minimum ESL comparisons are presented in Table F-5.3-6. Antimony, chromium, copper, cyanide (total), lead, mercury, nickel, selenium, silver, thallium, zinc, bis(2-ethylhexyl)phthalate, and chrysene are retained as COPECs because the HQs are greater than 0.3.

Table F-5.3-7 presents the HQs and HIs for each receptor/COPEC at AOC 32-004. The HI analysis indicates that all receptors have HIs greater than 1. The COPECs and receptors are discussed in the uncertainty section.

Nitrate does not have ESLs. It is retained as a COPEC and discussed in the uncertainty section.

F-5.4 Uncertainty Analysis

The uncertainty analysis describes the key sources of uncertainty related to the screening evaluations. This analysis can result in either adding or removing chemicals from the list of COPECs. This following is a qualitative uncertainty analysis of the issues relevant to evaluating potential ecological risk at each site.

F-5.4.1 Chemical Form

The assumptions used in the ESL derivations are conservative and not necessarily representative of actual conditions. These assumptions include maximum chemical bioavailability, maximum receptor ingestion rates, minimum body weight, and additive effects of multiple COPECs. These factors tend to result in conservative ESL estimates, which may lead to an overestimation of the potential risk. The assumption of additive effects for multiple COPECs may result in an over- or underestimation of the potential risk to receptors.

The chemical form of the individual COPCs was not determined as part of the investigation. Toxicological data are typically based on the most toxic and bioavailable chemical species, which are not typically found in the environment. Inorganic, radionuclide, and organic COPECs are generally not 100% bioavailable to receptors in the natural environment because of interference from other natural processes, such as the adsorption of chemical constituents to matrix surfaces (e.g., soil) or rapid oxidation or reduction changes that render harmful chemical forms unavailable to biotic processes. The ESLs were calculated to ensure a conservative indication of potential risk (LANL 2004, 087630), and the values are biased toward overestimating the potential risk to receptors.

F-5.4.2 Exposure Assumptions

The EPCs used in the calculations of HQs are the UCLs or the maximum detected concentrations in the soil/fill/tuff to depths of 5 ft bgs and are conservative estimates of exposure to each COPEC. The sampling efforts focused on areas of known contamination, and receptors were assumed to ingest 100% of their food and spend 100% of their time at the site. These exposure assumptions for terrestrial receptors at the three sites at former TA-32 are likely to overestimate potential ecological exposure and risk.

F-5.4.3 Toxicity Values

The HQs were calculated using ESLs, which are based on NOAELs as threshold effect levels; actual risk for a given COPEC/receptor combination occurs at a higher level, somewhere between the NOAEL-based threshold and the threshold based on the LOAEL. The use of NOAELs leads to an overestimation of potential risk to ecological receptors. ESLs are based on laboratory studies requiring extrapolation to wildlife receptors. Laboratory studies are typically based on artificial and maintained populations with genetically similar individuals and are limited to single chemical exposures in isolated and controlled conditions using a single exposure pathway. Wild species are concomitantly exposed to a variety of chemical and environmental stressors, potentially rendering them more susceptible to chemical stress. On the other hand, wild populations are probably more genetically diverse than laboratory populations, making wild populations, as a whole, less sensitive to chemical exposure than laboratory populations. The uncertainties associated with the ESLs tend to lead to an overestimation of potential risk.

F-5.4.4 Comparison with Background Concentrations

The UCL is intended to represent the average concentration of a contaminant and the RME over time for a receptor at a site. The RME is the maximum exposure that is reasonably expected to occur at a site and represents the average concentration that is contacted over the exposure period. Although the RME concentration does not reflect the maximum concentration that could be contacted at any one time, it is regarded as a reasonable estimate of the concentration that could be contacted over time. This is because an assumption of long-term contact with the maximum concentration is generally not reasonable. Whether some concentrations are elevated and reflect site releases is incorporated into the UCL calculations.

If the EPC is similar to the range(s) of background concentrations, the RME across the site is indistinguishable from background. Therefore, the receptor is exposed to an average concentration, which is comparable to naturally occurring levels across the site. For example, if the chromium EPC is 15 mg/kg and the ranges of background concentrations are 1.9 mg/kg to 36.5 mg/kg for soil and 0.25 mg/kg to 13 mg/kg for Qbt 2, Qbt 3, Qbt 4, then EPC is not a true reflection of potential toxicity. It is also an indication that site concentrations are not substantially different from background concentrations. Therefore, a conclusion that inorganic chemicals with EPCs similar to the range of background concentrations are contributing risk overestimates the potential risk and does not reflect actual exposure and risk.

At SWMU 32-002(b), and AOCs 32-003 and 32-004, although concentrations of inorganic chemicals were detected above background, the UCLs for some inorganic chemicals were similar to the range of background concentrations, indicating no potential risk from exposure across the site. This relationship is presented in Tables F-5.4-1 to F-5.4-3.

SWMU 32-002(b)

The ecological risk-screening assessments for this site are based on the exposure of ecological receptors to contamination to a depth of 5 ft bgs. The EPCs of nine inorganic COPECs are similar to background concentrations for soil and/or tuff, indicating that exposure of receptors to these inorganic chemicals is similar to background (Table F-5.4-1). Arsenic, barium, chromium, copper, cyanide (total), nickel, selenium, thallium, and zinc are eliminated as COPECs because the EPCs are similar to background. Antimony, lead, mercury, and silver are retained as COPECs for this site.

AOC 32-003

The ecological risk-screening assessments for this site are based on the exposure of ecological receptors to contamination to a depth of 5 ft bgs. The EPCs of all six inorganic COPECs are similar to background concentrations for soil and/or tuff, indicating exposure of receptors to these inorganic chemicals is similar to background (Table F-5.4-2). Antimony, chromium, nickel, selenium, sodium, and zinc are eliminated as COPECs because the EPCs are similar to background.

AOC 32-004

The ecological risk-screening assessments for this site are based on the exposure of ecological receptors to contamination to a depth of 5 ft bgs. The EPCs of eight inorganic COPECs are similar to background concentrations for soil and/or tuff, indicating that exposure of receptors to these inorganic chemicals is similar to background (Table F-5.4-3). Chromium, copper, cyanide (total), nickel, selenium, silver, thallium, and zinc are eliminated as COPECs because the EPCs are similar to background. Antimony, lead, and mercury are retained as COPECs.

F-5.4.5 Area Use Factors

In addition to the direct comparison of the EPC with the ESLs, area use factors (AUFs) are used to account for the amount of time a receptor is likely to spend within the contaminated areas based on the size of the receptor's home range (HR). The AUFs for individual organisms were developed by dividing the size of the site by the HR for that receptor. Because T&E species must be assessed on an individual basis (EPA 1999, 070086), the AUF is used for the Mexican spotted owl based on an HR of 366 ha. The kestrel (top carnivore) is used as the surrogate receptor for the Mexican spotted owl.

The site area for SWMU 32-002(b) is 0.0123 ha, which results in an AUF of 0.00003 for the Mexican spotted owl. Application of this AUF to the HI of the kestrel (top carnivore) results in an adjusted HI of 0.001. Therefore, there are no potential adverse impacts to the Mexican spotted owl.

The site area for AOC 32-003 is 0.0118 ha, which results in an AUF of 0.00003 for the Mexican spotted owl. Application of this AUF to the HI of the kestrel (top carnivore) results in an adjusted HI 0.0008. Therefore, there are no potential adverse impacts to the Mexican spotted owl.

The site area for AOC 32-004 is 0.0045 ha, which results in an AUF of 0.00001 for the Mexican spotted owl. Application of this AUF to the HI of the kestrel (top carnivore) results in an adjusted HI 0.0003. Therefore, there are no potential adverse impacts to the Mexican spotted owl.

F-5.4.6 Population Area Use Factors

EPA guidance is to manage the ecological risk to populations rather than to individuals, with the exception of T&E species (EPA 1999, 070086). One approach to addressing the potential effects on populations is to estimate the spatial extent of the area inhabited by the local population that overlaps with the contaminated area. The population area for each receptor is based on the individual receptor home range and its dispersal distance (Bowman et al. 2002, 073475). Bowman et al. (2002, 073475) estimate that the median dispersal distance for mammals is 7 times the linear dimension of the HR (i.e., the square root of the HR area). If only the dispersal distances for the mammals with HRs within the range of the screening receptors are used, the median dispersal distance becomes 3.6 times the square root of the HR ($R^2 = 0.91$) (Bowman et al. 2002, 073475). If it is assumed that the receptors can disperse over the same distance in any direction, the population area is circular and the dispersal distance is the radius of the circle. Therefore, the population area for each receptor can be derived by $\pi(3.6\sqrt{HR})^2$ or approximately 40HR.

The population area use factor (PAUF) is calculated by dividing the site area by the population area of the receptor (Table F-5.4-4). The HQs are adjusted by multiplying by the PAUFs for each remaining COPEC for each receptor after background comparison. The HQs for the plant and earthworm are not adjusted by PAUFs because these receptors do not have HRs. The adjusted HQs and HIs for each site are presented in Tables F-5.4-5, F-5.4-6, and F-5.4-7.

F-5.4.7 LOAEL Analysis

SWMU 32-002(b) and AOC 32-004 have adjusted HIs greater than 1.0 for the earthworm, primarily from mercury at both sites. To address these HIs and reduce the associated uncertainty, a LOAEL analysis was conducted using ESLs calculated based on a LOAEL rather than a NOAEL. The LOAEL-based ESLs were calculated based on toxicity information in the ECORISK Database, Version 2.5, and are presented in Table F-5.4-8 along with the basis for each LOAEL used in the ESL calculations. The analysis addresses some of the uncertainties and conservativeness of the ESLs used in the initial screening assessments. The HI analyses were conducted using the LOAEL-based ESLs. The HIs calculated using the LOAEL-based ESL for SWMU 32-002(b) and AOC 32-004 are presented in Tables F-5.4-9 and F-5.4-10, respectively.

F-5.4.8 Site Discussions

SWMU 32-002(b)

The adjusted HIs are less than 1.0 for all the ecological receptors, except for the earthworm and plant (Table F-5.4-5). The HI (184) for the earthworm is primarily from mercury, and the HI (241) for the plant is primarily from antimony.

The LOAEL analysis results in an HI above 1.0 for the earthworm from mercury (Table F-5.4-9). The NOAEL-based and LOAEL-based ESLs for mercury are 0.05 mg/kg and 0.5 mg/kg, respectively, for the earthworm, both overestimating the potential risk. The ESLs are not substantially different from the mercury BV (0.1 mg/kg), making it unlikely that the ESLs reflect an effect level. In addition, field observations made during the site visit and field activities found no indication of adverse impacts on the plant community (Attachment F-3). Because the plant community does not appear to be affected by COPECs, the earthworm population is also probably not affected. Field observations did not indicate adverse effects of any kind, and there appears to be functioning ecological habitat for all terrestrial receptors, including plants, invertebrates, birds, and mammals at the site. Therefore, the HI is not consistent with field observations and does not indicate potential risk to earthworm. However, elevated mercury concentrations were detected at SWMU 32-002(b) based on the 1996 samples, resulting in an elevated HI for the earthworm.

The LOAEL analysis results in an HI above 1.0 for the plant from antimony (Table F-5.4-9). However, the EPC is the maximum detection limit because antimony was not detected above background within 0–5 ft bgs at the site. The plant HI based on the maximum detection limit substantially overestimates the potential risk to the plant. Antimony was not detected above background in any sample within 0–5 ft bgs and had much lower detection limits than the one evaluated. In addition, field observations made during the site visit found no indication of adverse effects on the plant community (Attachment F-3). Field observations did not indicate adverse effects of any kind, and there appears to be functioning ecological habitat for all terrestrial receptors, including plants, invertebrates, birds, and mammals at the site. Therefore, the HI is not consistent with field observations and does not indicate potential risk to the plant.

AOC 32-003

All adjusted HIs are less than 1.0 (Table F-5.4-6). Therefore, no potential risk to any ecological receptor exists at the site.

AOC 32-004

The adjusted HIs are less than 1.0 for all the ecological receptors, except for the earthworm and plant (Table F-5.4-7). The HI (6) for the earthworm is primarily from mercury, and the HI (241) for the plant is primarily from antimony.

The LOAEL analysis results in an HI of 1.0 for earthworm (Table F-5.4-10). Therefore, the HI does not indicate potential risk to the earthworm.

The LOAEL analysis results in an HI above 1.0 for the plant from antimony (Table F-5.4-10). However, the EPC is the maximum detection limit because antimony was not detected above background at the site. The plant HI based on the maximum detection limit substantially overestimates the potential risk to the plant. Antimony was not detected above background in any sample and had much lower detection limits than the one evaluated. In addition, field observations made during the site visit found no indication of adverse effects on the plant community (Attachment F-3). Field observations did not indicate adverse effects of any kind, and there appears to be functioning ecological habitat for all terrestrial receptors, including plants, invertebrates, birds, and mammals at the site. Therefore, the HI is not consistent with field observations and does not indicate potential risk to the plant.

F-5.4.9 COPECs without ESLs

Several COPECs do not have ESLs for any receptor in version 2.5 of the ECORISK Database (LANL 2010, 110846) because literature searches for relevant toxicity data for these chemicals have not been completed. In an effort to address this uncertainty and provide a quantitative assessment of potential ecological risk, several online toxicity databases have been searched in order to determine if any relevant toxicity information are available. The online databases searched were

- EPA Ecotox Database,
- EPA Office of Pesticide Programs Aquatic Life Benchmarks,
- U.S. Army Corps of Engineers/EPA Environmental Residue-Effects,

- California Cal/Ecotox Database,
- Pesticide Action Network Pesticide Database,
- U.S. Army Wildlife Toxicity Assessment Program,
- USDA Integrated Pesticide Management Database,
- American Bird Conservancy Pesticide Toxicity Database, and
- Oak Ridge National Laboratory Risk Assessment Information System.

However, toxicity data were not obtained for several COPECs and receptors as a result of this online database search. Although toxicity data were not found in the online databases listed above, a search of the literature continues in an effort to determine if any relevant toxicity information exists.

In the absence of a chemical-specific ESL, COPEC concentrations can be compared with ESLs for a surrogate chemical. Comparison to surrogate ESLs provides an estimate of potential effects of a chemically related compound and a line of evidence to indicate the likelihood ecological receptors are potentially impacted.

Some COPECs without ESLs do not have chemical-specific toxicity data or surrogate chemicals to be used in the screening assessments and cannot be assessed quantitatively for potential ecological risk. These COPECs are often infrequently detected across the site. In these cases, comparisons to residential human health SSLs are presented as part of a qualitative assessment. The comparison of COPEC concentrations to residential human health SSLs is a viable alternative for several reasons. Animal studies are used to infer effects on humans and is the basic premise of modern toxicology (EPA 1989, 008021). In addition, toxicity values derived for the calculation of human health SSLs are often based on potential effects that are more sensitive than the ones used to derive ESLs (e.g., cellular effects for humans versus survival or reproductive effects for terrestrial animals). The EPA also applies uncertainty factors or modifying factors to ensure that the toxicity values are protective (i.e., they are adjusted by uncertainty factors to values much lower than the study results).

SWMU 32-002(b)

No ESLs are available for nitrate and perchlorate.

Nitrate was detected in 13 samples, with a maximum concentration of 8.5 mg/kg. The NMED residential SSL for nitrate is 125,000 mg/kg, indicating that potential toxicity is very low. In addition, nitrate is naturally occurring, and the detected concentrations probably reflect natural levels. Because of the potentially low toxicity and naturally occurring concentrations, nitrate is not retained as a COPEC.

Perchlorate was detected in three samples with a maximum detected concentration of 0.006 mg/kg. The NMED residential SSL of 54.8 mg/kg indicates that potential toxicity of perchlorate is low. Because of the potential low toxicity and the infrequent detection, perchlorate is not retained as a COPEC.

AOC 32-003

No ESL is available for sodium.

Sodium was detected in one sample at a concentration of 1970 mg/kg. As presented in Table F-5.4-2, the sodium EPC is similar to the ranges of background concentrations. Because of the similarity to background and the infrequent detection above background, sodium is not retained as COPEC.

AOC 32-004

No ESL is available for nitrate.

Nitrate was detected in one sample at a concentration of 0.26 mg/kg. The NMED residential SSL for nitrate is 125,000 mg/kg, indicating that potential toxicity is very low. In addition, nitrate is naturally occurring, and the detected concentration probably reflects natural levels. Because of the potentially low toxicity and naturally occurring concentrations, nitrate is not retained as a COPEC.

F-5.5 DOE Tier I Bioconcentration Guide

The DOE Tier I Biota Concentration Guides (BCG) (DOE 2002, 085637) are lower values for cesium-137 (21.6 pCi/g) and strontium-90 (21.6 pCi/g) than the ECORISK database final ESLs (680 pCi/g and 560 pCi/g, respectively). Cesium-137 and strontium-90 were COPCs at SWMU 32-002(b). Using the EPCs for cesium-137 and strontium-90 for each of these sites and the DOE Tier I BCG, the HQs for these radionuclides are all less than 1.0. These HQs are too small to impact the HIs for these sites. In addition, the DOE BCG incorporates bioaccumulation factors that are orders of magnitude higher than those in the ECORISK Database. Environmental surveillance and monitoring at the Laboratory indicate that bioaccumulation factors are not as high as those used by DOE (Bennett et al. 1996, 056035). Therefore, the ESL comparison is more representative than the BCG comparison.

F-5.6 Interpretation

F-5.6.1 Receptor Lines of Evidence

Based on the ecological risk-screening assessments, several COPECs (including COPECs without ESLs) were identified at the three sites at former TA-32. Receptors were evaluated using several lines of evidence: minimum ESL comparisons, HI analyses, comparison to background concentrations, potential effects to populations (individuals for T&E species), and LOAEL analyses.

Kestrel (Top Carnivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the kestrel (top carnivore), were less than 0.3.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The HIs were adjusted by the PAUF, which is the ratio of the site area to the kestrel population area. The adjusted HIs were less than 1.0 for the kestrel at all three sites.
- The kestrel (top carnivore) is a surrogate for the Mexican spotted owl. The HIs were adjusted by the AUF, which is the ratio of the site area to the individual home range. The adjusted HIs are less than 1.0 for all three sites.

These lines of evidence support the conclusion that no potential ecological risk to the kestrel (top carnivore) or the Mexican spotted owl exists at SWMU 32-002(b) and AOCs 32-003 and 32-004.

Kestrel (Intermediate Carnivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the kestrel (intermediate carnivore), were less than 0.3.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The HIs were adjusted by the PAUF, which is the ratio of the site area to the kestrel population area. The adjusted HIs were less than for the kestrel at all three sites.

These lines of evidence support the conclusion that no potential ecological risk to the kestrel (intermediate carnivore) exists at SWMU 32-002(b) and AOCs 32-003 and 32-004.

Robin (All Feeding Guilds)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the robin, were less than 0.3.
- The HI analysis had an HI less than 1 for the robin (herbivore) at AOC 32-003.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The HIs were adjusted by the PAUF, which is the ratio of the site area to the robin population area. The adjusted HIs were less than 1.0 for the robin at all three sites.

These lines of evidence support the conclusion that no potential ecological risk to the robin exists at SWMU 32-002(b) and AOCs 32-003 and 32-004.

Deer Mouse (Omnivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the deer mouse, were less than 0.3.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The HIs were adjusted by the PAUF, which is the ratio of the site area to the deer mouse population area. The adjusted HI was less than 1.0 at all three sites.

These lines of evidence support the conclusion that no potential ecological risk to the deer mouse exists at SWMU 32-002(b) and AOCs 32-003 and 32-004.

Desert Cottontail (Herbivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the cottontail, were less than 0.3.
- The HI analysis had an HI less than 1 for the cottontail at AOC 32-003.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The HIs were adjusted by the PAUF, which is the ratio of the site area to the cottontail population area. The adjusted HI was less than 1.0 at all three sites.

These lines of evidence support the conclusion that no potential ecological risk to the desert cottontail exists at SWMU 32-002(b) and AOCs 32-003 and 32-004.

Montane Shrew (Insectivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the shrew, were less than 0.3.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The HIs were adjusted by the PAUF, which is the ratio of the site area to the shrew population area. The adjusted HI was less than 1.0 at all three sites.

These lines of evidence support the conclusion that no potential ecological risk to the montane shrew exists at SWMU 32-002(b) and AOCs 32-003 and 32-004.

Red Fox (Carnivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the red fox, were less than 0.3.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The HIs were adjusted by the PAUF, which is the ratio of the site area to the red fox population area. The adjusted HI was less than 1.0 at all three sites.

These lines of evidence support the conclusion that no potential ecological risk to the red fox exists at SWMU 32-002(b) and AOCs 32-003 and 32-004.

Earthworm (Invertebrate)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the earthworm, were less than 0.3.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The LOAEL analyses resulted in an HI of 1.0 at AOC 32-004 and an HI of 18 at SWMU 32-002(b). The HI at SWMU 32-002(b) is due to mercury and is overestimated because the ESLs are not substantially different from the mercury BV (0.1 mg/kg).
- Field observations made during the site visit and field activities found no indication of adverse impacts on the plant community. Because the plant community does not appear to be affected by COPECs, the earthworm population is also probably not affected. Field observations did not indicate adverse effects of any kind and there appears to be functioning ecological habitat for all terrestrial receptors, including plants, invertebrates, birds, and mammals.

These lines of evidence support the conclusion that no potential ecological risk to the earthworm exists at AOCs 32-003 and 32-004. However, elevated mercury concentrations were detected in 1996 samples from SWMU 32-002(b), resulting in an elevated HI for the earthworm.

Plant

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the earthworm, were less than 0.3.
- Several COPECs were eliminated because their EPCs were similar to background concentrations.
- The LOAEL analyses resulted in HIs above 1.0 for the plant at SWMU 32-002(b) and AOC 32-004. The potential risks are based on the maximum detection limits for antimony. The use of the detection limits substantially overestimates the potential risk to the plant. Antimony was not detected above background in any sample and had much lower detection limits than the ones evaluated.
- The plant communities were evaluated during site visits. No evidence of adverse impacts of contamination to the plant communities based on field observations was found during site visits; the plant community was typical of the surrounding area and appears healthy. Field observations did not indicate adverse effects of any kind, and there appears to be functioning ecological habitat for all terrestrial receptors, including plants, invertebrates, birds, and mammals.

These lines of evidence support the conclusion that no potential ecological risk to the plant community exists at SWMU 32-002(b) and AOCs 32-003 and 32-004.

F-5.6.2 COPECs with No ESLs

The COPECs without ESLs were not evaluated for each receptor. If a residential SSL was available, it was used to estimate potential toxicity. All COPECs were eliminated based on these comparisons. The analysis of COPECs without ESLs supports the conclusion that there is no potential ecological risk to any receptor at SWMU 32-002(b) and AOCs 32-003 and 32-004.

F-6.0 CONCLUSIONS AND RECOMMENDATIONS

F-6.1 Human Health

The human health risk-screening assessments indicated no potential unacceptable risks or doses from COPCs for the industrial, recreational, construction worker, and residential scenarios at SWMU 32-002(b) and AOCs 32-003 and 32-004.

The total excess cancer risks were below or equivalent to the NMED target risk level of 1×10^{-5} (NMED 2009, 108070) for all four scenarios at all three sites evaluated. For SWMU 32-002(b) and AOC 32-004, the total excess cancer risks were slightly above the NMED target risk level. However, further evaluation of the EPC or COPCs contributing to the risks indicated that the residential EPC for arsenic was similar to background, and the risk did not incrementally increase above that which would result from exposure to naturally occurring levels of arsenic, or the COPCs (i.e., PAHs) were not site related. This evaluation resulted in the conclusion that no potential unacceptable risks exist from these sites for the residential scenario.

The HIs were less than or equivalent to the NMED target HI of 1.0 (NMED 2009, 108070) for all three sites evaluated.

The doses were below the DOE target dose of 15 mrem/yr at all three sites evaluated. The total equivalent risks ranged from 2×10^{-8} to 1×10^{-5} for the industrial scenario, 1×10^{-9} to 6×10^{-7} for the recreational scenario, 2×10^{-8} to 6×10^{-6} for the construction worker scenario, and 5×10^{-8} to 1×10^{-5} for the residential scenario.

The Laboratory's as low as reasonably achievable (ALARA) program description states that quantitative ALARA evaluations are not necessary for Laboratory activities that have a potential for annual public exposure less than a 3-mrem total effective dose equivalent individual dose ("Los Alamos National Laboratory Environmental ALARA Program," PD410, p. 7, effective November 8, 2008). The calculated radiation dose(s) for the residential scenario at the three sites ranged from 0.05 mrem/yr to 4 mrem/yr. The dose for SWMU 32-002(b) (4 mrem/yr) was background corrected by subtracting the background dose from the total dose per Standard Operating Procedure 5254, Performing ALARA analysis for Public Exposures. The background corrected dose for SWMU 32-002(b) was 3 mrem/yr, which satisfies PD410, as noted above. Therefore, radiation exposures to the public at the three sites evaluated at former TA-32 are ALARA.

F-6.2 Ecology

No potential ecological risks were found for any receptor at AOCs 32-003 and 32-004 based on minimum ESL comparisons, HI analyses, comparisons to background concentrations, potential effects to populations (individuals for T&E species), and LOAEL analyses. These lines of evidence, discussed above for each receptor, and the analysis of COPECs without ESLs support the conclusion that no potential ecological risks exist at these two sites at former TA-32. However, elevated mercury concentrations were detected at SWMU 32-002(b) based on the 1996 samples, resulting in an elevated HI for the earthworm.

F-7.0 REFERENCES

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

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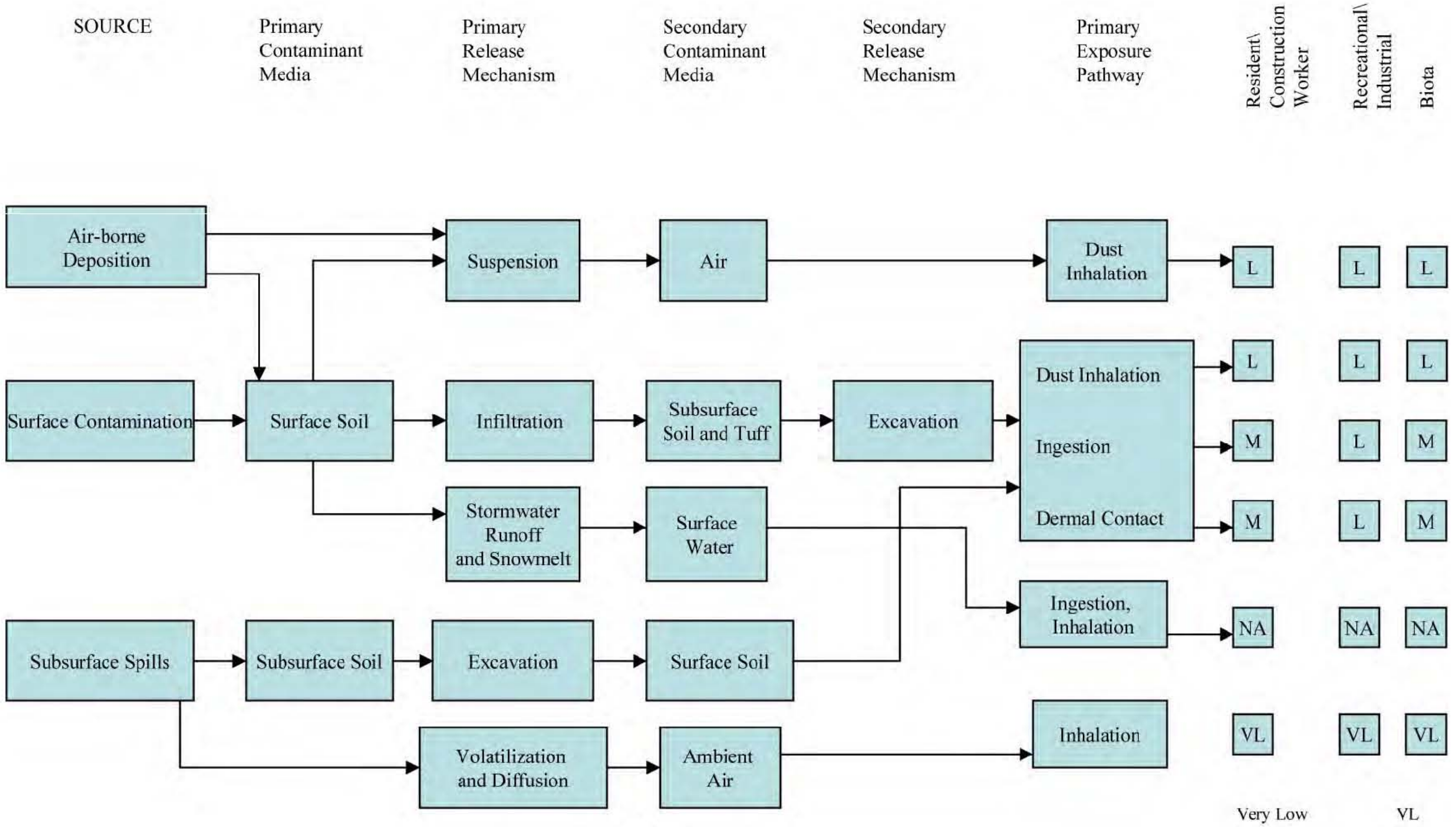


Very Low	VL
Low	L
Moderate	M
High	H
Not Applicable	NA

Figure F-3.1-1 Conceptual site model for Upper Los Alamos Canyon Aggregate Area

Table F-3.2-1
Physical and Chemical Properties of Inorganic COPCs

COPC	Kd[a] (cm^3/g)	Water Solubility[a,b] (g/L)
Antimony	45	Insoluble
Arsenic	29	Insoluble
Barium	41	Insoluble
Beryllium	790	Insoluble
Cadmium	75	Insoluble
Chromium	850[c]	Insoluble
Copper	35	Insoluble
Cyanide (total)	9.9	na[d]
Lead	900	Insoluble
Mercury	52	Insoluble
Nickel	65	Insoluble
Nitrate	0.0356	na
Perchlorate	na	2.45E+02
Selenium	5	Insoluble
Silver	8.3	Insoluble
Sodium	na	Soluble
Thallium	71[e]	Insoluble
Vanadium	1000	Insoluble
Zinc	62	Insoluble

[a] Information from http://rais.ornl.gov/cgi-bin/tox/TOX_select?select=nrad.

[b] Information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

[c] As chromium salts.

[d] na = Not available.

[e] As thallium salts.

Table F-3.2-2
Physical and Chemical Properties of Organic COPCs

COPC	Water Solubility[a] (mg/L)	Organic Carbon Coefficient K_{oc}[a] (L/kg)	Log Octanol-Water Partition Coefficient K_{ow}[a]	Vapor Pressure[a] (mm Hg at 25°C)
Acenaphthene	3.6E+00[b]	6.12E+03	3.92E+00[b]	2.5E-03[b]
Acetone	1.00E+06[b]	1.98E+00	-2.40E-01[b]	2.31E+02[b]
Anthracene	4.34E-02[b]	2.04E+04	4.45E+00[b]	2.67E-06[b]
Aroclor-1260	2.84E-04[b]	5.30E+05[c]	8.27E+00[b]	4.05E-05[b]
Benzo(a)anthracene	9.40E-03[b]	2.31E+05	5.76+00[b]	1.90E-06[b]
Benzo(a)pyrene	1.62E-03[b]	7.87E+05	6.13E+00[b]	5.49E-09[b]
Benzo(b)fluoranthene	1.50E-03[b]	8.03E+05	5.78E+00[b]	5.00E-07[b]
Benzo(g,h,i)perylene	2.60E-04[b]	2.68E+06	6.63E+00[b]	1.00E-10[b]
Benzoic acid	3.40E+03[b]	1.45E+01	1.87E+00[b]	7.00E-04[b]
Benzo(k)fluoranthene	8.00E-04[b]	7.87E+05	6.1E+00[b]	9.65E-10[b]
Bis(2-ethylhexyl)phthalate	2.70E-01[b]	1.65E+05	7.60E+00[b]	1.42E-07[b]
Butylbenzylphthalate	2.69E+00	9.36E+03	4.73E+00	8.25E-06
Chrysene	6.30E-03[b]	2.36E+05	5.81E+00[b]	6.23E-09[b]
Dibenz(a,h)anthracene	1.03E-03	2.62E+06	6.54E+00	1.39E-11
Dibenzofuran	3.1E+00	1.13E+04	4.12E+00	2.48E-03
Di-n-butylphthalate	1.12E+01	1.46E+03	4.50E+00	2.01E-05
Di-n-octylphthalate	2.00E-02	1.96E+05	8.1E+00	1.07E-07
Fluoranthene	2.06E-01[c]	7.09E+04[c]	5.16E+00[c]	9.22E-06[c]
Fluorene	1.89E+00[b]	1.13E+04	4.18E+00[b]	8.42E-04[b]
Indeno(1,2,3-cd)pyrene	1.90E-04[b]	2.68E+06	6.70E+00[b]	1.25E-10[b]
Methylene chloride	1.30E+04[b]	2.37E+01	1.30E+00[b]	4.30E+02[b]
Naphthalene	3.1E+01	1.84E+03	3.3E+00	8.5E-02
Phenanthrene	1.15E+00[b]	2.08E+04	4.46E+00[b]	1.12E-04[b]
Pyrene	1.35E-01[b]	6.94E+04	4.88E+00[b]	4.50E-06[b]
Tetrachloroethene	2.06E+02	1.07E+02	3.4E+00	1.85E+01
Trichlorofluoromethane	1.10E+03	4.86E+01	2.53E+00	8.03E+02

[a] Information from http://rais.ornl.gov/cgi-bin/tox/TOX_select?select=nrad, unless noted otherwise.

[b] Information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

[c] Information from NMED (2009, 108070).

Table F-3.2-3
Physical and Chemical Properties of Radionuclide COPCS

COPC	Soil-Water Partition Coefficient, Kd[a] (cm^3/g)	Water Solubility[b] (g/L)
Americium-241	680	Insoluble
Cesium-137	1000	Insoluble
Plutonium-238	4500	Insoluble
Plutonium-239/240	4500	Insoluble
Strontium-90	35	Insoluble
Tritium	9.9	Soluble
Uranium-234	0.4	Insoluble
Uranium-235/236	0.4	Insoluble
Uranium-238	0.4	Insoluble

[a] Information from Superfund Chemical Data Matrix (EPA 1996, 064708).

[b] Information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

Table F-3.3-1
EPCs at SWMU 32-002(b) 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)							
Antimony	13	0	0.075(U)	12(U)	n/a[a]	12(U)	Maximum detection limit
Arsenic	13	7	1	6.8	Normal	3.782	95% KM (t)
Barium	13	13	13	180	Gamma	86.36	95% Approximate Gamma
Chromium	13	12	1(U)	84	Gamma	53.9	95% KM (Chebyshev)
Copper	13	13	1.8	31	Lognormal	16.06	95% H-UCL
Cyanide (total)	3	0	0.28(U)	0.52(U)	n/a	0.52(U)	Maximum detection limit
Lead	13	13	4.4	220	Gamma	112.7	95% Approximate Gamma
Mercury	13	10	0.0523(U)	48	Gamma	29.27	95% KM (Chebyshev)
Nickel	13	5	2(U)	7.8	Gamma	3.928	95% KM (t)
Nitrate	3	2	0.55	3	n/a	3	Maximum detected concentration
Perchlorate	3	1	0.0051(U)	0.006	n/a	0.006	Maximum detected concentration
Selenium	13	3	0.26	1.2(U)	n/a	1[b]	Maximum detected concentration
Silver	13	8	0.097	21	Gamma	9.5	95% KM (BCA)
Thallium	13	1	0.21(U)	2.4(U)	n/a	1.3[b]	Maximum detected concentration
Zinc	13	13	21	190	Lognormal	83.56	95% H-UCL
Organic Chemicals (mg/kg)							
Aroclor-1260	3	2	0.031	0.041	n/a	0.041	Maximum detected concentration
Benzo(a)anthracene	9	1	0.039	0.34(U)	n/a	0.039[b]	Maximum detected concentration
Benzo(a)pyrene	9	1	0.061	0.34(U)	n/a	0.061[b]	Maximum detected concentration
Benzo(b)fluoranthene	9	2	0.039	0.34(U)	n/a	0.039[b]	Maximum detected concentration
Benzo(k)fluoranthene	9	1	0.072	0.34(U)	n/a	0.072[b]	Maximum detected concentration
Chrysene	9	3	0.038	0.18(U)	n/a	0.091[b]	Maximum detected concentration
Fluoranthene	9	3	0.044	0.18(U)	n/a	0.14[b]	Maximum detected concentration
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	3	3	0.00004	0.00032	n/a	0.00032	Maximum detected concentration
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	3	3	0.00000566	0.0000789	n/a	0.0000789	Maximum detected concentration

Table F-3.3-1 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	3	3	0.000000523	0.00000602	n/a	0.00000602	Maximum detected concentration
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	3	3	0.000000491	0.00000313	n/a	0.00000313	Maximum detected concentration
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	3	3	0.00000134	0.00000859	n/a	0.00000859	Maximum detected concentration
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	3	3	0.000000839	0.00000672	n/a	0.00000672	Maximum detected concentration
Hexachlorodibenzofuran[1,2,3,4,7,8-]	3	3	0.000000606	0.00000201	n/a	0.00000201	Maximum detected concentration
Hexachlorodibenzofuran[1,2,3,6,7,8-]	3	3	0.000000323	0.00000155	n/a	0.00000155	Maximum detected concentration
Hexachlorodibenzofuran[1,2,3,7,8,9-]	3	2	0.000000262(U)	0.000000485	n/a	0.000000485	Maximum detected concentration
Hexachlorodibenzofuran[2,3,4,6,7,8-]	3	3	0.000000444	0.00000299	n/a	0.00000299	Maximum detected concentration
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	3	3	0.000411	0.00246	n/a	0.00246	Maximum detected concentration
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	3	3	0.000013	0.000285	n/a	0.000285	Maximum detected concentration
Pentachlorodibenzodioxin[1,2,3,7,8-]	3	2	0.000000206(U)	0.00000109	n/a	0.00000109	Maximum detected concentration
Pentachlorodibenzofuran[1,2,3,7,8-]	3	2	0.000000151	0.000000216(U)	n/a	0.000000212[b]	Maximum detected concentration
Pentachlorodibenzofuran[2,3,4,7,8-]	3	3	0.00000037	0.00000093	n/a	0.00000093	Maximum detected concentration
Phenanthrene	9	1	0.072	0.35(U)	n/a	0.072[b]	Maximum detected concentration
Pyrene	9	3	0.041	0.18(U)	n/a	0.12[b]	Maximum detected concentration
Tetrachloroethene	3	1	0.00026(U)	0.006(U)	n/a	0.00053[b]	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	9	3	-0.002(U)	1.07	n/a	1.07	Maximum detected concentration
Cesium-137	7	5	0.046(U)	2.56	Normal	1.551	95% KM (t)
Plutonium-239/240	13	11	0.018(U)	5	Gamma	2.946	95% KM (Chebyshev)
Uranium-234	9	9	0.81	3.55	Gamma	2.092	95% Approximate Gamma
Uranium-235/236	9	1	0.027(U)	0.126(U)	n/a	0.102[b]	Maximum detected concentration
Uranium-238	9	9	0.592	3.04	Normal	1.855	95% Student's-t

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U or UJ) and thus the maximum detected concentration is less than the maximum concentration.

Table F-3.3-2
EPCs at SWMU 32-002(b) for the Ecological Receptors

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	30	0	0.075(U)	12(U)	n/a[a]	12(U)	Maximum detection limit
Arsenic	30	18	0.46(U)	7.5	Gamma	2.814	95% KM (t)
Barium	30	30	12.3	220	Lognormal	68.1	95% H-UCL
Chromium	30	29	1(U)	84	Gamma	32.27	95% KM (Chebyshev)
Copper	30	30	1.3	31	Lognormal	8.541	95% H-UCL
Cyanide (total)	15	0	0.1(U)	0.59(U)	n/a	0.59(U)	Maximum detection limit
Lead	30	30	2	220	Gamma	53.61	95% Approximate Gamma
Mercury	29	20	0.0185(U)	48	Gamma	9.211	95% KM (BCA)
Nickel	30	21	2(U)	22.6	Nonparametric	7.054	95% KM (BCA)
Nitrate	15	8	0.13	8.5	Gamma	2.108	95% KM (BCA)
Perchlorate	15	3	0.0021	0.006	n/a	0.006	Maximum detected concentration
Selenium	30	16	0.18	1.2(U)	Lognormal	0.448	95% KM (t)
Silver	30	20	0.037	21	Gamma	4.37	95% KM (BCA)
Thallium	30	5	0.13	2.4(U)	Nonparametric	0.305	95% KM (t)
Zinc	30	30	14.7	190	Gamma	57.53	95% Approximate Gamma
Organic Chemicals (mg/kg)							
Anthracene	26	1	0.085	0.39(U)	n/a	0.085[b]	Maximum detected concentration
Aroclor-1260	15	5	0.031	0.4	Gamma	0.109	95% KM (t)
Benzo(a)anthracene	26	4	0.023	0.39(U)	n/a	0.27[b]	Maximum detected concentration
Benzo(a)pyrene	26	4	0.03	0.41	n/a	0.41	Maximum detected concentration
Benzo(b)fluoranthene	26	5	0.039	0.69	Normal	0.168	95% KM (t)
Benzo(g,h,i)perylene	26	3	0.045	0.39(U)	n/a	0.3[b]	Maximum detected concentration
Benzo(k)fluoranthene	26	4	0.036	0.52	n/a	0.52	Maximum detected concentration
Benzoic acid	26	1	0.076	6.9(U)	n/a	0.076[b]	Maximum detected concentration

Table F-3.3-2 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Bis(2-ethylhexyl)phthalate	26	5	0.059	0.69(U)	Normal	0.185	95% KM (t)
Chrysene	26	6	0.038	0.48	Gamma	0.139	95% KM (t)
Dibenz(a,h)anthracene	26	1	0.09	0.69(U)	n/a	0.09[b]	Maximum detected concentration
Di-n-butylphthalate	26	1	0.16(U)	0.77	n/a	0.77	Maximum detected concentration
Fluoranthene	26	6	0.044	0.99	Lognormal	0.195	95% KM (BCA)
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	15	15	0.00000052	0.00032	Gamma	0.00014088	95% KM (Chebyshev)
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	15	10	0.000000195(U)	0.0000789	Gamma	0.000024791	95% KM (BCA)
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	15	8	0.0000000845(U)	0.00000602	Gamma	0.000001911	95% KM (BCA)
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	15	6	0.000000111(U)	0.00000313	Gamma	0.00000093950	95% KM (t)
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	15	8	0.000000118(U)	0.00000859	Gamma	0.0000030373	95% KM (BCA)
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	15	7	0.000000112(U)	0.00000672	Gamma	0.0000018685	95% KM (t)
Hexachlorodibenzofuran[1,2,3,4,7,8-]	15	8	0.0000000516(U)	0.00000201	Normal	0.00000088092	95% KM (t)
Hexachlorodibenzofuran[1,2,3,6,7,8-]	15	7	0.0000000556(U)	0.00000155	Normal	0.00000055747	95% KM (t)
Hexachlorodibenzofuran[1,2,3,7,8,9-]	15	3	0.0000000768(U)	0.000000485	n/a	0.000000485	Maximum detected concentration
Hexachlorodibenzofuran[2,3,4,6,7,8-]	15	7	0.0000000593(U)	0.00000299	Gamma	0.00000094145	95% KM (t)
Indeno(1,2,3-cd)pyrene	26	3	0.026	0.39(U)	n/a	0.26[b]	Maximum detected concentration
Methylene chloride	17	2	0.0015(U)	0.014	n/a	0.014	Maximum detected concentration
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	15	15	0.0000033	0.00246	Gamma	0.0011	95% KM (Chebyshev)
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	15	12	0.000000238(U)	0.000285	Gamma	0.00012548	95% KM (Chebyshev)
Pentachlorodibenzodioxin[1,2,3,7,8-]	15	3	0.0000000961(U)	0.00000109	n/a	0.00000109	Maximum detected concentration
Pentachlorodibenzofuran[1,2,3,7,8-]	15	3	0.0000000615(U)	0.00000023	n/a	0.00000023	Maximum detected concentration
Pentachlorodibenzofuran[2,3,4,7,8-]	15	7	0.0000000624(U)	0.00000116	Normal	0.00000053911	95% KM (t)
Phenanthrene	26	2	0.072	0.45	n/a	0.45	Maximum detected concentration
Pyrene	26	6	0.041	1	Lognormal	0.195	95% KM (BCA)
Tetrachloroethene	17	1	0.00026(U)	0.006(U)	n/a	0.00053[b]	Maximum detected concentration
Trichlorofluoromethane	17	1	0.003	0.012(U)	n/a	0.003[b]	Maximum detected concentration

Table F-3.3-2 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Radionuclides (pCi/g)							
Americium-241	22	3	-0.0158(U)	1.07	n/a	1.07	Maximum detected concentration
Cesium-137	23	5	0.06(U)	2.56	Normal	0.677	95% KM (t)
Plutonium-239/240	30	16	0.015(U)	5	Gamma	0.834	95% KM (t)
Strontium-90	15	1	-0.142(U)	0.45	n/a	0.45	Maximum detected concentration
Tritium	24	1	-0.75(U)	11.1(U)	n/a	0.09[b]	Maximum detected concentration
Uranium-234	24	22	0.333	3.55	Gamma	1.258	95% KM (BCA)
Uranium-235/236	24	6	0.012(U)	0.126(U)	Normal	0.0477	95% KM (t)
Uranium-238	24	22	0.211	3.04	Gamma	1.191	95% KM (BCA)

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U or UJ) and thus the maximum detected concentration is less than the maximum concentration.

Table F-3.3-3
EPCs at SWMU 32-002(b) for the Residential and Construction Worker Scenarios

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	45	2	0.075(U)	12(U)	n/a[a]	3.72[b]	Maximum detected concentration
Arsenic	45	31	0.353	7.91	Gamma	2.421	95% KM (Percentile Bootstrap)
Barium	45	45	6.85	220	Gamma	59.46	95% Approximate Gamma
Chromium	45	44	1(U)	167	Lognormal	42.67	95% KM (Chebyshev)
Copper	45	45	0.796	31	Lognormal	7.056	95% H-UCL
Cyanide (total)	22	0	0.1(U)	0.59(U)	n/a	0.59(U)	Maximum detection limit
Lead	45	45	0.407	220	Gamma	41.3	95% Approximate Gamma
Mercury	44	28	0.00889	48	Gamma	6.56	95% KM (BCA)
Nickel	45	36	1.46	28.5	Lognormal	9.347	95% KM (BCA)
Nitrate	22	13	0.13	8.5	Gamma	2.004	95% KM (BCA)
Perchlorate	22	3	0.0021	0.006	n/a	0.006	Maximum detected concentration
Selenium	45	25	0.18	1.2(U)	Nonparametric	0.442	95% KM (t)
Silver	45	30	0.26	21	Lognormal	8.256	95% KM (Chebyshev)
Thallium	45	14	0.075	2.4(U)	Nonparametric	0.251	95% KM (t)
Zinc	45	44	8.8(U)	190	Gamma	53.2	95% KM (BCA)
Organic Chemicals (mg/kg)							
Anthracene	34	1	0.085	0.4(U)	n/a	0.085[b]	Maximum detected concentration
Aroclor-1260	22	6	0.031	0.4	Gamma	0.0852	95% KM (t)
Benzo(a)anthracene	34	4	0.023	0.4(U)	n/a	0.27[b]	Maximum detected concentration
Benzo(a)pyrene	34	4	0.03	0.41	n/a	0.41	Maximum detected concentration
Benzo(b)fluoranthene	34	5	0.039	0.69	Normal	0.145	95% KM (t)
Benzo(g,h,i)perylene	34	3	0.045	0.4(U)	n/a	0.3[b]	Maximum detected concentration
Benzo(k)fluoranthene	34	4	0.036	0.52	n/a	0.52	Maximum detected concentration
Benzoic acid	34	1	0.076	6.9(U)	n/a	0.076[b]	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	34	8	0.059	0.7	Normal	0.219	95% KM (t)
Butylbenzylphthalate	34	2	0.051	0.69(U)	n/a	0.085b	Maximum detected concentration

Table F-3.3-3 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Chrysene	34	6	0.038	0.48	Gamma	0.123	95% KM (t)
Dibenz(a,h)anthracene	34	1	0.09	0.69(U)	n/a	0.09[b]	Maximum detected concentration
Di-n-butylphthalate	34	2	0.054	0.77	n/a	0.77	Maximum detected concentration
Fluoranthene	34	6	0.044	0.99	Lognormal	0.171	95% KM (BCA)
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	22	22	0.000000373	0.00032	Gamma	0.000099951	95% KM (Chebyshev)
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	22	12	0.000000195(U)	0.0000789	Gamma	0.00001891	95% KM (BCA)
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	22	9	0.0000000845(U)	0.00000602	Gamma	0.000001838	95% KM (t)
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	22	7	0.000000111(U)	0.000000313	Lognormal	0.00000073395	95% KM (t)
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	22	10	0.000000118(U)	0.00000859	Gamma	0.0000018393	95% KM (t)
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	22	9	0.000000112(U)	0.00000672	Gamma	0.0000013293	95% KM (t)
Hexachlorodibenzofuran[1,2,3,4,7,8-]	22	10	0.0000000516(U)	0.00000201	Gamma	0.00000067173	95% KM (t)
Hexachlorodibenzofuran[1,2,3,6,7,8-]	22	8	0.0000000556(U)	0.00000155	Gamma	0.0000004354	95% KM (t)
Hexachlorodibenzofuran[1,2,3,7,8,9-]	22	3	0.0000000361(U)	0.000000485	n/a	0.000000485	Maximum detected concentration
Hexachlorodibenzofuran[2,3,4,6,7,8-]	22	9	0.0000000593(U)	0.00000299	Gamma	0.00000068503	95% KM (t)
Indeno(1,2,3-cd)pyrene	34	3	0.026	0.4(U)	n/a	0.26[b]	Maximum detected concentration
Methylene chloride	25	4	0.0015(U)	0.014	n/a	0.014	Maximum detected concentration
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	22	22	0.00000321	0.00246	Gamma	0.00079401	95% KM (Chebyshev)
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	22	16	0.000000238(U)	0.000285	Gamma	0.000088594	95% KM (Chebyshev)
Pentachlorodibenzodioxin[1,2,3,7,8-]	22	3	0.000000091(U)	0.00000109	n/a	0.00000109	Maximum detected concentration
Pentachlorodibenzofuran[1,2,3,7,8-]	22	3	0.0000000615(U)	0.000000238(U)	n/a	0.00000023[b]	Maximum detected concentration
Pentachlorodibenzofuran[2,3,4,7,8-]	22	9	0.0000000624(U)	0.00000116	Normal	0.00000038135	95% KM (t)
Phenanthrene	34	2	0.072	0.45	n/a	0.45	Maximum detected concentration
Pyrene	34	7	0.041	1	Lognormal	0.158	95% KM (BCA)
Tetrachloroethene	25	1	0.00026(U)	0.006(U)	n/a	0.00053[b]	Maximum detected concentration
Trichlorofluoromethane	25	2	0.003	0.012(U)	n/a	0.006[b]	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	29	3	-0.0158(U)	1.07	n/a	1.07	Maximum detected concentration
Cesium-137	31	5	-0.06(U)	2.56	Normal	0.578	95% KM (t)

Table F-3.3-3 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Plutonium-239/240	38	17	-0.015(U)	5	Gamma	0.665	95% KM (t)
Strontium-90	22	1	-0.142(U)	0.45	n/a	0.45	Maximum detected concentration
Tritium	32	1	-0.75(U)	11.1(U)	n/a	0.09[b]	Maximum detected concentration
Uranium-234	32	26	0.333	3.55	Lognormal	1.365	95% KM (Chebyshev)
Uranium-235/236	32	7	0.012(U)	0.126(U)	Normal	0.0395	95% KM (t)
Uranium-238	32	27	0.211	3.04	Gamma	1	95% KM (BCA)

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U or UJ) and thus the maximum detected concentration is less than the maximum concentration.

Table F-3.3-4
Dioxin/Furan TEF Calculations for the Industrial and Recreational Scenarios (0–1 ft bgs)

Dioxin and Furan Congeners	EPC (mg/kg)	TEF*	TEF EPC (mg/kg)
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	0.00032	0.01	3.20E-06
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	0.0000789	0.01	7.89E-07
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	0.00000602	0.01	6.02E-08
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	0.00000313	0.1	3.13E-07
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	0.00000859	0.1	8.59E-07
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	0.00000672	0.1	6.72E-07
Hexachlorodibenzofuran[1,2,3,4,7,8-]	0.00000201	0.1	2.01E-07
Hexachlorodibenzofuran[1,2,3,6,7,8-]	0.00000155	0.1	1.55E-07
Hexachlorodibenzofuran[1,2,3,7,8,9-]	0.000000485	0.1	4.85E-08
Hexachlorodibenzofuran[2,3,4,6,7,8-]	0.00000299	0.1	2.99E-07
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	0.00246	0.0003	7.38E-07
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	0.000285	0.0003	8.55E-08
Pentachlorodibenzodioxin[1,2,3,7,8-]	0.00000109	1	1.09E-06
Pentachlorodibenzofuran[1,2,3,7,8-]	0.000000212	0.03	6.36E-09
Pentachlorodibenzofuran[2,3,4,7,8-]	0.00000093	0.3	2.79E-07
		2,3,7,8-TCDD Equivalent	**8.80E-06**

* TEF values from http://www.who.int/ipcs/assessment/tef_update/en/index.html.

Table F-3.3-5

Dioxin/Furan TEF Calculations for the Ecological Receptors (0–5 ft bgs)

Dioxin and Furan Congeners	EPC (mg/kg)	TEF*	TEF EPC (mg/kg)
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	0.00014088	0.01	1.41E-06
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	0.000024791	0.01	2.48E-07
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	0.000001911	0.01	1.91E-08
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	9.395E-07	0.1	9.40E-08
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	3.0373E-06	0.1	3.04E-07
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	1.8685E-06	0.1	1.87E-07
Hexachlorodibenzofuran[1,2,3,4,7,8-]	8.8092E-07	0.1	8.81E-08
Hexachlorodibenzofuran[1,2,3,6,7,8-]	5.5747E-07	0.1	5.57E-08
Hexachlorodibenzofuran[1,2,3,7,8,9-]	4.85E-07	0.1	4.85E-08
Hexachlorodibenzofuran[2,3,4,6,7,8-]	9.4145E-07	0.1	9.41E-08
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	0.0011	0.0003	3.30E-07
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	0.00012548	0.0003	3.76E-08
Pentachlorodibenzodioxin[1,2,3,7,8-]	1.09E-06	1	1.09E-06
Pentachlorodibenzofuran[1,2,3,7,8-]	2.3E-07	0.03	6.90E-09
Pentachlorodibenzofuran[2,3,4,7,8-]	5.3911E-07	0.3	1.62E-07
		2,3,7,8-TCDD Equivalent	**4.17E-06**

* TEF values from http://www.who.int/ipcs/assessment/tef_update/en/index.html.

Table F-3.3-6
Dioxin/Furan TEF Calculations
for the Residential and Construction Worker Scenarios (0–10 ft bgs)

Dioxin and Furan Congeners	EPC (mg/kg)	TEF*	TEF EPC (mg/kg)
Heptachlorodibenzodioxin[1,2,3,4,6,7,8-]	0.000099951	0.01	1.00E-06
Heptachlorodibenzofuran[1,2,3,4,6,7,8-]	0.00001891	0.01	1.89E-07
Heptachlorodibenzofuran[1,2,3,4,7,8,9-]	0.000001838	0.01	1.84E-08
Hexachlorodibenzodioxin[1,2,3,4,7,8-]	7.3395E-07	0.1	7.34E-08
Hexachlorodibenzodioxin[1,2,3,6,7,8-]	1.8393E-06	0.1	1.84E-07
Hexachlorodibenzodioxin[1,2,3,7,8,9-]	1.3293E-06	0.1	1.33E-07
Hexachlorodibenzofuran[1,2,3,4,7,8-]	6.7173E-07	0.1	6.72E-08
Hexachlorodibenzofuran[1,2,3,6,7,8-]	4.354E-07	0.1	4.35E-08
Hexachlorodibenzofuran[1,2,3,7,8,9-]	4.85E-07	0.1	4.85E-08
Hexachlorodibenzofuran[2,3,4,6,7,8-]	6.8503E-07	0.1	6.85E-08
Octachlorodibenzodioxin[1,2,3,4,6,7,8,9-]	0.00079401	0.0003	2.38E-07
Octachlorodibenzofuran[1,2,3,4,6,7,8,9-]	0.000088594	0.0003	2.66E-08
Pentachlorodibenzodioxin[1,2,3,7,8-]	1.09E-06	1	1.09E-06
Pentachlorodibenzofuran[1,2,3,7,8-]	2.3E-07	0.03	6.90E-09
Pentachlorodibenzofuran[2,3,4,7,8-]	3.8135E-07	0.3	1.14E-07
		2,3,7,8-TCDD Equivalent	**3.30E-06**

* TEF values from http://www.who.int/ipcs/assessment/tef_update/en/index.html.

Table F-3.3-7
EPCs at AOC 32-003 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)							
Antimony	2	0	0.29(U)	0.52(U)	n/a*	0.52(U)	Maximum detection limit
Beryllium	2	2	0.29	0.39	n/a	0.39	Maximum detected concentration
Chromium	2	2	3.6	8.1	n/a	8.1	Maximum detected concentration
Copper	2	2	5.4	11.5	n/a	11.5	Maximum detected concentration
Nickel	2	2	3.1	5.8	n/a	5.8	Maximum detected concentration
Selenium	2	0	0.52(U)	0.6(U)	n/a	0.6(U)	Maximum detection limit
Sodium	2	2	184	1970	n/a	1970	Maximum detected concentration
Zinc	2	2	42.9	90.4	n/a	90.4	Maximum detected concentration
Organic Chemicals (mg/kg)							
Aroclor-1260	7	6	0.0026	0.35	Normal	0.188	95% KM (t)
Benzo(a)anthracene	4	3	0.0143(U)	0.32	n/a	0.32	Maximum detected concentration
Benzo(a)pyrene	4	3	0.0202	0.44	n/a	0.44	Maximum detected concentration
Benzo(b)fluoranthene	4	2	0.0362(U)	0.57	n/a	0.57	Maximum detected concentration
Benzo(g,h,i)perylene	4	2	0.0184(U)	0.31	n/a	0.31	Maximum detected concentration
Benzo(k)fluoranthene	4	2	0.0306(U)	0.6	n/a	0.6	Maximum detected concentration
Chrysene	4	4	0.0248	0.68	n/a	0.68	Maximum detected concentration
Fluoranthene	4	4	0.0438	1.3	n/a	1.3	Maximum detected concentration
Indeno(1,2,3-cd)pyrene	4	2	0.00202(U)	0.3	n/a	0.3	Maximum detected concentration
Methylene chloride	2	1	0.0052(U)	0.016	n/a	0.016	Maximum detected concentration
Phenanthrene	4	4	0.0242	0.73	n/a	0.73	Maximum detected concentration
Pyrene	5	5	0.00455	1.1	Normal	0.814	95% Student's-t

* n/a = Not applicable.

Table F-3.3-8
EPCs at AOC 32-003 for the Ecological Receptors

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	20	0	0.08(U)	1.3(U)	n/a[a]	1.3(U)	Maximum detection limit
Beryllium	20	20	0.13	1.71	Nonparametric	0.707	95% Chebyshev (Mean, Sd)
Chromium	20	20	3.6	65.9	Gamma	22.35	95% Approximate Gamma
Copper	20	20	0.92	11.5	Lognormal	3.95	95% H-UCL
Nickel	20	20	3.1	32.5	Gamma	12.55	95% Approximate Gamma
Selenium	20	13	0.18	1.24(U)	Normal	0.289	95% KM (t)
Sodium	20	19	172	2730	Gamma	1524	95% KM (Chebyshev)
Zinc	20	20	19	90.4	Gamma	43.11	95% Approximate Gamma
Organic Chemicals (mg/kg)							
Anthracene	23	1	0.0103	2(U)	n/a	0.0103[b]	Maximum detected concentration
Aroclor-1260	26	15	0.0026	1.2	Gamma	0.179	95% KM (BCA)
Benzo(a)anthracene	23	5	0.00171(U)	0.44(U)	Normal	0.204	95% KM (t)
Benzo(a)pyrene	23	4	0.00192(U)	0.44	n/a	0.44	Maximum detected concentration
Benzo(b)fluoranthene	23	3	0.00171(U)	0.57	n/a	0.57	Maximum detected concentration
Benzo(g,h,i)perylene	23	3	0.00171(U)	0.44(U)	n/a	0.31[b]	Maximum detected concentration
Benzo(k)fluoranthene	23	2	0.000853	0.6	n/a	0.6	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	18	3	0.19	2(U)	n/a	0.82[b]	Maximum detected concentration
Chrysene	23	6	0.00171(U)	0.68	Normal	0.235	95% KM (t)
Fluoranthene	23	7	0.00171(U)	1.3	Gamma	0.288	95% KM (t)
Indeno(1,2,3-cd)pyrene	23	2	0.00171(U)	0.44(U)	n/a	0.3[b]	Maximum detected concentration
Methylene chloride	18	9	0.003	0.016	Normal	0.00871	95% KM (t)
Phenanthrene	23	6	0.0171(U)	0.73	Gamma	0.172	95% KM (t)
Pyrene	24	8	0.0006(U)	1.1	Gamma	0.223	95% KM (t)

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U) and thus the maximum detected concentration is less than the maximum concentration.

Table F-3.3-9
EPCs at AOC 32-003 for the Residential and Construction Worker Scenarios

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	27	0	0.08(U)	1.3(U)	n/a[a]	1.3(U)	Maximum detection limit
Beryllium	27	27	0.13	1.9	Nonparametric	0.781	95% Chebyshev (Mean, Sd)
Chromium	27	25	3.6	65.9	Gamma	30.51	95% Chebyshev (Mean, Sd)
Copper	27	25	0.92	11.5	Nonparametric	4.91	95% Chebyshev (Mean, Sd)
Nickel	27	27	2.88	32.5	Gamma	11.52	95% Approximate Gamma
Selenium	27	16	0.18	1.24(U)	Normal	0.289	95% KM (Percentile Bootstrap)
Sodium	27	24	172	2730	Gamma	1182	95% KM (BCA)
Zinc	27	27	19	90.4	Gamma	40.58	95% Approximate Gamma
Organic Chemicals (mg/kg)							
Anthracene	27	1	0.0103	2(U)	n/a	0.0103[b]	Maximum detected concentration
Aroclor-1260	36	21	0.0015	1.2	Gamma	0.142	95% KM (BCA)
Benzo(a)anthracene	27	5	0.00171(U)	0.44(U)	Normal	0.203	95% KM (t)
Benzo(a)pyrene	27	4	0.00192(U)	0.44	n/a	0.44	Maximum detected concentration
Benzo(b)fluoranthene	27	3	0.00171(U)	0.57	n/a	0.57	Maximum detected concentration
Benzo(g,h,i)perylene	27	3	0.00171(U)	0.44(U)	n/a	0.31[b]	Maximum detected concentration
Benzo(k)fluoranthene	27	2	0.000853(U)	0.6	n/a	0.6	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	22	6	0.067	2(U)	Normal	0.269	95% KM (t)
Chrysene	27	6	0.00171(U)	0.68	Normal	0.225	95% KM (t)
Fluoranthene	27	7	0.00171(U)	1.3	Gamma	0.262	95% KM (t)
Indeno(1,2,3-cd)pyrene	27	2	0.00171(U)	0.44(U)	n/a	0.3[b]	Maximum detected concentration
Methylene chloride	22	10	0.0033	0.016	Normal	0.00799	95% KM (t)
Phenanthrene	27	6	0.0171(U)	0.73	Gamma	0.156	95% KM (t)
Pyrene	28	8	0.0006(U)	1.1	Gamma	0.204	95% KM (t)

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U) and thus the maximum detected concentration is less than the maximum concentration.

Table F-3.3-10
EPCs at AOC 32-004 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)							
Antimony	7	0	10(U)	12(U)	n/a[a]	12(U)	Maximum detection limit
Chromium	7	7	1	32	Gamma	25.69	95% Approximate Gamma
Copper	7	7	1.2	26	Normal	15.88	95% Student’s-t
Lead	7	7	9.5	200	Gamma	150.3	95% Approximate Gamma
Mercury	7	1	0.1(U)	0.12(U)	n/a	0.11[b]	Maximum detected concentration
Nickel	7	1	2(U)	6.3	n/a	6.3	Maximum detected concentration
Selenium	7	0	1(U)	1.2(U)	n/a	1.2(U)	Maximum detection limit
Silver	7	1	2(U)	3.3	n/a	3.3	Maximum detected concentration
Thallium	7	0	2(U)	2.4(U)	n/a	2.4(U)	Maximum detection limit
Zinc	7	7	20	150	Normal	100.5	95% Student’s-t
Organic Chemicals (mg/kg)							
Anthracene	7	3	0.0457(U)	0.541	n/a	0.541	Maximum detected concentration
Benzo(a)anthracene	7	4	0.036	2.52	n/a	2.52	Maximum detected concentration
Benzo(a)pyrene	7	4	0.037	2.17	n/a	2.17	Maximum detected concentration
Benzo(b)fluoranthene	7	3	0.0677(U)	3.81	n/a	3.81	Maximum detected concentration
Benzo(g,h,i)perylene	7	3	0.0269	1.55	n/a	1.55	Maximum detected concentration
Benzo(k)fluoranthene	7	1	0.00229(U)	1.46(U)	n/a	1.36[b]	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	7	4	0.16(U)	1.8	n/a	1.8	Maximum detected concentration
Butylbenzylphthalate	7	5	0.16(U)	8.3	Normal	4.441	95% KM (t)
Chrysene	7	5	0.0372	2.68	Normal	1.748	95% KM (t)
Fluoranthene	7	6	0.0792	4.76	Gamma	4.738	95% KM (Chebyshev)
Phenanthrene	7	4	0.0317	3.23	n/a	3.23	Maximum detected concentration
Pyrene	7	5	0.0629	4.16	Normal	2.414	95% KM (t)
Radionuclides (pCi/g)							
Americium-241	6	1	0.009(U)	0.104(U)	n/a	0.091[b]	Maximum detected concentration

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U) and thus the maximum detected concentration is less than the maximum concentration.

Table F-3.3-11
EPCs at AOC 32-004 for the Ecological Receptors

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	11	0	0.22(U)	12(U)	n/a[a]	12(U)	Maximum detection limit
Chromium	11	11	1	44.6	Gamma	25.01	95% Approximate Gamma
Copper	11	11	1.2	26	Gamma	13.36	95% Approximate Gamma
Lead	11	11	3.7	200	Gamma	87.06	95% Approximate Gamma
Mercury	11	3	0.0142(U)	0.55	n/a	0.55	Maximum detected concentration
Nickel	11	5	2(U)	24.1	Gamma	10.61	95% KM (t)
Nitrate	2	1	0.24(U)	0.26	n/a	0.26	Maximum detected concentration
Selenium	11	2	0.23	1.2(U)	n/a	0.25[b]	Maximum detected concentration
Silver	11	3	0.058	3.3	n/a	3.3	Maximum detected concentration
Thallium	11	0	0.14(U)	2.4(U)	n/a	2.4(U)	Maximum detection limit
Zinc	11	11	20	150	Normal	84.08	95% Student's-t
Organic Chemicals (mg/kg)							
Acetone	4	1	0.002	0.024(U)	n/a	0.002[b]	Maximum detected concentration
Anthracene	15	5	0.0369(U)	0.541	Normal	0.191	95% KM (t)
Benzo(a)anthracene	15	9	0.0113	2.52	Gamma	0.804	95% KM (BCA)
Benzo(a)pyrene	15	8	0.0125(U)	2.17	Gamma	0.817	95% KM (BCA)
Benzo(b)fluoranthene	15	7	0.0234(U)	3.81	Normal	1.411	95% KM (t)
Benzo(g,h,i)perylene	15	6	0.0114	1.55	Normal	0.572	95% KM (t)
Benzo(k)fluoranthene	15	3	0.00185(U)	1.46(U)	n/a	1.36[b]	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	11	6	0.097	1.8	Normal	0.724	95% KM (t)
Butylbenzylphthalate	11	6	0.16(U)	8.3	Normal	2.892	95% KM (t)
Chrysene	15	10	0.0128	2.68	Gamma	0.95	95% KM (BCA)
Di-n-octylphthalate	11	1	0.097	0.89(U)	n/a	0.097[b]	Maximum detected concentration

Table F-3.3-11 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Fluoranthene	15	12	0.027	4.76	Gamma	2.549	95% KM (Chebyshev)
Indeno(1,2,3-cd)pyrene	15	1	0.00369(U)	0.5(U)	n/a	0.16 [b]	Maximum detected concentration
Phenanthrene	15	10	0.0104	3.23	Gamma	0.872	95% KM (BCA)
Pyrene	15	11	0.0209	4.16	Gamma	2.099	95% KM (Chebyshev)
Radionuclides (pCi/g)							
Americium-241	8	1	0.009(U)	0.104(U)	n/a	0.091[b]	Maximum detected concentration

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U) and thus the maximum detected concentration is less than the maximum concentration.

Table F-3.3-12
EPCs at AOC 32-004 for the Residential and Construction Worker Scenarios

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	12	0	0.22(U)	12(U)	n/a[a]	12(U)	Maximum detection limit
Chromium	12	12	1	44.6	Gamma	24.59	95% Approximate Gamma
Copper	12	12	1.2	26	Gamma	12.15	95% Approximate Gamma
Cyanide (total)	3	0	0.21(U)	0.55(U)	n/a	0.55(U)	Maximum detection limit
Lead	12	12	0.21	200	Gamma	79.4	95% Approximate Gamma
Mercury	12	3	0.0142(U)	0.55	n/a	0.55	Maximum detected concentration
Nickel	12	6	2(U)	24.1	Normal	10.77	95% KM (t)
Nitrate	3	1	0.22(U)	0.26	n/a	0.26	Maximum detected concentration
Selenium	12	3	0.23	1.2(U)	n/a	0.31[b]	Maximum detected concentration
Silver	12	4	0.054(U)	3.3	n/a	3.3	Maximum detected concentration
Thallium	12	0	0.14(U)	2.4(U)	n/a	2.4(U)	Maximum detection limit
Zinc	12	12	0.14	150	Gamma	85.4	95% Approximate Gamma
Organic Chemicals (mg/kg)							
Acetone	5	1	0.002	0.024(U)	n/a	0.002 [b]	Maximum detected concentration
Anthracene	16	5	0.0369(U)	0.541	Normal	0.186	95% KM (t)
Benzo(a)anthracene	16	9	0.0113	2.52	Gamma	0.797	95% KM (BCA)
Benzo(a)pyrene	16	8	0.0125(U)	2.17	Gamma	0.729	95% KM (t)
Benzo(b)fluoranthene	16	7	0.0234(U)	3.81	Normal	1.335	95% KM (t)
Benzo(g,h,i)perylene	16	6	0.0144(U)	1.55	Normal	0.541	95% KM (t)
Benzo(k)fluoranthene	16	3	0.00185(U)	1.46(U)	n/a	1.36[b]	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	12	7	0.058	1.8	Normal	0.663	95% KM (t)
Butylbenzylphthalate	12	6	0.16	8.3	Normal	2.672	95% KM (t)
Chrysene	16	10	0.0128	2.68	Gamma	0.958	95% KM (BCA)
Di-n-octylphthalate	12	1	0.097	0.89(U)	n/a	0.097 [b]	Maximum detected concentration

Table F-3.3-12 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Fluoranthene	16	12	0.027	4.76	Gamma	2.414	95% KM (Chebyshev)
Indeno(1,2,3-cd)pyrene	16	1	0.00369(U)	0.5(U)	n/a	0.16 [b]	Maximum detected concentration
Phenanthrene	16	10	0.0104	3.23	Gamma	0.853	95% KM (BCA)
Pyrene	16	11	0.0209	4.16	Gamma	1.21	95% KM (BCA)
Radionuclides (pCi/g)							
Americium-241	9	1	-0.019 (U)	0.104(U)	n/a	0.091 [b]	Maximum detected concentration

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U) and thus the maximum detected concentration is less than the maximum concentration.

Table F-3.3-13
EPCs for PAHs after Removing PAH Results at Location 32-06340 at AOC 32-004 for the Residential Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Anthracene	14	3	0.0369(U)	0.39(U)	n/a[a]	0.242[b]	Maximum detected concentration
Benzo(a)anthracene	14	7	0.0113	1.7	Gamma	0.49	95% KM (t)
Benzo(a)pyrene	14	6	0.0125(U)	1.93	Gamma	0.546	95% KM (t)
Benzo(b)fluoranthene	14	5	0.0234(U)	3.81	Normal	1.045	95% KM (t)
Benzo(g,h,i)perylene	14	4	0.0114(U)	1.55	n/a	1.55	Maximum detected concentration
Benzo(k)fluoranthene	14	3	0.00185(U)	1.36	n/a	1.36	Maximum detected concentration
Chrysene	14	8	0.0128	2.48	Gamma	0.69	95% KM (BCA)
Fluoranthene	14	10	0.027	3.79	Gamma	1.757	95% KM (Chebyshev)
Indeno(1,2,3-cd)pyrene	14	1	0.00369(U)	0.39(U)	n/a	0.16[b]	Maximum detected concentration
Phenanthrene	14	8	0.0104	1.52	Gamma	0.479	95% KM (BCA)
Pyrene	14	9	0.0209	2.86	Gamma	0.81	95% KM (BCA)

[a] n/a = Not applicable.

[b] The maximum concentration of the data set is a nondetect (U) and thus the maximum detected concentration is less than the maximum concentration.

Table F-4.1-1
Exposure Parameter Values Used to Calculate Chemical SSLs for the Residential, Industrial, Construction Worker, and Recreational Scenarios

Parameter	Residential Value	Industrial Value	Construction Worker Value	Recreational Value
Target HQ	1	1	1	1
Target cancer risk	10^{-5}	10^{-5}	10^{-5}	10^{-5}
Averaging time (carcinogen)	70 yr × 365 d	70 yr × 365 d	70 yr × 365 d	70 yr × 365 d
Averaging time (noncarcinogen)	ED × 365 d	ED × 365 d	ED × 365 d	ED × 365 d
Skin absorption factor	SVOC = 0.1	SVOC = 0.1	SVOC = 0.1	SVOC = 0.1
	Chemical-specific	Chemical-specific	Chemical-specific	Chemical-specific
Adherence factor–child	0.2 mg/cm^2	n/a[a]	n/a	0.2 mg/cm^2
Body weight–child	15 kg (0–6 yr of age)	n/a	n/a	31 kg (6–11 yr of age)
Cancer slope factor–oral (chemical-specific)	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$
Cancer slope factor–inhalation (chemical-specific)	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$
Exposure frequency	350 d/yr	225 d/yr	250 d/yr	225 events/yr
Exposure duration–child	6 yr	n/a	n/a	6 yr
Age-adjusted ingestion factor	114 mg-yr/kg-d	n/a	n/a	22.6 mg-yr/kg-d
Age-adjusted inhalation factor	11 m^3-yr/kg-d	n/a	n/a	0.8 m^3-yr/kg-d
Inhalation rate–child	10 m^3/d	n/a	n/a	1.2 m^3/d
Soil ingestion rate–child	200 mg/d	n/a	n/a	71.4 mg/d
Particulate emission factor	6.61 × 10^9 m^3/kg	6.61 × 10^9 m^3/kg	2.1 × 10^6 m^3/kg	6.61 × 10^9 m^3/kg
Reference dose–oral (chemical-specific)	(mg/kg-d)	(mg/kg-d)	(mg/kg-d)	(mg/kg-d)
Reference dose–inhalation (chemical-specific)	(mg/kg-d)	(mg/kg-d)	(mg/kg-d)	(mg/kg-d)
Exposed surface area–child	2800 cm^2/d	n/a	n/a	3525 cm^2/d
Age-adjusted skin contact factor for carcinogens	361 mg-yr/kg-d	n/a	n/a	273.3 mg-yr/kg-d
Volatilization factor for soil (chemical-specific)	(m^3/kg)	(m^3/kg)	(m^3/kg)	(m^3/kg)
Body weight–adult	70 kg	70 kg	70 kg	70 kg
Exposure duration[b]	30 yr	25 yr	1 yr	30 yr
Adherence factor–adult	0.07 mg/cm^2	0.2 mg/cm^2	0.3 mg/cm^2	0.07 mg/cm^2
Soil ingestion rate–adult	100 mg/d	100 mg/d	330 mg/d	25.6 mg/d
Exposed surface area–adult	5700 cm^2/d	3300 cm^2/d	3300 cm^2/d	5700 cm^2/d
Inhalation rate–adult	20 m^3/d	20 m^3/d	20 m^3/d	1.6 m^3/d

Note: Parameter values from NMED (2009, 108070).

[a] n/a = Not applicable.

[b] Exposure duration for lifetime resident is 30 yr. For carcinogens, the exposures are combined for child (6 yr) and adult (24 yr).

Table F-4.1-2
Parameter Values Used to Calculate Radionuclide SALs for the Residential and Recreational Scenarios

Parameter	Residential, Adult	Residential, Child	Recreational, Adult	Recreational, Child
Inhalation rate (m^3/yr)	7305[a]	3652.5[b]	14,035[c]	10,526[d]
Mass loading (g/m^3)	1.5×10^{-7} [e]	1.5×10^{-7} [e]	1.5×10^{-7} [e]	1.5×10^{-7} [e]
Outdoor time fraction	0.0599[f]	0.2236[g]	0.0228[h]	0.0228[h]
Indoor time fraction	0.8984[i]	0.7347[j]	0	0
Soil ingestion (g/yr)	36.5[k]	73[l]	225[m]	73[n]

[a] Calculated as [20 m^3/d × 350 d/yr] / [indoor + outdoor time fractions], where 20 m^3/d is the daily inhalation rate of an adult (NMED 2009, 108070).

[b] Calculated as [10 m^3/d × 350 d/yr] / [indoor + outdoor time fractions], where 10 m^3/d is the daily inhalation rate of a child (NMED 2009, 108070).

[c] Calculated as [1.60 m^3/d × 200 h/yr] / [indoor + outdoor time fractions], where 1.6 m^3/d is the adult inhalation rate for moderate activity (EPA 1997, 066596, Table 5-23).

[d] Calculated as [1.2 m^3/d × 200 h/yr] / [indoor + outdoor time fractions], where 1.2 m^3/d is the child inhalation rate for moderate activity (EPA 1997, 066596, Table 5-23).

[e] Calculated as [1/ 6.6 × 10^{+9} m^3/kg) × 1000 g/kg, where 6.6 × 10^{+9} m^3/kg is the particulate emission factor (2009, 108070).

[f] Calculated as [1.5 h/d × 350 d/yr] / 8766 h/yr, where 1.5 h/d is an estimate of time spent outdoors for an adult 12 yr and older (EPA 1997, 066598, Section 15.4-1).

[g] Calculated as [5.6 h/d × 350 d/yr] / 8766 h/yr, where 5.6 h/d is an estimate of time spent outdoors for a 3–11 yr old child (EPA 1997, 066598, Section 15.4-1).

[h] Calculated as [1 h/d × 200 d/yr] / 8766 h/yr, where 1 h/d is an estimate of exposure time for a recreational adult or child (LANL 2010, 108613).

[i] Calculated as [24-1.5 h/d × 350 d/yr] / 8766 h/yr, where 1.5 h/d is an estimate of time spent outdoors for an adult 12 yr and older (EPA 1997, 066598, Section 15.4-1).

[j] Calculated as [24-5.6 h/d × 350 d/yr] / 8766 h/yr, where 5.6 h/d is an estimate of time spent outdoors for a 3–11 yr old child (EPA 1997, 066598, Section 15.4-1).

[k] Calculated as [0.1 g/d × 350 d/yr] / [indoor + outdoor time fractions], where 0.1 g/d is the adult soil ingestion rate (NMED, 2009, 108070).

[l] Calculated as [0.2 g/d × 350 d/yr] / [indoor + outdoor time fractions], where 0.2 g/d is the child soil ingestion rate (NMED, 2009, 108070).

[m] Calculated as [(0.1 g/d × 3.9 h/d) × 200 h/yr] / [indoor + outdoor time fractions], where 3.9 h/d is the time-weighted average for “doers” ages 12-44 (EPA 1997, 066598, Table 15-10), and where 0.1 g/d is the adult soil-ingestion rate (NMED 2009, 108070).

[n] Calculated as [(0.4 g/d × 5.6 h/d) × 200 h/yr] / [indoor + outdoor time fractions], where 5.6 h/d is the time spent outdoors for a child (EPA 1997, 066598, Section 15.4.1), and where 0.4 g/d is the upper bound child soil-ingestion rate (EPA 1997, 066598, Table 4-23).

Table F-4.1-3
Parameter Values Used to Calculate Radionuclide SALs for the Industrial and Construction Worker Scenarios

Parameter	Industrial, Adult	Construction Worker, Adult
Inhalation rate (m^3/yr)	19,481[a]	19,478[b]
Mass loading (g/m^3)	1.5×10^{-7} [c]	0.0004[d]
Outdoor time fraction	0.2053[e]	0.2567[f]
Indoor time fraction	0	0
Soil ingestion (g/yr)	97.4[g]	321[h]

[a] Calculated as [20 m^3/d × 225 d/yr] / [indoor + outdoor time fractions], where 20 m^3/d is the daily inhalation rate of an adult and 225 d/yr is the exposure frequency (NMED 2009, 108070).

[b] Calculated as [20 m^3/d × 250 d/yr] / [indoor + outdoor time fractions], where 20 m^3/d is the daily inhalation rate of an adult and 250 d/yr is the exposure frequency (NMED 2009, 108070).

[c] Calculated as [1/ $6.6 \times 10^{+9}$ m^3/kg) × 1000 g/kg, where $6.6 \times 10^{+9}$ m^3/kg is the particulate emission factor (NMED 2009, 108070).

[d] Calculated as [1/ $2.1 \times 10^{+6}$ m^3/kg) × 1000 g/kg, where $2.1 \times 10^{+6}$ m^3/kg is the particulate emission factor (NMED 2009, 108070).

[e] Calculated as [8 h/d × 225 d/yr] / 8766 h/yr, where 8 h/d is an estimate of the average length of the work d.

[f] Calculated as [9 h/d × 250 d/yr] / 8766 h/yr, where 9 h/d is an estimate of the average length of the work day.

[g] Calculated as [0.1 g/d × 225 d/yr] / [indoor + outdoor time fractions], where 0.1 g/d is the adult soil ingestion rate (NMED 2009, 108070).

[h] Calculated as [0.33 g/d × 250 d/yr] / [indoor + outdoor time fractions], where 0.33 g/d is the adult soil ingestion rate (NMED 2009, 108070).

Table F-4.2-1
Industrial Carcinogenic Screening for SWMU 32-002(b)

COPC	EPC (mg/kg)	Industrial SSL* (mg/kg)	Cancer Risk
Arsenic	3.782	17.7	2E-06
Aroclor-1260	0.041	8.26	5E-08
Benzo(a)anthracene	0.039	23.4	2E-08
Benzo(a)pyrene	0.061	2.34	3E-07
Benzo(b)fluoranthene	0.039	23.4	2E-08
Benzo(k)fluoranthene	0.072	234	3E-09
Chrysene	0.091	2340	4E-10
Tetrachloroethene	0.00053	36.4	1E-10
2,3,7,8-TCDD equivalent	8.80E-06	2.04E-04	4E-07
		Total Excess Cancer Risk	**3E-06**

* SSLs from NMED (2009, 108070).

Table F-4.2-2
Industrial Noncarcinogenic Screening Evaluation for SWMU 32-002(b)

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Antimony	12(U)	454	3E-02
Barium	86.36	224000	4E-04
Chromium	53.9	2920[b]	2E-02
Copper	16.06	45400	4E-04
Cyanide (total)	0.52(U)	22700	2E-05
Lead	112.7	800	1E-01
Mercury	29.27	310[c]	9E-02
Nickel	3.928	22700	2E-04
Nitrate	3	1820000	2E-06
Perchlorate	0.006	795	8E-06
Selenium	1	5680	2E-04
Silver	9.5	5680	2E-03
Thallium	1.3	74.9	2E-02
Zinc	83.56	341000	2E-04
Fluoranthene	0.14	24400	6E-06
Phenanthrene	0.072	20500	4E-06
Pyrene	0.12	18300	7E-06
		HI	**0.3**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL is for hexavalent chromium.

[c] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

Table F-4.2-3
Industrial Radionuclide Screening for SWMU 32-002(b)

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Total Dose (mrem/yr)
Americium-241	1.07	180	0.09
Cesium-137	1.551	23	1.01
Plutonium-239/240	2.946	210	0.21
Uranium-234	2.092	1500	0.02
Uranium-235/236	0.102	87	0.02
Uranium-238	1.855	430	0.06
		Total Dose	**1**

*SALs from LANL (2009, 107655).

Table F-4.2-4
Recreational Carcinogenic Screening for SWMU 32-002(b)

COPC	EPC (mg/kg)	Recreational SSL* (mg/kg)	Cancer Risk
Arsenic	3.782	27.7	1E-06
Aroclor-1260	0.041	10.5	4E-08
Benzo(a)anthracene	0.039	30.1	1E-08
Benzo(a)pyrene	0.061	3.01	2E-07
Benzo(b)fluoranthene	0.039	30.1	1E-08
Benzo(k)fluoranthene	0.072	301	2E-09
Chrysene	0.091	3010	3E-10
Tetrachloroethene	0.00053	91.7	6E-11
2,3,7,8-TCDD equivalent	8.80E-06	3.19E-04	3E-07
		Total Excess Cancer Risk	**2E-06**

* SSLs from LANL (2010, 108613).

Table F-4.2-5
Recreational Noncarcinogenic Screening Evaluation for SWMU 32-002(b)

COPC	EPC (mg/kg)	Recreational SSL[a] (mg/kg)	HQ
Antimony	12(U)	317	4E-02
Barium	86.36	158000	5E-04
Chromium	53.9	1910[b]	3E-02
Copper	16.06	31700	5E-04
Cyanide (total)	0.52(U)	15800	3E-05
Lead	112.7	560	2E-01
Mercury	29.27	238	1E-01
Nickel	3.928	15800	2E-04
Nitrate	3	1260000	2E-06
Perchlorate	0.006	555	1E-05
Selenium	1	3960	3E-04
Silver	9.5	3960	2E-03
Thallium	1.3	52.3	2E-02
Zinc	83.56	238000	4E-04
Fluoranthene	0.14	13900	1E-05
Phenanthrene	0.072	12000	6E-06
Pyrene	0.12	10400	1E-05
		HI	**0.4**

[a] SSLs from LANL (2010, 108613).

[b] SSL is for hexavalent chromium.

Table F-4.2-6
Recreational Radionuclide Screening for SWMU 32-002(b)

COPC	EPC (pCi/g)	Recreational SAL* (pCi/g)	Total Dose (mrem/yr)
Americium-241	1.07	280	0.06
Cesium-137	1.551	210	0.11
Plutonium-239/240	2.946	300	0.15
Uranium-234	2.092	3200	0.01
Uranium-235/236	0.102	520	0.003
Uranium-238	1.855	2100	0.01
		Total Dose	**0.3**

* SALs from LANL (2009, 107655).

Table F-4.2-7
Construction Worker Carcinogenic Screening for SWMU 32-002(b)

COPC	EPC (mg/kg)	Construction Worker SSL[a] (mg/kg)	Cancer Risk
Aroclor-1260	0.0852	75.8	1E-08
Benzo(a)anthracene	0.27	213	1E-08
Benzo(a)pyrene	0.41	21.3	2E-07
Benzo(b)fluoranthene	0.145	213	7E-09
Benzo(k)fluoranthene	0.52	2060	3E-09
Butylbenzylphthalate	0.085	47600[b]	2E-11
Chrysene	0.123	20600	6E-11
Dibenz(a,h)anthracene	0.09	21.3	4E-08
Indeno(1,2,3-cd)pyrene	0.26	213	1E-08
Tetrachloroethene	0.00053	338	2E-11
		Total Excess Cancer Risk	**3E-07**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL is calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

Table F-4.2-8
Construction Worker Noncarcinogenic Screening Evaluation for SWMU 32-002(b)

COPC	EPC (mg/kg)	Construction Worker SSL[a] (mg/kg)	HQ
Antimony	3.72	124	3E-02
Arsenic	2.421	65.4	4E-07
Barium	59.46	4350	1E-02
Chromium	42.67	449[b]	1E-01
Copper	7.065	12400	6E-04
Cyanide (total)	0.59(U)	6190	1E-04
Lead	41.3	800	5E-02
Mercury	6.56	92.9[c]	7E-02
Nickel	9.347	6190	2E-03
Nitrate	2.004	496000	4E-06
Perchlorate	0.006	217	3E-05
Selenium	0.442	1550	3E-04
Silver	8.256	1550	5E-03
Thallium	0.251	20.4	1E-02
Zinc	53.2	92900	6E-04
Anthracene	0.085	66800	1E-06
Benzo(g,h,i)perylene	0.3	6680[d]	4E-05
Benzoic acid	0.076	952000[c]	E-08
Bis(2-ethylhexyl)phthalate	0.219	4760	5E-10
Di-n-butylphthalate	0.77	23800	3E-05
Fluoranthene	0.171	8910	2E-05
Methylene chloride	0.014	10600	1E-11
Phenanthrene	0.45	7150	6E-05
Pyrene	0.158	6680	2E-05
Trichlorofluoromethane	0.006	5820	1E-06
2,3,7,8-TCDD equivalent	3.30E-06	2.84E-04	1E-07
		HI	**0.3**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL is for hexavalent chromium.

[c] SSL is calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

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

Table F-4.2-9
Construction Worker Radionuclide Screening for SWMU 32-002(b)

COPC	EPC (pCi/g)	Construction Worker SAL* (pCi/g)	Total Dose (mrem/yr)
Americium-241	1.07	34	0.47
Cesium-137	0.578	18	0.48
Plutonium-239/240	0.665	36	0.28
Strontium-90	0.45	800	0.01
Tritium	0.09	320000	0.000004
Uranium-234	1.365	220	0.09
Uranium-235/236	0.0395	43	0.01
Uranium-238	1	160	0.09
		Total Dose	**1**

* SALs from LANL (2009, 107655).

Table F-4.2-10
Residential Carcinogenic Screening for SWMU 32-002(b)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	Cancer Risk
Arsenic	2.421	3.9	6E-06
Aroclor-1260	0.0852	2.22	4E-07
Benzo(a)anthracene	0.27	6.21	4E-07
Benzo(a)pyrene	0.41	0.621	7E-06
Benzo(b)fluoranthene	0.145	6.21	2E-07
Benzo(k)fluoranthene	0.52	62.1	8E-08
Bis(2-ethylhexyl)phthalate	0.219	347	6E-09
Butylbenzylphthalate	0.085	2600[b]	3E-10
Chrysene	0.123	621	2E-09
Dibenz(a,h)anthracene	0.09	0.621	1E-06
Indeno(1,2,3-cd)pyrene	0.26	6.21	4E-07
Methylene chloride	0.014	199	7E-10
Tetrachloroethene	0.00053	6.99	8E-10
2,3,7,8-TCDD equivalent	3.30E-06	4.50E-05	7E-07
		Total Excess Cancer Risk	**2E-05**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

Table F-4.2-11
Residential Noncarcinogenic Screening Evaluation for SWMU 32-002(b)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Antimony	3.72	31.3	1E-01
Barium	59.46	15600	4E-03
Chromium	42.67	219[b]	2E-01
Copper	7.065	3130	2E-03
Cyanide (total)	0.59(U)	1560	4E-04
Lead	41.3	400	1E-01
Mercury	6.56	23[c]	3E-01
Nickel	9.347	1560	6E-03
Nitrate	2.004	125000	2E-05
Perchlorate	0.006	54.8	1E-04
Selenium	0.442	391	1E-03
Silver	8.256	391	2E-02
Thallium	0.251	5.16	5E-02
Zinc	53.2	23500	2E-03
Anthracene	0.085	17200	5E-06
Benzo(g,h,i)perylene	0.3	1720[d]	2E-04
Benzoic acid	0.076	245000[c]	3E-07
Di-n-butylphthalate	0.77	6110	1E-04
Fluoranthene	0.171	2290	7E-05
Phenanthrene	0.45	1830	2E-04
Pyrene	0.158	1720	9E-05
Trichlorofluoromethane	0.006	2010	3E-06
		HI	**0.8**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL is for hexavalent chromium.

[c] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[d] Pyrene used as a surrogate for benzo(g,h,i)perylene based on structural similarity.

Table F-4.2-12
Residential Radionuclide Screening for SWMU 32-002(b)

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Total Dose (mrem/yr)
Americium-241	1.07	30	0.54
Cesium-137	0.578	5.6	1.55
Plutonium-239/240	0.665	33	0.3
Strontium-90	0.45	5.7	1.18
Tritium	0.09	750	0.002
Uranium-234	1.365	170	0.12
Uranium-235/236	0.0395	17	0.03
Uranium-238	1	87	0.17
		Total Dose	**4**

* SALs from LANL (2009, 107655).

Table F-4.2-13
Residential Carcinogenic Screening
Evaluation of Vapor Intrusion for SWMU 32-002(b)

COPC	EPC (mg/kg)	Vapor Intrusion Risk-Based Concentration* (mg/kg)	Cancer Risk
Methylene chloride	0.014	3.1	5E-08
Tetrachloroethene	0.00053	1.38	4E-09
		Total Excess Cancer Risk	**5E-08**

* Vapor intrusion risk values generated by the Johnson and Ettinger advanced soil model.

Table F-4.2-14
Residential Noncarcinogenic Screening
Evaluation of Vapor Intrusion for SWMU 32-002(b)

COPC	EPC (mg/kg)	Vapor Intrusion Risk-Based Concentration* (mg/kg)	HQ
Trichlorofluoromethane	0.00598	176	0.00003
HI			**0.00003**

* Vapor intrusion risk values generated by the Johnson and Ettinger advanced soil model.

Table F-4.2-15
Industrial Carcinogenic Screening for AOC 32-003

COPC	EPC (mg/kg)	Industrial SSL* (mg/kg)	Cancer Risk
Aroclor-1260	0.188	8.26	2E-07
Benzo(a)anthracene	0.32	23.4	1E-07
Benzo(a)pyrene	0.44	2.34	2E-06
Benzo(b)fluoranthene	0.57	23.4	2E-07
Benzo(k)fluoranthene	0.6	234	3E-08
Chrysene	0.68	2340	3E-09
Indeno(1,2,3-cd)pyrene	0.3	23.4	1E-07
Methylene Chloride	0.016	1090	1E-10
		Total Excess Cancer Risk	**3E-06**

* SSLs from NMED (2009, 108070).

Table F-4.2-16
Industrial Noncarcinogenic Screening Evaluation for AOC 32-003

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Antimony	0.52(U)	454	1E-03
Beryllium	0.39	2260	2E-04
Chromium	8.1	2920[b]	3E-03
Copper	11.5	45400	3E-04
Nickel	5.8	22700	3E-04
Selenium	0.6(U)	5680	1E-04
Zinc	90.4	341000	3E-04
Benzo(g,h,i)perylene	0.31	18300[c]	2E-05
Fluoranthene	1.3	24400	5E-05
Phenanthrene	0.73	20500	4E-05
Pyrene	0.814	18300	4E-05
		HI	**0.005**

[a] SSLs from NMED (2009, 108070).

[b] SSL is for hexavalent chromium.

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

Table F-4.2-17
Recreational Carcinogenic Screening for AOC 32-003

COPC	EPC (mg/kg)	Recreational SSL* (mg/kg)	Cancer Risk
Aroclor-1260	0.188	10.5	2E-07
Benzo(a)anthracene	0.32	30.1	1E-07
Benzo(a)pyrene	0.44	3.01	1E-06
Benzo(b)fluoranthene	0.57	30.1	2E-07
Benzo(k)fluoranthene	0.6	301	2E-08
Chrysene	0.68	3010	2E-09
Indeno(1,2,3-cd)pyrene	0.3	30.1	1E-07
Methylene Chloride	0.016	4520	4E-11
		Total Excess Cancer Risk	**2E-06**

* SSLs from LANL (2010, 108613).

Table F-4.2-18
Recreational Noncarcinogenic Screening Evaluation for AOC 32-003

COPC	EPC (mg/kg)	Recreational SSL* (mg/kg)	HQ
Antimony	0.52(U)	317	2E-03
Beryllium	0.39	1580	2E-04
Chromium	8.1	1910	4E-03
Copper	11.5	31700	4E-04
Nickel	5.8	15800	4E-04
Selenium	0.6(U)	3960	2E-04
Zinc	90.4	238000	4E-04
Benzo(g,h,i)perylene	0.31	10400	3E-05
Fluoranthene	1.3	13900	9E-05
Phenanthrene	0.73	12000	6E-05
Pyrene	0.814	10400	8E-05
		HI	**0.01**

* SSLs from LANL (2010, 108613).

Table F-4.2-19
Construction Worker Carcinogenic Screening for AOC 32-003

COPC	EPC (mg/kg)	Construction Worker SSL* (mg/kg)	Cancer Risk
Aroclor-1260	0.142	75.8	2E-08
Benzo(a)anthracene	0.203	213	1E-08
Benzo(a)pyrene	0.44	21.3	2E-07
Benzo(b)fluoranthene	0.57	213	3E-08
Benzo(k)fluoranthene	0.6	2060	3E-09
Chrysene	0.225	20600	1E-10
Indeno(1,2,3-cd)pyrene	0.3	213	1E-08
		Total Excess Cancer Risk	**3E-07**

* SSLs from NMED (2009, 108070).

Table F-4.2-20
Construction Worker Noncarcinogenic Screening Evaluation for AOC 32-003

COPC	EPC (mg/kg)	Construction Worker SSL[a] (mg/kg)	HQ
Antimony	1.3(U)	124	1E-02
Beryllium	0.781	144	5E-03
Chromium	30.51	449[b]	7E-02
Copper	4.91	12400	4E-04
Nickel	11.52	6190	2E-03
Selenium	0.289	1550	2E-04
Zinc	40.58	92900	4E-04
Anthracene	0.0103	66800	2E-07
Benzo(g,h,i)perylene	0.31	6680[c]	5E-05
Bis(2-ethylhexyl)phthalate	0.269	4760	6E-10
Fluoranthene	0.262	8910	3E-05
Methylene Chloride	0.00799	10600	8E-12
Phenanthrene	0.156	7150	2E-05
Pyrene	0.204	6680	3E-05
		HI	**0.09**

[a] SSLs from NMED (2009, 108070).

[b] SSL is for hexavalent chromium.

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

Table F-4.2-21
Residential Carcinogenic Screening for AOC 32-003

COPC	EPC (mg/kg)	Residential SSL* (mg/kg)	Cancer Risk
Aroclor-1260	0.142	2.22	6E-07
Benzo(a)anthracene	0.203	6.21	3E-07
Benzo(a)pyrene	0.44	0.621	7E-06
Benzo(b)fluoranthene	0.57	6.21	9E-07
Benzo(k)fluoranthene	0.6	62.1	1E-07
Bis(2-ethylhexyl)phthalate	0.269	347	8E-09
Chrysene	0.225	621	4E-09
Indeno(1,2,3-cd)pyrene	0.3	6.21	5E-07
Methylene Chloride	0.00799	199	4E-10
		Total Excess Cancer Risk	**1E-05**

* SSLs from NMED (2009, 108070).

Table F-4.2-22
Residential Noncarcinogenic Screening Evaluation for AOC 32-003

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Antimony	1.3(U)	31.3	4E-02
Beryllium	0.781	156	5E-03
Chromium	30.51	219[b]	1E-01
Copper	4.91	3130	2E-03
Nickel	11.52	1560	7E-03
Selenium	0.289	391	7E-04
Zinc	40.58	23500	2E-03
Anthracene	0.0103	17200	6E-07
Benzo(g,h,i)perylene	0.31	1720[c]	2E-04
Fluoranthene	0.262	2290	1E-04
Phenanthrene	0.156	1830	9E-05
Pyrene	0.204	1720	1E-04
		HI	**0.2**

[a] SSLs from NMED (2009, 108070).

[b] SSL is for hexavalent chromium.

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

Table F-4.2-23
Residential Carcinogenic Screening Evaluation of Vapor Intrusion for AOC 32-003

COPC	EPC (mg/kg)	Vapor Intrusion Risk-Based Concentration* (mg/kg)	Cancer Risk
Methylene chloride	0.016	2.29	7E-08
		Total Excess Cancer Risk	**7E-08**

* Vapor intrusion risk values generated by the Johnson and Ettinger advanced soil model.

Table F-4.2-24
Industrial Carcinogenic Screening for AOC 32-004

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	Cancer Risk
Benzo(a)anthracene	2.52	23.4	1E-06
Benzo(a)pyrene	2.17	2.34	9E-06
Benzo(b)fluoranthene	3.81	23.4	2E-06
Benzo(k)fluoranthene	1.36	234	6E-08
Bis(2-ethylhexyl)phthalate	1.8	1370	1E-08
Butylbenzylphthalate	4.441	9100[b]	5E-09
Chrysene	1.748	2340	7E-09
		Total Excess Cancer Risk	**1E-05**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

Table F-4.2-25
Industrial Noncarcinogenic Screening Evaluation for AOC 32-004

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Antimony	12(U)	454	3E-02
Chromium	25.69	2920[b]	9E-03
Copper	15.88	45400	3E-04
Lead	150.3	800	2E-01
Mercury	0.11	310[c]	4E-04
Nickel	6.3	22700	3E-04
Selenium	1.2(U)	5680	2E-04
Silver	3.3	5680	6E-04
Thallium	2.4(U)	74.9	3E-02
Zinc	100.5	341000	3E-04
Anthracene	0.541	183000	3E-06
Benzo(g,h,i)perylene	1.55	18300[d]	8E-05
Fluoranthene	4.738	24400	2E-04
Phenanthrene	3.23	20500	2E-04
Pyrene	2.414	18300	1E-04
		HI	**0.3**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL is for hexavalent chromium.

[c] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

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

Table F-4.2-26
Industrial Radionuclide Screening for AOC 32-004

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Total Dose (mrem/yr)
Americium-241	0.091	180	0.01
		Total Dose	**0.01**

* SAL from LANL (2009, 107655).

Table F-4.2-27
Recreational Carcinogenic Screening for AOC 32-004

COPC	EPC (mg/kg)	Recreational SSL* (mg/kg)	Cancer Risk
Benzo(a)anthracene	2.52	30.1	8E-07
Benzo(a)pyrene	2.17	3.01	7E-06
Benzo(b)fluoranthene	3.81	30.1	1E-06
Benzo(k)fluoranthene	1.36	301	5E-08
Bis(2-ethylhexyl)phthalate	1.8	1830	1E-08
Butylbenzylphthalate	4.441	13500	3E-09
Chrysene	1.748	3010	6E-09
		Total Excess Cancer Risk	**9E-06**

* SSLs from LANL (2010, 108613).

Table F-4.2-28
Recreational Noncarcinogenic Screening Evaluation for AOC 32-004

COPC	EPC (mg/kg)	Recreational SSL[a] (mg/kg)	HQ
Antimony	12(U)	317	4E-02
Chromium	25.69	1910[b]	1E-02
Copper	15.88	31700	5E-04
Lead	150.3	560	3E-01
Mercury	0.11	238	5E-04
Nickel	6.3	15800	4E-04
Selenium	1.2(U)	3960	3E-04
Silver	3.3	3960	8E-04
Thallium	2.4(U)	52.3	5E-02
Zinc	100.5	238000	4E-04
Anthracene	0.541	104000	5E-06
Benzo(g,h,i)perylene	1.55	10400[c]	1E-04
Fluoranthene	4.738	13900	3E-04
Phenanthrene	3.23	12000	3E-04
Pyrene	2.414	10400	2E-04
		HI	**0.4**

[a] SSLs from LANL (2010, 108613).

[b] SSL is for hexavalent chromium.

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

Table F-4.2-29
Recreational Radionuclide Screening for AOC 32-004

COPC	EPC (pCi/g)	Recreational SAL* (pCi/g)	Total Dose (mrem/yr)
Americium-241	0.091	280	0.005
		Total Dose	**0.005**

* SAL from LANL (2009, 107655).

Table F-4.2-30
Construction Worker Carcinogenic Screening for AOC 32-004

COPC	EPC (mg/kg)	Construction Worker SSL[a] (mg/kg)	Cancer Risk
Benzo(a)anthracene	0.797	213	4E-08
Benzo(a)pyrene	0.729	21.3	3E-07
Benzo(b)fluoranthene	1.335	213	6E-08
Benzo(k)fluoranthene	1.36	2060	7E-09
Butylbenzylphthalate	2.672	47600[b]	6E-10
Chrysene	0.958	20600	5E-10
Indeno(1,2,3-cd)pyrene	0.16	213	8E-09
		Total Excess Cancer Risk	**5E-07**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL is calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

Table F-4.2-31
Construction Worker Noncarcinogenic Screening Evaluation for AOC 32-004

COPC	EPC (mg/kg)	Construction Worker SSL[a] (mg/kg)	HQ
Antimony	12(U)	124	1E-01
Chromium	24.59	449[b]	5E-02
Copper	12.15	12400	1E-03
Cyanide (total)	0.55(U)	6190	9E-05
Lead	79.4	800	1E-01
Mercury	0.55	92.9[c]	6E-03
Nickel	10.77	6190	2E-03
Nitrate	0.26	496000	5E-07
Selenium	0.31	1550	2E-04
Silver	3.3	1550	2E-03
Thallium	2.4(U)	20.4	1E-01
Zinc	85.4	92900	9E-04
Acetone	0.002	263000	8E-09
Anthracene	0.186	66800	3E-06
Benzo(g,h,i)perylene	0.541	6680[d]	8E-05
Bis(2-ethylhexyl)phthalate	0.663	4760	1E-09
Di-n-octylphthalate	0.097	4760[e]	2E-05
Fluoranthene	2.414	8910	3E-04
Phenanthrene	0.853	7150	1E-04
Pyrene	1.21	6680	2E-04
		HI	**0.4**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL is for hexavalent chromium.

[c] SSL is calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

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

[e] SSL from EPA (2007, 099314).

Table F-4.2-32
Construction Worker Radionuclide Screening for AOC 32-004

COPC	EPC (pCi/g)	Construction Worker SAL* (pCi/g)	Total Dose (mrem/yr)
Americium-241	0.091	34	0.04
		Total Dose	**0.04**

* SAL from LANL (2009, 107655).

Table F-4.2-33
Residential Carcinogenic Screening for AOC 32-004

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	Cancer Risk
Benzo(a)anthracene	0.797	6.21	1E-06
Benzo(a)pyrene	0.729	0.621	1E-05
Benzo(b)fluoranthene	1.335	6.21	2E-06
Benzo(k)fluoranthene	1.36	62.1	2E-07
Bis(2-ethylhexyl)phthalate	0.663	347	2E-08
Butylbenzylphthalate	2.672	2600[b]	1E-08
Chrysene	0.958	621	2E-08
Indeno(1,2,3-cd)pyrene	0.16	6.21	3E-07
Total Excess Cancer Risk			**2E-05**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

Table F-4.2-34
Residential Noncarcinogenic Screening Evaluation for AOC 32-004

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Antimony	12(U)	31.3	4E-01
Chromium	24.59	219[b]	1E-01
Copper	12.15	3130	4E-03
Cyanide (total)	0.55(U)	1560	4E-04
Lead	79.4	400	2E-01
Mercury	0.55	23[c]	2E-02
Nickel	10.77	1560	7E-03
Nitrate	0.26	125000	2E-06
Selenium	0.31	391	8E-04
Silver	3.3	391	8E-03
Thallium	2.4(U)	5.16	5E-01
Zinc	85.4	23500	4E-03
Acetone	0.002	67500	3E-08
Anthracene	0.186	17200	1E-05
Benzo(g,h,i)perylene	0.541	1720[d]	3E-04
Di-n-octylphthalate	0.097	2400[e]	4E-05
Fluoranthene	2.414	2290	1E-03
Phenanthrene	0.853	1830	5E-04
Pyrene	1.21	1720	7E-04
		HI	**1**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL is for hexavalent chromium.

[c] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

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

[e] SSL from EPA (2007, 099314).

Table F-4.2-35
Residential Radionuclide Screening for AOC 32-004

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Total Dose (mrem/yr)
Americium-241	0.091	30	0.05
		Total Dose	**0.05**

* SAL from LANL (2009, 107655).

Table F-4.2-36
Residential Noncarcinogenic Screening Evaluation of Vapor Intrusion for AOC 32-004

COPC	EPC (mg/kg)	Vapor Intrusion Risk-Based Concentration* (mg/kg)	HQ
Acetone	0.002	19800000	1E-09
		HI	**1E-09**

* Vapor intrusion risk values generated by the Johnson and Ettinger advanced soil model.

Table F-4.2-37
Residential Carcinogenic Screening for AOC 32-004 after Removing PAH Results at Location 32-06340

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	Cancer Risk
Benzo(a)anthracene	0.49	6.21	8E-07
Benzo(a)pyrene	0.546	0.621	9E-06
Benzo(b)fluoranthene	1.045	6.21	2E-06
Benzo(k)fluoranthene	1.36	62.1	2E-07
Bis(2-ethylhexyl)phthalate	0.663	347	2E-08
Butylbenzylphthalate	2.672	2600[b]	1E-08
Chrysene	0.69	621	1E-08
Indeno(1,2,3-cd)pyrene	0.16	6.21	3E-07
		Total Excess Cancer Risk	**1E-05**

[a] SSLs from NMED (2009, 108070), unless otherwise noted.

[b] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

Table F-4.2-38
Residential Noncarcinogenic Screening Evaluation for AOC 32-004 after Removing PAH Results at Location 32-06340

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Antimony	12(U)	31.3	4E-01
Chromium	24.59	219[b]	1E-01
Copper	12.15	3130	4E-03
Cyanide (total)	0.55(U)	1560	4E-04
Lead	79.4	400	2E-01
Mercury	0.55	23[c]	2E-02
Nickel	10.77	1560	7E-03
Selenium	0.31	391	8E-04
Silver	3.3	391	8E-03
Thallium	2.4(U)	5.16	5E-01
Zinc	85.4	23500	4E-03
Acetone	0.002	67500	3E-08
Anthracene	0.242	17200	1E-05
Benzo(g,h,i)perylene	1.55	1720[d]	9E-04
Di-n-octylphthalate	0.097	2400[e]	4E-05
Fluoranthene	1.757	2290	8E-04
Phenanthrene	0.479	1830	3E-04
Pyrene	0.81	1720	5E-04
		HI	**1**

[a] SSLs from NMED (2009, 108070.)

[b] SSL is for hexavalent chromium.

[c] SSL from EPA regional screening tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

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

[e] SSL from EPA (2007, 099314).

Table F-5.3-1
ESLs for Terrestrial Receptors

Analyte	Red Fox	Carnivorous Kestrel	Omnivorous Kestrel	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Inorganic Chemicals (mg/kg)											
Antimony	45	na*	na	na	na	na	2.9	0.26	0.48	78	0.05
Arsenic	810	1100	160	42	26	18	160	15	32	6.8	18
Barium	41000	37000	11000	820	930	1000	3300	1300	1800	330	110
Beryllium	420	na	na	na	na	na	170	18	56	40	2.5
Chromium	30000	37000	7700	1900	1100	830	13000	750	1900	2.3	2.4
Copper	3800	1600	110	38	22	15	270	38	64	80	70
Cyanide (total)	2200	0.58	0.47	0.1	0.1	0.1	740	310	340	na	na
Lead	3700	810	120	21	16	14	370	72	120	1700	120
Mercury	46	0.28	0.082	0.07	0.022	0.013	22	1.7	3	0.05	34
Nickel	1200	2900	160	160	38	21	500	9.7	20	280	38
Selenium	84	97	5.6	1	0.87	0.75	2.1	0.66	0.83	4.1	0.52
Silver	4100	840	19	11	4.3	2.6	150	14	24	na	560
Thallium	2.8	75	6.6	9.2	1.6	0.9	2.8	0.032	0.068	na	0.1
Zinc	6000	3300	320	350	85	48	1800	98	170	120	160
Organic Chemicals (mg/kg)											
Acenaphthene	6200	na	na	na	na	na	490	120	160	na	0.25
Acetone	2900	30000	1200	7.5	14	170	1.4	15	1.2	na	na
Anthracene	5800	na	na	na	na	na	1100	210	310	na	6.8
Aroclor-1260	0.14	4.6	3.7	46	1.7	0.88	3000	10	20	na	na
Benzene	7600	na	na	na	na	na	35	47	24	na	na
Benzo(a)anthracene	32	64	45	5.2	6	7	6.2	3	3.4	na	18
Benzo(a)pyrene	380	na	na	na	na	na	280	53	85	na	na

Table F-5.3-1 (continued)

Analyte	Red Fox	Carnivorous Kestrel	Omnivorous Kestrel	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Benzo(b)fluoranthene	250	na	na	na	na	na	130	38	52	na	18
Benzo(g,h,i)perylene	94	na	na	na	na	na	540	24	47	na	na
Benzo(k)fluoranthene	400	na	na	na	na	na	350	62	100	na	na
Benzoic acid	350	na	na	na	na	na	4.2	1.0	1.3	na	na
Bis(2-ethylhexyl)phthalate	1.2	0.033	0.045	20	0.04	0.02	2700	0.59	1.1	na	na
Butylbenzylphthalate	1900	na	na	na	na	na	2300	90	160	na	na
Chrysene	25	na	na	na	na	na	6.5	2.4	3.1	na	na
Dibenz(a,h)anthracene	54	na	na	na	na	na	95	12	22	na	na
Dibenzofuran	na	na	na	na	na	na	na	na	na	na	6.1
Di-n-butylphthalate	5000	0.24	0.068	0.39	0.021	0.011	16000	180	370	na	160
Di-n-octylphthalate	16	na	na	na	na	na	16000	1.1	2.2	na	na
Fluoranthene	360	na	na	na	na	na	260	22	38	10	na
Fluorene	9300	na	na	na	na	na	1100	250	340	3.7	na
Indeno(1,2,3-cd)pyrene	270	na	na	na	na	na	590	62	110	na	na
Methylene chloride	1700	na	na	na	na	na	3.4	9	2.6	na	1600
Naphthalene	1200	590	100	3.4	5.7	16	12	27	9.7	na	1
Phenanthrene	290	na	na	na	na	na	59	10	15	5.5	na
Pyrene	360	460	190	71	46	34	110	22	32	10	na
Tetrachloroethene	31	na	na	na	na	na	8.8	0.18	0.36	na	10
2,3,7,8-TCDD	0.0000012	na	na	na	na	na	0.000048	0.00000029	0.00000058	5	na
Trichlorofluoromethane	160000	na	na	na	na	na	1700	52	98	na	na
Radionuclides (pCi/g)											
Americium-241	26000	62000	35000	13000	4000	4000	32000	31000	32000	44	21000
Cesium-137	680	2900	3700	4200	3700	3800	2300	2400	2400	1700	2300

Table F-5.3-1 (continued)

Analyte	Red Fox	Carnivorous Kestrel	Omnivorous Kestrel	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Plutonium-238	30000	130000	32000	8300	2100	2000	120000	92000	110000	44	110000
Plutonium-239/240	33000	160000	34000	8600	2100	2100	170000	110000	150000	47	160000
Strontium-90	560	1900	2400	600	930	1500	1300	1700	1700	1200	1300
Tritium	190000	580000	630000	300000	440000	600000	230000	340000	330000	48000	36000
Uranium-234	45000	190000	120000	48000	14000	14000	96000	94000	91000	51	14000
Uranium-235/236	4800	10000	10000	9000	6400	6400	5100	5100	5100	55	4000

Note: Values from ECORISK Database, Version 2.5 (LANL 2010, 110846).

* na = Not available.

Table F-5.3-2
Minimum ESL Comparison for SWMU 32-002(b)

COPCs	EPC	Minimum ESL	Receptor	HQ	COPEC
Inorganic Chemicals (mg/kg)					
Antimony	12(U)	0.05	Plant	**240**	**Yes**
Arsenic	2.814	6.8	Earthworm	**0.41**	**Yes**
Barium	68.1	110	Plant	**0.62**	**Yes**
Chromium (total)	32.27	2.3	Earthworm	**14.03**	**Yes**
Copper	8.541	15	Robin	**0.57**	**Yes**
Cyanide	0.59(U)	0.1	Robin	**5.9**	**Yes**
Lead	53.61	14	Robin	**3.83**	**Yes**
Mercury	9.211	0.013	Robin	**708.5**	**Yes**
Nickel	7.054	9.7	Shrew	**0.73**	**Yes**
Selenium	0.448	0.52	Plant	**0.86**	**Yes**
Silver	4.37	2.6	Robin	**1.68**	**Yes**
Thallium	0.305	0.032	Shrew	**9.53**	**Yes**
Zinc	57.53	48	Robin	**1.2**	**Yes**
Organic Chemicals (mg/kg)					
Anthracene	0.085	6.8	Plant	0.01	No
Aroclor-1260	0.109	0.14	Red fox	**0.78**	**Yes**
Benzo(a)anthracene	0.27	3	Shrew	0.09	No
Benzo(a)pyrene	0.41	53	Shrew	0.008	No
Benzo(b)fluoranthene	0.168	18	Plant	0.01	No
Benzo(g,h,i)perylene	0.3	24	Shrew	0.01	No
Benzo(k)fluoranthene	0.52	62	Shrew	0.008	No
Benzoic acid	0.076	1	Shrew	0.08	No
Bis(2-ethylhexyl)phthalate	0.185	0.02	Robin	**9.25**	**Yes**
Chrysene	0.139	2.4	Shrew	0.06	No
Dibenz(a,h)anthracene	0.09	12	Shrew	0.01	No
Di-n-butylphthalate	0.77	0.011	Robin	**70**	**Yes**
Fluoranthene	0.195	10	Earthworm	0.02	No
Indeno(1,2,3-cd)pyrene	0.26	62	Shrew	0.004	No
Methylene chloride	0.014	2.6	Deer mouse	0.005	No
Phenanthrene	0.45	5.5	Earthworm	0.08	No
Pyrene	0.195	10	Earthworm	0.02	No
Tetrachloroethene	0.00053	0.18	Shrew	0.003	No
Trichlorofluoromethane	0.003	52	Shrew	0.00006	No
2,3,7,8-TCDD equivalent	0.00000417	0.00000029	Shrew	**14.4**	**Yes**

Table F-5.3-2 (continued)

COPCs	EPC	Minimum ESL	Receptor	HQ	COPEC
Radionuclides (pCi/g)					
Americium-241	1.07	44	Earthworm	0.02	No
Cesium-137	0.677	680	Red fox	0.001	No
Plutonium-239/240	0.834	47	Earthworm	0.02	No
Strontium-90	0.45	560	Red fox	0.0008	No
Tritium	0.09	36000	Plant	0.000003	No
Uranium-234	1.258	51	Earthworm	0.02	No
Uranium-235/236	0.0477	55	Earthworm	0.0009	No
Uranium-238	1.191	55	Earthworm	0.02	No

Note: Bolded values indicate HQ greater than 0.3.

Table F-5.3-3
HI Analysis for COPECs at SWMU 32-002(b)

COPECs	EPC (mg/kg)	Red Fox	Carnivorous Kestral	Omnivorous Kestral	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Antimony	12(U)	0.267	na*	na	na	na	na	**4.14**	**46.2**	**25**	0.154	**240**
Arsenic	2.814	0.003	0.003	0.018	0.067	0.108	0.156	0.018	0.188	0.088	**0.414**	0.156
Barium	68.10	0.002	0.002	0.006	0.083	0.073	0.068	0.021	0.052	0.038	0.206	**0.619**
Chromium (total)	32.27	0.001	0.001	0.004	0.017	0.029	0.039	0.002	0.043	0.017	**14.03**	**13.45**
Copper	8.541	0.002	0.005	0.078	0.225	**0.388**	**0.569**	0.032	0.225	0.133	0.107	0.122
Cyanide (total)	0.59(U)	0.00027	**1.02**	**1.26**	**5.9**	**5.9**	**5.9**	0.001	0.002	0.002	na	na
Lead	53.61	0.014	0.066	**0.447**	**2.55**	**3.35**	**3.83**	0.145	**0.745**	**0.447**	0.032	**0.447**
Mercury	9.211	0.2	**32.9**	**112.33**	**131.59**	**418.68**	**708.54**	**0.419**	**5.42**	**3.07**	**184.22**	0.271
Nickel	7.054	0.006	0.002	0.044	0.044	0.186	**0.336**	0.014	**0.727**	**0.353**	0.025	0.186
Selenium	0.448	0.005	0.005	0.08	**0.448**	**0.515**	**0.597**	0.213	**0.679**	**0.54**	0.109	**0.862**
Silver	4.37	0.001	0.005	0.23	**0.397**	**1.02**	**1.68**	0.029	**0.312**	0.182	na	0.008
Thallium	0.305	0.109	0.004	0.046	0.033	0.191	**0.339**	0.109	**9.53**	**4.49**	**na**	**3.05**
Zinc	57.53	0.01	0.024	0.18	0.164	**0.677**	**1.2**	0.032	**0.587**	**0.338**	**0.479**	**0.36**
Aroclor-1260	0.109	**0.779**	0.024	0.029	0.002	0.064	0.124	0.000036	0.011	0.005	na	na
Bis(2-ethylhexyl)phthalate	0.185	0.154	**5.61**	**4.11**	0.009	**4.63**	**9.25**	0.000069	**0.314**	0.168	na	na
Di-n-butylphthalate	0.77	0.00015	**3.21**	**11.32**	**1.97**	**36.67**	**70**	0.000048	0.004	0.002	na	0.005
2,3,7,8-TCDD equivalent	4.17E-06	**3.48**	na	na	na	na	na	0.087	**14.4**	**7.19**	0.00000083	na
HI		**5**	**43**	**130**	**144**	**472**	**803**	**5**	**79**	**42**	**200**	**260**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.0.

* na = Not available.

Table F-5.3-4
Minimum ESL Comparison for AOC 32-003

COPCs	EPC	Minimum ESL	Receptor	HQ	COPEC
Inorganic Chemicals (mg/kg)					
Antimony	1.3(U)	0.05	Plant	**26**	**Yes**
Beryllium	0.707	2.5	Plant	0.28	No
Chromium (total)	22.35	2.3	Earthworm	**9.72**	**Yes**
Copper	3.95	15	Robin	0.26	No
Nickel	12.55	9.7	Shrew	**1.29**	**Yes**
Selenium	0.289	0.52	Plant	**0.56**	**Yes**
Zinc	43.11	48	Robin	**0.9**	**Yes**
Organic Chemicals (mg/kg)					
Aroclor-1260	0.179	0.14	Red fox	**1.28**	**Yes**
Benzo(a)anthracene	0.204	3	Shrew	0.07	No
Benzo(a)pyrene	0.44	53	Shrew	0.008	No
Benzo(b)fluoranthene	0.5	18	Plant	0.03	No
Benzo(g,h,i)perylene	0.31	24	Shrew	0.01	No
Benzo(k)fluoranthene	0.6	62	Shrew	0.01	No
Bis(2-ethylhexyl)phthalate	0.8	0.02	Robin	**40**	**Yes**
Chrysene	0.235	2.4	Shrew	0.1	No
Fluoranthene	0.288	10	Earthworm	0.03	No
Indeno(1,2,3-cd)pyrene	0.3	62	Shrew	0.005	No
Methylene chloride	0.00871	2.6	Deer mouse	0.003	No
Phenanthrene	0.172	5.5	Earthworm	0.03	No
Pyrene	0.223	10	Earthworm	0.02	No

Note: Bolded values indicate HQ greater than 0.3.

Table F-5.3-5
HI Analysis for COPECs at AOC 32-003

COPECs	EPC (mg/kg)	Red Fox	Carnivorous Kestral	Omnivorous Kestral	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Antimony	1.3(U)	0.029	na*	na	na	na	na	**0.448**	**5**	**2.71**	0.017	**26**
Chromium (total)	22.35	0.001	0.001	0.003	0.012	0.02	0.027	0.002	0.03	0.012	**9.72**	**9.31**
Nickel	12.55	0.01	0.004	0.078	0.078	**0.330**	**0.598**	0.025	**1.29**	**0.628**	0.045	**0.33**
Selenium	0.289	0.003	0.003	0.052	0.289	**0.332**	**0.385**	0.138	**0.438**	**0.348**	0.07	**0.556**
Zinc	43.11	0.007	0.018	0.135	0.123	**0.507**	**0.898**	0.024	**0.440**	0.254	**0.359**	0.269
Aroclor-1260	0.179	**1.28**	0.039	0.048	0.004	0.105	0.203	0.00006	0.018	0.009	na	na
Bis(2-ethylhexyl)phthalate	0.8	**0.667**	**24.2**	**17.8**	0.04	**20**	**40**	0.0003	**1.36**	**0.73**	na	na
	HI	**2**	**24**	**18**	0.5	**21**	**42**	0.6	**9**	**4**	**10**	**36**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.0.

* na = Not available.

Table F-5.3-6
Minimum ESL Comparison for AOC 32-004

COPCs	EPC	Minimum ESL	Receptor	HQ	COPEC
Inorganic Chemicals (mg/kg)					
Antimony	12(U)	0.05	Plant	**240**	**Yes**
Chromium (total)	25.01	2.3	Earthworm	**10.87**	**Yes**
Copper	13.36	15	Robin	**0.89**	**Yes**
Lead	87.06	14	Robin	**6.22**	**Yes**
Mercury	0.55	0.013	Robin	**42**	**Yes**
Nickel	10.61	9.7	Shrew	**1.09**	**Yes**
Selenium	0.25	0.52	Plant	**0.48**	**Yes**
Silver	3.3	2.6	Robin	**1.27**	**Yes**
Thallium	2.4(U)	0.032	Shrew	**75**	**Yes**
Zinc	84.08	48	Robin	**1.75**	**Yes**
Organic Chemicals (mg/kg)					
Acetone	0.002	1.2	Deer mouse	0.002	No
Anthracene	0.19	6.8	Plant	0.03	No
Benzo(a)anthracene	0.804	3	Shrew	0.27	No
Benzo(a)pyrene	0.817	53	Shrew	0.02	No
Benzo(b)fluoranthene	1.41	18	Plant	0.08	No
Benzo(g,h,i)perylene	0.57	24	Shrew	0.02	No
Benzo(k)fluoranthene	1.36	62	Shrew	0.02	No
Bis(2-ethylhexyl)phthalate	0.724	0.02	Robin	**36.2**	**Yes**
Butylbenzylphthalate	2.892	90	Shrew	0.03	No
Chrysene	0.95	2.4	Shrew	**0.4**	**Yes**
Di-n-octylphthalate	0.10	1.1	Shrew	0.09	No
Fluoranthene	2.55	10	Earthworm	0.25	No
Indeno(1,2,3-cd)pyrene	0.16	62	Shrew	0.003	No
Phenanthrene	0.872	5.5	Earthworm	0.16	No
Pyrene	2.10	10	Earthworm	0.21	No
Radionuclides (pCi/g)					
Americium-241	0.09	44	Earthworm	0.002	No

Note: Bolded values indicate HQ greater than 0.3.

Table F-5.3-7
HI Analysis for COPECs at AOC 32-004

COPECs	EPC (mg/kg)	Red Fox	Carnivorous Kestrel	Omnivorous Kestrel	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Antimony	12(U)	0.267	na*	na	na	na	na	**4.14**	**46.2**	**25**	0.15	**240**
Chromium (total)	25.01	0.001	0.001	0.003	0.01	0.02	0.03	0.002	0.03	0.01	**11**	**10**
Copper	13.36	0.004	0.01	0.12	**0.35**	**0.61**	**0.89**	0.05	**0.35**	0.21	0.17	0.19
Lead	87.06	0.02	0.11	**0.73**	**4.15**	**5.44**	**6.22**	0.24	**1.21**	**0.73**	0.05	**0.73**
Mercury	0.55	0.012	**1.96**	**6.71**	**7.86**	**25**	**42**	0.03	**0.32**	0.18	**11**	0.02
Nickel	10.61	0.01	0.004	0.07	0.07	0.28	**0.51**	0.02	**1.09**	**0.53**	0.04	0.28
Selenium	0.25	0.003	0.003	0.04	0.25	0.29	**0.33**	0.12	**0.38**	0.3	0.06	**0.48**
Silver	3.3	0.0008	0.004	0.174	0.3	**0.767**	**1.27**	0.02	0.24	0.14	na	0.01
Thallium	2.4(U)	**0.86**	0.03	**0.36**	0.26	**1.5**	**2.67**	**0.86**	**75**	**35.3**	na	**24**
Zinc	84.08	0.01	0.04	0.26	0.24	**0.99**	**1.75**	0.05	**0.86**	**0.49**	**0.7**	**0.53**
Bis(2-ethylhexyl)phthalate	0.724	**0.6**	**21.9**	**16.1**	0.04	**18.1**	**36.2**	0.00027	**1.23**	**0.66**	na	na
Chrysene	0.95	0.038	na	na	na	na	na	0.15	**0.4**	**0.31**	na	na
	HI	**2**	**24**	**25**	**13**	**53**	**92**	**6**	**127**	**64**	**23**	**277**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.0.

* na = Not available.

Table F-5.4-1
Comparison of EPCs to Background Concentrations for Inorganic COPECs SWMU 32-002(b)

COPECs	EPC (mg/kg)	Soil Background Concentrations (mg/kg)	Tuff Background Concentrations (mg/kg)
Antimony	12(U)	0.1–1	0.05–0.4
Arsenic	2.814	0.3–9.3	0.25–5
Barium	68.1	21–410	1.4–51.6
Chromium (total)	32.27	1.9–36.5	0.25–13
Copper	8.541	0.25–16	0.25–6.2
Cyanide (total)	0.59(U)	0.5*	0.5*
Lead	53.61	2–28	1.6–15.5
Mercury	9.211	0.1*	0.1*
Nickel	7.054	1–29	0.5–7
Selenium	0.448	0.1–1.7	0.3*
Silver	4.37	1*	0.2–1.9
Thallium	0.305	0.063–1	0.05–1.7
Zinc	57.53	14–75.5	5.5–65.6

Note: From LANL (1998, 059730).

* Value is the BV.

Table F-5.4-2
Comparison of EPCs to Background Concentrations for Inorganic COPECs at AOC 32-003

COPECs	EPC (mg/kg)	Soil Background Concentrations (mg/kg)	Tuff Background Concentrations (mg/kg)
Antimony	1.3(U)	0.1–1	0.05–0.4
Chromium (total)	22.35	1.9-36.5	0.25-13
Nickel	12.55	1–29	0.5–7
Selenium	0.289	0.1–1.7	0.3*
Sodium	1524	58–1800	130–7700
Zinc	43.11	14–75.5	5.5–65.6

Note: The ranges of background concentrations are from LANL (1998, 059730).

* Value is the BV.

Table F-5.4-3
Comparison of EPCs to Background Concentrations for Inorgaanic COPECs at AOC 32-004

COPECs	EPC (mg/kg)	Soil Background Concentrations (mg/kg)	Tuff Background Concentrations (mg/kg)
Antimony	12(U)	0.1–1	0.05–0.4
Chromium (total)	25	1.9-36.5	0.25-13
Copper	13.4	0.25–16	0.25–6.2
Lead	87.1	2–28	1.6–15.5
Mercury	0.3	0.1*	0.1*
Nickel	10.6	1–29	0.5–7
Selenium	0.2	0.1-1.7	0.3*
Silver	1.8	1*	0.2–1.9
Thallium	2.4(U)	0.063–1	0.05–1.7
Zinc	84.1	14–75.5	5.5–65.6

Note: The ranges of background concentrations are from LANL (1998, 059730).

* Value is the BV.

Table F-5.4-4
PAUFs and AUFs for Ecological Receptors

Receptor	HR[a] (ha)	Population Area[a] (ha)	PAUF SWMU 32-002(b) Site area = 0.0123 ha	PAUF AOC 32-003 Site area = 0.0118 ha	PAUF AOC 32-004 Site area = 0.0045 ha
Red fox	1038	41,520	3E-07	3E-07	1E-07
American kestrel	106	4240	3E-06	3E-06	1E-06
American robin	0.42	16.8	7E-04	7E-04	3E-04
Desert cottontail	3.1	124	1E-04	1E-04	4E-05
Montane shrew	0.39	15.6	8E-04	8E-04	3E-04
Deer mouse	0.077	3.08	4E-03	4E-03	1E-03
Mexican spotted owl[b]	366	n/a[c]	3E-05	3E-05	1E-05

Note: PAUF is calculated as the area of the site divided by the population area. No PAUF is calculated for earthworm or plants.

[a] Values from EPA (1993, 059384).

[b] Value for Mexican spotted owl is the AUF based on individual HR.

[c] n/a = Not applicable.

Table F-5.4-5
Adjusted HQs and HIs at SWMU 32-002(b)

COPECs	EPC (mg/kg)	Red Fox	Carnivorous Kestral	Omnivorous Kestral	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Antimony	12(U)	8E-08	na*	na	na	na	na	4E-04	4E-02	1E-01	0.154	**240**
Lead	53.61	4E-09	2E-07	1E-06	2E-03	2E-03	3E-03	1E-05	6E-04	2E-03	0.032	**0.447**
Mercury	9.211	6E-08	1E-04	3E-04	1E-01	3E-01	5E-01	4E-05	4E-03	1E-02	**184.2**	0.271
Silver	4.37	3E-10	2E-08	7E-07	3E-04	7E-04	1E-03	3E-06	2E-04	7E-04	na	0.008
Aroclor-1260	0.109	2E-07	7E-08	9E-08	2E-06	5E-05	9E-05	4E-09	9E-06	2E-05	na	na
Bis(2-ethylhexyl)phthalate	0.185	5E-08	2E-05	1E-05	7E-06	3E-03	7E-03	7E-09	2E-04	7E-04	na	na
Di-n-butylphthalate	0.77	5E-11	9E-06	3E-05	1E-03	3E-02	5E-02	5E-09	3E-06	8E-06	na	0.005
2,3,7,8-TCDD equivalent	4.17E-06	1E-06	na	na	na	na	na	9E-06	1E-02	3E-02	6E-07	na
Adjusted HI		1E-06	1E-04	4E-04	0.1	0.3	0.6	5E-04	0.06	0.1	**184**	**241**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.0.

* na = Not available.

Table F-5.4-6
Adjusted HQs and HIs at AOC 32-003

COPECs	EPC (mg/kg)	Red Fox	Carnivorous Kestral	Omnivorous Kestral	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Aroclor-1260	0.179	4E-07	1E-07	1E-07	3E-06	7E-05	1E-04	6E-09	1E-05	3E-05	na*	na
Bis(2-ethylhexyl)phthalate	0.8	2E-07	7E-05	5E-05	3E-05	1E-02	3E-02	3E-08	1E-03	3E-03	na	na
Adjusted HI		6E-07	7E-05	5E-05	3E-05	1E-02	3E-02	3E-08	1E-03	3E-03	na	na

* na = Not available.

Table F-5.4-7
Adjusted HQs and HIs at AOC 32-004

COPECs	EPC (mg/kg)	Red Fox	Carnivorous Kestrel	Omnivorous Kestrel	Herbivorous Robin	Omnivorous Robin	Insectivorous Robin	Cottontail	Shrew	Deer Mouse	Earthworm	Plant
Antimony	12(U)	3E-08	na*	na	na	na	na	1E-04	1E-02	4E-02	0.154	**240**
Lead	87.06	3E-09	1E-07	2E-04	1E-03	1E-03	2E-03	8E-06	3E-04	1E-03	0.05	**0.73**
Mercury	0.55	1E-09	2E-06	2E-03	2E-03	7E-03	1E-02	9E-07	9E-05	3E-04	**5.6**	0.01
Bis(2-ethylhexyl)phthalate	0.724	6E-08	2E-05	4E-03	1E-03	5E-03	1E-02	1E-08	3E-04	9E-04	na	na
Chrysene	0.95	4E-09	na	na	na	na	na	5E-06	1E-04	4E-04	na	na
Adjusted HI		0.0000001	0.00003	0.006	0.003	0.01	0.02	0.0002	0.01	0.04	**6**	**241**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.0.

* na = Not available.

Table F-5.4-8
Summary of LOAEL-Based ESL for Terrestrial Receptors

COPEC	Receptor	LOAEL-Based TRV	TRV Unit	LOAEL–Based ESL (mg/kg soil)	Approach to Deriving the LOAELs/LOECs*
Mercury	Earthworm	0.5	mg/kg soil	5.00E-01	Lowest observed effect concentration (LOEC) is equal to a LOEC taken directly from the literature. The no observed effect concentration (NOEC) was derived from this LOEC by applying an uncertainty factor 0.1.
Antimony	Plant	0.5	mg/kg soil	5.00E-01	The LOEC is derived from a LOEC with an unspecified exposure duration by applying an uncertainty factor of 0.1. The NOEC was derived from the same LOEC, except an uncertainty factor of 0.01 was applied.
Lead	Plant	576	mg/kg soil	5.70E+02	LOEC is extrapolated from the EPA geometric mean NOEC data set (http://www.epa.gov/ecotox/ecossl/pdf/eco-ssl_lead.pdf). Applied an uncertainty factor of 5 for maximum allowable toxicity concentration and calculated the geometric mean.

Table F-5.4-9
HI Analysis Using LOAEL-Based ESL for SWMU 32-002(b)

COPECs	EPC (mg/kg)	Earthworm	Plant
Antimony	12(U)	n/a*	**24**
Lead	53.61	n/a	0.09
Mercury	9.211	**18.4**	n/a
HI		**18**	**24**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.0.
* n/a = Not applicable.

Table F-5.4-10
HI Analysis Using LOAEL-Based ESL for AOC 32-004

COPECs	EPC (mg/kg)	Earthworm	Plant
Antimony	12(U)	n/a*	**24**
Lead	87.06	n/a	0.2
Mercury	0.55	**1.1**	n/a
HI		1	**24**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.0.
* n/a = Not applicable.

Attachment F-1

ProUCL Files
(on CD included with this document)

Attachment F-2

Johnson and Ettinger Model Spreadsheets
(on CD included with this document)

Attachment F-3

Ecological Scoping Checklist

ECOLOGICAL SCOPING CHECKLIST FOR SWMU 32-002(b), AOC 32-003, AND AOC 32-004

Part A—Scoping Meeting Documentation

Site ID	**SWMU 32-002(b), AOC 32-003, and AOC 32-004**
Form of site releases (solid, liquid, vapor). Describe all relevant known or suspected <u>mechanisms</u> of release (spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential <u>areas</u> of release. Reference locations on a map as appropriate.	Former TA-32 was occupied by the medical research facility from 1944 to 1953. Releases were generated from septic tanks, drainlines, outfalls, and a transformer station. All the structures at former TA-32 were removed after 1954. The potential areas of release would be the surface and subsurface media on the mesa and on the hillsides.
List of Primary Impacted Media **(Indicate all that apply.)**	**Surface soil –** X **Surface water/sediment –**Sediment **Subsurface –** X **Groundwater –** N/A **Other, explain –** None
FIMAD vegetation class based on Arcview vegetation coverage **(Indicate all that apply.)**	**Water –** N/A **Bare Ground/Unvegetated –** X **Spruce/fir/aspen/mixed conifer –** N/A **Ponderosa pine –** X **Piñon juniper/juniper savannah –** X **Grassland/shrubland –** X **Developed –** X
Is T&E Habitat Present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	No T&E habitat is present.
Provide list of Neighboring/ Contiguous/ Up-gradient sites, include a brief summary of COPCs and form of releases for relevant sites and reference map as appropriate. **(Use information to evaluate need to aggregate sites for screening.)**	There are no up-gradient sites from the SWMU/AOCs listed above. All contiguous and neighboring areas are commercial and residential areas of the townsite.
Surface Water Erosion Potential Information	Run-on to sites occurs from storms. Run-off may infiltrate into the shallow subsurface or move as sheet flow down the slope into Los Alamos Canyon.

Part B—Site Visit Documentation

Site ID	**SWMU 32-002(b), AOC 32-003, AOC 32-004**
Date of Site Visit	3/19/09
Site Visit Conducted by	John Branch, Andrew Goumas, Tracy McFarland

Receptor Information:

Estimate cover	Relative vegetative cover (high, medium, low, none) =low Relative wetland cover (high, medium, low, none) = none Relative structures/asphalt, etc. cover (high, medium, low, none) = high
Field notes on the FIMAD vegetation class to assist in ground-truthing the Arcview information	The areas in and around the SWMU/AOCs on the mesa top are all urban and highly developed and there is a very small percentage of naturally occurring vegetation. The natural vegetation on hillsides consists of ponderosa pine trees, piñon-juniper stands, and small scrub species.
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	There is no T&E habitat present at these sites.
Are ecological receptors present at the site? **(yes/no/uncertain)** **Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.**	Yes. Although the SWMU/AOCs are not abundantly populated with receptors, there are plant and other ecological receptors present. The general types of receptors are terrestrial biota such as reptiles, small mammals, insects, birds, and plants. The habitat around the SWMU/AOCs is highly developed and therefore not of high quality. The slope into Los Alamos Canyon also provides habitat for ecological receptors.

Contaminant Transport Information:

Surface water transport **Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).**	There is a low potential for surface water transport from the mesa top because all SWMU/AOCs were located in the subsurface, except for the transformer station. AOC 32-003 is located on mesa top and the potential for surface runoff is low because of vegetation.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation**	Sheet flow from the mesa top to the canyons occurs during summer storms and as a result of snow melt. Groundwater is located more than 1000 feet below the surface of the mesa top.
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. The sites are subsurface. The mesa top currently has storm drainage systems.

Ecological Effects Information:

Physical Disturbance **(Provide list of major types of disturbances, including erosion and construction activities, review historical aerial photos where appropriate.)**	The SWMU/AOCs have a high amount of physical disturbances due to commercial development, including roads and buildings.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	Yes, due to the developed commercial and residential area. The habitat is not of great quality.
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No. The area is highly developed.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport.
Not applicable.

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if the maximum value was captured by existing sample data.)**	Yes. The nature and extent of potential contamination has been defined for the SWMU and AOCs listed above.
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if other sites should aggregated to characterize potential ecological risk.)**	Yes. The extent of contamination has been defined.

Part C—Ecological Pathways Conceptual Exposure Model

Question A:

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10^{-5} atm-me/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Volatile organic compounds were not frequently detected, most were in the subsurface, and were at low concentrations.

Question B:

Could the soil contaminants reach receptors through fugitive dust carried in air?

- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Potential for dust entrainment on the mesa top is negligible due to the highly industrially developed area and landscaping.

Question C:

Can contaminated soil be transported to aquatic ecological communities?

- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Sites are subsurface or there is little transport. Not aquatic communities are present on the mesa top.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

- **Known or suspected presence of contaminants in groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: No seeps or springs are present on the mesa top and no perched water has been found. The depth to groundwater is greater than 1000 ft below ground surface.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Contaminants are unlikely to migrate to the regional aquifer given the depth to groundwater. The lack of a significant hydraulic driver (e.g., no pond water on the surface) facilitating infiltration also mitigates the potential for contaminants reaching groundwater.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **This question is only applicable to release sites located on or near the mesa edge.**
- **Consider the erodability of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Surface contamination is minimal across the site. There are no perched aquifers near these sites.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation: Volatile organic compounds were detected infrequently and at low concentrations.

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation: Buildings, roads, and parking areas minimize particulates and dust.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Most contamination is subsurface. The mesa top area is highly developed.

Question J:

Could contaminants interact with receptors through food web transport from surficial soils?

- **The chemicals may bioaccumulate in animals.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Some bioaccumulating contaminants were present but at low concentrations.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Surface and subsurface soil contamination is minor.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Most detected concentrations are subsurface.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Gamma-emitting radionuclides only detected at low concentrations.

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Provide explanation: There are no aquatic environments onsite.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There are no aquatic environments onsite.

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There are no aquatic environments onsite.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There are no aquatic environments onsite.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: There are no aquatic environments onsite.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: There are no aquatic environments onsite.

<u>Question T:</u>

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediment while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There are no aquatic environments onsite.

<u>Question U:</u>

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophilic organic contaminants and some metals may concentrate in an organism's tissues**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There are no aquatic environments onsite.

<u>Question V:</u>

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

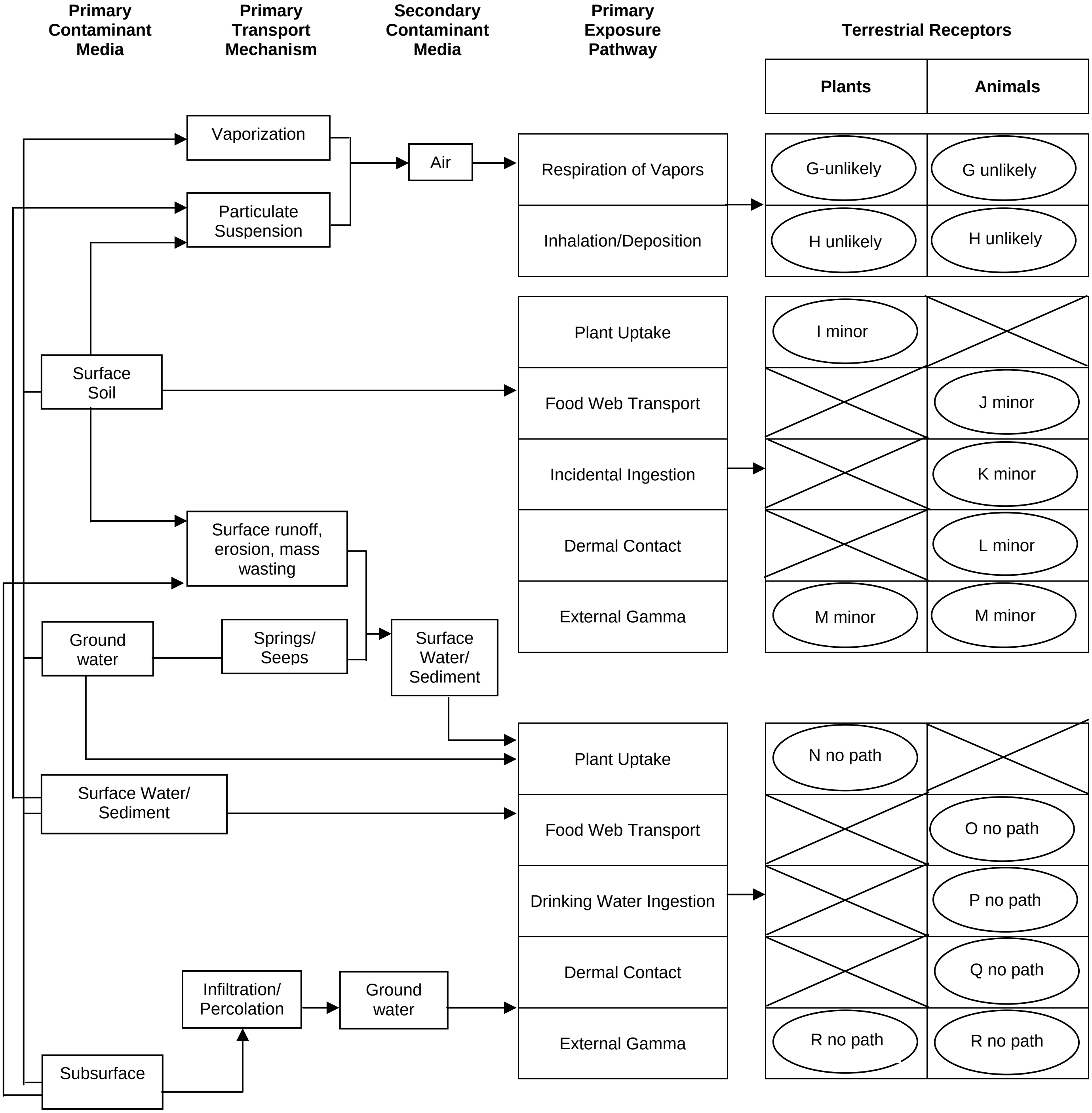
Aquatic Plants: 0

Aquatic Animals: 0

Provide explanation: There are no aquatic environments onsite.

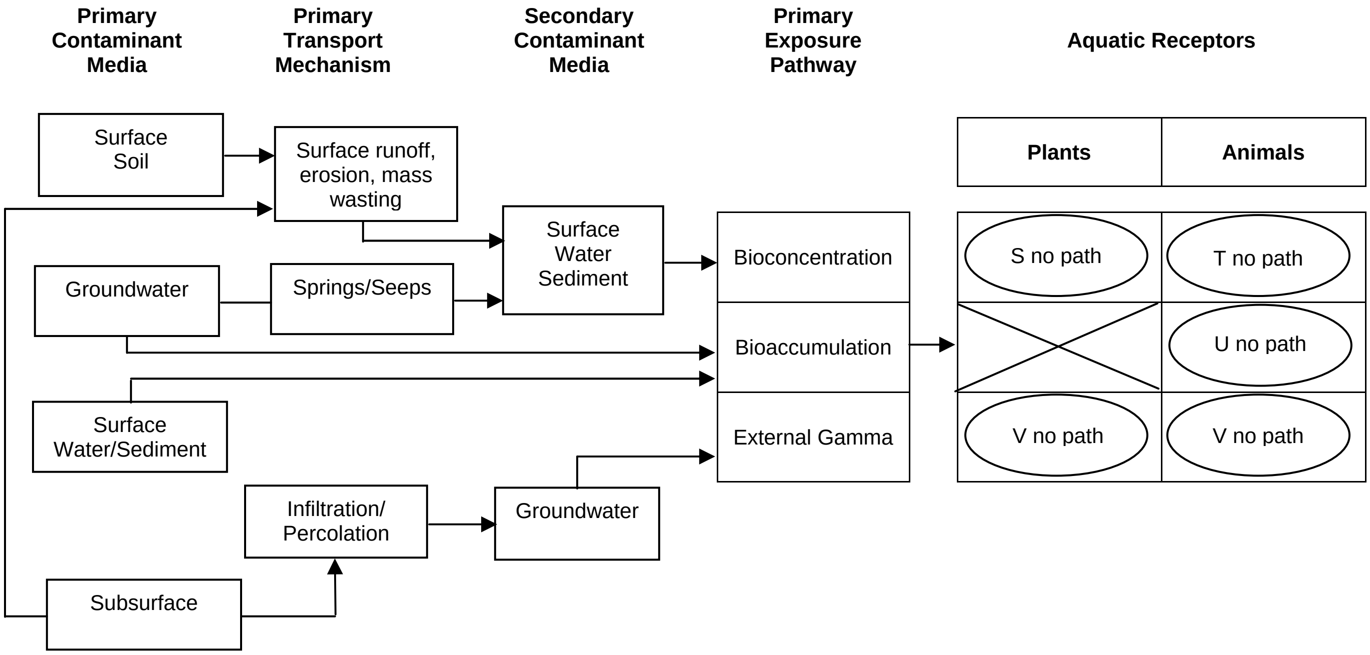
NOTE:
Letters in circles refer to questions on the Scoping Checklist

Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model



NOTE:
Letters in circles refer to questions on the Scoping Checklist

Ecological Scoping Checklist
Aquatic Receptors
Ecological Pathways Conceptual Exposure Model



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Jun Li

Name (signature):

Organization: Los Alamos Technical Associates, Inc.

Phone number: 505-662-1756

Date Completed: 10/15/2010

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Richard J. Mirenda

Name (signature): Richard J. Mirenda

Organization: Los Alamos National Laboratory

Phone number: 505-665-6953

Date Completed: 10/15/2010

Appendix G

Investigation-Derived Waste Management

G-1.0 INTRODUCTION

This appendix describes the management of the investigation-derived waste (IDW) and excavated media/debris generated during the sampling and remediation of the four sites located at former Technical Area 32 (TA-32) in the Upper Los Alamos Canyon Aggregate Area at Los Alamos National Laboratory (LANL or the Laboratory). These sites are Solid Waste Management Units (SWMUs) 32-002(a) and 32-002(b); and Areas of Concern (AOCs) 32-003 and 32-004.

All IDW generated during the field investigation was managed in accordance with Standard Operating Procedure (SOP) 5238, Characterization and Management of Environmental Program Waste. This procedure incorporates the requirements of all applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy orders, and Laboratory implementation requirements.

Consistent with Laboratory procedures, a waste characterization strategy form (WCSF) was prepared to address characterization approaches, on-site management, and final disposition options for wastes. Information from previous investigation wastes and analytical data and/or acceptable knowledge (AK) were used to complete the WCSF. The WCSF is included in Attachment G-1.

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

Wastes were staged in clearly marked and 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 WCSF and approved before waste was generated.

Investigation activities were conducted in a manner that minimizes the generation of waste. Waste minimization was accomplished by implementing the most recent version of the “Los Alamos National Laboratory Hazardous Waste Minimization Report” (LANL 2008, 104174).

G-2.0 WASTE STREAMS

The IDW streams that were generated and managed during the investigation and remedial activities at former TA-32 are described below and summarized in Table G-2.0-1.

- *Contact Waste:* This waste stream includes spent personal protective equipment (PPE), contaminated sampling supplies, and dry decontamination waste that may have come in contact with contaminated media. These wastes were containerized at the point of generation and were characterized based on AK of the waste materials, the extent of contamination of the contact waste, the methods of generation as well as existing analytical data available for the media with which it came into contact. These wastes were managed as hazardous or nonhazardous depending on the contaminants expected at the SWMUs or AOCs from which they were generated. Approximately 0.03 yd^3 of contact waste was generated and will be disposed of at an authorized treatment, storage, and disposal (TSD) facility.
- *Drill Cuttings:* This waste stream includes soil and tuff cuttings from boreholes. Approximately 0.65 yd^3 of cuttings was stored in lined 55-gal. drums within appropriate waste staging areas. All drums were directly sampled and were determined to be nonhazardous low-level waste (LLW) or

industrial waste. The waste was analyzed for total metals, toxicity characteristic leaching procedure (TCLP) metals, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), and radionuclides. All drill cuttings were disposed of at an authorized TSD facility.

- *Excavated Environmental Media and Debris:* This waste stream includes materials excavated or removed during the site investigation and remedial activities. Included are concrete and asphalt debris from cutting access holes in pavement. Approximately 5.1 yd^3 of debris was generated and collected at the point of generation. These wastes were characterized based on acceptable knowledge of processes associated with the debris, from site characterization sampling, and by directly sampling. The waste was analyzed for total metals, TCLP metals, PCBs, SVOCs, VOCs, and radionuclides. They were determined to be LLW or industrial waste and will be disposed of at an authorized TSD facility.

G-3.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

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

LANL (Los Alamos National Laboratory), November 2008. "Los Alamos National Laboratory Hazardous Waste Minimization Report," Los Alamos National Laboratory document LA-UR-08-7274, Los Alamos, New Mexico. (LANL 2008, 104174)

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

Waste Stream	Waste Type	Volume	Characterization Method	On-Site Management	Disposition
Contact waste	LLW or industrial	0.03 yd^3	AK and analytical results of site characterization	30-gal. drums	Pending disposal at TA-54 Area G or off-site authorized facilities
Drill cuttings	LLW or industrial	0.65 yd^3	Direct sampling	55-gal. drums	Pending disposal at TA-54 Area G or off-site authorized facilities
Excavated Environmental Media and Debris	LLW or industrial	5.1 yd^3	Direct sampling	55-gal. drums	Pending disposal at TA-54 Area G or off-site authorized facilities

Attachment G-1

Waste Documentation

Waste Characterization Strategy Form

Project Title	Implementation of the Accelerated Correction Actions Work Plan for Upper Los Alamos Canyon aggregate Area, Former Technical Area 32
Solid Waste Management Unit or Area of Concern #	AOCs: 32-003, 32-004 SWMUs: 32-002(a), 32-002(b)
Activity Type	Characterization sampling and remediation
Project Manager/ Waste Generator	Becky Coel-Roback
LANL Waste Management Coordinator	Ron DeSotel
Completed by	Jon Roberson
Date	1/25/2010

Description of Activity

This Waste Characterization Strategy Form (WCSF) identifies how wastes generated from implementing Accelerated Correction Actions Work Plan for Upper Los Alamos Canyon aggregate Area, Former Technical Area 32 (December 2009) will be managed. The work plan includes the proposed sampling and remediation activities for two solid waste management units (SWMUs) and two areas of concern (AOCs) in the Upper Los Alamos Canyon Aggregate Area at Los Alamos National Laboratory (the Laboratory). Samples will be collected to identify the extent of site contamination for SWMU 32-002(a), SWMU 32-002(b), and AOC 32-003. Additional samples will also be collected at AOC 32-004 to verify the 1996 sample results. Limited soil removal is proposed to remove elevated concentrations of metals and polychlorinated biphenyls at SWMU 32-002(a) and AOC 32-003.

Relevant Site History and Description

The septic system (structure 32-07) [SWMU 32-002(a)] received waste from building 32-01 and discharged to Los Alamos Canyon. Research activities at the site involved plutonium-238, plutonium-239, americium-241, and carbon-14. Inorganic and organic chemicals also may have been used at the facility. The laboratory (building 32-01) operated from 1944 to 1953 and was decommissioned in 1954. The septic tank was removed but no archival records are available on removal date or disposition of the tank. The drainline was removed in 1996.

The septic system (structure 32-08) [SWMU 32-002(b)] was installed when the SWMU 32-002(a) septic system could no longer meet the usage requirement of the laboratory (building 32-01). The influent line of SWMU 32-002(a) was diverted to the septic tank of SWMU 32-002(b), which also received effluent from building 32-02. The outfall of SWMU 32-002(b) was at the edge of Los Alamos Canyon. The septic tank was removed in 1988, and the drainline was removed in 1996.

Research activities at building 32-01 involved radionuclides. Inorganic and organic chemicals may also have been used. Because no industrial waste line served former TA-32, it is possible chemical and radioactive wastes may have been disposed of in sinks and drains connected to the septic systems at SWMUs 32-002(a) and 32-002(b).

The location of the former transformer station (structure 32-10) (AOC 32-003) was discovered during the 1993 Phase I Resource Conservation and Recovery (RCRA) facility investigation (RFI) (LANL 1995, 048944). Three transformers sat on a wooden platform on poles, approximately 20 ft aboveground (LASL 1948, 091749). Phase I RFI analytical results from samples collected in the immediate area indicated polychlorinated biphenyl (PCB) contamination (LANL 1995, 048944, p. 34).

The drainline and outfall (AOC 32-004) served building 32-03 and discharged directly to Los Alamos Canyon without passing through a septic tank. Building 32-03 included a vault room where a radioactive source was stored. The drainline of AOC 32-004 led directly to an outfall at the edge of the mesa without passing through a septic tank.

Characterization Strategy

This WCSF identifies the types of wastes expected, based on previous investigations. However, other types of waste may be encountered. An amendment to this WCSF shall be prepared and submitted for review and approval if any of the waste streams change in description or characterization approach or a new waste stream is generated. All wastes will be managed in accordance with SOP-5238, *Characterization and Management of Environmental Program Waste*.

All investigation-derived wastes (IDW) will initially be managed in accordance with data from previous investigation reports and due diligence document reviews that identify the sources of contaminants. Characterization of IDW will be completed through acceptable knowledge (AK), including associated environmental sampling data, process knowledge, and existing documents; and/or the waste may be directly sampled. Samples must be collected by trained sampling personnel in accordance with this WCSF and Environmental Protection Agency (EPA) guidance. Sampling personnel must record waste sampling information in accordance with EP-ERSS-SOP-5058, *Sample Control and Field Documentation* and EP-ERSS-SOP-5181, *Documentation for Waste and Environmental Services Technical Field Activities*. The field notebook must be used to document sample collection activities (e.g., equipment and sampling methods used, number and location of samples, etc.). Sampling personnel must also record field conditions, problems encountered, local sources of contamination (e.g., operating generators or vehicles), the personnel involved, equipment and supplies used, wastes generated, and field observations.

The selection of waste containers will be based on U.S. Department of Transportation requirements, waste types, and estimated volumes of IDW to be generated. Immediately following containerization, each waste container will be individually labeled with a unique identification number and with information regarding waste classification, contents, and date generated. A waste determination must be made within 45 days of the generation of the waste. A WAC exception form (WEF) must be used if the generator does not meet the 45 day deadline.

If analyses indicate the presence of listed constituents not previously detected, a due diligence document review may be performed to identify whether the contaminants are from a listed process. If no or inconclusive documentation of a listed source exists, the waste will not carry the listed hazardous waste numbers(s). If documentation exist that the contaminant(s) originated from a listed source but the levels are below residential screening levels and the land disposal restriction treatment standards, a "contained-in" request may be submitted to the New Mexico Environment Department (NMED), who may approve dropping the listings from the waste stream. A copy of either the ENV-RCRA approved due diligence or the NMED contained-in approval letter must accompany all waste profiles prepared for the subject waste(s).

Waste #1: Municipal Solid Waste (MSW) - This waste stream primarily consists of non-contact trash including but not limited to paper, cardboard, wood, plastic, food and beverage containers, empty solution containers, and other non-contact trash. It is estimated that less than 1 cubic yard of MSW will be generated.

Anticipated Regulatory Status: MSW

Characterization Approach: MSW will be characterized based on acceptable knowledge (AK) of the waste materials (including Material Safety Data Sheets) and methods of generation.

Management and Disposal Method: MSW will be segregated from all other waste streams. It is anticipated that the waste will be stored in plastic trash bags or other appropriate containers and disposed of at the County of Los Alamos solid waste transfer station or other authorized off-site solid waste facility.

Waste # 2: Drill Cuttings (IDW) - Drill cuttings consist of soil and rock removed during the mechanized drilling of boreholes. This may include small chips, unused core samples and returned rad-van samples collected with a hollow-stem auger core barrel. Cuttings will not contain residue of drilling additives (drilling mud or foam) as only dry drilling will be used. It is estimated that approximately 5 cubic yards of borehole cuttings will be generated during this investigation.

Anticipated Regulatory Status: Industrial, Hazardous waste, Low-level waste (LLW), Mixed low-level waste (MLLW), polychlorinated biphenyl (PCB) waste, Land applied

Characterization Approach: Waste characterization will be based upon the analytical results obtained from direct sampling of containerized waste. Cuttings will be sampled within 10 days of generation and submitted for analysis with a 21 day turnaround time. A hand auger or thin-wall tube sampler will be used in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler to collect waste material from each container, augering from the surface to the bottom of the waste in a sufficient number of locations to obtain a representative sample. The cuttings will be sampled within 10 days of generation and submitted for analysis with a 21 day turnaround time. Samples will be analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs, pesticides, herbicides, radionuclides, total metals, and toxicity characteristic metals. Total petroleum hydrocarbons (TPH) will be analyzed if staining or petroleum odor is observed. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility. Existing data from previous investigations may be used to supplement these analyses (e.g., to identify that perchlorates and nitrates are not present.)

Storage and Disposal Method: The cuttings will be collected and containerized at the point of generation and stored in will be stored in clearly marked and suitably constructed waste accumulation areas appropriate for the type of waste. The containers will be appropriate for the quantities of wastes generated (e.g., rolloffs, drums, B-12s, etc.). Cuttings meeting the criteria of the NMED-approved NOI decision tree for land application may be land applied. Land application of drill cuttings will be conducted in accordance with ENV-RCRA-QP-011, *Land*

Application of Drill Cuttings. Cuttings that cannot be land applied will be treated and/or disposed of at authorized on- or off-site facilities appropriate for the waste classification.

Waste #3: Contact IDW - This waste stream is comprised of PPE, sampling equipment and other materials that contacted or potentially contacted contaminated environmental media and that cannot be decontaminated. This includes but is not limited to plastic sheeting (e.g., tarps and liners), gloves, coveralls, booties, paper towels, plastic and glass sample bottles, and disposable sampling supplies. It is estimated that approximately 1 cubic yard of contact IDW will be generated during this investigation.

Anticipated Regulatory Status: Industrial, Hazardous, LLW, MLLW, PCB, Green is Clean

Characterization Approach: Contact IDW will be characterized using AK based on the direct sampling and analyses of the media with which it came into contact. An estimate of the extent that the waste is contaminated will be recorded. Results from the analytical data may be weighted by the extent of contamination for determining whether wastes are characteristics.

Storage and Disposal Method: The contact waste may be separately containerized in drums or it may be placed into the same containers as the media with which it is contaminated. It will be stored in clearly marked and suitably constructed areas appropriate for the type of waste. For disposal, separately containerized contact waste may be also be combined with the material that it contacted (the WPF will document the decision to combine the waste streams). Wastes will be treated and/or disposed of in authorized on- or off-site facilities appropriate for the waste classification.

Waste #4: Decontamination fluids - This waste stream consists of liquid wastes generated from the decontamination of excavation, sampling and drilling equipment. This waste stream will be generated only if dry decontamination methods are not effective. It is estimated that less than 55 gallons of decontamination fluids will be generated from this activity.

Anticipated Regulatory Status: Industrial, Hazardous, LLW, MLLW, PCB

Characterization Approach: The decontamination water will be characterized by direct sampling of the containerized fluids within 10 days of containerization and submitted for analysis with a 21 day turnaround time. Representative waste characterization samples will be collected with a 21 day analytical data turnaround to ensure that wastes can be dispositioned within 90 days, if necessary. Samples will be collected from the storage container in accordance with LANL SOP-06.15, *COLIWASA Sampler for Liquids and Slurries.* If the container does not permit COLIWASA or bailer sampling, the type of sampling equipment used will be appropriate for the waste container and properly operated in accordance with Chapter 7 and Appendix E of the RCRA Waste Sampling Draft Technical Guidance (EPA 530-D-02-002, August 2002, http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/rwsdtg.pdf). Samples will be analyzed for VOCs, SVOCs, PCBs, radionuclides, total metals, and other analyses required to meet the WAC of the receiving facility. Note that decontamination fluids destined for LANL's sanitary plant (SWS) must be sampled by ENV-RCRA for microtox analysis, total suspended solids (TSS), total dissolved solids (TDS), oil and grease, and pH. Submit a request for analysis at https://esp-esh-as01-f5.lanl.gov/~esh19/databases/rfa_form.shtml.

Storage and Disposal Method: These wastes will be containerized in drums at the point of generation and stored in clearly marked and suitably constructed areas appropriate for the type of waste. It is expected that most of the decontamination fluids will be treated on-site at the

SWS or Radioactive Liquid Waste Treatment Facility (RLWTF). Wastes that do not meet the WAC for the on-site facilities will be solidified and treated and/or disposed of in authorized on- or off-site facilities appropriate for the waste classification.

Waste #5: Petroleum Contaminated Soils (PCS) - PCS may be generated from releases of products such as hydraulic fluid, motor oil, unleaded gasoline, or diesel fuel (e.g. from the rupture of hydraulic or fuel hoses, or spills during maintenance or filling equipment) onto soil. PCS spills must be reported in accordance with the project specific exhibit F. Absorbent padding, paper towels, spill pillows or other absorbent material used to contain the released material may be added to the PCS waste for storage and disposal. It is estimated that less than one cubic yard of PCS will be generated.

Anticipated Regulatory Status: New Mexico Special Waste (NMSW), Industrial, Hazardous, LLW, MLLW, PCB

Characterization Approach: The PCS may be sampled in place if sampling and containerization can occur the same day as the spill. If sampling cannot occur the same day as the spill, the PCS should immediately be containerized and sampled in the container within 10 days. Samples should be collected in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler (containerized or deeper spills) or, if the spill is shallow and being sampled in place or the waste container is small, in accordance with Spade and Scoop Method for Collection of Soil Samples (SOP-06.11). Samples will be analyzed for VOCs, SVOC, pesticides, herbicides, PCBs, radionuclides, perchlorate, total metals, TPH, TCLP metals and TCLP organics. Other constituents must be analyzed as needed to meet the receiving disposal facility's WAC.

Storage and Disposal Method: PCS will be stored in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the most restrictive waste classification appropriate to the area where the spill occurred. If the PCS is suspect or known hazardous or MLLW, it will initially be managed in a registered hazardous waste accumulation area pending analysis. All PCS will be treated/disposed at an authorized off-site facility appropriate for the waste classification.

Waste # 6: Excavated Soil – This waste consists of soil and rock excavated from SWMU 32-002(a) and AOC 32-003. Less than 1 percent non-hazardous debris may be associated with the soil.

Anticipated Regulatory Status: Industrial, Hazardous, LLW, MLLW, PCB

Characterization Approach: Waste characterization will be based upon the analytical results obtained from direct sampling of the waste. The soil will be sampled within 10 days of generation and submitted for analysis with a 21 day turnaround time. Representative samples will be collected for each excavation location. A hand auger or thin-wall tube sampler will be used in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler to collect waste material from each container, augering from the surface to the bottom of the waste in a sufficient number of locations to obtain a representative sample. Samples will be analyzed for VOCs, SVOCs, pesticides, herbicides, total metals, toxicity characteristic metals, PCBs, and radionuclides. Additional analyses may be required to meet the WAC of the receiving facility or if process knowledge or visual observations indicate that other contaminants may be present (e.g., asbestos or total petroleum hydrocarbons).

Storage and Disposal Method: Excavated material will be containerized at the point of generation in a clearly marked and suitably constructed storage area appropriate for the type of waste. The excavated material will be disposed of at an authorized on- or off-site disposal facility appropriate for the waste classification.

Waste # 7: Debris - This waste stream consists of asphalt and concrete from cutting access holes for the drilling and excavations. It is estimated that less than one cubic yard of debris will be generated from this activity. Debris will contain less than 1% excavated soil.

Anticipated Regulatory Status: Industrial, Hazardous, LLW, MLLW, PCB, Recycled

Characterization Approach: When possible, the debris will be characterized by direct sampling in accordance with SOP-5194, R0, Chip Sampling of Porous Surfaces. Qualified sampling personnel will make the decision in the field of how many samples are necessary to represent the debris and will document these decisions in the field notebook. Debris will be sampled within 10 days of generation and submitted for analysis with a 21 day turnaround time. Samples will be analyzed for total metals, VOCs, SVOCs, pesticides, herbicides, radionuclides, PCBs, and TCLP metals. Additional analyses may be required to meet the WAC of the receiving facility or if process knowledge or visual observations indicate that other contaminants may be present.

Storage and Disposal Method: Debris will be containerized at the point of generation in a clearly marked and suitably constructed storage area appropriate for the type of waste. The excavated material will be disposed of at an authorized on- or off-site disposal facility appropriate for the waste classification.

Clean debris (non-hazardous, non-radioactive, non-PCB) may be recycled in a manner consistent with LANL procedures and the approved work plan. . If debris cannot be recycled, it will be treated and/or disposed of in authorized on-site or off-site facilities appropriate for the waste classification.

Characterization Table

Waste Description	**Waste # 1 MSW**	**Waste #2 Drill Cuttings**	**Waste #3 Contact IDW**	**Waste #4 Decon Fluids**	**Waste #5 PCS**	**Waste #6 Excavated Soil**	**Waste #7 Debris**
Volume	< 1 cy	5 cy	<1 cy	< 55 gal	<1 cy	5 cy	1 cy
Packaging	Approved Container	Approved Container	Approved Container	Approved Container	Approved Container	Approved Container	Approved Container
Regulatory Classification							
Radioactive		X	X	X	X	X	X
Solid	X	X	X	X	X	X	X
MSW	X						
Hazardous		X	X	X	X	X	X
MLLW (hazardous and radioactive)		X	X	X	X	X	X
Toxic Substances Control Act (TSCA)		X	X	X	X	X	X
New Mexico Special Waste					X		
Industrial		X	X	X	X	X	X
Green is Clean			X				
Characterization Method							
Acceptable knowledge (AK): Existing Data/Documentation	X		X	X	X		
AK: Site Characterization			X				
Direct Sampling		X		X	X	X	X
Analytical Testing							
Volatile Organic Compounds (EPA 8260-B)		X		X	X	X	X
Semivolatile Organic Compounds (EPA 8270-C)		X		X	X	X	X
Organic Pesticides (EPA 8081-A)		AK			AK	AK	AK
Organic Herbicides (EPA 8151-A)		AK			AK	AK	AK
PCBs (EPA 8082)		X		X	X	X	X
Total Metals (EPA 6010-B/7471-A)		X		X	X	X	X
Total petroleum hydrocarbon (TPH)-GRO (EPA 8015-M)		X			X	X[a]	X[a]
TPH-DRO (EPA 8015-M)		X			X	X[a]	X[a]
TCLP Metals (EPA 1311/6010-B)		X[a]			X	X[a]	X[a]
TCLP Organics					X		
Tritium (liquid scintillation) (EPA 906.0)		X		X	X[d]	X	X
Gamma spectroscopy		X		X	X	X	X

Waste Description	Waste # 1 MSW	Waste #2 Drill Cuttings	Waste #3 Contact IDW	Waste #4 Decon Fluids	Waste #5 PCS	Waste #6 Excavated Soil	Waste #7 Debris
(EPA 901.1)							
Isotopic plutonium (chem. separation/alpha spec.) (HASL-300)		X		X	X^{d}	X	X
Isotopic uranium (chem. separation/alpha spec.) (HASL-300)		X		X	X^{d}	X	X
Strontium-90 (EPA 905)		X		X	X^{d}	X	X
Americium-241 (chem. separation/alpha spec.) (HASL-300)		X		X	X^{d}	X	X
Gross Alpha (EPA 900)				X			
Gross Beta (EPA900)				X			
TDS				X^{e}			
TSS				X^{e}			
COD				X^{e}			
TTO (Method 624, 625A, 625B)				X^{e}			
Oil/ grease				X			
pH				X			
Microtox				X			
Perchlorate		X		X	X	X	X
Nitrates		X		X^{e}	X	X	X
Waste Profile Form #	NA	TBD	TBD	TBD	TBD	TBD	TBD

[a] If needed

[b] If waste is destined for Energy Solutions facility in Clive, Utah.

[c] If waste is destined for an authorized New Mexico Special Waste Facility, it will require TPH data.

[d] If waste may have contacted radioactively-contaminated soil.

[e] If the waste is destined for the RLWTF.

Note: Section 1.2 of the TCLP method 1311 states "If a total analysis of the waste demonstrates that individual analytes are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP need not be run." The methodology for using total waste analyses determination for the 40 TC constituents is as follows;

Liquids – Wastes containing less than 0.5% filterable solids do not require extraction and therefore by filtering the waste and measuring the total constituent levels of the filtrate and comparing those levels to regulatory levels is appropriate.

Solids – Constituent concentrations from the extraction fluid of wastes that are 100% physical solids are divided by 20 (reflecting the 20 to 1 ratio of TCLP extraction) and then compared to the regulatory levels. If the theoretical levels do not equal or exceed the regulatory levels, the TCLP need not be run. If the levels do equal or exceed the regulatory levels, the generator will run TCLP analyses.

Signatures	**Date**
ADEP Project Manager (Sign below) Becky Coel-Roback	2/17/10
Preparer (Sign below) Jon Roberson	2/1/10
WES Waste Management Coordinator (Sign below) Ron DeSotel	2/17/10
ENV-RCRA Representative (Sign below) Ann Sherrard	2/1/10
Waste Certification Program Representative (Sign below) Michelle Coriz Michelle L Coriz	2/1/10
WES-WA Representative (Sign below) Andy Elicio	02/01/10

Roberson, Jon

From: Saundra Martinez [saundra@lanl.gov]
Sent: Monday, January 25, 2010 1:17 PM
To: Roberson, Jon
Subject: Emailing: DocEditPrint_wconcur

Environmental Programs (EP) Document Signature Form

Document Catalog Number: EP2010-0039
(Please prefix the name of all electronic versions of this document with this number.)

Document Title /Subject: Implementation of the Accelerated Correction Actions Work Plan for Upper Los Alamos Canyon aggregate Area, Former Technical Area 32 AOCs: 32-003, 32-004 SWMUs: 32-002(a), 32 002(b) Characterization sampling and remediation

PRSs: None **OUO Information: Y / N**

Associated Document Catalog Number(s): None

Author: Coel-Roback, Becky J 665 5011 becky_cr@lanl.gov

Organization: EP: Corrective Actions Projects (CAP) – PKG #1728

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Status/Comments: POC: Jon Roberson, 505-328-0326

Reviewer Signatures: (By signing below, the reviewer indicates that he/she **reviewed and approv** the document. Conditional approval may be indicated by checking the COMMENTS ATTACHED bo

Reviewer (Print reviewer's name under title)	**Signature**	**Date**	**Comments Attached**
- SIGNATURES ON FINAL DOCUMENT -			

Document Catalog Number EP2010-0039

H2135

Los Alamos
NATIONAL LABORATORY
EST. 1943

Waste Profile Form

For rapid processing, complete all sections in black or blue ink and mail to: Waste Acceptance Group at MS J496.
For assistance with completing this form, contact your WMC. Click here for instruction in completing the form.

Contact (*if other than given below*)

Reference Number
(*for Waste Acceptance Group Use Only*)

Generator's Z Number 146032	Waste Generator's Name (*print*) Becky Coel-Roback	WMC's Z Number 235056	WMC's Name (*print*) Deborah Lazowski	Generator's Phone 505-665-5011
Generator's Mail Stop M992	Waste Generating Group PMFS-DO	Waste Stream Technical Area 32	Building NA	Room	WMC Phone 505-500-7595

Waste Accumulation (*check only one*)
☐ Satellite Accumulation Area Site No: ______
☐ Less-than-90-days Storage Area Site No: ______
☐ TSDF Site No: ______
☐ Universal Waste Storage Area Site No: ______
☐ Used Oil for Recycle Site No: ______
ER Use Only
☒ ER Site SWMU/AOC No. 32-002(a)

☐ PCBs Storage Area Site No: ______
☐ NM Special Waste Site No: ______
☐ Rad Staging Area Site No: ______
☒ Rad Storage Area Site No: 5517
☐ None of the Above

Method of Characterization (*check as many as apply*)
☒ Chemical Physical Analysis ☒ Attached Sample No: See Section 5 #3
☒ Radiological Analysis ☒ Attached Sample No: See Section 5 #3
☐ PCB Analysis ☐ Attached Sample No: ______
☐ Acceptable Knowledge Documentation ☐ Attached Documentation No: ______
☐ MSDS ☐ Attached

Section 1 – Waste Prevention/Minimization (*answer all questions*)

Can hazard segregation, elimination, or material substitution be used? ☐ Yes (*provide comments*) ☒ No
Can any of the materials in the waste stream be recycled or reused? ☐ Yes (*provide comments*) ☒ No
Has waste minimization been incorporated into procedures or other process controls? ☒ Yes ☐ No (*provide comments*)
Can this waste be generated outside a RCA? ☐ Yes (*provide comments*) ☐ No ☒ N/A
Comments:

Section 2 – Chemical and Physical Information

Waste Type (*check only one*)
☐ Unused/Unspent Chemical (complete all sections as appropriate)
☒ Process Waste/Spent Chemical/Other (complete all sections)

Radiological Information
Was Waste generated in a RCA?
☐ Yes ☒ No
☐ Non-radioactive
☒ Radioactive – Low Level
☐ Radioactive – Transuranic

Waste Destination (*check only one*)
☐ SWWS (complete Attachment 1)
☐ RLWTF (complete Attachment 2
☐ RLWTP (complete Attachment 3)
☐ TA-16/HE (complete Attachment 4)
☐ NTS (complete Attachment 5)

Classification Information
☒ Unclassified
☐ Classified/Sensitive

Waste Category (*check all that apply*)
☒ Inorganic
☒ Organic
☐ Solvent*
☐ Degreaser*
☐ Dioxin
☐ Electroplating
☐ Treated Hazardous Waste or Residue
☐ No-Longer Contained-In
☐ Explosive Process
☐ Infectious/Medical
☐ Biological
☐ Beryllium
☐ Empty Container (see instructions)
☐ Battery (see instructions)
Asbestos ☐ Friable
☐ non-friable
PCB Source Concentration
☐ PCB < 50 ppm
☐ PCB ≥ 50 - < 500 ppm
☐ PCB ≥ 500 ppm
☐ Hazardous Waste Contaminated Soil
☐ Untreated Hazardous Debris
☐ Commercial Solid Waste
☐ Other (describe below)
* See Instructions

Waste Source (*check only one*)
Waste Source A
☐ Decon
☐ Materials Processing Production
☐ Research/Development/Testing
☐ Scheduled Maintenance
☐ Housekeeping - Routine
☐ Spill Cleanup - Routine
☐ Sampling – Routine Monitoring
☐ Other (describe below)

Waste Source B
☐ Abatement
☐ Construction/Upgrades
☐ Demolition
☐ Decon/Decom
☒ Investigative Derived
☐ Orphan/Legacy
☐ Remediation/Restoration
☐ Repacking (secondary)
☐ Unscheduled Maintenance
☐ Housekeeping (non-routine)
☐ Spill Cleanup (non-routine)
☐ Non-Petroleum Tanks
☐ Petroleum Tanks

☐ Other (describe below)

Waste Matrix (*check only one*)
Gas
☐ ≤1.5 Atmospheres Pressure
☐ >1.5 Atmospheres Pressure
☐ Liquefied Compressed Gas
Liquid
☐ Aqueous
☐ Non-Aqueous
☐ Suspended Solids/Aqueous
☐ Suspended Solids/Non-Aqueous
Solid
☐ Powder/Ash/Dust
☐ Solid
☐ Sludge
☐ Absorbed/Solidified Liquid
☒ Debris

Matrix Type (*check only one*)
☐ Homogeneous
☒ Heterogeneous (describe below)
Broken up asphalt pavement with incidental soil

Estimated Annual Volume (m^3):
0.21

Section 3 – Process and Waste Description

Process Description:
Removal of asphalt paving from ground for Upper LA Canyon ACA project. SMWU/AOC 32-002(a).

Waste Description:
Asphalt pavement with incidental soil.

Section 4 – Characteristics

Ignitability (*check only one*)	**Corrosivity** (*check only one*) (pH)	**Reactivity** (*check as many as apply*)	**Boiling Point** (check only one)
(°F) (°C)	☐ ≤ 2.0	☐ RCRA Unstable	(°F) (°C)
☐ < 73 < 22.8	☐ 2.1 – 4.0	☐ Water Reactive	☐ ≤ 95 ≤ 35
☐ 73 – 99 22.8 - 37.2	☐ 4.1 – 6.0	☐ Cyanide Bearing	☐ > 95 > 35
☐ 100 – 139 37.8 - 59.4	☐ 6.1 – 9.0	☐ Sulfide Bearing	
☐ 140 – 200 60.0 - 93.3	☐ 9.1 - 12.4	☐ Pyrophoric	
☐ > 200 > 93.3	☐ ≥ 12.5	☐ Shock Sensitive	
☐ EPA Ignitable – Non-liquid	☐ Liquid corrosive to steel	☐ Explosive - DOT Div.: ________	
☐ DOT Flammable Gas	☒ Non-aqueous	☒ Non-reactive	☒ Not applicable
☐ DOT Oxidizer			
☒ Not Ignitable			

	Characterization Method				Concentration of Contaminants				
				None or	Contaminant present at				
Identify for all contaminants listed.	AK	TCLP	Total	Non-detect	Minimum		Maximum		Regulatory Limit
Toxicity Characteristic Metals					(10,000 ppm = 1%)				
Arsenic	☐	☒	☐	☒		to		ppm	5.0 ppm
Barium	☐	☒	☐	☐	0.516	to	0.518	ppm	100.0 ppm
Cadmium	☐	☒	☐	☐	0.0024	to	0.0026	ppm	1.0 ppm
Chromium (Total)	☐	☒	☐	☒		to		ppm	5.0 ppm
Lead	☐	☒	☐	☒		to		ppm	5.0 ppm
Mercury	☐	☒	☐	☒		to		ppm	0.2 ppm
Selenium	☐	☒	☐	☒		to		ppm	1.0 ppm
Silver	☐	☒	☐	☒		to		ppm	5.0 ppm
Toxicity Characteristic Organics									
Benzene	☐	☐	☒	☒		to		ppm	0.5 ppm
Carbon Tetrachloride	☐	☐	☒	☒		to		ppm	0.5 ppm
Chlorobenzene	☐	☐	☒	☒		to		ppm	100.0 ppm
Chloroform	☐	☐	☒	☒		to		ppm	6.0 ppm
o – cresol	☐	☐	☒	☒		to		ppm	200.0 ppm
m - cresol	☐	☐	☒	☒		to		ppm	200.0 ppm
p – cresol	☐	☐	☒	☒		to		ppm	200.0 ppm
Cresol – mixed	☐	☐	☒	☒		to		ppm	200.0 ppm
1,4-Dichlorobenzene	☐	☐	☒	☒		to		ppm	7.5 ppm
1,2-Dichloroethane	☐	☐	☒	☒		to		ppm	0.5 ppm
1,1-Dichloroethylene	☐	☐	☒	☒		to		ppm	0.7 ppm
2,4-Dinitrotoluene	☐	☐	☒	☒		to		ppm	0.13 ppm
Hexachlorobenzene	☐	☐	☒	☒		to		ppm	0.13 ppm
Hexachlorobutadiene	☐	☐	☒	☒		to		ppm	0.5 ppm
Hexachloroethane	☐	☐	☒	☒		to		ppm	3.0 ppm
Methyl ethyl ketone	☒	☐	☐	☒		to		ppm	200.0 ppm
Nitrobenzene	☐	☐	☒	☒		to		ppm	2.0 ppm
Pentachlorophenol	☐	☐	☒	☒		to		ppm	100.0 ppm
Pyridine	☒	☐	☐	☒		to		ppm	5.0 ppm
Tetrachloroethylene	☐	☐	☒	☒		to		ppm	0.7 ppm
Trichloroethylene	☐	☐	☒	☒		to		ppm	0.5 ppm
2,4,5-Trichlorophenol	☐	☐	☒	☒		to		ppm	400.0 ppm
2,4,6-Trichlorophenol	☐	☐	☒	☒		to		ppm	2.0 ppm
Vinyl chloride	☐	☐	☒	☒		to		ppm	0.2 ppm
Herbicides and Pesticides									
Chlordane	☐	☐	☒	☒		to		ppm	0.03 ppm
2,4-D	☐	☐	☒	☒		to		ppm	10.0 ppm
Endrin	☐	☐	☒	☒		to		ppm	0.02 ppm
Heptachlor (& its epoxide)	☐	☐	☒	☒		to		ppm	0.008 ppm
Lindane	☐	☐	☒	☒		to		ppm	0.4 ppm
Methoxychlor	☐	☐	☒	☒		to		ppm	10.0 ppm
Toxaphene	☐	☐	☒	☒		to		ppm	0.5 ppm
2,4,5-TP (Silvex)	☐	☐	☒	☒		to		ppm	1.0 ppm

Section 5 – Additional Constituents and Contaminants

Additional Constituents and Contaminants. Please account for 100% of waste. Range should be given within guidelines of individual constituents. List all other constituents (including inerts) not identified above and attach any applicable analysis. No chemical formula allowed in this field. Continue in Section 3 Additional information as necessary. CAS numbers are needed for all chemical constituents, for material without a CAS number, enter "No CAS Number." Contact Waste Acceptance at 5-4000 for assistance.

CAS No.	Name of constituent	Minimum		Maximum	
NA	Soil	0.5	to	1	%
NA	Asphalt	99	to	100	%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
			to		%
	Total of max. ranges of this section and page 2		101	in %	

Additional Information (Use additional sheet if necessary.)

If additional information is available on the chemical, physical, or radiological character of the waste not covered on this form, provide it below

1. WSCF: EP2010-0039
2. Waste Stream #7: Debris
3. Sample event 2683, WST32-10-13898 results attached.
4. SMWU/AOC: 32-002(a).
5. Due diligence for SMWU/AOC 32-002(a) is attached.
6. Based on historical information, Upper LA Canyon Aggregate Area (LANL 2006, 091915) and the investigative report (LANL 2009, 106597) there is no documentation in directing use, storage or manufacture of herbicides and pesticides at this location.
7. Through historical information and process knowledge, (MSDS) there is no indication that MEK (Methyl ethyl ketone) and Pyridine would be present in asphalt.

Section 6 - Work Control Documentation (answer all questions)

Do the procedures for this process cover how to manage this waste? ☒ Yes ☐ No (*provide comments*)

Do the procedures for this process address controls to prevent changes to waste constituents and concentrations or addition or removal of waste to/from containers? ☒ Yes ☐ No (*provide comments*)

Comments:

Section 7 – Packaging and Storage Control

Describe how the waste will be packaged in according to the applicable WAC.

DOT approved containers.

Identify the storage management controls that will be used for this waste stream: (*check all that apply*)

☐ Tamper Indication Devices ☐ Limited use locks with log-in for waste ☐ Locked cabinet or building ☒ Other (describe) 55-gallon drum in sec

Section 8 – Waste Certification Statements (*check only one*)

☒ Waste appears to meet WAC attachment for: LANL WAC Attachment 3, Solid LLW

☐ Waste stream needs exception/exemption for treatment, storage, or disposal at:

☐ Waste does not meet the criteria for any known TSDF. (DOE approval is required. Contact the office of the Principle Associate Director for Weapons Programs [PADWP] for assistance.)

Waste Generator Certification: Based on my knowledge of the waste and/or chemical/physical analysis, I certify that the waste characterization information on this form is correct and that it meets the requirements of the applicable waste acceptance criteria. I understand that this information will be made available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: ______ Date: 9/15/10

Waste Management Coordinator: I have reviewed this form and any associated attachments and the characterization information provided appears to be complete and accurate. I certify, to the best of my knowledge, that the waste characterization information provided by the waste generator meets the requirements of the applicable WAC.

Signature: ______ Date: 9-15-10

GREEN IS CLEAN MATERIAL DISPOSAL REQUEST FORM

To: SWO GIC Operation for Pre-Approval FAX 665-8347 | **( ) Approved For Shipment to TA-54 Area G (665-4356): Date Approved ________ SWO Approver Initials**

SWO GIC Request #: ____________

SWO Reviewer Name: **K. ~~GREUTSMACHER~~** Gruetzmacher

Z# 099731

Authorized GIC Generator (x) Yes ( ) No

Acceptable Knowledge Materials: (x) For SWO verification and potential release
( ) For Database Entry Only (Direct released by generator without shipment to SWO)

Waste Generator Return:
Name: Becky Coel-Roeback FAX
#: 146032

WMC Z# 235056	WMC Name (PRINT) Deborah Lazowski	WMC Tel. # 505 500 7595	WMC Mail Stop M992	Date Submitted 10/12/10	RCA Type ( ) β/γ ( ) α (x) Both	Classified Material ( ) Yes (x) No	Pure Beta Emitter ( ) Yes (x) No

Generator Group EP-CAP	(x) Routine ( ) Non-routine	( ) Surface (x) Volume	Compactible (x) Yes ( ) No	(x) Generator Will Deliver ( ) SWO to Pick Up Load at (Specify) TA-Bldg-Rm ________	Waste Verification Location (x) TA-54-2 (α,β,γ) ( ) TA-48 (β,γ) ( ) Other (Specify) ________

GIC ID #	Generated At (TA-Bldg-Rm)	Charge Code* (Cost Cntr/ Prog/ Acct/Work Pkg)	Vol. (Ft³)	Wt. (Lbs)	Material Description	Disposition (Percent) Solid	Re-cycle	LLW	Date Processed	Veri-fier Init.	Comments
7031759	TA-32	61000A MR3A 0224 JPT0	0.5	0.5	Contact waste, gloves , tubing						

NOTE: This shipment is exempt from DOT requirements. The activity level is less than 2 nanocuries per gram, and does not meet the DOT definition of a radioactive material.

- **Waste Generator Certification**: *Based on my process knowledge of the waste and/or chemical/physical/radiological analysis, the waste is expected to be free of radioactive contamination,and I certify that the information on this form is correct. I understand that this information may be made available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.*

  Waste Generator Signature (Required): ________ **Date:** 10/12/10

- **Waste Management Coordinator**: *I have reviewed this form, and to the best of my knowledge, the information is complete and accurate.*

  WMC Signature (Required): ________ **Date:** 10/12/10

- **GIC Verifier Name** (Required): ________ **Date:** ________

*Although there is no charge for Green is Clean waste, the complete generator "Charge Code" is required; it is the participant identifier in the database