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subject: Delivery of Justification for Class III Permit Modification, LTES 1, Cable Debris Site

Please find attached the Justification for Class III Permit Modification, LTES 1, Cable Debris Site binder. Also included is the informational poster (in small format) that will be available for public viewing on April 17, 2012.

Delivery of this package includes the following locations:

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SNL1221

Justification for
Class III Permit Modification
March 2012

LTES 1
Operable Unit 1306
Cable Debris Site
(Technical Area III)

NFA Submitted March 2009
NOD Response Submitted February 2010

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Sandia National Laboratories/New Mexico Long Term Environmental Stewardship Program

INVESTIGATION REPORT AND PROPOSAL FOR CORRECTIVE ACTION COMPLETE FOR LTES SITE 1—CABLE DEBRIS SITE

March 2009

Sand Number 2009-1119 P
Unclassified Unlimited Release

United States Department of Energy
Sandia Site Office

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ACRONYMS AND ABBREVIATIONS

AOP	Administrative Operating Procedure
ARCOC	Analysis Request and Chain-of-Custody
bgs	below ground surface
CAC	Corrective Action Complete
COC	constituent of concern
COOC	Compliance Order on Consent
DOE	Department of Energy
EB	equipment blank
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
EM	Environmental Management
HE	high explosive
HI	hazard index
HQ	hazard quotients
KAFB	Kirtland Air Force Base
LTES	long term environmental stewardship
MDA	minimum detectable activity
MDL	method detection limit
mg/kg	milligram per kilogram
mrem	millirem
NFA	no further action
NMED	New Mexico Environment Department
RCRA	Resource Conservation and Recovery Act
RCT	Radiation Control Technician
RME	reasonable maximum exposure
RPSD	Radiation Protection Sample Diagnostics
SMO	Sample Management Office
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TA	Technical Area
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TEDE	total effective dose equivalent
TOP	Technical Operating Procedure
UXO	unexploded ordnance
UXOSO	Unexploded Ordnance Safety Officer
VCA	voluntary corrective action
yr	year

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1.0 PROJECT BACKGROUND AND REGULATORY HISTORY

This Investigation Report describes the Voluntary Corrective Action (VCA) that was completed at the Long Term Environmental Stewardship (LTES) Site 1, Cable Debris Site, located in Technical Area (TA) III of Sandia National Laboratories New Mexico (SNL/NM). The VCA included the removal of surface debris from the site, including the surge basin and surrounding area, confirmatory soil sampling, and other activities completed as part of site closure.

This VCA was conducted under Section VI.H.3 and 4 of the Compliance Order on Consent (COOC) between the Department of Energy (DOE), Sandia Corporation, and the New Mexico Environment Department (NMED) (NMED, 2004). The VCA was designed to accomplish segregation and removal of the surface debris. After removal of the surface debris, soil sampling was performed to confirm the site does not pose unacceptable risk to human health and the environment. The cleanup is consistent with overall corrective action objectives and requirements, and is consistent with the VCA process established in the COOC. Visual surveys, along with final confirmatory sampling were used to verify the objectives were met. As required by Section VI.H of the COOC, the VCA Plan (SNL/NM, 2008) was submitted to the NMED on May 2008 and the field work started on August 2008. The NMED approved the VCA Plan on October 25, 2008 (Bearzi, 2008). All field activities were completed by January 30, 2009, including demobilization and validation of the confirmatory soil sampling analytical results. This Investigation Report presents the results of the VCA and was submitted to the NMED within 90 days of completion of the VCA field work as required by the COOC.

2.0 LTES SITE 1: CABLE DEBRIS SITE

2.1 Summary

SNL/NM personnel conducted a VCA at LTES Site 1 to remove solid waste and confirm there are no known or specific environmental concerns at this site. The assessment was conducted to determine whether environmental contamination was released to the environment via the surface debris at the site. This report provides documentation that the site has been adequately characterized, that no significant releases of contaminants to the environment occurred, and that it does not pose a threat to human health or the environment under either the industrial or residential land-use scenarios. The surface debris removal was completed on January 30, 2009.

Review and analysis of all relevant data for LTES Site 1 indicate that concentrations of constituents of concern (COCs) at this site are below applicable risk assessment action levels as well as confirm that no release to the environment from the debris is evident. However, if NMED were to consider a release was evident and deem as a SWMU, then a determination of Corrective Action Complete (CAC) without controls (NMED, 2004) is recommended for LTES Site 1. This determination is based upon confirmatory soil sampling results that demonstrate COCs released from the site into the environment occur at levels that are protective of human health and the environment.

2.2 Site Description and Operational History

2.2.1 Site Description

The LTES Site 1 is located within the boundaries of Kirtland Air Force Base (KAFB) (Figure 2.2.1-1) in TA III of SNL/NM on KAFB land permitted to the DOE. The LTES Site 1 consisted of surface debris piles located primarily within a surge basin, with some minor debris located outside the surge basin in the general vicinity. A surge basin is hole or depression that is part of a drainage system that provides additional storage and retention of water during heavy rainfall or flood events. The surge basin at the LTES Site 1 is a circular depression approximately 1.3 acres in size (Figure 2.2.1-2).

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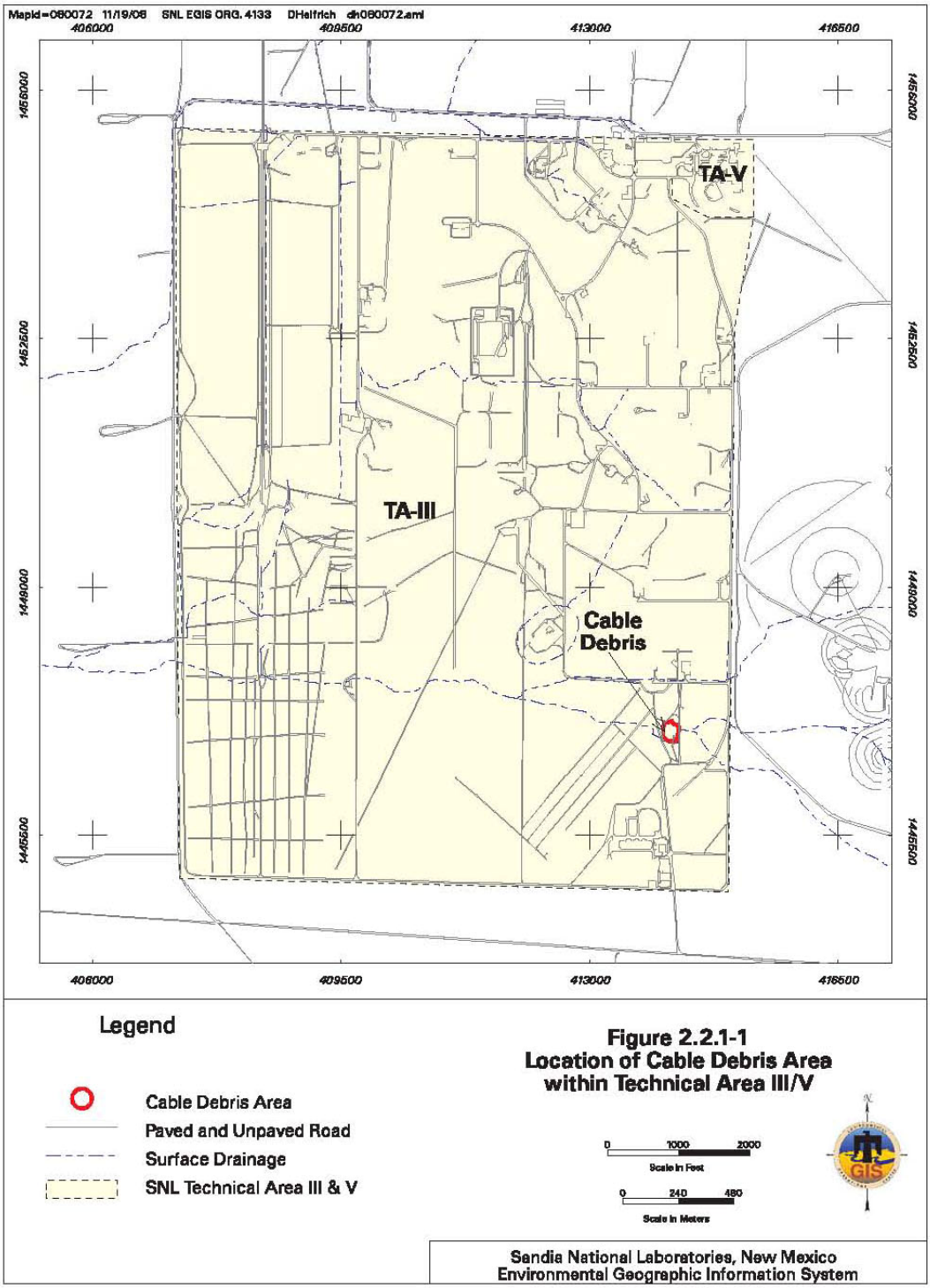

Figure 2.2.1-1. Location of Cable Debris Site within Technical Area-III

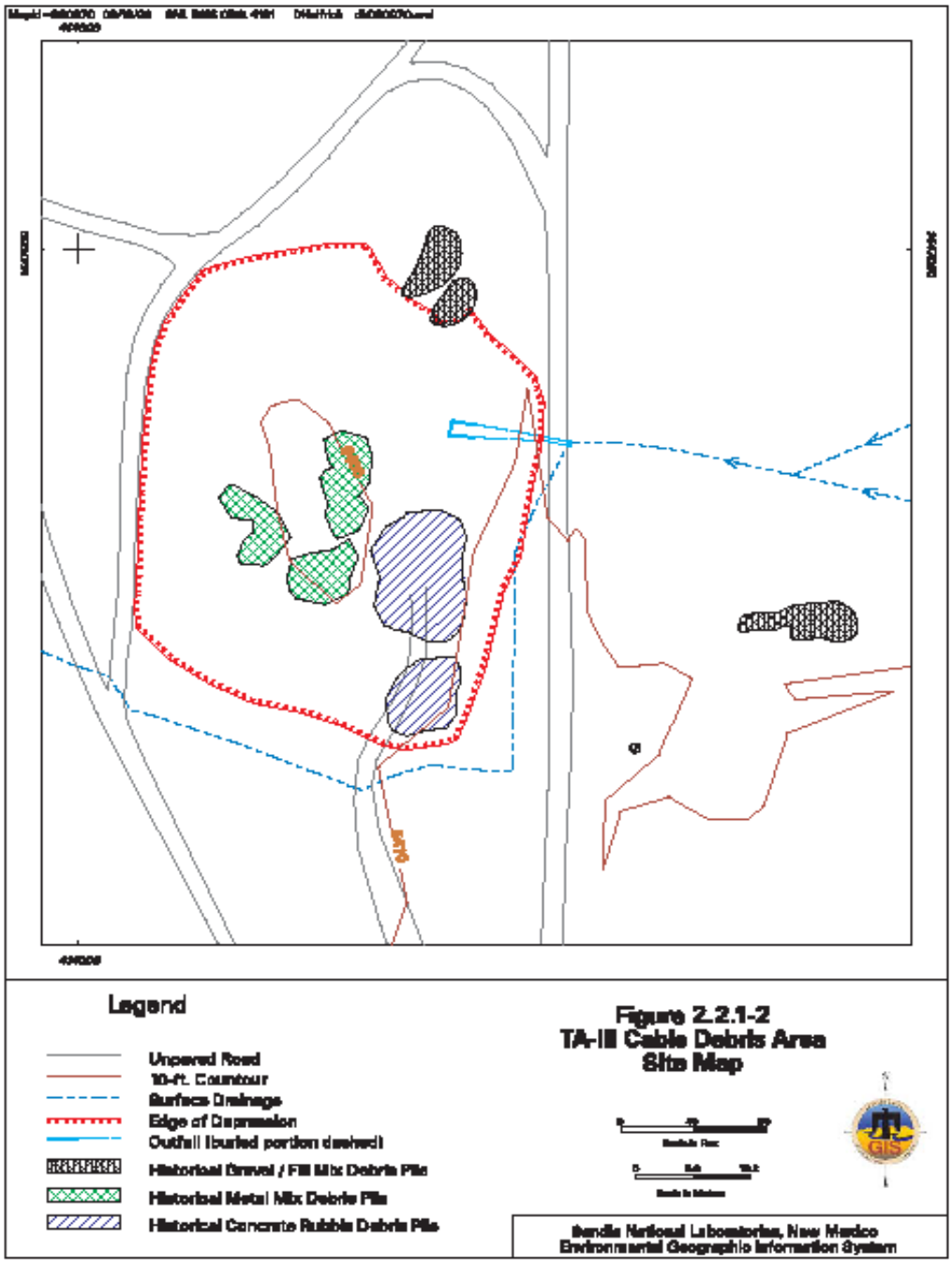

Figure 2.2.1-2. TA-III Cable Debris Site Map

Three of the debris piles were primarily comprised of metal cables with other metal debris, including rebar, steel pipe, tubes, weldments, welded steel fixtures, spent rocket motors and powder actuated cable cutters. The remaining two piles in the surge basin were comprised primarily of concrete rubble and rebar; one of these piles is located on the edge of the basin. In addition, there are five smaller debris piles directly east of the surge basin which are primarily comprised of small cobbles, fill dirt and some minor solid waste that includes paper, plastic, and small metal debris. Based upon visual inspection, there was no indication that these piles contain anything other than minor solid waste — no soil staining or other signs of contamination were observed. Pre- and post-debris removal photographs of the site are provided in Annex A.

The area surrounding the surge basin is part of the east mesa and generally flat with a gentle slope to the southwest (i.e., towards the Rio Grande). No major arroyo channels occur in the area. Precipitation is low in the region (approximately 8 inches per year) and surface runoff is minimal, except during major precipitation events. The area has been previously disturbed and vegetation primarily consists of desert grasses, cacti, tumbleweeds, and other annual species typical of disturbed areas of the east mesa ecosystem.

2.2.2 Operational History

The operational history at the LTES Site 1 is unknown. However, based on the available information, this location has never been an active site and the contamination is limited to the surface debris (i.e., solid waste) that was probably transported to the area from various test areas. However, prior to 1995, no information is available and the precise origin of the debris is unknown.

2.3 Land Use

2.3.1 Current Land Use

The current land use for LTES Site 1 is industrial (DOE et al., 1995).

2.3.2 Future/Proposed Land Use

The projected future land use for LTES Site 1 is industrial (DOE et al., 1995).

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3.0 VCA AND INVESTIGATORY ACTIVITIES

3.1 Summary

Between August 2008 and January 2009 a VCA was completed for the LTES Site 1. The primary focus of the VCA was debris segregation, sizing, and final disposition. The debris was processed to a manageable size, segregated, and disposed of either through recycling or waste disposal paths. Confirmatory soil samples were collected after the debris was removed. Sample locations were biased to the areas where debris was located. The samples were primarily analyzed for target analyte list (TAL) metals using Environmental Protection Agency (EPA) Method 6020, high explosives (HE) using EPA Method 8330, and radionuclides using gamma spectroscopy. In addition, two waste characterization samples were also analyzed for semi-volatile compounds (SVOCs) using EPA Method 8270, and toxicity characteristic leaching procedure (TCLP) metals using EPA Method 3005/ 3010. These activities and results are discussed in the following sections.

3.2 VCA Field Implementation

Implementation of the VCA at LTES Site 1as documented in the NMED-approved VCA Plan (SNL/NM, 2008) addressed two primary waste streams, metals and concrete. In addition, assorted solid waste was generated during the sorting and segregation process. All three of these waste streams are discussed below.

3.2.1 Metal

Segregation and sizing of the metal debris was conducted using a shear attachment on an excavator. Once sized, all metal was placed into roll-off containers for recycling. A large round steel target filled with concrete was dismantled during the metal segregation. The concrete was removed from the steel target casing using a hammer attachment on the excavator, and the resulting debris was then separated into its respective debris waste streams.

The Unexploded Ordnance Safety Officer (UXOSO) performed an initial visual inspection on the metal debris piles for potential Unexploded Ordnance (UXO) debris. Potential UXO items found included six powder actuated cable cutters, and several spent rocket motors and rocket motor casings. These items were placed in a segregated staging area. None of the rocket motors

were live. Of the 6 powder actuated cable cutters found onsite, only one of the cutters was potentially “live”, and was taken by KAFB Explosive Ordnance Disposal (EOD) before disposal.

An SNL/NM Radiation Control Technician (RCT) performed radiological surveys of approximately 10% of metal debris. No radioactive contamination was detected as part of these confirmatory surveys. Metal debris staged in roll-off containers was transported and recycled offsite by a SNL/NM contractor.

3.2.2 Concrete

Concrete debris piles were mechanically screened using a Screen-All Plant. The Screen-All Plant was fitted with a 2-inch screen deck to segregate the concrete from soil. Concrete for recycling was required to meet the size specification of approximately 2-feet, by 2-feet, by 2-feet maximum dimensions. Concrete determined to be greater than this size specification, after screening, was sized using a hammer attachment on the excavator. A water truck was used to spray water on the concrete debris piles to control dust throughout the screening activities. A front-end loader with a bucket attachment was used to place the concrete debris onto the screen deck. The concrete and other potential debris (metal, wood, and solid waste) was then segregated from soil. The screened concrete was stockpiled directly on the ground surface and later loaded and transported to the existing SNL/NM concrete recycling area in TA III. The screened soil was stockpiled in the bottom of the retention basin and confirmation soil samples were collected (see Section 3.3 for sampling results).

Specific debris items, including a poly-lined 55-gallon drum full of stained soil, a burlap wrangler bag containing activated carbon, and a lead acid battery were placed in a segregated staging area. The lead acid battery was disposed of as hazardous waste through the SNL/NM Hazardous Waste Management Facility (HWMF). In addition, several fragments of lead were found along the east slope of the storm water retention basin. The lead fragments were separated from the soil and other debris using the Screen-All Plant, screened for radiological contamination, and re-used through the SNL/NM Lead Bank.

The UXOSO performed an initial visual inspection on the concrete debris piles. As this work progressed the UXOSO continually inspected both the initial concrete debris piles and the screened debris piles generated by the Screen-All Plant operations for any potential UXO debris or items. No UXO debris or items were present in the initial or screened debris piles.

An SNL/NM RCT performed radiological surveys of approximately 10% of the concrete debris. No radioactive contamination was detected as part of these confirmatory surveys. All concrete debris was processed for re-use through the SNL/NM concrete recycling program in TA III.

3.2.3 Solid Waste

A small volume of solid waste was generated during the concrete screening process. The solid waste was segregated into the following three primary waste streams; general solid waste (including metals, plastics, some construction debris, and trash), electrical cable of various sizes, and wood. The quantity and disposition of the solid waste is summarized in Table 3.2-1.

3.2.4 Summary

Debris streams and quantities of existing materials at the LTES Site 1 are summarized in Tables 3.2-1 and 3.2-2.

Table 3.2-1 Quantity and Disposition of General Debris

Debris Type	Approximate Quantity	Unit	Disposition
Metal	5	30 yd^3 roll off container	Recycled Offsite
Concrete Rubble	150	Tons	Recycled
Lead Fragments	1000-1500	Pounds	SNL/NM Lead Bank
General Solid Waste	10	Yd^3	Sanitary Landfill via the SNL/NM Solid Waste Transfer Facility
Wood	400	Pounds	Recycled
Electrical Cable	400	Pounds	Recycled

Table 3.2-2 Type and Quantity of Segregated Debris Items

Item	Quantity	Location	Disposition
Spent Rocket Motors and Rocket Motor Casings	9	Metal Debris Pile	Recycled through SNL/NM Reapplications High Risk Material Program
Cable Cutters (spent)	5	Metal Debris Pile	Recycled through SNL/NM Reapplications High Risk Material Program
Cable Cutter (live)	1	Metal Debris Pile	Picked up by KAFB EOD
20 Gallon Drum with Cable Cutter Actuator Batteries	1	Concrete Pile	Disposed as Hazardous Waste through SNL/NM HWMF
55 Gallon Overpacked Drum with Stained Soil	1	Concrete Pile	Disposed as Solid Waste through SNL/NM HWMF
Activated Carbon	1 Burlap Wrangler Bag	Concrete Pile; material was containerized in an overpack container.	Disposed as Hazardous Waste through SNL/NM HWMF
Lead Acid Battery	1	Concrete Pile	Disposed of as Hazardous Waste through SNL/NM HWMF

3.3 Investigation 2—Soil Sampling

Once the debris was sized, segregated, and stock piled; confirmatory soil sampling was conducted in accordance with the technical approach, requirements, and procedures in the VCA Plan (SNL/NM, 2008). On September 4 and September 9, 2008, surface soil samples were collected from 25 locations, including four samples collected from the screened soil stockpile that will remain onsite for use as fill material. Samples CDS-A1-0006-SS, CDS-A1-0006D-SS, CDS-A1-0022-SS, and CDS-A1-0025-SS characterize the screened soil stockpile. All 25 confirmatory soil samples (plus the three duplicates for a total of 28 samples) that represent post-VCA site conditions were analyzed for metals and HE. In addition, five of the 25 soil samples were also analyzed for radionuclides.

Two waste characterization samples were also collected: one sample was collected from the 55-gallon over packed drum containing stained soil and one sample was collected from the granular activated carbon found during the debris removal. These samples were used for waste characterization and final disposal purposes only, and do not represent post-VCA end-state conditions (i.e., this material was removed from the site). Therefore, these analytical results were used for proper waste disposal only and are not discussed further in Section 3.3.2. In addition, these analytical results are not included in the data tables and the risk assessment presented in Section 4.4 and Annex C. Figure 3.3-1 shows confirmatory soil sample locations and Table 3.3-1 summarizes the sample location and date, laboratory analyses, and analytical methods.

3.3.1 Soil Sampling Methodology

Surface (0 to 2-inch depth) confirmatory soil samples were collected at locations biased to the areas where debris was located. 32 total samples (including 3 field duplicates, 2 waste characterization and two equipment blanks) were collected for analysis. Radiological analyses were only performed on 5 confirmatory samples, and TCLP metals and SVOCs analyses were only performed on the 2 waste characterization samples for in the over packed drum and granular activated carbon (one sample each). All samples were documented and handled in accordance with applicable SNL/NM operating procedures and transported to off-site laboratories for analysis.

Samples were collected by personnel from the Environmental Management (EM) Program to a maximum depth of 2 inches using a spade or scoop. Soil was placed directly into sample containers and the samples were immediately labeled and placed in a cooler and stored at 4°C. Samples were delivered to the Sample Management Office (SMO) for processing and shipment to General Engineering Laboratories, Inc for analysis. A completed Analysis Request and Chain-of-Custody form (ARCOC) accompanied each shipment. Final confirmatory analytical results were evaluated using EPA SW-846 criteria, the SNL/NM SMO “Procedure for Completing the Contract Verification Review (CVR)" (SMO 05-03) (SNL/NM April 2007), and the "Data Validation Procedure for Chemical and Radiochemical Data” (AOP [Administrative Operating Procedure] 00-03) (SNL/NM, 2007) to verify data quality and defensibility. The ARCOCs, and data validation documentation are provided in Annex B.

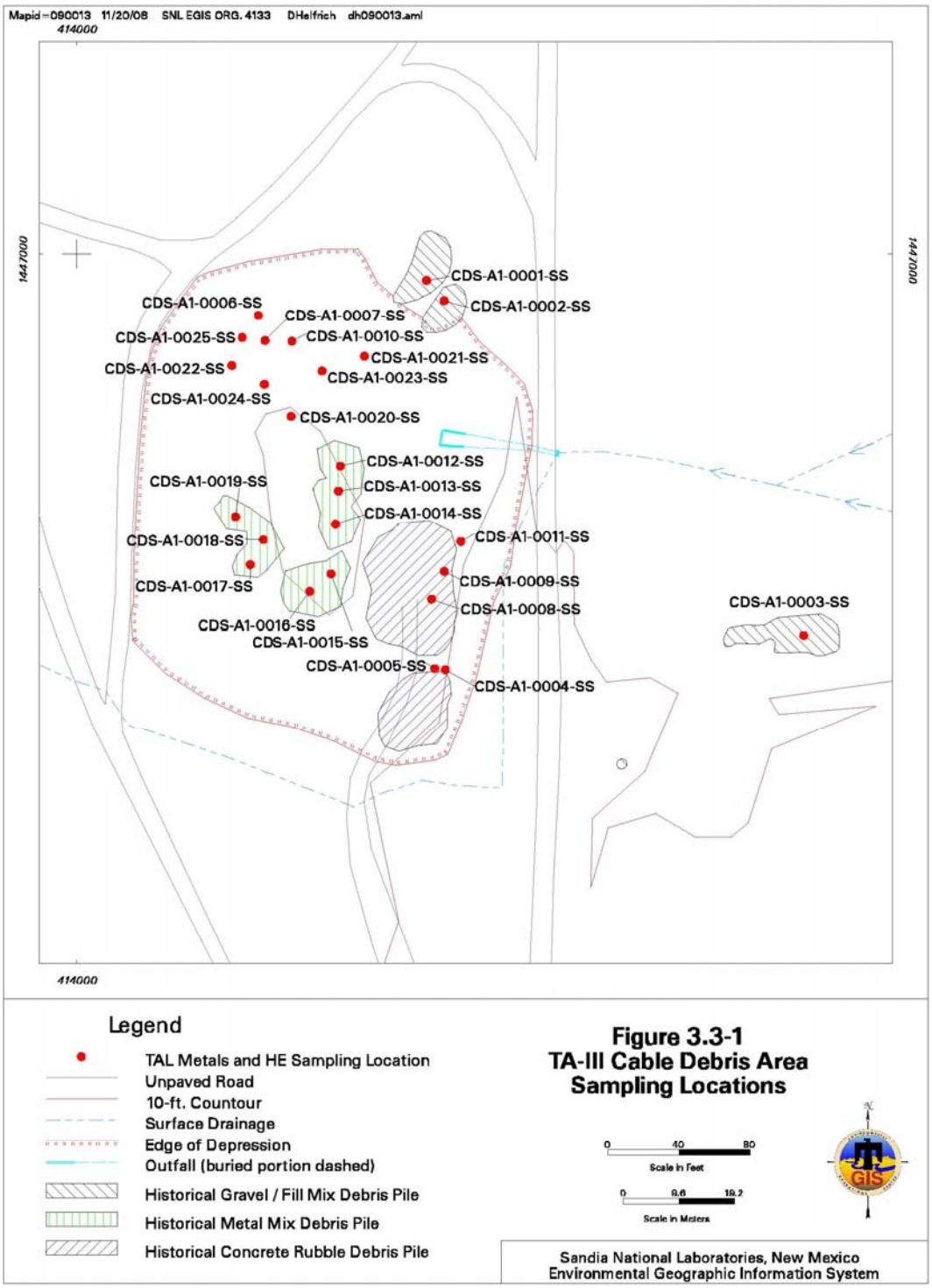

Figure 3.3-1 TA-III Cable Debris Site Sampling Locations

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Table 3.3-1
Summary of Area Sampled, Analytical Methods, and Laboratories Used for LTES Site 1 Soil Samples

Sample Location	Sample Analysis	Analytical Methods	Sample Date
CDS-A1-0001-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/09/08
CDS-A1-0002-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/09/08
CDS-A1-0003-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0004-SS	TAL Metals, HE, Radionuclides	EPA Methods 6020 and 8330, Gamma spectroscopy	09/09/08
CDS-A1-0005-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/09/08
CDS-A1-0006-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0006D-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0007-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0008-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/09/08
CDS-A1-0009-SS	TAL Metals, HE, Radionuclides	EPA Methods 6020 and 8330, Gamma spectroscopy	09/09/08
CDS-A1-0010-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0011-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/09/08
CDS-A1-0012-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0012D-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0013-SS	TAL Metals, HE, Radionuclides	EPA Methods 6020 and 8330, Gamma spectroscopy	09/04/08
CDS-A1-0014-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0015-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0016-SS	TAL Metals, HE, Radionuclides	EPA Methods 6020 and 8330, Gamma spectroscopy	09/04/08
CDS-A1-0017-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0018-SS	TAL Metals, HE, Radionuclides	EPA Methods 6020 and 8330, Gamma spectroscopy	09/04/08
CDS-A1-0018D-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0019-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0020-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0021-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0022-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0023-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0024-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0025-SS	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-0026-SS[1]	TAL Metals, HE, SVOCs, TCLP Metals	EPA Methods 6020, 8330, and 8270	09/04/08
CDS-A1-0027-SS[1]	TAL Metals, HE, SVOCs, TCLP Metals	EPA Methods 6020, 8330, and 8270	09/04/08
CDS-A1-EB1	TAL Metals, HE	EPA Methods 6020, and 8330	09/04/08
CDS-A1-EB2	TAL Metals, HE	EPA Methods 6020, and 8330	09/09/08

[1] This sample is a waste characterization sample. Analytical results are not included in this report

3.3.2 Soil Sampling Results

Analytical results for the final confirmatory soil samples that represent post-VCA conditions (28 samples including 3 duplicates) are presented and discussed in this section.

TAL Metals

TAL metals results for the 28 confirmation soil samples collected from the LTES Site 1 are summarized in Table 3.3.2-1. Method detection limit (MDL) for the metals in soil analyses are presented in Table 3.3.2-2. The following detections above background were reported:

- Four samples contained elevated arsenic levels ranging from 4.62 to 6.06J milligram per kilogram (mg/kg), above the background concentration of 4.4 mg/kg.
- Seventeen samples contained elevated barium levels ranging from 137 to 245 mg/kg, above the background concentration of 130 mg/kg.
- Twelve samples contained elevated beryllium levels ranging from 0.688 to 1.13 mg/kg, compared to a background concentration of 0.65 mg/kg.
- One sample contained elevated chromium at 22.6J mg/kg, compared to a background concentration of 21.8 mg/kg.
- Eleven samples contained elevated cobalt levels ranging from 5.21 to 8.91 mg/kg, compared to a background concentration of 5.2 mg/kg.
- Nine samples contained elevated copper levels ranging from 15.5 to 261 mg/kg, compared to a background concentration of 15.4 mg/kg.
- Twenty samples contained elevated lead levels ranging from 37.4J to 2000 mg/kg, compared to a background concentration of 21.4 mg/kg.
- Nine samples contained elevated nickel levels ranging from 12.7 to 20.3 mg/kg, compared to a background concentration of 11.5 mg/kg.
- Seventeen samples contained elevated vanadium levels ranging from 21.8 to 33.2 mg/kg, compared to a background concentration of 20.4 mg/kg.
- Nineteen samples contained elevated zinc levels ranging from 62.8 to 816 mg/kg, compared to a background concentration of 62 mg/kg.

The MDLs for antimony, cadmium, and thallium were above their respective background concentrations due to analytical sample dilution. There are no available background values for iron.

HE Compounds

HE compound analytical results for the 28 soil samples collected from the LTES Site 1 are summarized in Table 3.3.2-3. MDLs for the HE soil analyses are presented in Table 3.4.2-4. No HE compounds were detected in any of the soil samples.

Radionuclides

Consistent with the VCA Plan (SNL/NM, 2008), radiological analyses were requested for five of the 25 confirmatory soil samples (not including duplicates) to confirm that radionuclides are not COCs at the LTES Site 1. Gamma spectroscopy analytical results are summarized in Table 3.3.2-5. Cesium-137 was the only radionuclide detected at activity levels above the NMED-approved background value. Cobalt-60 does not have a background value, but it was not detected in the five samples.

Table 3.3.2-1
Summary of LTES Site 1
Confirmatory Soil Sampling, Metals Analytical Results

Sample Attributes			Metals (EPA Method SW846 3005/SW846 3050) (mg/kg) [a]										
Record Number[b]	ER Sample ID	Sample Depth(ft)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead
612009	CDS-A1-0001-SS	0-0.5	8160 B J	0.907 J (0.967)	1.49	64.2	0.385	0.207	6.8 J	2.81	5.46	6710	9.27 J
612009	CDS-A1-0002-SS	0-0.5	8160 B J	1.21	1.57	62.8	0.366	0.212	7.08 J	2.79	6.25	6660	8.22 J
611998	CDS-A1-0003-S	0-0.5	13400 J	**ND (22) J**	2.41	94	0.546	**ND (120)**	10.9	4.12	8.17	11100	7.62
612009	CDS-A1-0004-SS	0-0.5	9170 B J	1.48	2.35	93.2	0.424	0.269	7.75 J	3.33	6.25	7560	12.4 J
612009	CDS-A1-0005-SS	0-0.5	7940 B J	1.35	1.65	71.5	0.376	0.26	7.24 J	2.94	5.97	6960	13.7 J
611998	CDS-A1-0006-SS	0-0.5	13000 J	1.42J	3.87	**140**	0.519	**ND (120)**	12.2	4.61	**21.6**	11800	**149**
611998	CDS-A1-006D-SS	0-0.5	13300 J	ND (1.18) J	4.41	**151**	0.558	**ND (120)**	13.4	4.59	**15.8**	12600	**2000**
611998	CDS-A1-0007-SS	0-0.5	15400 J	1.54	3.59	**151**	0.598	**ND (120)**	13.6	**5.42**	**15.8**	12500	**545**
612009	CDS-A1-0008-SS	0-0.5	12600 B J	1.59	2.92	129	0.538	0.471	10.2 J	4.27	9.57	9430	**98.4 J**
612009	CDS-A1-0009-SS	0-0.5	11900 B J	3.1	2.45	105	0.491	0.555	10.8 J	3.9	10.3	8900	**94 J**
611998	CDS-A1-0010-SS	0-0.5	12200 J	1.15	2.94	124	0.509	**ND (120)**	10.2	3.79	7.85	10600	**50.1**
612009	CDS-A1-0011-SS	0-0.5	8080 B J	0.892 J (0.962)	2.43	126	0.365	0.235	7.57 J	4.02	5.91	7500	8.77 J
611998	CDS-A1-0012-SS	0-0.5	19500 J	0.592 J (0.975)	4.13	**187**	**0.709**	**ND (120)**	16.2	**5.86**	13.5	15100	**90**
611998	CDS-A1-0012D-SS	0-0.5	19400 J	0.599 J (0.975)	4.15	**189**	**0.736**	**ND (120)**	17.6	**6.06**	**261**	26900	**169**
611998	CDS-A1-0013-SS	0-0.5	18100 J	0.578 J (0.978)	3.97	**190**	**0.707**	**ND (120)**	15.6	**5.58**	12.9	14700	**169**
611998	CDS-A1-0014-SS	0-0.5	15400 J	1.08	3.62	**169**	0.615	**ND (120)**	13.7	4.97	10.9	13000	**154**
611998	CDS-A1-0015-SS	0-0.5	21900 J	ND (0.306)	4.37	**221**	**0.852**	**ND (120)**	18.9	**6.91**	**15.5**	17100	**117**
611998	CDS-A1-0016-SS	0-0.5	23000 J	2.15	**4.62**	**217**	**0.812**	**ND (120)**	20	**6.66**	**16.5**	20400	**166**
611998	CDS-A1-0017-SS	0-0.5	25700	2.73 J (4.87)	**5.35 J**	**239**	**1.13**	**ND (120)**	20.8 J	**8.59**	**24.3 J**	21900	**527 J**
611998	CDS-A1-0018-SS	0-0.5	20400	ND (0.306)	**4.8 J**	**194**	**0.958**	**ND (120)**	16.3 J	**6.79**	**18.5 J**	18100	**37.4 J**
611998	CDS-A1-0018D-SS	0-0.5	25400	2.25 J (4.96)	**6.06 J**	**245**	**1.12**	**ND (120)**	**22.6 J**	**8.91**	**27.5 J**	22500	**61.7 J**
611998	CDS-A1-0019-SS	0-0.5	13900	0.404 J (0.986)	3.68 J	**140**	0.641	**ND (120)**	11.3 J	4.99	10 J	12200	15.3 J
611998	CDS-A1-0020-SS	0-0.5	14600	0.486 J (0.984)	3.51 J	**156**	**0.724**	**ND (120)**	12.6 J	**5.21**	21.3 J	12600	**57 J**
611998	CDS-A1-0021-SS	0-0.5	9880	0.568 J (0.988)	2.86 J	126	0.554	**ND (120)**	8.42 J	3.88	7.37 J	9340	9.32 J
611998	CDS-A1-0022-SS	0-0.5	16600	ND (0.307)	3.86 J	**171**	**0.843**	**ND (120)**	13.5 J	**5.83**	11.5 J	13500	**53.5 J**
611998	CDS-A1-0023-SS	0-0.5	13100	3.59	3.32 J	**137**	0.641	**ND (120)**	12 J	4.84	13.9 J	11600	**120 J**
611998	CDS-A1-0024-SS	0-0.5	12000	0.971 J (0.977)	2.79 J	130	**0.672**	**ND (120)**	13.9 J	4.3	10 J	10800	**109 J**
611998	CDS-A1-0025-SS	0-0.5	13500	1.79	3.08 J	**140**	**0.668**	**ND (120)**	10.7 J	4.67	11.2 J	11200	**203 J**
Background concentration – Southwest Area Supergroup[d]			69,957[e]	3.9	4.4	130	0.65	<1	21.8	5.2	15.4	NA	21.4
Quality Assurance/Quality Control Samples (all in mg/L)													
611998	CDS-A1-EB1	NA	ND (0.005)	ND (0.0005)	ND (0.0015)	ND (0.0005)	ND (0.0001)	0.0239	0.00165 J (0.003)	ND (0.0001)	0.00117	0.08	ND (0.0005)
612009	CDS-A1-EB2	NA	0.0772	ND (0.0005)	ND (0.0015)	0.000917 J (0.002)	ND (0.0001)	0.0189	ND (0.0015)	ND (0.0001)	0.000401 J (0.001)	ND (0.078)	ND (0.0005)

Table 3.3.2-1 (continued)
Summary of LTES Site 1
Confirmatory Soil Sampling, Metals Analytical Results

Sample Attributes			Metals (EPA Method SW846 3005/SW846 3050/SW846 7470/SW846 7471) (mg/kg) [a]							
Record Number[b]	ER Sample ID	Sample Depth(ft)	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
612009	CDS-A1-0004-SS	0-0.5	173	ND (0.25)	7.17	ND (0.486) J	ND (0.0994)	ND (0.22)	14.8 J	27.6
612009	CDS-A1-0005-SS	0-0.5	196	ND (0.25)	6.02	ND (0.491)	ND (0.0994)	ND (0.22)	11.8 J	27.4
611998	CDS-A1-0006-SS	0-0.5	312	0.0144	9.72	ND (0.492)	ND (0.0996)	**ND (2.4)**	**22.1**	**99.4**
611998	CDS-A1-006D-SS	0-0.5	291	0.0145	9.94	ND (0.498)	ND (0.0994)	**ND (2.4)**	**21.8**	**103**
611998	CDS-A1-0007-SS	0-0.5	286	0.0149	10.8	ND (0.497)	ND (0.0998)	**ND (2.4)**	**22.5**	**93.8**
612009	CDS-A1-0008-SS	0-0.5	300	ND (0.25)	9.42	ND (0.492) J	ND (0.099)	ND (0.22)	17.4 J	**93.9**
612009	CDS-A1-0009-SS	0-0.5	238	ND (0.25)	8.38	ND (0.486) J	ND (0.0982)	ND (0.22)	16.1 J	**108**
611998	CDS-A1-0010-SS	0-0.5	212	0.0126	8.36	ND (0.487)	ND (0.099)	**ND (2.4)**	**22**	55.1
612009	CDS-A1-0011-SS	0-0.5	149	ND (0.25)	8.02	ND (0.497) J	ND (0.096)	ND (0.22)	17.3 J	30.8
611998	CDS-A1-0012-SS	0-0.5	303	0.0243	**13.2**	ND (0.489)	ND (0.0975)	**ND (2.4)**	**27.5**	**816**
611998	CDS-A1-0012D-SS	0-0.5	374	0.0247	**14.2**	ND (0.491)	ND (0.0975)	**ND (2.4)**	**28.4**	**250**
611998	CDS-A1-0013-SS	0-0.5	315	0.0262	**12.8**	ND (0.486)	ND (0.0978)	**ND (2.4)**	**27**	**148**
611998	CDS-A1-0014-SS	0-0.5	297	0.0177	10.9	ND (0.485)	ND (0.0977)	**ND (2.4)**	**24**	**126**
611998	CDS-A1-0015-SS	0-0.5	397	0.0253	**15.6**	ND (0.484)	ND (0.0988)	**ND (2.4)**	**29.9**	**189**
611998	CDS-A1-0016-SS	0-0.5	351	0.0311	**16**	ND (0.498)	ND (0.0982)	**ND (2.4)**	**30.5**	**645**
611998	CDS-A1-0017-SS	0-0.5	460	0.0335	**19.4**	ND (0.484) J	ND (0.487)	**ND (2.4)**	**31.5**	**147**
611998	CDS-A1-0018-SS	0-0.5	344	0.0256	**15.6**	ND (0.494) J	ND (0.493)	**ND (2.4)**	**26.9**	**112**
611998	CDS-A1-0018D-SS	0-0.5	428	0.0325	**20.3**	ND (0.495) J	ND (0.496)	**ND (2.4)**	**33.2**	**150**
611998	CDS-A1-0019-SS	0-0.5	257	0.013	10.8	ND (0.484) J	ND (0.0986)	**ND (2.4)**	**21.6**	48.3
611998	CDS-A1-0020-SS	0-0.5	282	0.0203	11.3	ND (0.496) J	ND (0.0984)	**ND (2.4)**	**21.4**	**64.5**
611998	CDS-A1-0021-SS	0-0.5	174	0.0086 J (0.0114)	7.81	ND (0.497) J	ND (0.0988)	**ND (2.4)**	18.5	31.6
611998	CDS-A1-0022-SS	0-0.5	289	0.0189	**12.7**	ND (0.486) J	ND (0.099)	**ND (2.4)**	**24.4**	**62.8**
611998	CDS-A1-0023-SS	0-0.5	270	0.0147	10.2	ND (0.494) J	ND (0.0984)	**ND (2.4)**	20.4	**97.9**
611998	CDS-A1-0024-SS	0-0.5	278	0.0173	9.91	ND (0.484) J	ND (0.0977)	**ND (2.4)**	17.8	**69.4**
611998	CDS-A1-0025-SS	0-0.5	268	0.0154	9.89	ND (0.486) J	ND (0.0996)	**ND (2.4)**	20.3	**92.7**
Background concentration– Southwest Area Supergroup[d]			831[e]	<0.25	11.5	<1	<1	<1.1	20.4	62
Quality Assurance/Quality Control Samples (all in mg/L)										
611998	CDS-A1-EB1	NA	ND (0.001)	ND (0.00003)	ND (0.0005)	ND (0.001)	ND (0.0002)	0.000475 J (0.001)	ND (0.003)	ND (0.014)
612009	CDS-A1-EB2	NA	0.00147 J (0.005)	ND (0.00003)[UJ]	ND (0.0005)	ND (0.001)	ND (0.0002)	0.000611 J (0.001)	ND (0.003)	ND (0.13)

Note: Values in **bold** exceed background soil concentrations.

[a]EPA November 1986.

[b]Analysis request/chain-of-custody record.

[c]Samples were used for waste characterization and disposal only

[d]Dinwiddie September 1997.

[e]From USGS (1994) NURE Data Program.

EPA = U.S. Environmental Protection Agency.
ft = Foot (feet).
ID = Identification.

J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
J = Analytical result was qualified as an estimated value.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
Mg/L = Milligram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
SS = Surface soil sample.

Table 3.3.2-2
Summary of LTES Site 1
Confirmatory Soil Sampling, Metals Analytical MDLs

Analyte	Method Detection Limit (mg/kg) [a]
Aluminum	0.973 - 4.99
Antimony	0.297 - 3.01
Arsenic	0.286 - 1.43
Barium	0.0969 - 0.497
Beryllium	0.0194 - 0.0998
Cadmium	0.0191 - 0.0956
Chromium	0.194 - 0.998
Cobalt	0.0191 - 0.0998
Copper	0.0388 - 1.91
Iron	1.95 - 95.6
Lead	0.0954 - 0.498
Manganese	0.954 - 3.98
Mercury	0.00131 - 0.0018
Nickel	0.0956 - 0.499
Selenium	0.477 - 0.499
Silver	0.096 - 0.971
Thallium	0.0382 - 0.0399
Vanadium	0.389 - 3.82
Zinc	0.382 - 2

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.

Table 3.3.2-3
Summary of LTES Site 1
Confirmatory Soil Sampling, HE Compound Analytical Results

Record Number	ER Sample ID	Sample Depth(ft)	HE (EPA Method SW846 3535/SW846 8330[a]) (μg/kg)
612009[b]	CDS-A1-0001-SS	0-0.5	ND (50)
612009	CDS-A1-0002-SS	0-0.5	ND (50)
611998	CDS-A1-0003-S	0-0.5	ND (50)
612009	CDS-A1-0004-SS	0-0.5	ND (50)
612009	CDS-A1-0005-SS	0-0.5	ND (50)
611998	CDS-A1-0006-SS	0-0.5	ND (50)
611998	CDS-A1-006D-SS	0-0.5	ND (50)
611998	CDS-A1-0007-SS	0-0.5	ND (50)
612009	CDS-A1-0008-SS	0-0.5	ND (50)
612009	CDS-A1-0009-SS	0-0.5	ND (50)
611998	CDS-A1-0010-SS	0-0.5	ND (50)
612009	CDS-A1-0011-SS	0-0.5	ND (50)
611998	CDS-A1-0012-SS	0-0.5	ND (50)
611998	CDS-A1-0012D-SS	0-0.5	ND (50)
611998	CDS-A1-0013-SS	0-0.5	ND (50)
611998	CDS-A1-0014-SS	0-0.5	ND (50)
611998	CDS-A1-0015-SS	0-0.5	ND (50)
611998	CDS-A1-0016-SS	0-0.5	ND (50)
611998	CDS-A1-0017-SS	0-0.5	ND (50)
611998	CDS-A1-0018-SS	0-0.5	ND (50)
611998	CDS-A1-0018D-SS	0-0.5	ND (50)
611998	CDS-A1-0019-SS	0-0.5	ND (50)
611998	CDS-A1-0020-SS	0-0.5	ND (50)
611998	CDS-A1-0021-SS	0-0.5	ND (50)
611998	CDS-A1-0022-SS	0-0.5	ND (50)
611998	CDS-A1-0023-SS	0-0.5	ND (50)
611998	CDS-A1-0024-SS	0-0.5	ND (50)
611998	CDS-A1-0025-SS	0-0.5	ND (50)
Quality Assurance/Quality Control Samples (all in ug/L)			
611998	CDS-A1-EB1	NA	R
612009	CDS-A1-EB2	NA	R

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]Samples were used for waste characterization and disposal only
EPA = U.S. Environmental Protection Agency.
ft = Foot (feet).
HE = High explosive(s).
ID = Identification.
μg/kg = Microgram(s) per kilogram.
NA = Not applicable.
ND ( )= Not detected above the MDL, shown in parentheses.
R = Rejected value.
SS = Surface soil sample.

Table 3.3.2-4
Summary of LTES Site 1
Confirmatory Soil Sampling, HE Compound Analytical MDLs

Analyte	HE EPA Method Detection Limit[a] (μg/kg)
1,3,5-Trinitrobenzene	50
1,3-Dinitrobenzene	50
2,4,6-Trinitrotoluene	50
2,4-Dinitrotoluene	50
2,6-Dinitrotoluene	50
2-Amino-4,6-dinitrotoluene	50
2-Nitrotoluene	50
3-Nitrotoluene	50
4-Amino-2,6-dinitrotoluene	50
4-Nitrotoluene	50
HMX	50
Nitro-benzene	50
RDX	50
Tetryl	50

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
HE = High explosive(s).
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
MDL = Method detection limit.
μg/kg = Microgram(s) per kilogram.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
Tetryl = Methyl-2,4,6-trinitrophenylnitramine.

Table 3.3.2-5
Summary of LTES Site 1
Confirmatory Soil Sampling, Gamma Spectroscopy Analytical Results

Sample Attributes			Activity (EPA Method 901.1[a]) (pCi/g)							
			Cesium-137		Cobalt-60		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
612009	CDS-A1-0004-SS	0-0.5	**0.124**	.0271	ND (0.0117)	--	ND (0.069)	--	ND (0.596)	--
612009	CDS-A1-0009-SS	0-0.5	**0.137**	.0286	ND (0.0169)	--	ND (0.0655)	--	0.526 J	.239
611998	CDS-A1-0013-SS	0-0.5	**0.307**	.047	ND (0.0134)	--	ND (0.0767)	--	0.963 J	.713
611998	CDS-A1-0016-SS	0-0.5	**0.341**	.0398	ND (0.0121)	--	ND (0.0627)	--	0.725 J	.594
611998	CDS-A1-0018-SS	0-0.5	**0.398**	.0397	ND (0.014)	--	ND (0.0796)	--	ND (0.703)	--
Background concentration-Southwest Area Supergroup[d]			0.079	NA	NE	NA	0.16	NA	1.4	NA

Note: Values in **bold** exceed background soil activities.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]Two standard deviations about the mean detected activity.
[d]Dinwiddie September 1997.
EPA = U.S. Environmental Protection Agency.
ft = Foot (feet).
ID = Identification.
MDA = Minimum detectable activity.
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
pCi/g = Picocurie(s) per gram.
SS = Surface soil sample.
-- = Error not calculated for nondetect results.

3.3.3 Quality Assurance/Quality Control Samples and Data Validation Results

Quality assurance/quality control samples were collected at an approximate frequency of 1 per 20 field samples. These included duplicate and equipment blank (EB) samples. Aqueous EB samples were collected at an approximate frequency of 1 per 20 site samples to check for potential cross-contamination between sample locations via sampling equipment. The EB samples were analyzed for the same analytical parameters as the soil samples.

All laboratory data were reviewed and evaluated according to SNL/NM ER Project "Data Validation Procedure for Chemical and Radiochemical Data," Administrative Operating Procedure (AOP) 00-03 (SNL/NM, 2007). In addition, SNL/NM Department 7713 (Radiation Protection Sample Diagnostics [RPSD] Laboratory) reviewed all gamma spectroscopy results according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM, 2007). Based upon these reviews and evaluations, the data are acceptable for use in this request for a determination of CAC without controls. Annex B contains the data validation reports for the samples collected at this site.

3.4 Site Sampling Data Gaps

Analytical data from the site assessment were sufficient for characterizing the nature and extent of possible COC releases. There are no further data gaps regarding characterization of LTES Site 1.

4.0 CONCEPTUAL SITE MODEL

The conceptual site model for LTES Site 1, is shown in Figure 4.0-1 and is based upon the COCs identified in the soil samples collected from beneath the debris removed from this site and the potential exposure pathways. This section summarizes the nature and extent of contamination, the environmental fate of the COCs, and a summary of the site risk assessment (human health and ecological) presented in Annex C.

4.1 Nature and Extent of Contamination

Potential COCs at LTES Site 1 are TAL metals and HE compounds based on the surface debris at the site. No HE compounds were detected in any of the soil samples collected at this site. As summarized in Section 3.3.2, multiple metals were detected above the NMED-approved maximum background concentrations for SNL/NM Southwest Area Supergroup soils. When a metal concentration exceeded its maximum background screening value, it was considered further in the risk assessment process. Two of the four representative gamma spectroscopy radionuclides, cesium-137 and cobalt-60, were either detected at activities exceeding the corresponding background level (cesium-137) or did not have a corresponding background level available (cobalt-60) and were also evaluated in the risk assessment process.

4.2 Environmental Fate

Potential COCs may have been released into the shallow subsurface via leaching and transport in surface water as it percolates downward. However, the primary COCs (metals) are relatively immobile and transport though the shallow subsurface (i.e., vadose zone) is unlikely. The depth to groundwater at the site (approximately 485 feet below ground surface (bgs)) and the correspondingly thick vadose zone precludes migration of potential COCs into the groundwater system. The potential pathways to receptors include soil ingestion, dermal contact, and inhalation, which could occur as a result of receptor exposure to contaminated surface soil at the site. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Annex C provides additional discussion on the fate and transport of COCs at LTES Site 1.

Table 4.2-1 summarizes the potential COCs for LTES Site 1. All potential COCs were retained in the conceptual site model and were evaluated in both the human health and ecological risk

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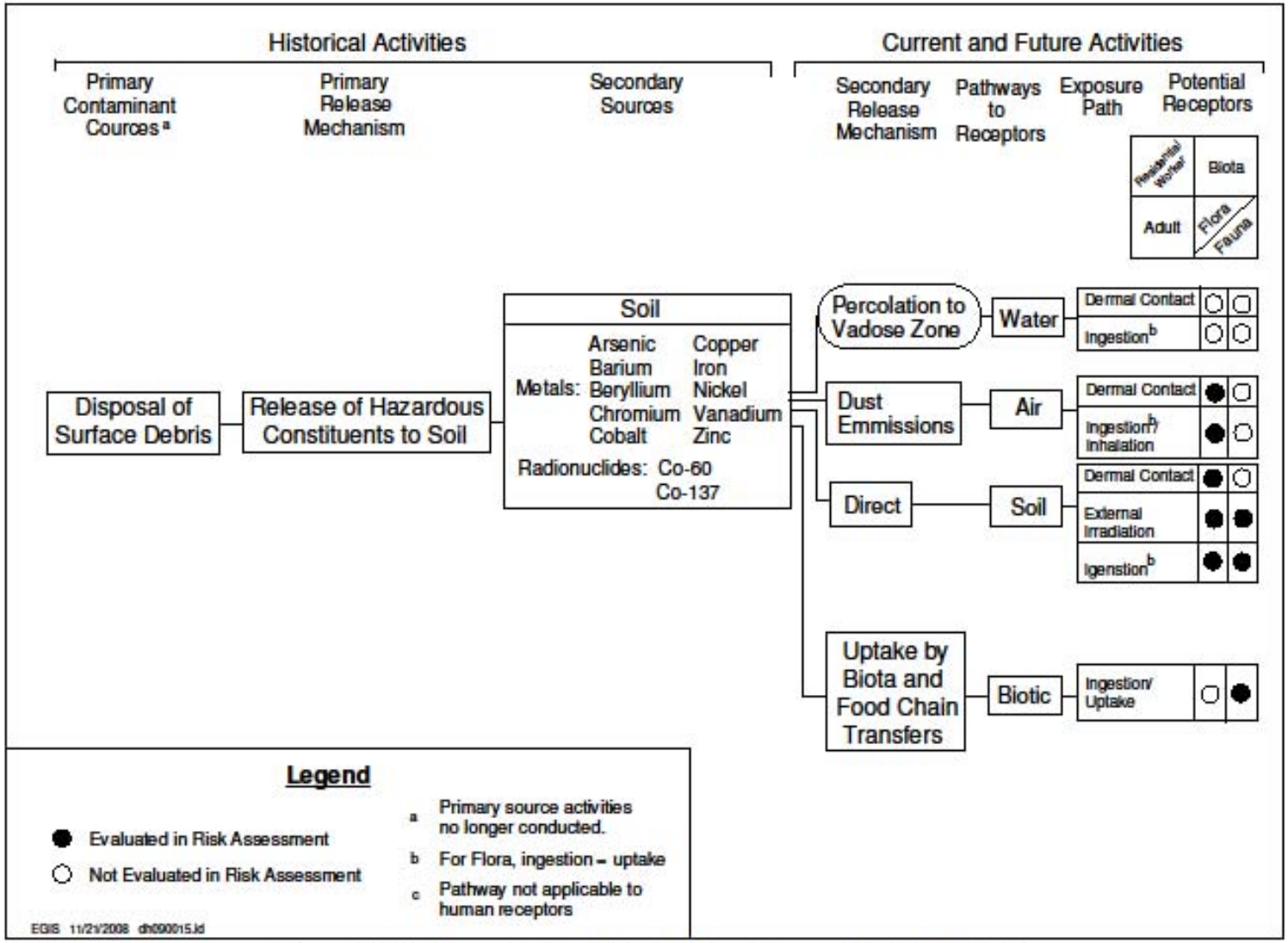

Figure 4.0-1. Conceptual Site Model Flow Diagram for LTES Site 1

Table 4.2-1
Summary of Potential COCs for LTES Site 1

COC Type		Number of Samples[a]	COCs Detected or with Concentrations Greater than Background or Nonquantified Background	Maximum Background Limit/Southwest Area Supergroup[b] (mg/kg)	Maximum Concentration[c] (All Samples) (mg/kg)	Average Concentration[d] (mg/kg)	Number of Samples Where COCs Detected or with Concentrations Greater than Background or Nonquantified Background[e]
HE Compounds		28	None	NA	NA	NA	NA
TAL Metals		28	Arsenic	4.4	6.06	3.44	4
		28	Barium	130	245	149	17
		28	Beryllium	0.65	1.13	0.645	12
		28	Chromium	21.8	22.6 J	12.9	1
		28	Cobalt	5.2	8.91	5.02	11
		28	Copper	15.4	261	21.6	9
		28	Iron	NA	26900	12974	NA
		28	Lead	21.4	2000	181	20
		28	Nickel	11.5	20.3	11.0	9
		28	Vanadium	20.4	33.2	22.0	17
		28	Zinc	62	816	136	19
Radionuclides (pCi/g)	Gamma Spectroscopy	5	Cesium-137	0.079	0.398	0.261	5

[a]Number of samples includes duplicates.
[b]Dinwiddie September 1997.
[c]Maximum concentration is either the maximum amount detected, or for radionuclides, the greater of either the maximum detection or the maximum MDA above background.
[d]Average concentration includes all samples except blanks. The average is calculated as the sum of detected amounts and one-half of the MDLs for nondetect results, divided by the number of samples.
[e]See appropriate data table for sample locations.
[f]An average MDA is not calculated because of the variability in instrument counting error and the number of reported nondetect activities for gamma spectroscopy.
COC = Constituent of concern.
HE = High explosive(s).
J = Analytical result was qualified as an estimated value.
MDA = Minimum detectable activity.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.

assessments. The current and future land use for LTES Site 1 is industrial (DOE et al., 1995).

The potential human receptors at the site are considered to be an industrial worker and resident. The exposure routes for the receptors are dermal contact and ingestion/inhalation. The major exposure route modeled in the human health risk assessment is soil ingestion for COCs. The dermal pathway is included because of the potential for receptors to be exposed to the contaminated soil.

No pathways to groundwater and no intake routes through flora or fauna are considered appropriate for either the industrial or residential land-use scenarios. Annex C provides additional discussion of the exposure routes and receptors at LTES Site 1.

4.3 Site Assessment

Site assessment at LTES Site 1 included risk assessments for both human health and ecological risk. This section briefly summarizes the site assessment results, and Annex C discusses the risk assessment in more detail.

4.3.1 Summary

The site assessment concluded that LTES Site 1 poses no significant threat to human health under either the industrial or residential land-use scenarios. Ecological risks were found to be low.

4.3.2 Risk Assessments

Risk assessments were performed for both human health and ecological risk at LTES Site 1. This section summarizes the results.

4.3.2.1 Human Health

LTES Site 1 has been recommended for an industrial land-use scenario (DOE et al., 1995). Because metals were detected above background it was necessary to perform a human health risk assessment analysis for the site. Annex C provides a complete discussion of the risk assessment process, results, and uncertainties. The risk assessment process provides a

quantitative evaluation of the potential adverse human health effects from constituents in the site's soil by calculating the hazard index (HI) and excess cancer risk for both industrial and residential land-use scenarios.

Using conservative assumptions and a reasonable maximum exposure (RME) approach to risk assessment, calculations for nonradiological COCs show that for the industrial land-use scenario the HI (0.08) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 4E-6. Thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi, 2001). The incremental HI is 0.05, and the incremental excess cancer risk is 1.1E-6 for the industrial land-use scenario. Incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the residential land-use scenario the HI (1.01) is slightly above the accepted numerical guidance from the EPA. The estimated excess cancer risk is 1.6E-5. Thus, excess cancer risk is above the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi, 2001). The incremental HI is 0.74 and the incremental excess cancer risk is 4.3E-6 for the residential land-use scenario. Incremental risk calculations indicate insignificant risk to human health for the residential land-use scenario.

Although both the HI and estimated excess cancer risk are above the NMED guideline for the residential land-use scenario, maximum concentrations were used in the risk calculation. Since the site has been adequately characterized, average concentrations are more representative of actual site conditions. Using the upper 95% confidence limit of the mean concentrations for the main contributors to excess cancer risk and hazards, arsenic (3.8 mg/kg, below the background concentration and thus, eliminated for the risk calculation; and iron, 14700 mg/kg), the total HI and estimated excess cancer risk are reduced to 0.5 and 1.1E-8, respectively. Thus, using more realistic concentrations in the risk calculations that more accurately depict actual site conditions, both the total HI and excess cancer risks are below NMED guidelines.

The incremental total effective dose equivalent (TEDE) and corresponding estimated cancer risk from radiological COCs are much lower than EPA guidance values. The estimated TEDE is 0.009 millirem per year (mrem/yr) for the industrial land-use scenario, which is much lower than

the EPA's numerical guidance of 15 mrem/yr (EPA, 1997a). The corresponding incremental estimated cancer risk value is 1.3E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is 0.023 mrem/yr with an associated cancer risk of 2.5E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM, 1998). Therefore, LTES Site 1 is eligible for unrestricted radiological release.

The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 4.3.2-1.

Table 4.3.2-1
Summation of Incremental Radiological and Nonradiological Risks from LTES Site 1 Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	1.1E-6	1.3E-7	1.2E-6
Residential	4.3E-6	2.5E-7	4.6E-6

Uncertainties associated with the calculations are considered small relative to the conservatism of the risk assessment analysis. Therefore, it is concluded that this site poses insignificant risk to human health under both the industrial and residential land-use scenarios.

4.3.2.2 Ecological

An ecological assessment that corresponds with the procedures in the EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997b) also was performed as set forth by the NMED Risk-Based Decision Tree in the "RPMP [RCRA Permits Management Program] Document Requirement Guide" (NMED, 1998). An early step in the evaluation compared COC concentrations and identified potentially bioaccumulative constituents (see Annex C for more information). This methodology also required developing a site conceptual model and a food web model, as well as selecting ecological receptors, as presented in "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico" (IT, 1998). The risk assessment also includes the estimation of exposure and ecological risk.

Based upon the uncertainty analysis within the ecological risk assessment, the potential for ecological risks at the LTES Site 1 is expected to be low. Hazard quotients (HQs) greater than unity were predicted; however, closer examination of the exposure assumptions revealed an overestimation of risk primarily attributed to conservative toxicity benchmarks; the use of maximum concentrations, maximum bioavailability, and maximum area use to estimate exposure; and the contribution of background risk.

4.4 Baseline Risk Assessments

This section discusses the baseline risk assessments for human health and ecological risk.

4.4.1 Human Health

Because the results of the human health risk assessment summarized in Section 4.3.2.1 indicate that LTES Site 1 poses insignificant risk to human health under both the industrial and residential land-use scenarios, a baseline human health risk assessment is not required for this site.

4.4.2 Ecological

Based upon the uncertainty analysis within the ecological risk assessment, the potential for ecological risks at the LTES Site 1 is expected to be low. HQs greater than unity were predicted; however, closer examination of the exposure assumptions revealed an overestimation of risk primarily attributed to conservative toxicity benchmarks; the use of maximum concentrations, maximum bioavailability, and maximum area use to estimate exposure; and the contribution of background risk.

5.0 RECOMMENDATION FOR CORRECTIVE ACTION COMPLETE WITHOUT CONTROLS DETERMINATION

5.1 Rationale

Based upon field investigation results, confirmatory soil sample analytical data, and the human health and ecological risk assessment analyses, a determination of CAC without controls is recommended for LTES Site 1 for the following reasons:

- The surface debris has been removed and the soil has been sampled for all potential COCs.
- No COCs are present in the soil at levels considered hazardous to human health for either an industrial or residential land-use scenario.
- None of the COCs warrant ecological concern because the ecological risks were acceptable per NMED guidance.

5.2 Criterion

Based upon the evidence provided in Section 5.1, a determination of CAC without controls (NMED, 2004) is recommended for LTES Site 1. This is consistent with the NMED's no further action (NFA) Criterion 5, which states, "the SWMU/AOC [Area of Concern] has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use" (NMED, 1998).

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6.0 REFERENCES

Bearzi, J.P. (New Mexico Environment Department), August 2008. "Notice of Approval Voluntary Corrective Action Plan for LTES Site 1 – Cable Debris Site, May 2008 Sandia National Laboratories, EPA ID #NM5890110518 HWB-SNL-08-014" Hazardous Waste Bureau, New Mexico Environment Department, Santa Fe, New Mexico. January 23, 2001.

Bearzi, J.P. (New Mexico Environment Department), January 2001. Memorandum to RCRA-Regulated Facilities, "Risk-Based Screening Levels for RCRA Corrective Action Sites in New Mexico," Hazardous Waste Bureau, New Mexico Environment Department, Santa Fe, New Mexico. January 23, 2001.

Dinwiddie, R.S. (New Mexico Environment Department), September 1997. Letter to M.J. Zamorski (U.S. Department of Energy), Request for Supplemental Information: Background Concentrations Report, SNL/KAFB. September 24, 1997.

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

IT, see IT Corporation.

IT Corporation (IT), July 1998. "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico," IT Corporation, Albuquerque, New Mexico.

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U.S. Environmental Protection Agency (EPA), 1997b. "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risks," Interim Final, U.S. Environmental Protection Agency, Washington, D.C.

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ANNEX A
TA III Cable Debris Site
Field Photos

LTES Site 1 Metal Cable Piles Pre-Debris Removal

LTES Site 1 Metal Cable Piles Pre-Debris Removal

LTES Site 1 Concrete Pile Pre-Debris Removal

LTES Site 1 Cable Debris Removal

LTES Site 1 Steel Target Concrete Removal

LTES Site 1 Cable Recycling

LTES Site 1 Spent 5 inch Rocket Motors

LTES Site 1 Concrete Screen All

LTES Site 1 Powder Activated Cable Cutters

LTES Site 1 Dry Cell Batteries

LTES Site 1 Lead Fragments

LTES Site 1 Overpacked Drum (soil)

LTES Site 1 Concrete Staging Area

LTES Site 1 Soil Piles

LTES Site 1 Unique Material Staging Area

LTES Site 1Post Debris Removal

LTES Site 1Post Debris Removal

ANNEX B
TA-III Cable Debris Site
Soil Sample Data Validation Results

CONTRACT LABORATORY

ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab

Batch No. N/A

SMO Use

ARCOC 611998

Dept. No./Mail Stop:	4131 MS 1042	Date Samples Shipped:	9/4/08	Project/Task No.:	96750/01.03.06 ☐
Project/Task Manager:	S. Salinas	Carrier/Waybill No.		SMO Authorization:	
Project Name:	TS - Cable Debris Site	Lab Contact:	E. Kent	Contract #	691436
Record Center Code:		Lab Destination:	GEL	Send Report to SMO:	SEE BOTTLE ORDER
Service Order No.:	CF 093-08	SMO Contact/Phone:	W. Palencia		

Send Preliminary/Copy Report to:

☐ Validation Required

☐ Released by COC No.:

Bill to: Sandia National Laboratories (Accounts Payable); P.O. Box 5800, MS-0154; Albuquerque, NM 87185-0154

Location	Tech Area
Building	Room

Sample No.-Fraction	Sample Location Detail	Beginning Depth (ft)	Non GW & WW Spatial Coordinates Easting (X)	Northing (Y)	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Vol	Preser-vative	Collect Method	Sample Type	F (filtered) NF (non)	Parameter & Method Requested	Lab Sample Id
086739-001	CDS-A1-0003--S	N/A	N/A	N/A	9/4/08 0905	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086742-001	CDS-A1-0006-SS	N/A	N/A	N/A	1000	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086743-001	CDS-A1-006D-SS	N/A	N/A	N/A	1000	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086744-001	CDS-A1-0007-SS	N/A	N/A	N/A	1003	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086747-001	CDS-A1-0010-SS	N/A	N/A	N/A	0958	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086749-001	CDS-A1-0012-SS	N/A	N/A	N/A	0913	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086750-001	CDS-A1-0012D-SS	N/A	N/A	N/A	0913	S	G	16 oz.	N	C	DU	N/A	TAL, HE	
086751-001	CDS-A1-0013-SS	N/A	N/A	N/A	0917	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086751-002	CDS-A1-0013-SS	N/A	N/A	N/A	0917	S	G	8 oz.	N	C	SA	N/A	Gamma Spec	
086752-001	CDS-A1-0014-SS	N/A	N/A	N/A	0922	S	G	16 oz.	N	C	SA	N/A	TAL, HE	

RMMA ☐ ☑ Ref. No.

Sample Disposal ☐ Return to Client ☑ Disposal by lab

Turnaround Time ☐ 7 Day * ☐ 15 Day * ☑ 30 Day

Return Samples By: ☐ Negotiated TAT

Sample Tracking SMO Use

Date Entered:

Entered by:

QC inits.

Special Instructions/QC Requirements:

EDD Yes ☑ No ☐

Level D Package Yes ☐ No ☑

*Send/e-mail report to:

TAL EPA Method 6020/7471

HE EPA Method 8330

SVOC Method 8270

*Please list as separate report.

Abnormal Conditions on Receipt

Lab Use

Sample Team Members

Name	Signature	Init	Company/Organization/Phone/Cellular
Danielle M. Nieto			SNL/4133/845-7706

1. Relinquished by		Org. 4133	Date 9/4/08	Time 1130	3. Relinquished by	Org.	Date	Time
1. Received by	SMO	Org. 4133	Date 9/4/08	Time 1130	3. Received by	Org.	Date	Time
2. Relinquished by		Org.	Date	Time	4. Relinquished by	Org.	Date	Time
2. Received by		Org.	Date	Time	4. Received by	Org.	Date	Time

*Prior confirmation with SMO required for 7 and 15 day TAT

CONTRACT LABORATORY
Analysis Request And Chain Of Custody (Continuation)

AR/COC- 611998

Project Name: TS - Cable Debris Site
Location: Tech Area
Building: Room

Project/Task Manger: S. Salinas

Project/Task No.: 96750/01.03.06

Reference LOV (available at SMO)

Sample No-Fraction	Sample Location detail	Beginning Depth (ft)	Non GW Spatial Coordinates Easting	Non GW Spatial Coordinates Northing	Date/Time (hr) Collected	Sample Matrix	Container Type	Container Volume	Preser-vative	Collection Method	Sample Type	F(Filtered) NF (Non)	Parameter & Method Requested	Lab Samp ID (Lab use)
086753-001	CDS-A1-0015-SS	N/A	N/A	N/A	9/4/08 0930	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086754-001	CDS-A1-0016-SS	N/A	N/A	N/A	0933	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086754-002	CDS-A1-0016-SS	N/A	N/A	N/A	0933	S	G	8 oz.	N	C	SA	N/A	Gamma Spec	
086755-001	CDS-A1-0017-SS	N/A	N/A	N/A	0937	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086756-001	CDS-A1-0018-SS	N/A	N/A	N/A	0940	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086756-002	CDS-A1-0018-SS	N/A	N/A	N/A	0940	S	G	8 oz.	N	C	SA	N/A	Gamma Spec	
086757-001	CDS-A1-0018-SS	N/A	N/A	N/A	0940	S	G	16 oz.	N	C	DU	N/A	TAL, HE	
086758-001	CDS-A1-0019-SS	N/A	N/A	N/A	0946	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086759-001	CDS-A1-0020-SS	N/A	N/A	N/A	0949	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086760-001	CDS-A1-0021-SS	N/A	N/A	N/A	0952	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086761-001	CDS-A1-0022-SS	N/A	N/A	N/A	0954	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086762-001	CDS-A1-0023-SS	N/A	N/A	N/A	1015	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086763-001	CDS-A1-0024-SS	N/A	N/A	N/A	1013	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086794-001	CDS-A1-0025-SS	N/A	N/A	N/A	1011	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086795-001	CDS-A1-0026-SS	N/A	N/A	N/A	1026	S	G	2x500mL	N	C	SA	N/A	TAL, HE, SVOCs, TCLP	
086796-001	CDS-A1-0027-SS	N/A	N/A	N/A	1023	S	G	2x500mL	N	C	SA	N/A	TAL, HE, SVOCs, TCLP	
086797-001	CDS-A1-EB1	N/A	N/A	N/A	1040	W	G	500mL	HNO3	G	EB	N/A	TAL	
086797-002	CDS-A1-EB1	N/A	N/A	N/A	1040	W	G	2x1L	N	G	EB	N/A	HE	

Abnormal Conditions on Receipt

LAB USE

Recipient Initials_____

SF 2001-COC (5/03)

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab

Batch No. N/A

SMO Use

ARCOC 612009

Dept. No./Mail Stop:	4131 MS 1042	Date Samples Shipped:	9/9/08	Project/Task No.:	96750/01.03.06 ☐
Project/Task Manager:	S. Salinas	Carrier/Waybill No.		SMO Authorization:	
Project Name:	TS - Cable Debris Site	Lab Contact:	E. Kent	Contract #	P.O. # 691436
Record Center Code:		Lab Destination:	GEL CHARLESTON, S.C.	Send Report to SMO:	
Service Order No.:	CF 093-08	SMO Contact/Phone:	W. Palencia		

Send Preliminary/Copy Report to:

☐ Validation Required

☐ Released by COC No.:

Location Tech Area

Building Room

Bill to: Sandia National Laboratories (Accounts Payable); P.O. Box 5800, MS-0154; Albuquerque, NM 87185-0154

Sample No.-Fraction	Sample Location Detail	Beginning Depth (ft)	Non GW & WW Spatial Coordinates Easting (X)	Northing (Y)	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Vol	Preser-vative	Collect Method	Sample Type	F (filtered) NF (non)	Parameter & Method Requested	Lab Sample Id
086737-001	CDS-A1-0001-SS	N/A	N/A	N/A	9/9/08 908	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086738-001	CDS-A1-0002-SS	N/A	N/A	N/A	906	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086740-001	CDS-A1-0004-SS	N/A	N/A	N/A	852	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086740-002	CDS-A1-0004-SS	N/A	N/A	N/A	852	S	G	8 oz	N	C	SA	N/A	Gamma Spec	
086741-001	CDS-A1-0005-SS	N/A	N/A	N/A	856	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086745-001	CDS-A1-0008-SS	N/A	N/A	N/A	902	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086746-001	CDS-A1-0009-SS	N/A	N/A	N/A	859	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086746-002	CDS-A1-0009-SS	N/A	N/A	N/A	859	S	G	8 oz.	N	C	SA	N/A	Gamma Spec	
086748-001	CDS-A1-0011-SS	N/A	N/A	N/A	904	S	G	16 oz.	N	C	SA	N/A	TAL, HE	
086798-001	CDS-A1-EB2	N/A	N/A	N/A	916	W	G	500mL	HNO3	G	EB	N/A	TAL	

RMMA ☐ ☑ Ref. No.

Sample Disposal ☐ Return to Client ☑ Disposal by lab

Turnaround Time ☐ 7 Day * ☐ 15 Day * ☑ 30 Day

Return Samples By: ☐ **Negotiated TAT**

Sample Tracking SMO Use

Date Entered:

Entered by:

QC inits.

Special Instructions/QC Requirements:

EDD Yes ☑ No ☐

Level D Package Yes ☐ No ☑

***Send/e-mail report to:**

TAL EPA Method 6020/7471

HE EPA Method 8330

SVOC Method 8270

***Please list as separate report.**

Abnormal Conditions on Receipt

Lab Use

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	Danielle M. Nieto	Danielle M. Nieto	DN	SNL/4133/845-7706

1. Relinquished by Danielle M. Nieto	Org. 4133	Date 9/9/08	Time 0940	3. Relinquished by	Org.	Date	Time
1. Received by	Org. 4133	Date 9/9/08	Time 0940	3. Received by	Org.	Date	Time
2. Relinquished by	Org.	Date	Time	4. Relinquished by	Org.	Date	Time
2. Received by	Org.	Date	Time	4. Received by	Org.	Date	Time

*Prior confirmation with SMO required for 7 and 15 day TAT

SF 2001-COC (5/03)

CONTRACT LABORATORY
Analysis Request And Chain Of Custody (Continuation)

AR/COC- 612009

Project Name:	TS - Cable Debris Site	Project/Task Manger: S. Salinas										Project/Task No.: 96750/01.03.06		
Location	Tech Area													
Building	Room	**Reference LOV (available at SMO)**												Lab use
Sample No-Fraction	Sample Location detail	Beginning Depth (ft)	Non GW Spatial Coordinates Easting	Northing	Date/Time (hr) Collected	Sample Matrix	Container Type	Volume	Preser-vative	Collection Method	Sample Type	F(Filtered) NF (Non)	Parameter & Method Requested	Lab Samp ID
086798-002	CDS-A1-EB2	N/A	N/A	N/A	9/9/02 9:16	W	G	2x1L	N	G	EB	N/A	HE	

Abnormal Conditions on Receipt **LAB USE**

Recipient Initials_____

Metals Data Validation Results

Memorandum

DATE: October 29, 2008

TO: File

FROM: David Schwent

SUBJECT: Inorganic Data Review and Validation - SNL
Site: Cable Debris Site Sampling
AR/COC: 611998
SDG: 215227/215230/215231/215232
Laboratory: GEL
Project/Task No: 96750.01.03.06

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

Summary

The samples were prepared and analyzed with accepted procedures using methods EPA6010 (ICP), EPA6020 (ICP-MS) and EPA7470A/7471A (CVAA). Problems were identified with the data package that result in the qualification of data.

ICP Analysis:

Blanks: Sb of Batch 791944 was detected in the initial calibration blank (ICB), continuing calibration blank (CCB), and method blank (MB) at concentrations > the method detection limit (MDL) but < the practical quantitation limit (PQL). The associated result of sample 215230-001 was a detect <5X the highest calibration blank concentration and <5X the MB concentration and will be qualified "22U,B,B3" at 5X the value of the ICB (ug/l) (highest blank value).

MS: The MS percent recovery (%R) for Sb of Batch 791944 was <75% but >30%. The associated result of sample 215230-002 was a detect and will be qualified "J-,MS3"; the associated results of samples -001 and -003 were non-detects (NDs) and will be qualified "UJ,MS3." It should be noted that the result of sample -001 was qualified "U" (ND) due to blank contamination and will be further qualified "UJ" due to the low MS %R, as shown on the sample findings summary.

ICP-MS Analysis:

Blanks: Ca of Batch 791975 was detected in the MB at a concentration > the MDL but < the PQL. The associated result of sample 215232-001 was a detect <5X the MB concentration and will be qualified "0.10U,B" at 5X the value of the MB (mg/l).

Blanks: Zn of Batch 791975 was detected in the MB at a concentration > the MDL but < the PQL. The associated result of sample 215232-001 was a detect <5X the MB concentration and will be qualified "0.014U,B" at 5X the value of the MB (mg/l).

Blanks: Cd was detected in the equipment blank (EB) (sample 215232-001) at a concentration > the MDL but < the PQL. All associated sample results were detects <5X the EB concentration and will be qualified "120U,B2" at 5X the value of the EB (ug/l).

Blanks: Tl was detected in the EB (sample 215232-001) at a concentration > the MDL but < the PQL. All associated sample results were detects <5X the EB concentration and will be qualified "2.4U,B2" at 5X the value of the EB (ug/l).

Blanks: Na was detected in the EB (sample 215232-001) at a concentration > the MDL but < the PQL. The associated results of samples 215227-006, -007, -011, -012, -014, -015, -017, -019, -021, -022, -023, and 215230-001 were detects <5X the EB concentration and will be qualified "480U,B2" at 5X the value of the EB (ug/l).

MS: The MS %R for Se of Batch 792306 was <75% but >30%. The associated result of sample 215230-002 was a detect and will be qualified "J-,MS3"; all other associated sample results were NDs and will be qualified "UJ,MS3."

MS: The MS %R for As of Batch 792306 was >125%. All associated sample results were detects and will be qualified "J+,MS2."

MS: The MS %R for Cr of Batch 792306 was >125%. All associated sample results were detects and will be qualified "J+,MS2."

MS: The MS %R for Cu of Batch 792306 was >125%. All associated sample results were detects and will be qualified "J+,MS2."

Serial Dilution: The serial dilution percent difference (%D) for Al of Batch 792301 was >10%. All associated sample results were detects and will be qualified "J,D1."

Serial Dilution: The serial dilution %D for Mg of Batch 792301 was >10%. All associated sample results were detects and will be qualified "J,D1."

Serial Dilution: The serial dilution %D for Pb of Batch 792306 was >10%. All associated sample results were detects and will be qualified "J,D1."

CVAA Analysis:

Blanks: Hg of Batch 791848 was detected in the ICB and CCB at negative concentrations with absolute values > the MDL but < the PQL. The associated result of sample 215230-002 was a ND and will be qualified "UJ,B4."

Data are acceptable. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

All Analyses: All samples were analyzed within the prescribed holding times and properly preserved.

ICP-MS INSTRUMENT TUNE

ICP-MS Analysis: The instrument tune data were not reported and could not be evaluated. No sample data should be qualified as a result.

Calibration

All Analyses: All initial and continuing calibration QC acceptance criteria were met, except for the following. Initial calibration y-intercept values and correlation coefficients (R^2) values for target analytes were not reported and could not be evaluated. No sample data should be qualified as a result.

Reporting Limit Verification

ICP-MS Analysis: All CRI recoveries met QC acceptance criteria, except the following. The CRI %R for Al of Batch 792301 was <30% and the %R for Mg of Batch 792301 was <70% but >30%. However, all associated sample results were detects >5X the PQL and will not be qualified.

All Other Analyses: All CRA/CRI recoveries met QC acceptance criteria.

Blanks

ICP Analysis: No target analytes were detected in the blanks, except the following. Sb of Batch 791944 was detected in the ICB, CCB, and MB at concentrations > the MDL but < the PQL. However, the associated result of sample 215230-002 was a detect >5X the highest calibration blank value and >5X the MB value and will not be qualified; the associated result of sample -003 was ND and will not be qualified.

ICP-MS Analysis: No target analytes were detected in the blanks, except as noted above in the summary section and the following. Fe, Al, Be, Co, Mg, Cr, Cu, Cd, Ca, Tl, Zn, Na, Sb, and As were detected in one or more of the blanks at concentrations > the MDL but < the PQL. However, all associated sample results, except the results qualified above in the summary section, were either NDs or detects >5X the highest calibration blank concentration and/or MB concentration and/or EB concentration and will not be qualified. It should be noted that the EB detect results for Ca and Zn were qualified “U” (ND) by MB contamination and, therefore, can not affect other field samples.

CVAA Analysis: No target analytes were detected in the blanks, except as noted above in the summary section and the following. Hg of Batch 791848 was detected in the ICB and CCB at negative concentrations with absolute values > the MDL but < the PQL. However, the associated results of samples 215230-001 and -003 were detects >5X the MDL and will not be qualified. Hg of Batch 791843 was detected in the CCB at a negative concentration with an

absolute value > the MDL but < the PQL. However, all associated sample results were detects >5X the MDL and will not be qualified.

ICP-MS INTERNAL STANDARDS

ICP-MS Analysis: Internal standards data were not reported and could not be evaluated. No sample data should be qualified as a result.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

ICP Analysis: All MS (PS) QC acceptance criteria were met, except as noted above in the summary section. The MSD analysis was assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

ICP-MS Analysis: All MS (PS) QC acceptance criteria were met, except as noted above in the summary section. The MSD analysis was not assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

CVAA Analysis: All MS (PS) QC acceptance criteria were met. The MSD analysis was not assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

Laboratory Replicate

ICP Analysis: All replicate QC acceptance criteria were met.

ICP-MS Analysis: All replicate QC acceptance criteria were met. It should be noted that the laboratory replicate relative percent difference (RPD) for Mg of Batch 792306 was >20% but <35%, which is the acceptable limit for samples of soil matrix. No sample data should be qualified as a result. No laboratory replicate analysis was performed for Batch 791975 but the LCSD analysis was used as a measure of precision. No sample data should be qualified as a result.

CVAA Analysis: All replicate QC acceptance criteria were met. No laboratory replicate analysis was performed for Batch 791857 but the LCSD analysis was used as a measure of precision. No sample data should be qualified as a result.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

ICP Analysis: All LCS QC acceptance criteria were met. No LCSD analyses were performed. The laboratory replicate analyses were used as measures of laboratory precision. No sample data will be qualified as a result.

ICP-MS/CVAA Analyses: All LCS/LCSD QC acceptance criteria were met.

Detection Limits/Dilutions

All Analyses: All detection limits were properly reported. All samples of Batches 792301, 792306, were diluted the standard 2X soils dilution for all ICP-MS analytes, except 10X dilutions for various analytes of the following samples that were performed to bring over-range target analyte concentrations into the linear calibration range of the instrument and due to high internal standard native concentration: samples 215227-001, -002, -003, -004, -005, -006, -008, -010, -011, -012, -018, -019, 020,-021,-022, and -023, and samples 215230-001, -002, and -003. Samples 215227-014, -015, -017 were diluted 20X for Ca and ample 215230-002 was diluted 100X for Cu and Fe due to over-range concentrations of the target analytes. Sample 215227-015 was diluted 5X for Ag to minimize matrix suppression. Samples 215227 -014 and -017 were diluted 5X for Sb and Ag due to the affects of high Ca concentrations. All associated batch QC samples were diluted at dilution factors that resulted in relative dilution factors to the samples that were ≤5X. No sample data will be qualified as a result. No other samples required dilution.

ICP Interference Check Sample (ICS A and AB)

ICP-MS Analysis: The ICS A and ICS AB raw data were not reported and could not be evaluated. No sample data should be qualified as a result. It should be noted that all ICS AB recoveries still met QC acceptance criteria. No sample data should be qualified as a result.

ICP SERIAL DILUTION

ICP Analysis: The serial dilution analysis met all QC acceptance criteria.

ICP-MS Analysis: The serial dilution analysis met all QC acceptance criteria, except as noted above in the summary section.

Other QC

No field blanks (FBs) were submitted on the AR/COC. All RPDs of the field duplicates (FDs) (samples 215227-007 and -017 were <35%, except for the following analytes: Cu, Pb, Fe, and Zn. No QC acceptance criteria for the evaluation of FDs are currently in place.

No other specific issues were identified which affect data quality.

Memorandum

DATE: October 29, 2008

TO: File

FROM: David Schwent

SUBJECT: Inorganic Data Review and Validation - SNL
Site: Cable Debris Site Sampling
AR/COC: 611998
SDG: 215227/215230/215231/215232
Laboratory: GEL
Project/Task No: 96750.01.03.06

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

Summary

The samples were prepared and analyzed with accepted procedures using methods EPA6010 (ICP) and EPA7470A (CVAA). Problems were identified with the data package that result in the qualification of data.

ICP Analysis:

Blanks: Se was detected in the initial calibration blank (ICB) at a negative concentration with absolute value > the method detection limit (MDL) but < the practical quantitation limit (PQL). All associated sample results were non-detects (NDs) and will be qualified "UJ,B4."

CRI: The CRI percent recovery (%R) of Se was <70% but >30%. All associated sample results were NDs and will be qualified "UJ,DL3."

CVAA Analysis:

Blanks: Hg was detected in the ICB and continuing calibration blank (CCB) at negative concentrations with absolute values > the MDL but < the PQL. All associated sample results were NDs and will be qualified "UJ,B4."

Data are acceptable. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

All Analyses: All samples were analyzed within the prescribed holding times and properly preserved.

Calibration

All Analyses: All initial and continuing calibration QC acceptance criteria were met, except for the following. Initial calibration y-intercept values and correlation coefficients (R^2) values for target analytes were not reported and could not be evaluated. No sample data should be qualified as a result.

Reporting Limit Verification

ICP Analysis: All CRI recoveries met QC acceptance criteria, except as noted above in the summary section.

CVAA Analysis: All CRA recoveries met QC acceptance criteria.

Blanks

All Analyses: No target analytes were detected in the blanks, except as noted above in the summary section.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

ICP Analysis: All MS (PS) QC acceptance criteria were met.

CVAA Analysis: All MS (PS) QC acceptance criteria were met, except the following. The MS %R of Hg was <75% but >30%. However, the %R was below the QC acceptance limit by only 1% and the PS %R was within QC acceptance criteria. Therefore, based on professional judgment, no sample data should be qualified as a result.

Laboratory Replicate

All Analyses: All replicate QC acceptance criteria were met.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

All Analyses: All LCS QC acceptance criteria were met. No LCSD analyses were performed. The laboratory replicate analyses were used as measures of laboratory precision. No sample data will be qualified as a result.

Detection Limits/Dilutions

All Analyses: All detection limits were properly reported. No samples required dilution.

ICP Interference Check Sample (ICS A and AB)

ICP Analysis: The ICS A and ICS AB raw data were not reported and could not be evaluated. No sample data should be qualified as a result. It should be noted that all ICS AB recoveries still met QC acceptance criteria. No sample data should be qualified as a result.

ICP SERIAL DILUTION

ICP Analysis: The serial dilution analysis met all QC acceptance criteria.

Other QC

No equipment blanks (EBs), field blanks (FBs), or field duplicates (FDs) were submitted on the AR/COC.

No other specific issues were identified which affect data quality.

Memorandum

DATE: October 27, 2008

TO: File

FROM: David Schwent

SUBJECT: Inorganic Data Review and Validation - SNL
Site: Cable Debris Site Sampling
AR/COC: 612009
SDG: 215471/215473
Laboratory: GEL
Project/Task No: 96750.01.03.06

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

Summary

The samples were prepared and analyzed with accepted procedures using methods EPA6010 (ICP), EPA6020 (ICP-MS) and EPA7470A/7471A (CVAA). Problems were identified with the data package that result in the qualification of data.

ICP-MS Analysis:

Blanks: Tl of Batch 793924 was detected in method blank (MB) at a concentration > the method detection limit (MDL) but < the practical quantitation limit (PQL). All associated sample results were detects <5X the MB concentration and will be qualified "0.22U,B" at 5X the value of the MB.

Blanks: Zn of Batch 793897 was detected in the MB at a concentration > the MDL but < the PQL. The associated result of sample 215473-001 was a detect <5X the MB concentration and will be qualified "0.13U,B" at 5X the value of the MB.

Blanks: Fe of Batch 793897 was detected in the MB at a concentration > the MDL but < the PQL. The associated result of sample 215473-001 was a detect <5X the MB concentration and will be qualified "0.078U,B" at 5X the value of the MB.

MS: The MS percent recovery (%R) for Cr of Batch 793924 was >125%. All associated sample results were detects and will be qualified "J+,MS2."

MS: The MS percent recovery (%R) for Se of Batch 793924 was <75% but >30%. All associated sample results were non-detects (NDs) and will be qualified "UJ,MS3."

MS: The MS %R for V of Batch 793924 was >125%. All associated sample results were detects and will be qualified "J+,MS2."

Serial Dilution: The serial dilution percent difference (%D) for Al of Batch 793924 was >10%. All associated sample results were detects and will be qualified "J,D1."

Serial Dilution: The serial dilution %D for Pb of Batch 793924 was >10%. All associated sample results were detects and will be qualified "J,D1."

CVAA Analysis:

Blanks: Hg of Batch 794317 was detected in the MB at a concentration > the MDL but < the PQL. All associated sample results were detects <5X the MB concentration and will be qualified "0.025U,B" at 5X the value of the MB.

MS: No MS or PS analysis was performed for Hg of Batch 794320. As a result, there was no measure of matrix-specific accuracy data for Hg. The associated result of sample 215473-001 was a ND and will be qualified "UJ,MS1" due to lack of matrix-specific accuracy data.

Data are acceptable. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

All Analyses: All samples were analyzed within the prescribed holding times and properly preserved.

ICP-MS INSTRUMENT TUNE

ICP-MS Analysis: The instrument tune data were not reported and could not be evaluated. No sample data should be qualified as a result.

Calibration

All Analyses: All initial and continuing calibration QC acceptance criteria were met, except for the following. Initial calibration y-intercept values and correlation coefficients (R^2) values for target analytes were not reported and could not be evaluated. No sample data should be qualified as a result.

Reporting Limit Verification

All Analyses: All CRA/CRI recoveries met QC acceptance criteria.

Blanks

ICP Analysis: No target analytes were detected in the blanks.

ICP-MS Analysis: No target analytes were detected in the blanks, except as noted above in the summary section and the following. Al, Ca, Tl, Ba, Mg, Mn, Zn, Cd, Cu, Fe, and Na were detected in one or more of the blanks at concentrations > the MDL but < the PQL. However, all associated sample results were detects >5X the highest calibration blank concentration and/or MB concentration and/or EB concentration and will not be qualified.

CVAA Analysis: No target analytes were detected in the blanks, except as noted above in the summary section.

ICP-MS INTERNAL STANDARDS

ICP-MS Analysis: Internal standards data were not reported and could not be evaluated. No sample data should be qualified as a result.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

ICP Analysis: All MS (PS) QC acceptance criteria were met. The MSD analysis was not assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

ICP-MS Analysis: All MS (PS) QC acceptance criteria were met, except as noted above in the summary section. The MSD analysis of Batch 793924 was not assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

CVAA Analysis: All MS (PS) QC acceptance criteria were met, except as noted above in the summary section. The MSD analysis of Batch 794317 was not assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

Laboratory Replicate

ICP Analysis: All replicate QC acceptance criteria were met.

ICP-MS Analysis: All replicate QC acceptance criteria were met. No laboratory replicate analysis was performed for Batch 793897 but the LCSD analysis was used as a measure of precision. No sample data should be qualified as a result.

CVAA Analysis: All replicate QC acceptance criteria were met. No laboratory replicate analysis was performed for Batch 7934320 but the LCSD analysis was used as a measure of precision. No sample data should be qualified as a result.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

ICP Analysis: All LCS QC acceptance criteria were met. No LCSD analyses were performed. The laboratory replicate analyses were used as measures of laboratory precision. No sample data will be qualified as a result.

ICP-MS/CVAA Analyses: All LCS/LCSD QC acceptance criteria were met.

Detection Limits/Dilutions

All Analyses: All detection limits were properly reported. All samples of Batch 793924 were diluted the standard 2X soils dilution for all ICP-MS analytes, except the following dilutions that were performed to bring over-range target analyte concentrations into the linear calibration range of the instrument: samples 215471-003, -006, -007, and -009 were diluted 10X for Ca, samples -006 and -007 were diluted 10X for Al, and all samples were diluted 40X for Mn. All associated batch QC samples were diluted at dilution factors that resulted in relative dilution factors to the samples that were ≤5X. No sample data will be qualified as a result. No other samples required dilution.

ICP Interference Check Sample (ICS A and AB)

ICP-MS Analysis: The ICS A and ICS AB raw data were not reported and could not be evaluated. No sample data should be qualified as a result. It should be noted that all ICS AB recoveries still met QC acceptance criteria. No sample data should be qualified as a result.

ICP SERIAL DILUTION

ICP Analysis: The serial dilution analysis met all QC acceptance criteria.

ICP-MS Analysis: The serial dilution analysis met all QC acceptance criteria, except as noted above in the summary section.

Other QC

No field blanks (FBs) or field duplicates (FDs) were submitted on the AR/COC.

No other specific issues were identified which affect data quality.

High Explosive Compound Data Validation Results

Memorandum

DATE: October 29, 2008

TO: File

FROM: David Schwent

SUBJECT: Organic GC Data Review and Validation – SNL
Site: Cable Debris Site Sampling
AR/COC: 611998
SDG: 215227/215230/215231/215232
Laboratory: GEL
Project/Task No: 96750.01.03.06

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

Summary

All samples was prepared and analyzed with accepted procedures using method EPA8330 (HEs). Problems were identified with the data package that result in the qualification of data.

MS/MSD: No MS/MSD analyses were performed for Batch 792095. As a result, there was no measure of matrix-specific accuracy for the field sample of the batch. All associated results of sample 215232-002, except the result for RDX, were non-detects (NDs) and will be qualified "UJ,MS1" due to lack of matrix-specific accuracy data; the result for RDX was a detect and will be qualified "J,MS1" due to lack of matrix-specific accuracy data.

Confirmation: For the equipment blank (EB) sample (sample 215232-002), the confirmation relative percent difference (RPD) of RDX was >40% but <75%. The associated RDX result will be qualified "J,V2."

Confirmation by LC/MS/MS: The client requested that sample 215232-002 (client sample fraction ID 086797-002) be reanalyzed by LC/MS/MS to confirm the results of the sample, specifically, the detect result of RDX. The sample was reanalyzed by method EPA 8321 (HEs by LC/MS/MS) is the data package SDG 216993 with all confirmation QC elements meeting acceptance criteria. The results of sample 216993-001 (client sample fraction ID 086797-R02) from the LC/MS/MS reanalysis were all NDs, including the result for RDX. Therefore the original RDX detect result was not confirmed. Since original RDX result of sample 215232-002 was a detect > practical quantitation limit (PQL) and the

LC/MS/MS result was a ND, the result for RDX will be qualified “R,V3” due to not being confirmed by LC/MS/MS.

Data are acceptable, except as noted above. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times and Preservation

All samples were extracted and analyzed within the prescribed holding times and properly preserved.

Calibration

All initial and continuing calibration QC acceptance criteria were met.

Blanks

No target analytes were detected in the blanks, except the following. RDX was detected in the EB (sample 215232-002) at a concentration > the PQL. However, all associated sample results were NDs and the RDX detect result of the EB has been qualified R due to not being confirmed by LC/MS/MS reanalysis. Therefore, no sample data will be qualified as a result.

Surrogates

All surrogate recovery and retention time QC acceptance criteria were met.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

All LCS/LCSD QC acceptance criteria were met. No LCSD analysis was performed for Batches 792084 and 792094. The MSD analysis was used as a measure of laboratory precision for both batches. No sample data will be qualified as a result.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

All MS/MSD QC acceptance criteria were met, except as noted above in the summary section.

TARGET COMPOUND IDENTIFICATION/CONFIRMATION

All confirmation QC acceptance criteria were met, except as noted above in the summary section.

Detection Limits/Dilutions

All detection limits were reported correctly. All samples were diluted 2X, the standard dilution for HE analyses.

Other QC

No field blanks (FBs) were submitted on the AR/COC. All RPDs of the field duplicates (FDs) (samples 215227-007 and -017 were <35%. No QC acceptance criteria for the evaluation of FDs are currently in place.

No other specific issues that affect data quality were identified.

Memorandum

DATE: October 25, 2008

TO: File

FROM: David Schwent

SUBJECT: Organic GC Data Review and Validation – SNL
Site: Cable Debris Site Sampling
AR/COC: 612009
SDG: 215471/215473
Laboratory: GEL
Project/Task No: 96750.01.03.06

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

Summary

All samples was prepared and analyzed with accepted procedures using method EPA8330 (HEs). Problems were identified with the data package that result in the qualification of data.

> MS/MSD: No MS/MSD analyses were performed for Batch 793412. As a result, there was no measure of matrix-specific accuracy for the field sample of the batch. All associated results of sample 215473-002, except the result for RDX, were non-detects (NDs) and will be qualified "UJ,MS1" due to lack of matrix-specific accuracy data; the result for RDX was a detect and will be qualified "J,MS1" due to lack of matrix-specific accuracy data.
>
> Confirmation: For the equipment blank (EB) sample (sample 215473-002), the confirmation relative percent difference (RPD) of RDX was >75% with the result of the primary column being >5X the practical quantitation limit (PQL) and the result of the confirmation column being <5X the PQL. In addition, RDX was detected at a similar concentration based on presumptive evidence (P-flagged by the laboratory) in a second EB sample from the same client sampling site pointing to likely contamination of the sampling site EB water. Therefore, the RDX result of sample -002 will be qualified "R,V2" based on professional judgment.

Data are acceptable, except as noted above. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times and Preservation

All samples were extracted and analyzed within the prescribed holding times and properly preserved.

Calibration

All initial and continuing calibration QC acceptance criteria were met.

Blanks

No target analytes were detected in the blanks, except the following. RDX was detected in the EB (sample 215473-002) at a concentration > the practical quantitation limit (PQL). However, all associated sample results were NDs and the RDX detect result of the EB has been qualified R due high confirmation RPD (see summary section above). Therefore, no sample data will be qualified as a result.

Surrogates

All surrogate recovery and retention time QC acceptance criteria were met.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

All LCS/LCSD QC acceptance criteria were met. No LCSD analysis was performed for Batch 793410. The MSD analysis was used as a measure of laboratory precision for both batches. No sample data will be qualified as a result.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

All MS/MSD QC acceptance criteria were met, except as noted above in the summary section.

TARGET COMPOUND IDENTIFICATION/CONFIRMATION

All confirmation QC acceptance criteria were met, except as noted above in the summary section.

Detection Limits/Dilutions

All detection limits were reported correctly. All samples were diluted 2X, the standard dilution for HE analyses.

Other QC

No field blanks (FBs) or field duplicates (FDs) were submitted on the AR/COC.

No other specific issues that affect data quality were identified.

Radiological Data Validation Results

Memorandum

Date: October 28, 2008

To: File

From: David Schwent

Subject: Radiochemical Data Review and Validation – SNL
Site: Cable Debris Site Sampling
AR/COC: 611998
SDG: 215227/215230/215231/215232
Laboratory: GEL
Project/Task No: 96750.01.03.06

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

SUMMARY

The samples were prepared and analyzed with accepted procedures using method HASL300 (gamma spec). Problems were identified with the data package that result in the qualification of data.

Gamma Spec Analysis:

X-Flag: The Ra-224 results of samples 215227-009, -013, and -016 were X-flagged by the laboratory due to interference and will be qualified "R,Z1."

Forced Activity Calculation: For sample 215227-009, the laboratory identified no valid peak for Th-231 and the MDA was biased low due to a forced activity calculation. The associated sample result should be considered a non-detect (ND) at the calculated MDA and will be qualified "BD,Z2."

Forced Activity Calculation: For sample 215227-013, the laboratory identified no valid peak for Th-231 and the MDA was biased low due to a forced activity calculation. The associated sample result should be considered a ND at the calculated MDA and will be qualified "BD,Z2."

Forced Activity Calculation: For sample 215471-016, the laboratory identified no valid peak for Be-7, Bi-212, and Th-231 and the MDAs were biased low due to forced activity calculations. The associated sample results should be considered NDs at the calculated MDAs and will be qualified "BD,Z2."

Quantification: For samples 215227-009, -013, and -016, the results of Am-241 were either < the associated 2-sigma total propagated uncertainty (TPU) or < the associated minimum detectable activity (MDA) and will be qualified "BD,FR3."

Quantification: For sample 215227-009, the result of Be-7 was either < the associated 2-sigma TPU or < the associated MDA and will be qualified "BD,FR3."
Quantification: For samples 215227-009, -013, and -016, the results of Co-60 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified "BD,FR3."

Quantification: For samples 215227-009, -013, and -016, the results of Ra-223 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified "BD,FR3."

Quantification: For samples 215227-009, -013, and -016, the results of Th-227 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified "BD,FR3."

Quantification: For sample 215227-016, the result of Th-234 was either < the associated 2-sigma TPU or < the associated MDA and will be qualified "BD,FR3."

Quantification: For samples 215227-009, -013, and -016, the results of U-235 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified "BD,FR3."

Quantification: For sample 215227-016, the result of U-238 was either < the associated 2-sigma TPU or < the associated MDA and will be qualified "BD,FR3."

Quantification: For sample 215227-013 the result of Be-7 was ≥ the associated MDA and <3X the MDA and will be qualified "J,FR7."

Quantification: For samples 215227-009 and -013, the results of Th-234 were ≥ the associated MDA and <3X the MDA and will be qualified "J,FR7."

Quantification: For samples 215227-009 and -013, the results of U-238 were ≥ the associated MDA and <3X the MDA and will be qualified "J,FR7."

Data are acceptable, except as noted above. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

All samples were analyzed within the prescribed holding times and properly preserved.

CALIBRATION

All calibration QC acceptance criteria were met.

QUANTIFICATION

All quantification QC acceptance criteria were met, except as noted above in the summary section.

BLANKS

No target analytes were detected in the method blank (MB).

Tracer/Carrier Recovery

No tracer analyses were required by this method.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

All LCS QC acceptance criteria were met. No LCSD analysis was performed. The laboratory replicate analysis was used as a measure of laboratory precision. No sample data will be qualified as a result.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

No MS/MSD analyses were required by this method.

REPLICATES

All laboratory replicate QC acceptance criteria were met.

DETECTION LIMITS/DILUTIONS

All Analyses: All detection limits were properly reported. No samples required dilution.

OTHER QC

No equipment blanks (EBs), field blanks (FBs), or field duplicates (FDs) were submitted on the AR/COC.

No other specific issues were identified that affect data quality.

Memorandum

Date: October 27, 2008

To: File

From: David Schwent

Subject: Radiochemical Data Review and Validation – SNL
Site: Cable Debris Site Sampling
AR/COC: 612009
SDG: 215471/215473
Laboratory: GEL
Project/Task No: 96750.01.03.06

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

SUMMARY

The samples were prepared and analyzed with accepted procedures using method HASL300 (gamma spec). Problems were identified with the data package that result in the qualification of data.

Gamma Spec Analysis:

X-Flag: The Ra-224 results of samples 215471-004 and -008 were X-flagged by the laboratory due to interference and will be qualified "R,Z1."

Forced Activity Calculation: For sample 215471-004, the laboratory identified no valid peak for Bi-212 and Th-231 and the MDAs were biased low due to forced activity calculations. The associated sample results should be considered non-detects (NDs) at the calculated MDAs and will be qualified "BD,Z2."

Forced Activity Calculation: For sample 215471-008, the laboratory identified no valid peak for Am-241, Bi-212, and Th-231 and the MDAs were biased low due to forced activity calculations. The associated sample results should be considered NDs at the calculated MDAs and will be qualified "BD,Z2."

Quantification: For sample 215471-004, the result of Am-241 was either < the associated 2-sigma total propagated uncertainty (TPU) or < the associated minimum detectable activity (MDA) and will be qualified "BD,FR3."

Quantification: For samples 215471-004 and -008, the results of Be-7 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified “BD,FR3.”

Quantification: For samples 215471-004 and -008, the results of Co-60 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified “BD,FR3.”

Quantification: For samples 215471-004 and -008, the results of Ra-223 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified “BD,FR3.”

Quantification: For samples 215471-004 and -008, the results of U-235 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified “BD,FR3.”

Quantification: For sample 215471-004, the result of U-238 was either < the associated 2-sigma TPU or < the associated MDA and will be qualified “BD,FR3.”

Quantification: For samples 215471-004 and -008, the results of Th-227 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified “BD,FR3.”

Quantification: For samples 215471-004 and -008, the results of Th-234 were either < the associated 2-sigma TPU or < the associated MDA and will be qualified “BD,FR3.”

Quantification: For sample 215471-008 the result of U-238 was ≥ the associated MDA and <3X the MDA and will be qualified “J,FR7.”

Data are acceptable, except as noted above. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

All samples were analyzed within the prescribed holding times and properly preserved.

CALIBRATION

All calibration QC acceptance criteria were met.

QUANTIFICATION

All quantification QC acceptance criteria were met, except as noted above in the summary section.

BLANKS

No target analytes were detected in the method blank (MB).

Tracer/Carrier Recovery

No tracer analyses were required by this method.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

All LCS QC acceptance criteria were met. No LCSD analysis was performed. The laboratory replicate analysis was used as a measure of laboratory precision. No sample data will be qualified as a result.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

No MS/MSD analyses were required by this method.

REPLICATES

All laboratory replicate QC acceptance criteria were met.

DETECTION LIMITS/DILUTIONS

All Analyses: All detection limits were properly reported. No samples required dilution.

OTHER QC

No equipment blanks (EB), field blanks (FBs), or field duplicates (FDs) were submitted on the AR/COC.

No other specific issues were identified that affect data quality.

ANNEX C

LTES SITE 1:

RISK ASSESSMENT REPORT

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I. Site Description and History

The Long Term Environmental Stewardship (LTES) Site 1, Cable Debris Site is located within the boundaries of Kirtland Air Force Base (KAFB) in Technical Area (TA)-III of Sandia National Laboratories (SNL/NM). The Cable Debris Site consisted of surface debris piles within a surge basin. A surge basin is part of a drainage system in the local vicinity that provides additional storage and retention of water during heavy rainfall or flood events. The surge basin is a circular depression approximately 1.3 acres in size.

Three of the debris piles were primarily comprised of metal cables with other metal debris, including rebar, steel pipe, tubes, weldments, welded steel fixtures, spent rocket motors and powder actuated cable cutter(s). The remaining two piles in the surge basin were comprised primarily of concrete rubble and rebar; one of these piles is located on the edge of the basin. In addition, there are five smaller debris piles directly east of the surge basin which are primarily comprised of small cobbles, fill dirt and some minor solid waste that includes paper, plastic, and small metal debris. Based upon visual inspection, there is no indication that these piles contain anything other than minor solid waste — no soil staining or other signs of contamination were observed.

The area surrounding the surge basin is generally flat with a gentle slope to the southwest. No major arroyo channels occur in the area. Precipitation is low in the region (approximately 8 inches per year) and surface runoff is minimal. Vegetation primarily consists of desert grasses, cacti, and tumbleweeds.

The operational history at the Cable Debris Site is unknown. However, based on the available information, this location has never been an active site and the contamination is limited to the surface debris (i.e., solid waste) that was probably transported to the area from various test areas. However, prior to 1995, no information is available and the precise origin of the debris is unknown.

II. Data Quality Objectives

The primary data quality objectives (DQO) for the voluntary corrective action (VCA) confirmatory sampling program is to produce defensible analytical results. Confirmatory soil samples were collected and biased to the areas where debris was located. The samples will be analyzed for target analyte list (TAL) metals using Environmental Protection Agency (EPA) Method 6010, high explosive (HE) compounds using EPA Method 8330, and radionuclides, in a limited number of samples.

Laboratory data for verification used for this project required an analytical Level III data package provided by an off-site laboratory. Inorganic compound analyses shall be performed by the laboratory using EPA procedures contained in the most recent edition of “Test Methods for Evaluating Solid Waste” (SW-846) (EPA November 1986), or equivalent, nationally recognized, validated analytical methods.

Laboratory data were evaluated using EPA SW-846 criteria and the SNL/NM SMO “Procedure for Completing the Contract Verification Review (CVR)" (SMO 05-03) (SNL/NM April 2007), and "Data Validation Procedure for Chemical and Radiochemical Data” (AOP [Administrative Operating Procedure] 00-03) (SNL/NM July 2007). These SNL/NM procedures were developed

in accordance with EPA “Contract Laboratory Program National Functional Guidelines for Inorganic and Organic Data Review” (EPA February 1994).

Confirmation sampling was established to provide the data to support this final risk assessment and closure of the site. Results were screened against the risk criteria to determine whether additional remediation was necessary. The sampling conducted at this site was designed to:

- Determine whether hazardous waste or hazardous constituents were released at the site.
- Characterize the nature and extent of any releases.
- Provide analytical data of sufficient quality to support risk assessments.

The reviews confirmed that the analytical data are defensible and therefore acceptable for use in the request for a determination of corrective action complete (CAC) without controls. Therefore, the DQOs have been fulfilled.

III. Determination of Nature, Rate, and Extent of Contamination

III.1 Introduction

The determination of the nature, migration rate, and extent of contamination at LTES Site 1 is based upon an initial conceptual model validated with confirmatory sampling at the site. The initial conceptual model was developed from archival site research, and site inspections as summarized in the LTES Site 1 VCA Work Plan (SNL/NM, May 2008).

III.2 Nature of Contamination

Both the nature of contamination and the potential for the degradation of constituents of concern (COC) at LTES Site 1 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for HE compounds, TAL metals, and radionuclides by gamma spectroscopy. The analytes and methods used are appropriate to characterize the COCs and any potential degradation products at LTES Site 1.

III.3 Rate of Contaminant Migration

Potential COCs may have been released into the vadose zone via surface water runoff. However, the primary COCs (metals) are relatively immobile and transport though the vadose is unlikely. The depth to groundwater at the site (approximately 485 feet below ground surface [bgs]) precludes migration of potential COCs into the groundwater system.

III.4 Extent of Contamination

Contamination at the site resulted from the surface debris piles within a surge basin. Although some residual COCs remain in the soil at LTES Site 1, gross contamination (i.e., the debris) has been removed. The collection of final confirmation soil samples was sufficient to characterize residual contamination present after completion of the cleanup activities (i.e. current conditions).

IV. Comparison of COCs to Background Screening Levels

Site history and characterization activities are used to identify potential COCs. The LTES Site 1 NFA proposal describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs that were evaluated in this risk assessment included all detected inorganic, and radiological COCs for which samples were analyzed. Nondetected HE compounds not included in this assessment were determined to have detection limits low enough to ensure protection of human health and the environment. In order to provide conservatism in this risk assessment, the calculation used only the maximum detected concentration value of each COC found for the entire site. The SNL/NM maximum background concentration (Dinwiddie September 1997) was selected to provide the background screen listed in Tables 1 and 2.

Nonradiological inorganic constituents that are essential nutrients, such as magnesium, calcium, potassium, and sodium, are not included in this risk assessment (EPA 1989). However based on the nature of the debris previously found onsite (i.e., metals), iron was retained as a potential COC. Both radiological and nonradiological COCs are evaluated. The nonradiological COCs included in the risk assessment consist of both inorganic and HE compounds; however, only inorganic compounds are included in the risk assessment as no HE compounds were detected.

Table 1 lists the nonradiological COCs for the human health and the ecological risk assessments at LTES Site 1. Table 2 lists radiological COCs for the human health and ecological risk assessments. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997).

Table 1
Nonradiological COCs for Human Health and Ecological Risk Assessments at LTES Site 1 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (Maximum Aquatic)	Log K_{ow} (for Organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Inorganic						
Aluminum	25700	69,957[c]	Yes	1,305[d]	--	**Yes**
Antimony	3.59	3.9	Yes	16,000[e]	--	**Yes**
Arsenic	6.06 J	4.4	**No**	44[f]	--	**Yes**
Barium	245	130	**No**	170[g]	--	**Yes**
Beryllium	1.13	0.65	**No**	19[f]	--	No
Cadmium	0.555	<1	Yes	64[f]	--	**Yes**
Chromium, total	22.6 J	21.8	**No**	16[f]	--	No
Cobalt	8.91	5.2	**No**	10,000[h]	--	**Yes**
Copper	261	15.4	**No**	6[f]	--	No
Iron	26900	NA	**No**	--	--	--
Lead	2000	21.4	**No**	49[f]	--	**Yes**
Manganese	460	831[c]	Yes	100,000[h]	--	**Yes**
Mercury	0.0335	<0.25	Yes	5,500[f]	--	**Yes**
Nickel	20.3	11.5	**No**	47[f]	--	**Yes**
Vanadium	33.2	20.4	**No**	3,000[g]	--	**Yes**
Zinc	816	62	**No**	47[f]	--	**Yes**

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.

[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]NMED March 1998.
[c]USGS 1994.
[d]Wren, C.D. and G.L. Stephenson 1991.
[e]Callahan et al. 1979.
[f]Yanicak March 1997.
[g]Neumann 1976.
[h]Vanderploeg et al 1975.

BCF = Bioconcentration factor.
COC = Constituent of concern.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
– = Information not available.

Table 2
Radiological COCs for Human Health and Ecological Risk Assessments at LTES Site 1 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (All Samples) (pCi/g)[a]	SNL/NM Background Activity (pCi/g)[b]	Is Maximum COC Activity Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (Maximum Aquatic)	Is COC a Bioaccumulator?[c] (BCF >40)
Co-60	ND (0.0169)	NA	**No**	16[d]	No
Cs-137	0.398	0.079	**No**	3,000[e]	**Yes**
U-235	ND (0.0796)	0.16	Yes	900[f]	**Yes**
U-238	0.963 J	1.4	Yes	900[f]	**Yes**

Note: **Bold** indicates COCs that exceed background screening values and/or are bioaccumulators.
[a]Value listed is the greater of either the maximum detection or the highest MDA.
[b]Dinwiddie September 1997, Southwest Area Supergroup.
[c]NMED March 1998.
[d]Yanicak March 1997.
[e]Whicker and Schultz 1982.
[f]Baker and Soldat 1992.
BCF = Bioconcentration factor.
COC = Constituent of concern.
MDA = Minimum detectable activity.
ND ( ) = Not detected above the MDA, shown in parentheses.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.

V. Fate and Transport

The primary releases of COCs at LTES Site 1 were to the soil resulting from surface debris. Wind, water, and biota are natural mechanism of COC transport from the primary release point; however, because the debris was solid waste, none of these mechanisms are considered to be of potential significance as a transport mechanism at this site. Because groundwater at this site is approximately 485 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

The COCs at LTES Site 1 include both inorganic and HE compounds. The inorganic COCs include both radiological and nonradiological analytes. The inorganic COCs are elemental in form and are not considered to be degradable. Transformations of these inorganic constituents could include changes in valence (oxidation/reduction reactions) or incorporation into organic forms (e.g., the conversion of selenite or selenate from soil to seleno-amino acids in plants). Radiological COCs will undergo decay to stable isotopes or radioactive daughter elements. However, because of the long half-life of the radiological COCs (Cs-137, Co-60, U-235 and U-238), the aridity of the environment at this site, and the lack of potential contact with biota, none of these mechanisms is expected to result in significant losses or transformations of the inorganic COCs. The organic COCs (HE compounds) at LTES Site 1 were 100 percent nondectect.

Table 3 summarizes the fate and transport processes that can occur at LTES Site 1. COCs at this site include radiological and nonradiological inorganic analytes. Wind, surface water, and biota are considered to be of low significance as potential transport mechanisms at this site. Significant leaching into the subsurface soil is unlikely, and leaching into the groundwater at this site is highly unlikely. The potential for transformation of COCs is low, and loss through decay of the radiological COCs is insignificant because of their long half-lives.

Table 3
Summary of Fate and Transport at LTES Site 1

Transport and Fate Mechanism	Existence at Site	Significance
Wind	Yes	Low
Surface runoff	Yes	Low
Migration to groundwater	No	None
Food chain uptake	Yes	Low
Transformation/degradation	Yes	Low

VI. Human Health Risk Assessment

VI.1 Introduction

The human health risk assessment of this site includes a number of steps that culminate in a quantitative evaluation of the potential adverse human health effects caused by constituents located at the site. The steps to be discussed include the following:

Step 1.	Site data are described that provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways are identified by which a representative population might be exposed to the COCs.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The first component of the tiered approach is a screening procedure that compares the maximum concentration of the COC to an SNL/NM maximum background screening value. COCs that are not eliminated during the first screening procedure are carried forward in the risk assessment process.
Step 4.	Toxicological parameters are identified and referenced for COCs that were not eliminated during the screening procedure.
Step 5.	Potential toxicity effects (specified as a hazard index [HI]) and estimated excess cancer risks are calculated for nonradiological COCs and background. For radiological COCs, the incremental total effective dose equivalent (TEDE) and incremental estimated cancer risk are calculated by subtracting applicable background concentrations directly from maximum on-site contaminant values. This background subtraction applies only when a radiological COC occurs as contamination and exists as a natural background radionuclide.
Step 6.	These values are compared with guidelines established by the EPA, NMED, and the DOE to determine whether further evaluation and potential site cleanup are required. Nonradiological COC risk values also are compared to background risk so that an incremental risk can be calculated.
Step 7.	Uncertainties of the above steps are addressed.

VI.2 Step 1. Site Data

Section I of this risk assessment provides the site description and history for LTES Site 1. Section II presents a comparison of results to DQOs. Section III discusses the nature, rate, and extent of contamination.

VI.3 Step 2. Pathway Identification

LTES Site 1 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Appendix 1 for default exposure pathways and parameters). However, the residential land-use scenario is also considered in the pathway analysis. Because of the location and characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust. Soil ingestion is included for the radiological COCs as well. The dermal pathway is included for the nonradiological COCs because of the potential for the receptor to be exposed to contaminated soil. No water pathways to the groundwater are considered; depth to groundwater at LTES Site 1 is approximately 485 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure 1 shows the conceptual model flow diagram for LTES Site 1.

Pathway Identification

Nonradiological Constituents	Radiological Constituents
Soil ingestion	Soil ingestion
Inhalation (dust)	Inhalation (dust)
Dermal contact	Direct gamma

VI.4 Step 3. Background Screening Procedure

This section discusses Step 3, the background screening procedure, which compares the maximum COC concentration to the background screening level. The methodology and results are described in the following sections.

VI.4.1 Methodology

Maximum concentrations of nonradiological COCs were compared to the approved SNL/NM maximum screening levels for this area. The SNL/NM maximum background concentration was selected to provide the background screen in Table 1 and used to calculate risk attributable to background in Section VI.6.2. Only the COCs that were detected above the corresponding SNL/NM maximum background screening levels or did not have either a quantifiable or calculated background screening level were considered in further risk assessment analyses.

For the radiological COCs that exceed the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that do not exceed these background levels are not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, “Radiation Protection of the Public and the Environment” (DOE 1993). Radiological COCs that do not have background screening values and were detected above the analytical minimum detectable activity (MDA) are carried through the risk assessment at the maximum levels. The resultant radiological COCs remaining after this step are referred to as background-adjusted radiological COCs.

VI.4.2 Results

Tables 1 and 2 show LTES Site 1 maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. For the TAL metals, ten constituents were measured at a concentration greater than its background screening value and one metal did not have a corresponding established background screening value.

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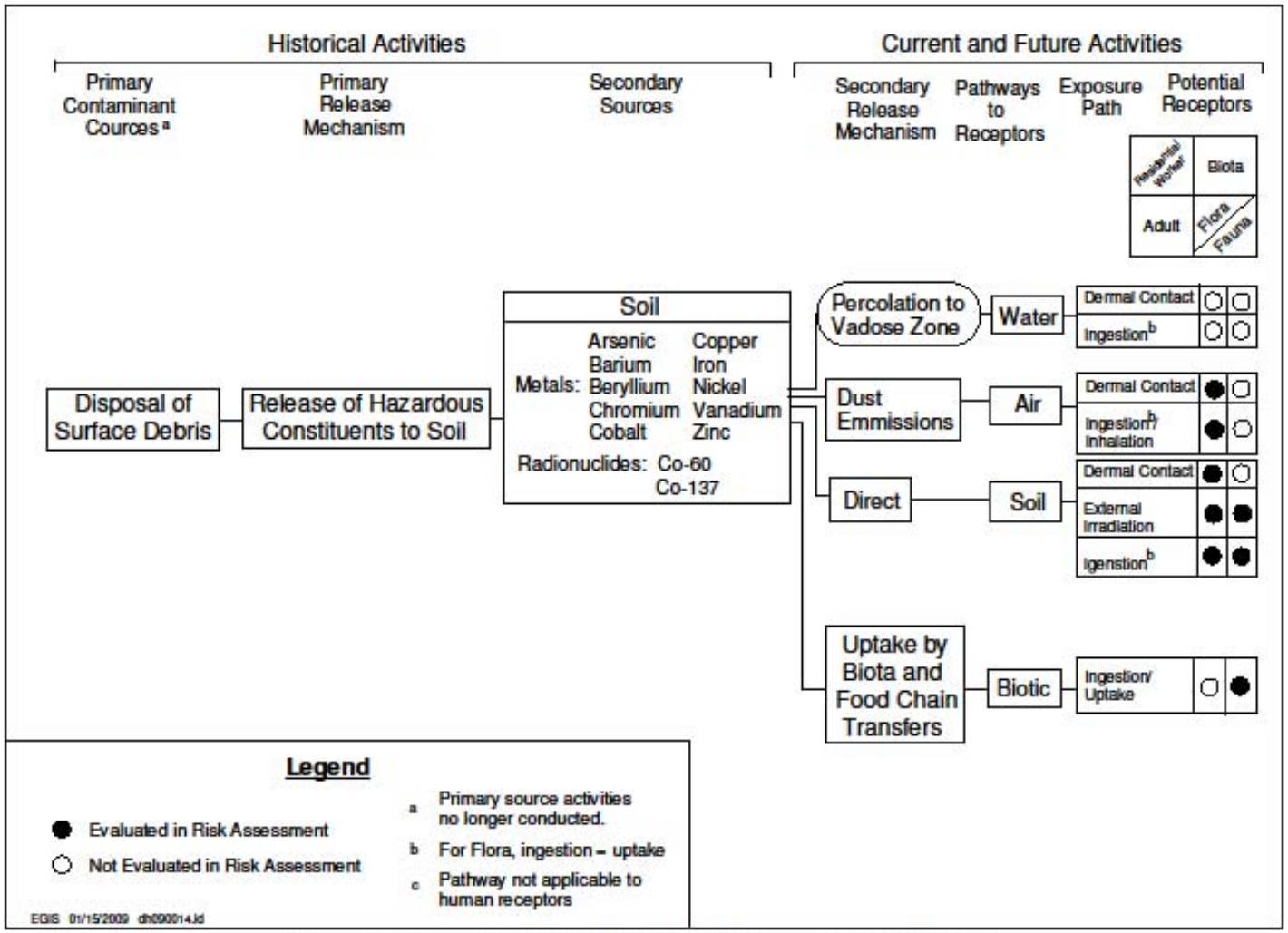

Figure 1. Conceptual Site Model Flow Diagram for LTES Site 1

The maximum concentration value for lead is 2,000 milligrams (mg) per kilogram (/kg) and the 95 % upper confidence limit (UCL) of the mean for a nonparametric distribution is 300 mg/kg (Appendix 2). The EPA intentionally does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. However, the New Mexico Environment Department (NMED) guidance for lead screening concentrations for construction and industrial land use scenarios is 800 mg/kg (NMED December 2006). The EPA screening guidance value for a residential land use scenario is 400 mg/kg (EPA 2008a). The 95% UCL of the mean concentration for all three land use scenarios at this site are less than the screening values; therefore, lead is eliminated from further consideration in the human health risk assessment. In addition the sample with the maximum concentration was in a duplicate sample and this maximum concentration was most likely due to a nugget effect. If this sample were not included within the UCL calculation, the 95 % UCL of the mean for lead is decreased to 193 mg/kg.

For the radiological COCs, two constituents (Co-60 and Cs-137) had MDA or detected values greater than the background screening levels. The greater of either the maximum detection or the highest MDA is conservatively used in the risk assessment.

VI.5 Step 4. Identification of Toxicological Parameters

Tables 1 and 2 list the COCs retained in the risk assessment and provides the values for the available toxicological information. The toxicological values for the nonradiological COCs presented in Table 4 were obtained from the Integrated Risk Information System IRIS) (EPA 2008), the Technical Background Document for Development of Soil Screening Levels (NMED December 2006), and the EPA Region 6 electronic database (EPA 2008b). Dose conversion factors (DCFs) used in determining the excess TEDE values for radiological COCs for the individual pathways are the default values provided in the RESRAD computer code (Yu et al. 1993a) as developed in the following documents:

- DCFs for ingestion and inhalation were taken from “Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion” (EPA 1988).

- DCFs for surface contamination of the site were taken from DOE/EH-0070, “External Dose-Rate Conversion Factors for Calculation of Dose to the Public” (DOE 1988).

- DCFs for volume contamination (exposure to contamination deeper than the immediate surface of the site) were calculated using the methods discussed in “Dose-Rate Conversion Factors for External Exposure to Photon Emitters in Soil” (Kocher 1983) and in ANL/EAIS-8, “Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil” (Yu et al. 1993b).

VI.6 Step 5. Exposure Assessment and Risk Characterization

Section VI.6.1 describes the exposure assessment for this risk assessment. Section VI.6.2 provides the risk characterization, including the HI and excess cancer risk for both the potential nonradiological COCs and associated background for the industrial and residential land-use

Table 4
Toxicological Parameter Values for LTES Site 1 Nonradiological COCs

COC	RfD_o (mg/kg-d)	Confidence[a]	RfD_{inh} (mg/kg-d)	Confidence[a]	SF_o $(mg/kg\text{-}day)^{-1}$	SF_{inh} $(mg/kg\text{-}day)^{-1}$	Cancer Class[b]	ABS
Inorganic								
Arsenic	3E-4[c]	M	–	–	1.5E+0[c]	1.5E+1[e]	A	0.03[d]
Barium	2E-1[c]	M	2E-1[e]	–	–	–	D	0.01[d]
Beryllium	2E-3[c]	L to M	5.7E-6[c]	M	–	8.4E+0[c]	B1	0.01[d]
Chromium, total	1.5E+0[c]	L	–	–	–	–	D	0.01[d]
Cobalt	2E-2[c]	–	5.7E-6[f]	–	–	9.8E+0[e]	–	0.01[d]
Copper	3.7E-2[e]	–	–	–	–	–	D	0.01[d]
Iron	7E-1[e]	–	–	–	–	–	–	0.01[d]
Nickel	2E-2[c]	M	–	–	–	–	–	0.01[d]
Vanadium	5E-3[c]	–	–	–	–	–	–	0.01[d]
Zinc	3E-2[1]	M to H	–	–	–	–	D	0.01[d]

[a]Confidence associated with IRIS (EPA 1998a) database values. Confidence: L = low, M = medium, H = high.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 1998a):
A = Human carcinogen
B1 = Probable human carcinogen. Limited human data are available
D = Not classifiable as to human carcinogenicity.
[c]Toxicological parameter values from IRIS electronic database (EPA 2008).
[d]Toxicological parameter values from NMED 2006.
[e]Toxicological parameter values from EPA Region 6 electronic database (EPA 2008b).
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
HEAST = Health Effects Assessment Summary Tables.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram day.
$(mg/kg\text{-}day)^{-1}$ = Per milligram per kilogram day.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
– = Information not available.

Table 5
Toxicological Parameter Values for LTES Site 1 Radiological COCs
Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
Co-60	1.9E-11	6.9E-11	9.8E-6	A
Cs-137	3.2E-11	1.9E-11	2.1E-6	A

[a]Yu et al. 1993a.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989): A = Human carcinogen for high dose and high dose rate (i.e., greater than 50 rem per year). For low-level environmental exposures, the carcinogenic effect has not been observed and documented.
1/pCi = One per picocurie.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
g/pCi-yr = Gram(s) per picocurie-year.
SF_{ev} = External volume exposure slope factor.
SF_{inh} = Inhalation slope factor.
SF_o = Oral (ingestion) slope factor.

scenarios. The incremental TEDE and incremental estimated cancer risk are provided for the background-adjusted radiological COCs for both industrial and residential land-use scenarios.

VI.6.1 Exposure Assessment

Appendix 1 provides the equations and parameter input values used to calculate intake values and subsequent HI and excess cancer risk values for the individual exposure pathways. The appendix shows parameters for both industrial and residential land-use scenarios. The equations for nonradiological COCs are based upon the Risk Assessment Guidance for Superfund (RAGS) (EPA 1989). Parameters are based upon information from the RAGS (EPA 1989), the Technical Background Document for Development of Soil Screening Levels (NMED December 2000), as well as other EPA and NMED guidance documents. Parameters reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For radiological COCs, the coded equations provided in RESRAD computer code are used to estimate the incremental TEDE and cancer risk for individual exposure pathways. Further discussion of this process is provided in the “Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD” (Yu et al. 1993a). Although the designated land-use scenario for this site is industrial, risk and TEDE values for a residential land-use scenario are also presented.

VI.6.2 Risk Characterization

Table 6 shows an HI of 0.08 for the LTES Site 1 nonradiological COCs and an estimated excess cancer risk of 4E-6 for the designated industrial land-use scenario. The numbers presented include exposure from soil ingestion, dermal contact, and dust and volatile inhalation for nonradiological COCs. Table 7 shows an HI of 0.02 and an estimated excess cancer risk of 1E-6 for the LTES Site 1 associated background constituents under the designated industrial land-use scenario.

Table 6
Risk Assessment Values for LTES Site 1 Nonradiological COCs

COC	Maximum Concentration (All Samples) (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	6.06 J	0.02	3.8E-6	0.28	1.6E-5
Barium	245	0.00	–	0.02	–
Beryllium	1.13	0.00	4.9E-10	0.01	1.0E-9
Chromium, total	22.6 J	0.00	–	0.00	–
Cobalt	8.91	0.00	4.5E-9	0.01	9.6E-9
Copper	261	0.01	–	0.09	–
Iron	26900	0.04	–	0.49	–
Nickel	20.3	0.00	–	0.01	–
Vanadium	33.2	0.00	–	0.06	–
Zinc	816	0.00	–	0.04	–
Total		0.08	3.8E-6	**1.01**	**1.6E-5**

[a]EPA 1989.
[b]Maximum concentration was one-half of the detection limit.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Concentration was qualified as an estimated value.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
– = Information not available or not applicable.

Table 7
Risk Assessment Values for LTES Site 1 Nonradiological Background Constituents

COC	Background Concentration[a] (mg/kg)	Industrial Land-Use Scenario[b]		Residential Land-Use Scenario[b]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	4.4	0.02	2.8E-6	0.20	1.1E-5
Barium	130	0.00	–	0.01	–
Beryllium	0.65	0.00	2.8E-10	0.00	6.0E-9
Chromium, total	21.8	0.00	–	0.00	–
Cobalt	5.2	0.00	2.6E-9	0.00	5.6E-9
Copper	15.4	0.00	–	0.01	–
Iron	NA	NC	NC	NC	NC
Nickel	11.5	0.00	–	0.01	–
Vanadium	20.4	0.00	–	0.04	–
Zinc	62	0.00	–	0.00	–
Total		0.02	2.8E-6	0.27	**1.1E-5**

[a]Dinwiddie 1997, Coyote Test Field Area Supergroup.
[b]From EPA 1989.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
NA = Not established
NC = Not calculated.
SWMU = Solid Waste Management Unit.
– = Information not available.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the industrial land-use scenario, a TEDE is calculated for an individual on the site, which results in an incremental TEDE of 0.009 millirem (mrem)/year (yr). In accordance with EPA guidance found in Office of Solid Waste and Emergency Response (OSWER) Directive No. 9200.4-18 (EPA 1997b), an incremental TEDE of 15 mrem/yr is used for the probable land-use scenario (industrial in this case); the calculated dose value for LTES Site 1for the industrial land use is well below this guideline. The estimated excess cancer risk is 1.3E-7.

The HI is 1.01 with an estimated excess cancer risk of 1.6E-5 for the nonradiological COCs under the residential land-use scenario (Table 6). The numbers in the table include exposure from soil ingestion, dermal contact, and dust inhalation. Based upon the nature of local soil, other exposure pathways are not evaluated (see Appendix 1). Table 7 shows an HI of 0.27 and an estimated excess cancer risk of 1.1E-5 for the associated background constituents at LTES Site 1 under the residential land-use scenario.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 0.023 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998) for a complete loss of institutional controls (residential land use in this case); the calculated dose value for LTES Site 1 for the residential land-use scenario is well below this guideline. Consequently, LTES Site 1 is eligible for unrestricted radiological release as the residential land-use scenario resulted in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 2.5E-7. The excess cancer risk from the nonradiological and radiological COCs should be summed to provide risk estimates for persons exposed to both types of carcinogenic contaminants, as noted in OSWER Directive No. 9200.4-18, “Establishment of Cleanup Levels for CERCLA [Comprehensive Environmental Response, Compensation, and Liability Act] Sites with Radioactive Contamination” (EPA 1997b). This summation is tabulated in Section VI.9, “Summary.”

VI.7 Step 6. Comparison of Risk Values to Numerical Guidelines

The human health risk assessment analysis evaluated the potential for adverse health effects for both the industrial (the designated land-use scenario for this site) and residential land-use scenarios.

For the nonradiological COCs under the industrial land-use scenario, the HI is 0.08 (lower than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The excess cancer risk is 4E-6. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determines risks by evaluating background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background concentrations are assumed to have a hazard quotient (HQ) of 0.00. The incremental HI is 0.05 and the estimated incremental cancer risk is 1.1E-6 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering an industrial land-use scenario.

For the radiological COCs under the industrial land-use scenario, the incremental TEDE is 0.009 mrem/yr, which is significantly lower than EPA's numerical guideline of 15 mrem/yr (EPA 1997b). The incremental estimated excess cancer risk is 1.3E-7.

For the nonradiological COCs under the residential land-use scenario, the calculated HI is 1.01 which is slightly above the numerical guidance. The excess cancer risk is 1.6E-5. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is above the suggested acceptable risk value. The incremental HI is 0.74 the estimated incremental cancer risk is 4.3E-6 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering a residential land-use scenario.

Though both the HI and estimated excess cancer risk are above the NMED guideline for the residential land-use scenario, maximum concentrations were used in the risk calculation. Since the site has been adequately characterized, average concentrations are more representative of actual site conditions. Using the upper 95% confidence limit of the mean concentrations for the main contributors to excess cancer risk and hazards (summarized in Appendix 2), arsenic (3.8 mg/kg, below background and thus, eliminated for the risk calculation; and iron, 14830 mg/kg), the total HI and estimated excess cancer risk are reduced to 0.5 and 1.1E-8, respectively. Thus, using more realistic concentrations in the risk calculations that more accurately depict actual site conditions, both the total HI and excess cancer risks are below NMED guidelines.

The incremental TEDE for a residential land-use scenario from the radiological components is 0.023 mrem/yr, which is significantly lower than the numerical guideline of 75 mrem/yr suggested in the SNL/NM "RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The estimated excess cancer risk is 2.5E-7.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at LTES Site 1 was based upon the initial conceptual model that was validated with confirmatory sampling conducted across the site. The DQOs contained in the Work Plan are appropriate for use in risk-screening assessments. The data collected, based upon sample location, density, and depth, and are representative of the site. The analytical requirements and results satisfy the DQOs. The confirmatory analytical data were reviewed and verified/validated according to "Data Validation Procedure for Chemical and Radiochemical Data," in SNL/NM Environmental Restoration Project Administrative Operating Procedure (AOP) 00-03, Revision 2 (SNL/NM July 2007). In addition, the RPSD Laboratory reviewed all gamma spectroscopy results according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM April 2007). Data packages from the each analytical laboratory were determined to be defensible and acceptable for use in this risk assessment. Therefore, the DQOs have been fulfilled. Therefore, there is no uncertainty associated with the data quality used to perform the risk screening assessment at LTES Site 1.

Because of the location, history, and future land use, there is low uncertainty in the land-use scenario and the potentially affected populations that were considered in performing the risk assessment analysis. Based upon the COCs found in near-surface soil and the location and physical characteristics of the site, there is low uncertainty in the exposure pathways relevant to the analysis.

An RME approach is used to calculate the risk assessment values. Specifically, the parameter values in the calculations are conservative and calculated intakes may be overestimated. Maximum measured values of COC concentrations are used to provide conservative results.

Table 4 shows the uncertainties (confidence levels) in nonradiological toxicological parameter values. There is a mixture of estimated values and values from the IRIS (EPA 2008), the Technical Background Document for Development of Soil Screening Levels (NMED December 2006), and EPA Region 6 (EPA, 2008a). Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 2008), Technical Background Document for Development of Soil Screening Levels (NMED December 2000), the Risk Assessment Information System (ORNL 2003) or the EPA regions (EPA 2008a, EPA 2008b). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

Risk assessment values for nonradiological COCs are within the acceptable range for human health under an industrial land-use scenario compared to established numerical guidance.

For the radiological COCs, the conclusion of the risk assessment is that potential effects on human health for both industrial and residential land-use scenarios are within guidelines and represent only a small fraction of the estimated 360 mrem/yr received by the average U.S. population (NCRP 1987).

The overall uncertainty in all of the steps in the risk assessment process is not considered to be significant with respect to the conclusion reached.

VI.9 Summary

LTES Site 1 contains identified COCs consisting of some inorganic and radiological compounds. Because of the location of the site, the designated industrial land-use scenario, and the nature of contamination, potential exposure pathways identified for this site include soil ingestion, dermal contact, and dust inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways are applied to the residential land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the industrial land-use scenario the HI (0.08) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 4E-6. Thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.05, and the incremental excess cancer risk is 1.1E-6 for the industrial land-use scenario. Incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the residential land-use scenario the HI (1.01) is slightly above the accepted numerical guidance from the EPA. The estimated excess cancer risk is 1.56E-5. Thus, excess cancer risk is above the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.74 and the incremental excess cancer risk is 4.3E-6 for the residential land-use scenario. Incremental risk calculations indicate insignificant risk to human health for the residential land-use scenario.

Though both the HI and estimated excess cancer risk are above the NMED guideline for the residential land-use scenario, maximum concentrations were used in the risk calculation. Since the site has been adequately characterized, average concentrations are more representative of actual site conditions. Using the upper 95% confidence limit of the mean concentrations for the main contributors to excess cancer risk and hazards (summarized in Appendix 2), arsenic (3.8 mg/kg, below background and thus, eliminated for the risk calculation; and iron, 14700 mg/kg), the total HI and estimated excess cancer risk are reduced to 0.5 and 1.1E-8, respectively. Thus, using more realistic concentrations in the risk calculations that more accurately depict actual site conditions, both the total HI and excess cancer risks are below NMED guidelines.

The incremental TEDE and corresponding estimated cancer risk from radiological COCs are much lower than EPA guidance values. The estimated TEDE is 0.009 mrem/yr for the industrial land-use scenario, which is much lower than the EPA's numerical guidance of 15 mrem/yr (EPA 1997b). The corresponding incremental estimated cancer risk value is 1.3E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is 0.023 mrem/yr with an associated risk of 2.5E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, LTES Site 1 is eligible for unrestricted radiological release.

The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 8.

Table 8
Summation of Incremental Radiological and Nonradiological Risks from LTES Site 1

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	1.1E-6	1.3E-7	1.2E-6
Residential	4.3E-6	2.5E-7	4.6E-6

Uncertainties associated with the calculations are considered small relative to the conservatism of this risk assessment analysis. Therefore, it is concluded that this site poses insignificant risk to human health under both the industrial and residential land-use scenarios.

VII. Ecological Risk Assessment

VII.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at LTES Site 1. A component of the NMED Risk-Based Decision Tree (NMED March 1998) is to conduct an ecological assessment that corresponds with that presented in EPA's Ecological RAGS (EPA 1997c). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed risk assessment. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of both bioaccumulation and fate and transport potential) are addressed in previous sections of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a risk assessment whereby a more quantitative estimate of ecological risk is conducted. Although this

assessment is conservative in the estimation of ecological risks, ecological relevance and professional judgment are also used as recommended by the EPA (1998) to ensure that predicted exposures of selected ecological receptors reflect those reasonably expected to occur at the site.

VII.2 Scoping Assessment

The scoping assessment focuses primarily on the likelihood of exposure of biota at, or adjacent to, the site to constituents associated with site activities. Included in this section are an evaluation of existing data and a comparison of maximum detected concentrations to background concentrations, examination of bioaccumulation potential, and fate and transport potential. A scoping risk-management decision (Section VII.2.4) involves summarizing the scoping results and determining whether further examination of potential ecological impacts is necessary.

VII.2.1 Data Assessment

As indicated in Section IV (Tables 4 and 5), constituents in soil within the 0- to 5-foot depth interval that are identified as COPECs for this site include the following:

- Arsenic
- Barium
- Beryllium
- Chromium, total
- Cobalt
- Copper
- Iron
- Lead
- Nickel
- Vanadium
- Zinc
- Co-60
- Cs-137

VII.2.2 Bioaccumulation

Among the COPECs listed in Section VII.2.1, the following are considered to have bioaccumulation potential in aquatic environments (Section IV, Tables 4 and 5):

- Arsenic
- Barium
- Cobalt
- Copper
- Iron
- Lead
- Nickel
- Vanadium
- Zinc
- Cs-137

However, it should be noted that as directed by the NMED (March 1998), bioaccumulation for inorganic constituents is assessed exclusively based upon maximum reported bioconcentration factors (BCFs) for aquatic species. Because only aquatic BCFs are used to evaluate the bioaccumulation potential for metals, bioaccumulation in terrestrial species is likely to be overpredicted.

VII.2.3 Fate and Transport Potential

The potential for the COPECs to migrate from the source of contamination to other media or biota is discussed in Section V. As noted in Table 6 (Section V), wind, surface water, and biota (food chain uptake) are expected to be of low significance as transport mechanisms for COPECs at this site. Degradation, transformation, and radiological decay of the COPECs are also expected to be of low significance.

VII.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it is concluded that complete ecological pathways may be associated with this site and that COPECs also exist at the site. As a consequence, a detailed ecological risk assessment is deemed necessary to predict the potential level of ecological risk associated with the site.

VII.3 Risk Assessment

As concluded in Section VII.2.4, both complete ecological pathways and COPECs are associated with this site. The ecological risk assessment performed for the site involves a quantitative estimate of current ecological risks using exposure models in association with exposure parameters and toxicity information obtained from the literature. The estimation of potential ecological risks is conservative to ensure that ecological risks are not underpredicted.

Components within the risk assessment include the following:

- Problem Formulation—sets the stage for the evaluation of potential exposure and risk.
- Exposure Estimation—provides a quantitative estimate of potential exposure.
- Ecological Effects Evaluation—presents benchmarks used to gauge the toxicity of COPECs to specific receptors.
- Risk Characterization—characterizes the ecological risk associated with exposure of the receptors to environmental media at the site.
- Uncertainty Assessment—discusses uncertainties associated with the estimation of exposure and risk.
- Risk Interpretation—evaluates ecological risk in terms of HQs and ecological significance.
- Risk Assessment Scientific/Management Decision Point—presents the decision to risk managers based upon the results of the risk assessment.

VII.3.1 Problem Formulation

Problem formulation is the initial stage of the risk assessment that provides the introduction to the risk evaluation process. Components that are addressed in this section include a discussion of ecological pathways and the ecological setting, identification of COPECs, and

selection of ecological receptors. The conceptual model, ecological food webs, and ecological endpoints (other components commonly addressed in an ecological risk assessment) are presented in "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico" (IT July 1998) and are not duplicated here.

VII.3.1.1 Ecological Pathways and Setting

LTES Site 1 is approximately 1.3 acres in size. The site is located in an area dominated by grassland habitat with the exception of the surge basin which is unvegetated. . No threatened or endangered species exist at this site, and seeps, or springs are associated with the site.

Complete ecological pathways may exist at this site through the exposure of plants and wildlife to COPECs in the soil at this site. It is assumed that direct uptake of COPECs from soil is the major route of exposure for plants and that exposure of plants to wind-blown soil is minor. Exposure modeling for the wildlife receptors is limited to the food and soil ingestion pathways and external radiation. Because of the lack of surface water at this site, exposure to COPECs through the ingestion of surface water is considered insignificant. Inhalation and dermal contact also are considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Groundwater is not expected to be affected by COPECs at this site.

VII.3.1.2 COPECs

The onsite surface debris was the primary source of COPECs at LTES Site 1. All COPECs identified for this site are listed in Section VII.2. The COPECs include both radiological and nonradiological analytes. The analytes were screened against background concentrations and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area were considered to be COPECs. All organic analytes detected in the soil. Nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, are not included in this risk assessment as set forth by the EPA (1989). In order to provide conservatism, this ecological risk assessment is based upon the maximum soil concentrations of the COPECs measured in the upper 5 feet of soil at this site. Tables 1 and 2 present maximum concentrations for the COPECs.

VII.3.1.3 Ecological Receptors

A nonspecific perennial plant is selected as the receptor to represent plant species at the site (IT July 1998). Vascular plants are the principal primary producers at the site and are key to the diversity and productivity of the wildlife community associated with the site. The deer mouse (*Peromyscus maniculatus*) and the burrowing owl (*Speotyto cunicularia*) are used to represent wildlife use. Because of its opportunistic food habits, the deer mouse is used to represent a mammalian herbivore, omnivore, and insectivore. The burrowing owl is selected to represent a top predator at this site. The burrowing owl is present at SNL/NM and is designated a species of management concern by the U.S. Fish and Wildlife Service in Region 2, which includes the state of New Mexico (USFWS September 1995).

VII.3.2 Exposure Estimation

For nonradiological COPECs, direct uptake from the soil is considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors is limited to food and soil ingestion pathways. Inhalation and dermal contact are considered insignificant

pathways with respect to ingestion (Sample and Suter 1994). Drinking water is also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse is modeled under three dietary regimes: as an herbivore (100 percent of its diet as plant material), as an omnivore (50 percent of its diet as plants and 50 percent as soil invertebrates), and as an insectivore (100 percent of its diet as soil invertebrates). The burrowing owl is modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Because the exposure in the burrowing owl from a diet consisting of equal parts of herbivorous, omnivorous, and insectivorous mice would be equivalent to the exposure consisting of only omnivorous mice, the diet of the burrowing owl is modeled with intake of omnivorous mice only. Both species are modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 9 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for use of the factors presented in this table is described in the ecological risk assessment methodology document (IT July 1998).

Although home range is also included in this table, exposures for this risk assessment are modeled using an area use factor of 1.0, implying that all food items and soil ingested come from the site being investigated. The maximum COPEC concentrations measured in the upper five feet of soil were used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

For the radiological dose-rate calculations, the deer mouse is modeled as an herbivore (100 percent of its diet as plants), and the burrowing owl is modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Both are modeled with soil ingestion comprising 2 percent of the total dietary intake. Receptors are exposed to radiation both internally and externally from Co-60 and Cs-137. Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose-rate models from DOE (1995) as presented in the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998). Radionuclide-dependent data for the dose-rate calculations were obtained from Baker and Soldat (1992). The external dose-rate model examines the total-body dose rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external dose-rate model is the same for both the deer mouse and the burrowing owl. The internal total-body dose-rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides for a conservative estimate for absorbed dose. This concentrated radiation source at the center of the body of the receptor is assumed to be a “point” source. Radiation emitted from this point source is absorbed by the body tissues to contribute to the absorbed dose. Alpha and beta emitters are assumed to transfer 100 percent of their energy to the receptor as they pass through tissues. Gamma-emitting radionuclides transfer only a fraction of their energy to the tissues because gamma rays interact less with matter than do beta or alpha emitters. The external and internal dose-rate results are summed to calculate a total dose rate from exposure to Co-60 and Cs-137.

Table 10 provides the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 11 presents maximum concentrations in soil and derived concentrations in tissues of the various food chain elements that are used to model dietary exposures for each of the wildlife receptors.

Table 9
Exposure Factors for Ecological Receptors at LTES Site 1

Receptor Species	Class/Order	Trophic Level	Body Weight (kg)[a]	Food Intake Rate (kg/day)[b]	Dietary Composition[c]	Home Range (acres)
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Herbivore	2.39E-2[d]	3.72E-3	Plants: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Omnivore	2.39E-2[d]	3.72E-3	Plants: 50% Invertebrates: 50% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Insectivore	2.39E-2[d]	3.72E-3	Invertebrates: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Burrowing owl (*Speotyto cunicularia*)	Aves/ Strigiformes	Carnivore	1.55E-1[f]	1.73E-2	Rodents: 100% (+ Soil at 2% of intake)	3.5E+1[g]

[a]Body weights are in kg wet weight.
[b]Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kg dry weight per day.
[c]Dietary compositions are generalized for modeling purposes. Default soil intake value of 2 percent of food intake.
[d]Silva and Downing 1995.
[e]EPA 1993, based upon the average home range measured in semiarid shrubland in Idaho.
[f]Dunning 1993.
[g]Haug et al. 1993.
EPA = U.S. Environmental Protection Agency.
kg = Kilogram(s).
SWMU = Solid Waste Management Unit.

Table 10
Transfer Factors Used in Exposure Models for COPECs at LTES Site 1

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Arsenic	4.0E-2 [a]	1.0E+0 [b]	2.0E-3 [a]
Barium	1.5E-1 [a]	1.0E+0 [b]	2.0E-4 [c]
Beryllium	1.0E-2 [a]	1.0E+0 [b]	1.0E-3 [a]
Chromium, total	4.0E-2 [c]	1.3E-1 [d]	3.0E-2 [c]
Cobalt	4.0E-1 [c]	1.0E+0 [b]	3.0E-2 [c]
Copper	8.0E-1 [e]	2.5E-1 [f]	1.0E-2 [a]
Lead	9.0E-2 [c]	4.0E-2 [f]	8.0E-4 [c]
Nickel	2.0E-1 [c]	3.8E-1 [d]	6.0E-3 [a]
Vanadium	5.5E-3 [a]	1.0E+0 [b]	2.5E-3 [a]
Zinc	1.0E+0 [a]	3.0E-1 [f]	1.0E-1 [a]

[a]From Baes et al. (1984).
[b]Default value.
[c]From NCRP (January 1989).
[d]From Ma (1982).
[e]From IAEA (1992).
[f]From Stafford et al. (1991).
NCRP = National Council on Radiation Protection and Measurements.
SWMU = Solid Waste Management Unit.

Table 11
Media Concentrations[a] for COPECs at LTES Site 1

COPEC	Soil (Maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Arsenic	6.06 J[d]	2.42E-1	6.06E+0	2.05E-2
Barium	245	3.68E+1	2.45E+2	9.11E-2
Beryllium	1.13	1.13E-2	1.13E+0	1.85E-3
Chromium, total	22.6 J[d]	9.04E-1	2.94E+0	2.22E-1
Cobalt	8.91	3.56E+0	8.91E+0	6.01E-1
Copper	261	2.09E+2	6.53E+1	4.45E+0
Lead	2000	1.80E+2	8.00E+1	4.25E-1
Nickel	20.3	4.06E+0	7.71E+0	1.18E-1
Vanadium	33.2	1.83E-1	3.32E+1	1.36E-1
Zinc	816	1.22E+3	2.45E+2	2.35E+2

[a]In milligrams per kilogram. All biotic media are based upon dry weight of the media. Soil concentration measurements are assumed to have been based upon dry weight. Values have been rounded to two significant digits after calculation.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Based upon the deer mouse with an omnivorous diet. Product of the average concentration ingested in food and soil times the food-to-muscle transfer factor times a wet weight-dry weight conversion factor of 3.125 (EPA 1993).
[d]Estimated value.
COPEC = Constituent of potential ecological concern.

VII.3.3 Ecological Effects Evaluation

Table 12 shows benchmark toxicity values for the plant and wildlife receptors. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Sufficient toxicity information was not available to estimate the LOAELs or NOAELs for some COPECs.

The benchmark used for exposure of terrestrial receptors to radiation was 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (IAEA 1992) for the protection of terrestrial populations. Because plants and insects are less sensitive to radiation than vertebrates (Whicker and Schultz 1982), the dose of 0.1 rad/day should also protect other groups within the terrestrial habitat of LTES Site 1.

VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures are compared to plant and wildlife benchmark values, respectively. Table 13 presents the results of these comparisons. HQs are used to quantify the comparison with benchmarks for plants and wildlife exposure.

HQs for plants exceeded unity for chromium, copper, lead, vanadium, and zinc. For the deer mice, HQs exceeded unity for arsenic, barium, lead, and vanadium. For the burrowing owl, only lead and zinc exceeded unity. As directed by the NMED, HIs were calculated for each of the receptors (the HI is the sum of chemical-specific HQs for all pathways for a given receptor). All receptors had total HIs greater than unity, with a maximum HI of 100 for the generic plant.

Tables 14 and 15 summarize the internal and external dose rate model results for Cs-137 for the deer mouse and burrowing owl, respectively. The total radiation dose rate to the deer mouse was predicted to be 3.4E-5 rad/day and that for the burrowing owl was 2.8E-5 rad/day. The dose rates for the deer mouse and the burrowing owl are lower than the benchmark of 0.1 rad/day.

Table 12
Toxicity Benchmarks for Ecological Receptors at LTES Site 1

Constituent of Potential Ecological Concern	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Inorganic							
Arsenic	10	mouse	0.126	0.133	mallard	5.14	5.14
Barium	500	rat[h]	5.1	10.5	chicks	20.8	20.8
Beryllium	10	rat	0.66	1.29	--	--	--
Chromium, total	1	rat	2737	5354	black duck	1	1
Cobalt	20	--	--	--	--	--	--
Copper	100	mink	11.7	29.8	chicks	47	47
Lead	50	rat	8	15.7	Am. kestrel	3.85	3.85
Nickel	30	rat	40	78.2	mallard	77.4	77.4
Vanadium	2	Rat[i]	0.21	0.381	mallard	11.4	11.4
Zinc	50	rat	160	313	chicken	14.5	14.5

[a]In milligrams per kilogram soil dry weight.
[b]From Efroymson et al. (1997).
[c]Body weights (in kilograms) for the no-observed-adverse-effect level (NOAEL) conversion are as follows: lab mouse, 0.030; lab rat, 0.350, (except where noted).
[d]From Sample et al. (1996), except where noted.
[e]In milligrams per kilogram body weight per day.
[f]Based upon NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.0239 kilogram and a mammalian scaling factor of 0.25.
[g]Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[h]Body weight: 0.435 kilogram.
[i]Body weight: 0.26 kilogram.
NOAEL = no observed adverse effect level.
SWMU = Solid waste management unit.
-- = insufficient toxicity data.

Table 13
HQs for Ecological Receptors at LTES Site 1

COPEC	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Inorganic					
Arsenic	6.1E-01	4.2E-01	**3.8E+00**	**7.2E+00**	3.1E-03
Barium	4.9E-01	6.2E-01	**2.2E+00**	**3.7E+00**	2.7E-02
Beryllium	1.1E-01	4.1E-03	7.2E-02	1.4E-01	–
Chromium, total	**2.3E+01**	3.9E-05	6.9E-05	9.9E-05	7.5E-02
Cobalt	4.5E-01	–	–	–	–
Copper	**2.6E+00**	**1.1E+00**	7.4E-01	3.7E-01	2.3E-02
Lead	**4.0E+01**	**2.2E+00**	**1.7E+00**	**1.2E+00**	**1.2E+00**
Nickel	6.8E-01	8.9E-03	1.3E-02	1.6E-02	7.5E-04
Vanadium	**1.7E+01**	3.5E-01	**7.1E+00**	**1.4E+01**	7.8E-03
Zinc	**1.6E+01**	6.2E-01	3.7E-01	1.3E-01	**1.9E+00**
HI[b]	**1.0E+02**	**5.3E+00**	**1.6E+01**	**2.7E+01**	**3.2E+00**

Note: **Bold** text indicates HQ or HI exceeds unity.
[b]The HI is the sum of individual HQs.
COPEC = Constituent of potential ecological concern.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

Table 14
Total Dose Rates for Deer Mice
Exposed to Radionuclides at LTES Site 1

Radionuclide	Maximum Activity (pCi/g)	Total Dose (rad/day)
Co-60	ND (0.0169)	3.3E-6
Cs-137	0.398	3.1E-5
Total Dose		3.4E-5

MDA = Minimum detectable activity.
pCi/g = Picocurie(s) per gram.

Table 15
Total Dose Rates for Burrowing Owls
Exposed to Radionuclides at LTES Site 1

Radionuclide	Maximum Activity (pCi/g)	Total Dose (rad/day)
Co-60	ND (0.0169)	3.3E-6
Cs-137	0.398	2.5E-5
Total Dose		2.8E-5

MDA = Minimum detectable activity.
pCi/g = Picocurie(s) per gram.

VII.3.5 Uncertainty Assessment

Many uncertainties are associated with the characterization of ecological risks at LTES Site 1. These uncertainties result from assumptions used in calculating risk that could overestimate or underestimate true risk presented at a site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk rather than to underestimate them. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum measured analyte concentrations in soil to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, and the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ values for the deer mouse. Each of these uncertainties, which are consistent among each of the Site-specific ecological risk assessments, is discussed in greater detail in the uncertainty section of the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to Co-60 and Cs-137 are primarily related to those inherent in the radionuclide-specific data. Radionuclide-dependent data are measured values that have their associated errors. The dose rate models used for these calculations are based upon conservative estimates on receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic but conservative estimate of a receptor's internal and external exposure to radionuclides in soil. It should also be noted that none of the radiological COPECs at this site were detected, and all are represented in the dose models by their maximum detection limit.

The assumption of an area use factor of 1.0 is a source of uncertainty for the burrowing owl at this site. Because LTES Site 1 is approximately 6.5 acre in size and the home range of the burrowing owl is 35 acres, an area use factor of approximately 0.18 would be justified for this receptor. This is sufficient to reduce the burrowing owl HQ for lead from 1.3 to 0.25.

A further source of uncertainty associated with the prediction of ecological risks at this site is the use of the maximum measured concentrations to evaluate exposure and risk. This results in a conservative exposure scenario that does not necessarily reflect actual site conditions. To evaluate the potential effect on risk predictions by the use of the maximum concentrations as exposure point concentrations, upper confidence limits (UCLs) of the mean (Appendix 2) soil concentrations were calculated for arsenic (3.8 mg/kg), barium (UCL= 165 mg/kg), chromium (14.3 mg/kg), copper (35.9 mg/kg), lead (300 mg/kg), vanadium (23.9 mg/kg), and zinc (186 mg/kg). The 95% UCL for arsenic, and chromium are less than their background screening level, indicating that average exposures for these COPECs at this site are within background levels. Exposures to plants at the 95% UCL concentrations for lead, vanadium, and zinc reduce the HQs to 6.0, 12, and 3.7, indicating low average risk to this receptor from these three COPECs. All of the deer mouse HQs are reduced to levels below 10, indicating low average risk to this receptor from these COPECs.

Based upon this uncertainty analysis, the potential for ecological risks at LTES Site 1 is expected to be low. HQs greater than unity were predicted; however, closer examination of the exposure assumptions revealed an overestimation of risk primarily attributed to conservative toxicity benchmarks; the use of maximum concentrations, maximum bioavailability, and maximum area use to estimate exposure; and the contribution of background risk.

VII.3.6 Risk Interpretation

Ecological risks associated with LTES Site 1 were estimated through a risk assessment that incorporated site-specific information when available. Initial predictions of potential risk to plants and deer mice from exposure to several metals were based on maximum measured soil concentrations, highly conservative plant toxicity benchmarks, and assumptions of high bioavailability. Actual risk to this receptor is expected to be low based on more realistic exposure assumptions. Predictions of potential risk to the deer mice from exposures to metals are also attributable to conservative exposure assumptions. For the burrowing owl, the initial prediction of risk from exposure to lead is attributable to the assumption of 100 percent area use by this receptor. Based upon this final analysis, the potential for ecological risks associated with LTES Site 1 is expected to be low.

VII.3.7 Risk Assessment Scientific/Management Decision Point

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for NFA or whether additional data should be collected to more thoroughly assess actual ecological risk at the site. With respect to this site, ecological risks are predicted to be low. The scientific/management decision is to recommend this site for NFA.

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APPENDIX 1
EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Introduction

Sandia National Laboratories/New Mexico (SNL/NM) personnel use a default set of exposure routes and associated default parameter values developed for each future land-use designation being considered for SNL/NM Environmental Restoration (ER) Project sites. This default set of exposure scenarios and parameter values are invoked for risk assessments unless site-specific information suggests other parameter values. Because many SNL/NM ER project sites have similar types of contamination and physical settings, SNL/NM personnel believes that the risk assessment analyses at these sites can be similar. A default set of exposure scenarios and parameter values facilitates the risk assessments and subsequent review.

The default exposure routes and parameter values used are those that SNL/NM personnel view as resulting in a Reasonable Maximum Exposure (RME) value. Subject to comments and recommendations by the U.S. Environmental Protection Agency (EPA) Region VI and New Mexico Environment Department (NMED), SNL/NM personnel will use these default exposure routes and parameter values in future risk assessments.

At SNL/NM, all ER project sites exist within the boundaries of the Kirtland Air Force Base. Approximately 240 potential waste and release sites have been identified where hazardous, radiological, or mixed materials may have been released to the environment. Evaluation and characterization activities have occurred at all of these sites to varying degrees. Among other documents, the SNL/NM ER draft Environmental Assessment (DOE 1996) presents a summary of the hydrogeology of the sites and the biological resources present. When evaluating potential human health risk the current or reasonably foreseeable land use negotiated and approved for the specific Solid Waste Management Unit/Area of Concern (SWMU/AOC), aggregate, or watershed will be used. The following references generally document these land uses: *Workbook: Future Use Management Area 2 (DOE et al. September 1995); Workbook: Future Use Management Area 1 (DOE et al. October 1995); Workbook: Future Use Management Areas 3, 4, 5, and 6 (DOE and USAF January 1996); Workbook: Future Use Management Area 7 (DOE and USAF March 1996)*. At this time, all SNL/NM SWMUs have been tentatively designated for either industrial or recreational future land use. The NMED has also requested that risk calculations be performed based upon a residential land-use scenario. Therefore, all three land-use scenarios will be addressed in this document.

The SNL/NM ER Project has screened the potential exposure routes and identified default parameter values to be used for calculating potential intake and subsequent hazard index (HI), excess cancer risk and dose values. The EPA (EPA 1989) provides a summary of exposure routes that could potentially be of significance at a specific waste site. These potential exposure routes consist of:

- Ingestion of contaminated drinking water
- Ingestion of contaminated soil

- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables

- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming
- Dermal contact with chemicals in water
- Dermal contact with chemicals in soil
- Inhalation of airborne compounds (vapor phase or particulate)
- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water; and exposure from ground surfaces with photon-emitting radionuclides)

Based upon the location of the SNL/NM SWMUs and the characteristics of the surface and subsurface at the sites, we have evaluated these potential exposure routes for different land-use scenarios to determine which should be considered in risk assessment analyses (the last exposure route is pertinent to radionuclides only). At SNL/NM SWMUs, there is currently no consumption of fish, shellfish, fruits, vegetables, meat, eggs, or dairy products that originate on site. Additionally, no potential for swimming in surface water is present due to the high-desert environmental conditions. As documented in the RESRAD computer code manual (ANL 1993), risks resulting from immersion in contaminated air or water are not significant compared to risks from other radiation exposure routes.

For the industrial and recreational land-use scenarios, SNL/NM ER has, therefore, excluded the following four potential exposure routes from further risk assessment evaluations at any SNL/NM SWMU:

- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming
- Dermal contact with chemicals in water

That part of the exposure pathway for radionuclides related to immersion in contaminated air or water is also eliminated.

Based upon this evaluation, for future risk assessments the exposure routes that will be considered are shown in Table 1.

Table 1
Exposure Pathways Considered for Various Land-Use scenarios

Industrial	Recreational	Residential
Ingestion of contaminated drinking water	Ingestion of contaminated drinking water	Ingestion of contaminated drinking water
Ingestion of contaminated soil	Ingestion of contaminated soil	Ingestion of contaminated soil
Inhalation of airborne compounds (vapor phase or particulate)	Inhalation of airborne compounds (vapor phase or particulate)	Inhalation of airborne compounds (vapor phase or particulate)
Dermal contact (nonradiological constituents only) soil only	Dermal contact (nonradiological constituents only) soil only	Dermal contact (nonradiological constituents only) soil only
External exposure to penetrating radiation from ground surfaces	External exposure to penetrating radiation from ground surfaces	External exposure to penetrating radiation from ground surfaces

Equations and Default Parameter Values for Identified Exposure Routes

In general, SNL/NM personnel expects that ingestion of compounds in drinking water and soil will be the more significant exposure routes for chemicals; external exposure to radiation may also be significant for radionuclides. All of the above routes will, however, be considered for their appropriate land-use scenarios. The general equation for calculating potential intakes via these routes is shown below. The equations are taken from “Assessing Human Health Risks Posed by Chemicals: Screening-Level Risk Assessment” (NMED March 2000) and “Technical Background Document for Development of Soil Screening Levels” (NMED December 2000). Equations from both documents are based upon the “Risk Assessment Guidance for Superfund” (RAGS): Volume 1 (EPA 1989, 1991). These general equations also apply to calculating potential intakes for radionuclides. A more in-depth discussion of the equations used in performing radiological pathway analyses with the RESRAD code may be found in the RESRAD Manual (ANL 1993). RESRAD is the only code designated by the U.S. Department of Energy (DOE) in DOE Order 5400.5 for the evaluation of radioactively contaminated sites (DOE 1993). The Nuclear Regulatory Commission (NRC) has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff. EPA Science Advisory Board reviewed the RESRAD model. EPA used RESRAD in their rulemaking on radiation site cleanup regulations. RESRAD code has been verified, undergone several benchmarking analyses, and been included in the International Atomic Energy Agency’s VAMP and BIOMOVS II projects to compare environmental transport models.

Also shown are the default values SNL/NM ER will use in RME risk assessment calculations for industrial, recreational, and residential land-use scenarios, based upon EPA and other governmental agency guidance. The pathways and values for chemical contaminants are discussed first, followed by those for radionuclide contaminants. RESRAD input parameters that are left as the default values provided with the code are not discussed. Further information relating to these parameters may be found in the RESRAD Manual (ANL 1993) or by directly accessing the RESRAD websites at: http://web.ead.anl.gov/resrad/home2/ or http://web.ead.anl.gov/resrad/documents/.

Generic Equation for Calculation of Risk Parameter Values

The equation used to calculate the risk parameter values (i.e., hazard quotients/HI, excess cancer risk, or radiation total effective dose equivalent [TEDE] [dose]) is similar for all exposure pathways and is given by:

Risk (or Dose) = Intake x Toxicity Effect (either carcinogenic, noncarcinogenic, or radiological)

$$= C \times (CR \times EFD/BW/AT) \times \text{Toxicity Effect} \qquad (1)$$

where;

C = contaminant concentration (site specific)
CR = contact rate for the exposure pathway
EFD= exposure frequency and duration
BW = body weight of average exposure individual
AT = time over which exposure is averaged.

For nonradiological constituents of concern (COCs), the total risk/dose (either cancer risk or HI) is the sum of the risks/doses for all of the site-specific exposure pathways and contaminants. For radionuclides, the calculated radiation exposure, expressed as TEDE is compared directly to the exposure guidelines of 15 millirem per year (mrem/year) for industrial and recreational future use and 75 mrem/year for the unlikely event that institutional control of the site is lost and the site is used for residential purposes (EPA 1997).

The evaluation of the carcinogenic health hazard produces a quantitative estimate for excess cancer risk resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of the quantitative estimate with the potentially acceptable risk of 1E-5 for nonradiological carcinogens. The evaluation of the noncarcinogenic health hazard produces a quantitative estimate (i.e., the HI) for the toxicity resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of this quantitative estimate with the EPA standard HI of unity (1). The evaluation of the health hazard from radioactive compounds produces a quantitative estimate of doses resulting from the COCs present at the site. This estimated dose is used to calculate an assumed risk. However, this calculated risk is presented for illustration purposes only, not to determine compliance with regulations.

The specific equations used for the individual exposure pathways can be found in RAGS (EPA 1989) and are outlined below. The RESRAD Manual (ANL 1993) describes similar equations for the calculation of radiological exposures.

Soil Ingestion

A receptor can ingest soil or dust directly by working in the contaminated soil. Indirect ingestion can occur from sources such as unwashed hands introducing contaminated soil to food that is then eaten. An estimate of intake from ingesting soil will be calculated as follows:

$$I_s = \frac{C_s * IR * CF * EF * ED}{BW * AT}$$

where:

I_s = Intake of contaminant from soil ingestion (milligrams [mg]/kilogram [kg]-day)
C_s = Chemical concentration in soil (mg/kg)
IR = Ingestion rate (mg soil/day)
CF = Conversion factor (1E-6 kg/mg)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

It should be noted that it is conservatively assumed that the receptor only ingests soil from the contaminated source.

Soil Inhalation

A receptor can inhale soil or dust directly by working in the contaminated soil. An estimate of intake from inhaling soil will be calculated as follows (EPA August 1997):

$$I_s = \frac{C_s * IR * EF * ED * \left(1/VF \text{ or } 1/PEF \right)}{BW * AT}$$

where:

I_s = Intake of contaminant from soil inhalation (mg/kg-day)
C_s = Chemical concentration in soil (mg/kg)
IR = Inhalation rate (cubic meters [m^3]/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
VF = soil-to-air volatilization factor (m^3/kg)
PEF = particulate emission factor (m^3/kg)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Soil Dermal Contact

$$D_a = \frac{C_s * CF * SA * AF * ABS * EF * ED}{BW * AT}$$

where:

D_a = Absorbed dose (mg/kg-day)
C_s = Chemical concentration in soil (mg/kg)
CF = Conversion factor (1E-6 kg/mg)
SA = Skin surface area available for contact (cm^2/event)
AF = Soil to skin adherence factor (mg/cm^2)
ABS = Absorption factor (unitless)
EF = Exposure frequency (events/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Ingestion

A receptor can ingest water by drinking it or through using household water for cooking. An estimate of intake from ingesting water will be calculated as follows (EPA August 1997):

$$I_w = \frac{C_w * IR * EF * ED}{BW * AT}$$

where:

I_w = Intake of contaminant from water ingestion (mg/kg/day)
C_w = Chemical concentration in water (mg/liter [L])
IR = Ingestion rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Inhalation

The amount of a constituent taken into the body via exposure to volatilization from showering or other household water uses will be evaluated using the concentration of the constituent in the water source (EPA 1991 and 1992). An estimate of intake from volatile inhalation from groundwater will be calculated as follows (EPA 1991):

$$I_w = \frac{C_w * K * IR_i * EF * ED}{BW * AT}$$

where:

I_w = Intake of volatile in water from inhalation (mg/kg/day)
C_w = Chemical concentration in water (mg/L)
K = volatilization factor (0.5 L/m^3)
IR_i = Inhalation rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged—days)

For volatile compounds, volatilization from groundwater can be an important exposure pathway from showering and other household uses of groundwater. This exposure pathway will only be evaluated for organic chemicals with a Henry's Law constant greater than $1x10^{-5}$ and with a molecular weight of 200 grams/mole or less (EPA 1991).

Tables 2 and 3 show the default parameter values suggested for use by SNL/NM at SWMUs, based upon the selected land-use scenarios for nonradiological and radiological COCs, respectively. References are given at the end of the table indicating the source for the chosen parameter values. SNL/NM uses default values that are consistent with both regulatory guidance and the RME approach. Therefore, the values chosen will, in general, provide a conservative estimate of the actual risk parameter. These parameter values are suggested for use for the various exposure pathways, based upon the assumption that a particular site has no

unusual characteristics that contradict the default assumptions. For sites for which the assumptions are not valid, the parameter values will be modified and documented.

Summary

SNL/NM personnel will use the described default exposure routes and parameter values in risk assessments at sites that have an industrial, recreational, or residential future land-use scenario. There are no current residential land-use designations at SNL/NM ER sites, but NMED has requested this scenario to be considered to provide perspective of the risk under the more restrictive land-use scenario. For sites designated as industrial or recreational land use, SNL/NM will provide risk parameter values based upon a residential land-use scenario to indicate the effects of data uncertainty on risk value calculations or in order to potentially mitigate the need for institutional controls or restrictions on SNL/NM ER sites. The parameter values are based upon EPA guidance and supplemented by information from other government sources. If these exposure routes and parameters are acceptable, SNL/NM will use them in risk assessments for all sites where the assumptions are consistent with site-specific conditions. All deviations will be documented.

Table 2
Default Nonradiological Exposure Parameter Values for Various Land-Use scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency (day/yr)	250[a,b]	8.7 (4 hr/wk for 52 wk/yr)[a,b]	350[a,b]
Exposure Duration (yr)	25[a,b,c]	30[a,b,c]	30[a,b,c]
Body Weight (kg)	70[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]
Averaging Time (days) for Carcinogenic Compounds (= 70 yr x 365 day/yr) for Noncarcinogenic Compounds (= ED x 365 day/yr)	25,550[a,b] 9,125 [a,b]	25,550[a,b] 10,950[a,b]	25,550 [a,b] 10,950 [a,b]
Soil Ingestion Pathway			
Ingestion Rate (mg/day)	100[a,b]	200 Child[a,b] 100 Adult[a,b]	200 Child [a,b] 100 Adult [a,b]
Inhalation Pathway			
Inhalation Rate (m^3/day)	20[a,b]	15 Child[a] 30 Adult[a]	10 Child[a] 20 Adult[a]
Volatilization Factor (m^3/kg)	Chemical Specific	Chemical Specific	Chemical Specific
Particulate Emission Factor (m^3/kg)	1.36E9[a]	1.36E9[a]	1.36E9[a]
Water Ingestion Pathway			
Ingestion Rate (liter/day)	2.4[a]	2.4[a]	2.4[a]
Dermal Pathway			
Skin Adherence Factor (mg/cm^2)	0.2[a]	0.2 Child[a] 0.07 Adult[a]	0.2 Child[a] 0.07 Adult[a]
Exposed Surface Area for Soil/Dust (cm^2/day)	3,300[a]	2,800 Child[a] 5,700 Adult[a]	2,800 Child[a] 5,700 Adult[a]
Skin Adsorption Factor	Chemical Specific	Chemical Specific	Chemical Specific

[a]Technical Background Document for Development of Soil Screening Levels (NMED 2000).
[b]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[c]Exposure Factors Handbook (EPA August 1997).
ED = Exposure duration.
EPA = U.S. Environmental Protection Agency.
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not available.
wk = Week(s).
yr = Year(s).

Table 3
Default Radiological Exposure Parameter Values for Various Land-Use scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency	8 hr/day for 250 day/yr	4 hr/wk for 52 wk/yr	365 day/yr
Exposure Duration (yr)	25[a,b]	30[a,b]	30[a,b]
Body Weight (kg)	70 Adult[a,b]	70 Adult[a,b]	70 Adult[a,b]
Soil Ingestion Pathway			
Ingestion Rate	100 mg/day[c]	100 mg/day[c]	100 mg/day[c]
Averaging Time (days) (= 30 yr x 365 day/yr)	10,950[d]	10,950[d]	10,950[d]
Inhalation Pathway			
Inhalation Rate (m^3/yr)	7,300[d,e]	10,950[e]	7,300[d,e]
Mass Loading for Inhalation g/m^3	1.36 E-5[d]	1.36 E-5 [d]	1.36 E-5 [d]
Food Ingestion Pathway			
Ingestion Rate, Leafy Vegetables (kg/yr)	NA	NA	16.5[c]
Ingestion Rate, Fruits, Non-Leafy Vegetables & Grain (kg/yr)	NA	NA	101.8[b]
Fraction Ingested	NA	NA	0.25[b,d]

[a]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[b]Exposure Factors Handbook (EPA August 1997).
[c]EPA Region VI guidance (EPA 1996).
[d]For radionuclides, RESRAD (ANL 1993).
[e]SNL/NM (February 1998).
EPA = U.S. Environmental Protection Agency.
g = Gram(s)
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not applicable.
wk = Week(s).
yr = Year(s).

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APPENDIX 2
CALCULATION OF THE UPPER CONFIDENCE LIMITS OF MEAN CONCENTRATIONS

For conservatism, Sandia National Laboratories/New Mexico personell use the maximum concentration of the constituents of concern (COCs) for initial risk calculation. If the maximum concentrations produce risk above New Mexico Environment Department (NMED) guidelines, conservatism with this approach is evaluated and, if appropriate, a more realistic approach is applied. When the site has been adequately characterized, an estimate of the mean concentration of the COCs is more representative of actual site conditions. The NMED has proposed the use of the 95% upper confidence limit (UCL) of the mean to represent average concentrations at a site (NMED December 2000). The 95% UCL is calculated according to NMED guidance using the U.S. Environmental Protection Agency ProUCL version 4.00.02 program (EPA 2008). Attached are the outputs from that program and the calculated UCLs used in the risk analysis.

IX. References

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UCL Runs of the LTES Site 1, Cable Debris Site

Arsenic

General Statistics			
Number of Valid Observations	28	Number of Distinct Observations	28
Raw Statistics		Log-transformed Statistics	
Minimum	1.49	Minimum of Log Data	0.399
Maximum	6.06	Maximum of Log Data	1.802
Mean	3.438	Mean of log Data	1.179
Median	3.55	SD of log Data	0.353
SD	1.113		
Coefficient of Variation	0.324		
Skewness	0.209		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.98	Shapiro Wilk Test Statistic	0.951
Shapiro Wilk Critical Value	0.924	Shapiro Wilk Critical Value	0.924
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	**3.796**	95% H-UCL	3.92
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4.479
95% Adjusted-CLT UCL	3.793	97.5% Chebyshev (MVUE) UCL	4.923
95% Modified-t UCL	3.797	99% Chebyshev (MVUE) UCL	5.797
Gamma Distribution Test			
k star (bias corrected)	8.138		
Theta Star	0.422		
nu star	455.7		
Approximate Chi Square Value (.05)	407.2	Nonparametric Statistics	
	0.040		
Adjusted Level of Significance	4	95% CLT UCL	3.784
Adjusted Chi Square Value	404.4	95% Jackknife UCL	3.796

Anderson-Darling Test Statistic	0.299
Anderson-Darling 5% Critical Value	0.746
Kolmogorov-Smirnov Test Statistic	0.105
Kolmogorov-Smirnov 5% Critical Value	0.165
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	3.847
95% Adjusted Gamma UCL	3.874

95% Standard Bootstrap UCL	3.774
95% Bootstrap-t UCL	3.806
95% Hall's Bootstrap UCL	3.804
95% Percentile Bootstrap UCL	3.781
95% BCA Bootstrap UCL	3.778
95% Chebyshev(Mean, Sd) UCL	4.355
97.5% Chebyshev(Mean, Sd) UCL	4.752
99% Chebyshev(Mean, Sd) UCL	5.531

Barium

General Statistics			
Number of Valid Observations	28	Number of Distinct Observations	24
Raw Statistics		Log-transformed Statistics	
Minimum	62.8	Minimum of Log Data	4.14
Maximum	245	Maximum of Log Data	5.501
Mean	148.7	Mean of log Data	4.942
Median	140	SD of log Data	0.367
SD	49.57		
Coefficient of Variation	0.333		
Skewness	0.152		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.968	Shapiro Wilk Test Statistic	0.941
Shapiro Wilk Critical Value	0.924	Shapiro Wilk Critical Value	0.924
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	**164.6**	95% H-UCL	170.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	195.6
95% Adjusted-CLT UCL	164.4	97.5% Chebyshev (MVUE) UCL	215.5
95% Modified-t UCL	164.7	99% Chebyshev (MVUE) UCL	254.8
Gamma Distribution Test			
k star (bias corrected)	7.611		
Theta Star	19.53		
nu star	426.2		
Approximate Chi Square Value (.05)	379.4	Nonparametric Statistics	
	0.040		
Adjusted Level of Significance	4	95% CLT UCL	164.1
Adjusted Chi Square Value	376.6	95% Jackknife UCL	164.6
		95% Standard Bootstrap UCL	164.1

Anderson-Darling Test Statistic	0.342
Anderson-Darling 5% Critical Value	0.746
Kolmogorov-Smirnov Test Statistic	0.131
Kolmogorov-Smirnov 5% Critical Value	0.165
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	167
95% Adjusted Gamma UCL	168.2

95% Bootstrap-t UCL	164.9
95% Hall's Bootstrap UCL	164.4
95% Percentile Bootstrap UCL	163.5
95% BCA Bootstrap UCL	163.6
95% Chebyshev(Mean, Sd) UCL	189.5
97.5% Chebyshev(Mean, Sd) UCL	207.2
99% Chebyshev(Mean, Sd) UCL	241.9

Chromium

General Statistics			
Number of Valid Observations	28	Number of Distinct Observations	27
Raw Statistics		Log-transformed Statistics	
Minimum	6.8	Minimum of Log Data	1.917
Maximum	22.6	Maximum of Log Data	3.118
Mean	12.92	Mean of log Data	2.504
Median	12.4	SD of log Data	0.34
SD	4.335		
Coefficient of Variation	0.335		
Skewness	0.533		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.95	Shapiro Wilk Test Statistic	0.963
Shapiro Wilk Critical Value	0.924	Shapiro Wilk Critical Value	0.924
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	**14.32**	95% H-UCL	14.61
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	16.63
95% Adjusted-CLT UCL	14.36	97.5% Chebyshev (MVUE) UCL	18.23
95% Modified-t UCL	14.33	99% Chebyshev (MVUE) UCL	21.37
Gamma Distribution Test			
k star (bias corrected)	8.326		
Theta Star	1.552		
nu star	466.3		
Approximate Chi Square Value (.05)	417.2	Nonparametric Statistics	
	0.040		
Adjusted Level of Significance	4	95% CLT UCL	14.27
Adjusted Chi Square Value	414.3	95% Jackknife UCL	14.32
		95% Standard Bootstrap UCL	14.25

Anderson-Darling Test Statistic	0.263
Anderson-Darling 5% Critical Value	0.746
Kolmogorov-Smirnov Test Statistic	0.0857
Kolmogorov-Smirnov 5% Critical Value	0.165
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	14.44
95% Adjusted Gamma UCL	14.54

95% Bootstrap-t UCL	14.39
95% Hall's Bootstrap UCL	14.38
95% Percentile Bootstrap UCL	14.29
95% BCA Bootstrap UCL	14.38
95% Chebyshev(Mean, Sd) UCL	16.49
97.5% Chebyshev(Mean, Sd) UCL	18.04
99% Chebyshev(Mean, Sd) UCL	21.07

Copper

General Statistics			
Number of Valid Observations	28	Number of Distinct Observations	25
Raw Statistics		Log-transformed Statistics	
Minimum	5.46	Minimum of Log Data	1.697
Maximum	261	Maximum of Log Data	5.565
Mean	21.6	Mean of log Data	2.554
Median	11.35	SD of log Data	0.744
SD	47.28		
Coefficient of Variation	2.189		
Skewness	5.163		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.293	Shapiro Wilk Test Statistic	0.785
Shapiro Wilk Critical Value	0.924	Shapiro Wilk Critical Value	0.924
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	36.82	95% H-UCL	23.11
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	27.91
95% Adjusted-CLT UCL	45.61	97.5% Chebyshev (MVUE) UCL	32.74
95% Modified-t UCL	38.27	99% Chebyshev (MVUE) UCL	42.23
Gamma Distribution Test			
k star (bias corrected)	1.006		
Theta Star	21.47		
nu star	56.33		
Approximate Chi Square Value (.05)	40.08	Nonparametric Statistics	
	0.040		
Adjusted Level of Significance	4	95% CLT UCL	36.3
Adjusted Chi Square Value	39.24	95% Jackknife UCL	36.82
		95% Standard Bootstrap UCL	**35.86**

Anderson-Darling Test Statistic	3.684
Anderson-Darling 5% Critical Value	0.772
Kolmogorov-Smirnov Test Statistic	0.267
Kolmogorov-Smirnov 5% Critical Value	0.17
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	30.36
95% Adjusted Gamma UCL	31.01

95% Bootstrap-t UCL	115.8
95% Hall's Bootstrap UCL	97.21
95% Percentile Bootstrap UCL	39.5
95% BCA Bootstrap UCL	56.39
95% Chebyshev(Mean, Sd) UCL	60.55
97.5% Chebyshev(Mean, Sd) UCL	77.4
99% Chebyshev(Mean, Sd) UCL	110.5

Iron

General Statistics			
Number of Valid Observations	28	Number of Distinct Observations	27
Raw Statistics		Log-transformed Statistics	
Minimum	6660	Minimum of Log Data	8.804
Maximum	26900	Maximum of Log Data	10.2
Mean	12974	Mean of log Data	9.402
Median	12000	SD of log Data	0.374
SD	5124		
Coefficient of Variation	0.395		
Skewness	1.088		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.904	Shapiro Wilk Test Statistic	0.964
Shapiro Wilk Critical Value	0.924	Shapiro Wilk Critical Value	0.924
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
			1483
95% Student's-t UCL	14623	**95% H-UCL**	**0**
			1703
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4
			1880
95% Adjusted-CLT UCL	14779	97.5% Chebyshev (MVUE) UCL	0
			2227
95% Modified-t UCL	14656	99% Chebyshev (MVUE) UCL	1
Gamma Distribution Test			
k star (bias corrected)	6.646		
Theta Star	1952		
nu star	372.2		
Approximate Chi Square Value (.05)	328.5	Nonparametric Statistics	
Adjusted Level of Significance	0.040	95% CLT UCL	1456

	4		6
			1462
Adjusted Chi Square Value	325.9	95% Jackknife UCL	3
			1454
		95% Standard Bootstrap UCL	3
			1498
Anderson-Darling Test Statistic	0.427	95% Bootstrap-t UCL	4
			1482
Anderson-Darling 5% Critical Value	0.747	95% Hall's Bootstrap UCL	2
			1465
Kolmogorov-Smirnov Test Statistic	0.128	95% Percentile Bootstrap UCL	5
			1469
Kolmogorov-Smirnov 5% Critical Value	0.166	95% BCA Bootstrap UCL	6
Data appear Gamma Distributed at 5% Significance			1719
Level		95% Chebyshev(Mean, Sd) UCL	4
			1902
		97.5% Chebyshev(Mean, Sd) UCL	1
			2260
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	8
95% Approximate Gamma UCL	14700		
95% Adjusted Gamma UCL	14814		

Lead

General Statistics			
Number of Valid Observations	28	Number of Distinct Observations	27
Raw Statistics		Log-transformed Statistics	
Minimum	7.62	Minimum of Log Data	2.031
Maximum	2000	Maximum of Log Data	7.601
Mean	180.5	Mean of log Data	4.181
Median	92	SD of log Data	1.435
SD	380.8		
Coefficient of Variation	2.109		
Skewness	4.377		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.438	Shapiro Wilk Test Statistic	0.935
Shapiro Wilk Critical Value	0.924	Shapiro Wilk Critical Value	0.924
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	303.1	95% H-UCL	424.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	422.1
95% Adjusted-CLT UCL	362.5	97.5% Chebyshev (MVUE) UCL	530.7
95% Modified-t UCL	313	99% Chebyshev (MVUE) UCL	743.9
Gamma Distribution Test			
k star (bias corrected)	0.567		
Theta Star	318.6		
nu star	31.73		
Approximate Chi Square Value (.05)	19.86	Nonparametric Statistics	
	0.040		
Adjusted Level of Significance	4	95% CLT UCL	298.9
Adjusted Chi Square Value	19.28	95% Jackknife UCL	303.1
		95% Standard Bootstrap UCL	**300.2**

Anderson-Darling Test Statistic	1.181
Anderson-Darling 5% Critical Value	0.799
Kolmogorov-Smirnov Test Statistic	0.208
Kolmogorov-Smirnov 5% Critical Value	0.174
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	288.5
95% Adjusted Gamma UCL	297.2

95% Bootstrap-t UCL	540
95% Hall's Bootstrap UCL	690.2
95% Percentile Bootstrap UCL	312.7
95% BCA Bootstrap UCL	391.5
95% Chebyshev(Mean, Sd) UCL	494.2
97.5% Chebyshev(Mean, Sd) UCL	630
99% Chebyshev(Mean, Sd) UCL	896.6

Vanadium

General Statistics			
Number of Valid Observations	28	Number of Distinct Observations	27
Raw Statistics		Log-transformed Statistics	
Minimum	11.8	Minimum of Log Data	2.468
Maximum	33.2	Maximum of Log Data	3.503
Mean	21.99	Mean of log Data	3.053
Median	21.9	SD of log Data	0.289
SD	5.935		
Coefficient of Variation	0.27		
	0.021		
Skewness	7		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.968	Shapiro Wilk Test Statistic	0.945
Shapiro Wilk Critical Value	0.924	Shapiro Wilk Critical Value	0.924
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	**23.9**	95% H-UCL	24.39
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	27.36
95% Adjusted-CLT UCL	23.84	97.5% Chebyshev (MVUE) UCL	29.66
95% Modified-t UCL	23.9	99% Chebyshev (MVUE) UCL	34.19
Gamma Distribution Test			
k star (bias corrected)	11.86		
Theta Star	1.854		
nu star	664.4		
Approximate Chi Square Value (.05)	605.6	Nonparametric Statistics	
	0.040		
Adjusted Level of Significance	4	95% CLT UCL	23.84
Adjusted Chi Square Value	602.2	95% Jackknife UCL	23.9
		95% Standard Bootstrap UCL	23.82

Anderson-Darling Test Statistic	0.326
Anderson-Darling 5% Critical Value	0.745
Kolmogorov-Smirnov Test Statistic	0.104
Kolmogorov-Smirnov 5% Critical Value	0.165
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	24.13
95% Adjusted Gamma UCL	24.27

95% Bootstrap-t UCL	23.91
95% Hall's Bootstrap UCL	23.78
95% Percentile Bootstrap UCL	23.82
95% BCA Bootstrap UCL	23.74
95% Chebyshev(Mean, Sd) UCL	26.88
97.5% Chebyshev(Mean, Sd) UCL	29
99% Chebyshev(Mean, Sd) UCL	33.15

Zinc

General Statistics			
Number of Valid Observations	28	Number of Distinct Observations	28
Raw Statistics		Log-transformed Statistics	
Minimum	27.4	Minimum of Log Data	3.311
Maximum	816	Maximum of Log Data	6.704
Mean	133	Mean of log Data	4.427
Median	93.25	SD of log Data	0.887
SD	178.8		
Coefficient of Variation	1.345		
Skewness	3.097		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.561	Shapiro Wilk Test Statistic	0.917
Shapiro Wilk Critical Value	0.924	Shapiro Wilk Critical Value	0.924
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	190.5	95% H-UCL	184.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	221
95% Adjusted-CLT UCL	209.7	97.5% Chebyshev (MVUE) UCL	264
95% Modified-t UCL	193.8	99% Chebyshev (MVUE) UCL	348.5
Gamma Distribution Test			
k star (bias corrected)	1.112		
Theta Star	119.5		
nu star	62.28		
Approximate Chi Square Value (.05)	45.13	Nonparametric Statistics	
	0.040		
Adjusted Level of Significance	4	95% CLT UCL	188.5
Adjusted Chi Square Value	44.23	95% Jackknife UCL	190.5
		95% Standard Bootstrap UCL	**185.8**

Anderson-Darling Test Statistic	1.457
Anderson-Darling 5% Critical Value	0.769
Kolmogorov-Smirnov Test Statistic	0.188
Kolmogorov-Smirnov 5% Critical Value	0.169
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	183.5
95% Adjusted Gamma UCL	187.2

95% Bootstrap-t UCL	298.1
95% Hall's Bootstrap UCL	477.1
95% Percentile Bootstrap UCL	189.6
95% BCA Bootstrap UCL	215.2
95% Chebyshev(Mean, Sd) UCL	280.3
97.5% Chebyshev(Mean, Sd) UCL	344
99% Chebyshev(Mean, Sd) UCL	469.2

National Nuclear Security Administration
Sandia Site Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

FEB 12 2010

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

James Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Road East, Bldg. 1
Santa Fe, NM 87505

Subject: Department of Energy (DOE)/Sandia National Laboratories/New Mexico (SNL/NM) Responses for Notice of Disapproval for Long Term Environmental Stewardship (LTES) Site 1 – Cable Debris Site

Dear Mr. Bearzi:

The Investigation Report and Proposal for Corrective Action Complete for LTES Site 1-Cable Debris Site at SNL/NM was submitted to the New Mexico Environment Department (NMED) for review and approval in March 2009. NMED reviewed this document and issued a Notice of Disapproval (NOD) in a letter to DOE and Sandia dated September 21, 2009. The letter is entitled, "Notice of Disapproval: Investigation Report and Proposal For Corrective Action Complete For Long Term Environmental Stewardship (LTES) Site 1 - Cable Debris Site At Sandia National Laboratories New Mexico, March 2009, Sandia National Laboratories, EPA ID# NM5890110518 HWB-SNL-08-014". On behalf of DOE, and Sandia, DOE is submitting responses to comments received in the September NOD.

In addition, upon review of the data validation reporting process, an analytical unit reporting discrepancy was discovered which caused us to over-estimate the initial confirmation sampling results for Cadmium and Thallium. Further clarification and investigation report page changes are provided with the NOD response to comments.

Should you have any questions, please feel free to contact me at (505) 845-6036, or John Gould of my staff at (505) 845-6089.

Sincerely,

Patty Wagner
Manager

Enclosure

cc w/enclosure:
W. Moats, NMED HWB (Via Certified Mail)
L. King, EPA, Region 6 (Via Certified Mail)
B. Salem, NMED HWB
T. Skibitski, NMED-OB
B. Birch, NMED-OB
Records Center, SNL/NM, Org.6765, MS 1089

cc w/o enclosure:
A. Blumberg, SNL/NM, Org. 11100, MS 0141
M. Hazen, SNL/NM, Org. 4000, MS 0143
S. Gutierrez, SNL/NM, Org. 4100, MS. 0725
R. Brandhuber, SNL/NM, Org. 4130, MS 0729
D. Miller, SNL/NM, Org 6765, MS 0718
T. Copper, SNL/NM, Org 4133, MS 0729
J. Cochran, SNL/NM, Org. 6765, MS 0719
M. Nagy, SNL/NM, Org. 4131, MS 0730
S. Salinas, SNL/NM, Org. 4131, MS 0730
Records Center, SNL/NM, Org.6765, MS 1089
J. Estrada, NNSA/SSO, MS 0184
J. Gould, NNSA/SSO, MS 0184

DOE/Sandia Responses for Notice of Disapproval for Long-term Environmental Stewardship (LTES) Site 1 – Cable Debris Site

CERTIFICATION STATEMENT

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to ensure that qualified personnel properly gather and evaluate 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 or imprisonment for knowing violations.

Michael W. Hazen, Vice President
Sandia Corporation
Albuquerque, New Mexico
Co-Operator

2/5/10
Date signed

Patty Wagner, Manager
U.S. Department of Energy
National Nuclear Security Administration
Sandia Site Office (SSO)
Owner and Co-Operator

2/11/10
Date signed

Sandia National Laboratories
Albuquerque, New Mexico
February 5, 2010

DOE/Sandia Responses to NMED "Notice of Disapproval: Investigation Report and Proposal for Corrective Action Complete for Long Term Environmental Stewardship (LTES) Site 1-Cable Debris Site at Sandia National Laboratories/New Mexico, March 2009, EPA ID# NM 5890110518 HWB-SNL-08-014"

INTRODUCTION

This document responds to comments received in a letter from the New Mexico Environment Department (NMED) to the U.S. Department of Energy (DOE) and Sandia Corporation (Sandia) dated September 21, 2009 regarding the Investigation Report and Proposal for Corrective Action Complete for Long Term Environmental Stewardship (LTES) Site 1-Cable Debris Site at Sandia National Laboratories/New Mexico (SNL/NM). The letter is entitled "Notice of Disapproval: Investigation Report and Proposal for Corrective Action Complete for Long Term Environmental Stewardship (LTES) Site 1-Cable Debris Site at Sandia National Laboratories/New Mexico, March 2009, EPA ID# NM 5890110518 HWB-SNL-08-014." The NMED has identified several deficiencies that required additional information or resolution.

This document lists each NMED comment, and the DOE/Sandia response to that comment. The NMED comment is listed in boldface, followed by the DOE/Sandia response, written in normal font under "Response."

Sandia is a multiprogram laboratory operated by Sandia Corporation, a wholly-owned subsidiary of Lockheed Martin Corporation, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Comment 1: The minimum detection limit (MDL) for twenty-one of twenty-eight soil samples analyzed cadmium and the MDL for twenty of twenty-five soil samples analyzed for thallium were above their corresponding approved background level. In the case of cadmium, the MDL was above the applicable soil screening level for a residential scenario. The Permittees must resample the soil to achieve lower MDL for both cadmium and thallium.

Response 1: Soil samples were collected at the site on November 10, 2009, as shown on Figure 1 (Attachment 1). Soil samples were collected from the same locations as the previous sampling event for those locations that had elevated cadmium or thallium method detection limit (MDLs). The soil samples were analyzed for cadmium and thallium using Environmental Protection Agency (EPA) Method 6010/6020. The results of the re-sampling are summarized in Table 1 (Attachment 2), and the corresponding analysis request/chain of custody (AR/COC) and data validation (DV) report are presented in Attachment 3.

As summarized in Table 1, all except one of the cadmium detections were below the NMED-approved background value, and all of the thallium detections were below the corresponding thallium background value. The maximum cadmium detection was 2.13 J milligrams per kilogram (mg/kg) which is only slightly greater than the NMED-approved background value and is significantly below the cadmium NMED residential soil screening level of 79.9 mg/kg. In addition, ten of the thallium samples were qualified as non-detects due to low concentration thallium detections in the continuing calibration blank. These non-detects were below the NMED-approved background value for thallium.

Upon review of the validation reporting process, an analytical units reporting discrepancy was discovered. Analytical Quality Associates (AQA) Incorporated reports their data validation analytical corrections for metals in micrograms per kilogram (µg/kg). Within the Investigation Report and Proposal for Corrective Action Complete for Long Term Environmental Stewardship (LTES) Site 1 -Cable Debris Site (SNL/NM, March 2009) the data validation analytical corrections for metals were reported in mg/kg but not converted from µg/kg as reported by AQA. The detection limits (DL) for cadmium and thallium were effected by the data validation due to the use of incorrect units and not accounting for the normalized soil preparation factor. The cadmium and thallium DLs, as reported in Table 3.3.2-1 of the investigation report, were incorrectly reported in mg/kg. The cadmium and thallium DLs were revised in Table 3.3.2-1 (Attachment 4). As result of this correction all of the thallium soil samples were below the corresponding approved background level, and all of the cadmium DLs were significantly below the residential NMED soil screening level for cadmium. Also presented in Attachment 4 are the Investigation Report the impacted page changes and the revised DV report based on the cadmium and thallium corrections discussed above.

Therefore, based upon field investigation results, initial confirmatory soil sample analytical data, the human health and ecological risk assessment analyses, and the cadmium and thallium confirmatory soil re-sampling analytical data, a determination of correction action complete (CAC) without controls is recommended for LTES Site 1 for the following reasons:

- The surface debris has been removed and the soil has been sampled for all potential constituents of concern (COCs).

- No COCs are present in the soil at levels considered hazardous to human health for either an industrial or residential land-use scenario.

- None of the COCs warrant ecological concern because the ecological risks were acceptable per NMED guidance.

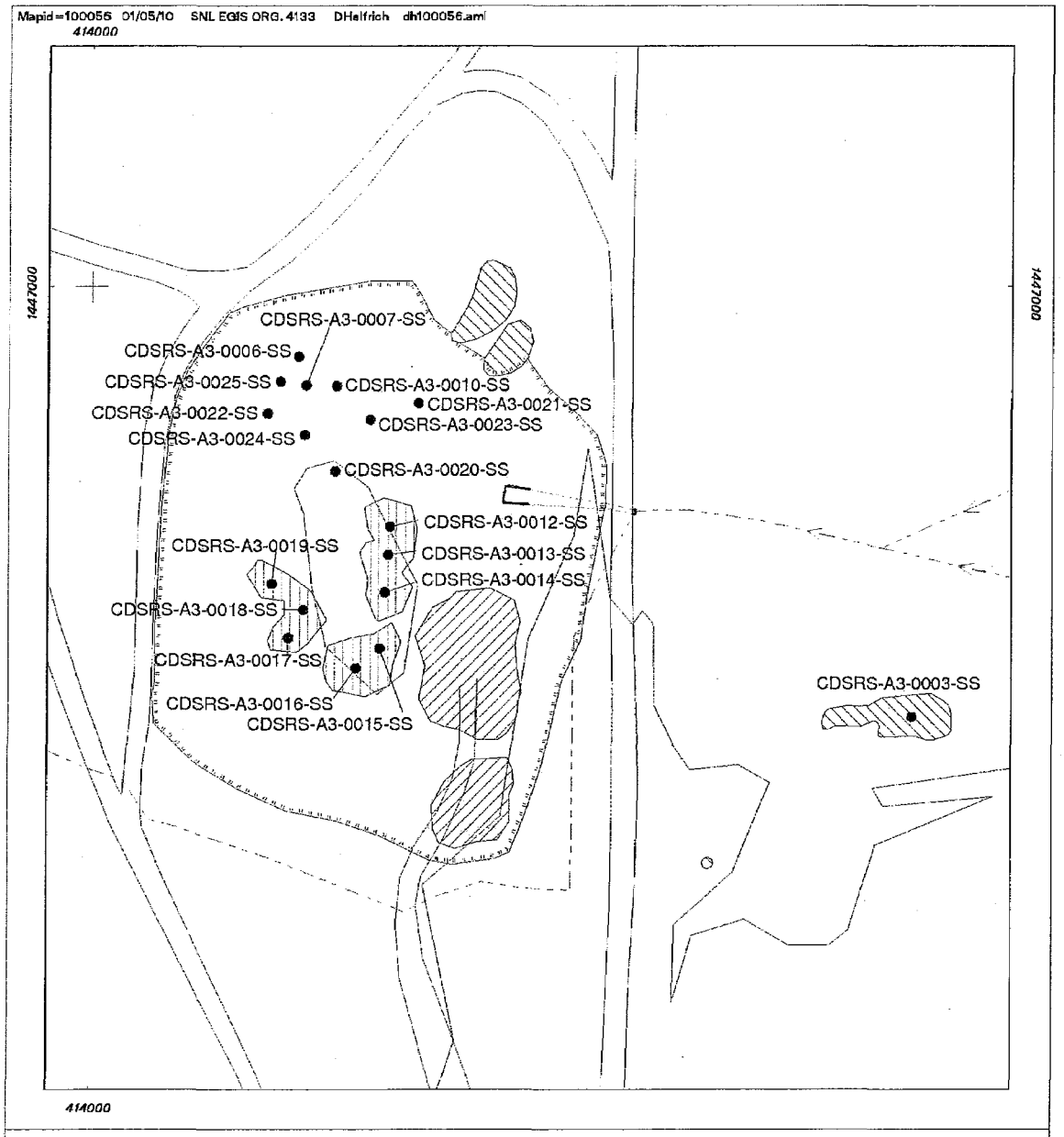
Comment 2: All four soil samples analyzed for cesium-137 resulted in activity levels exceeding background. Additional soil sampling to determine the extent of the cesium-137 contamination is needed.

Response 2: DOE and Sandia consider additional cesium-137 characterization to not be necessary, as explained below.

The comparison background value for cesium-137 within the risk assessment was for subsurface soils. Some surface soil removal occurred at the location of the concrete debris removal and the depth of soil removed is unknown. Therefore, erring on the side of conservatism, the cesium-137 subsurface background value was used for comparison. Only one of the four cesium-137 samples was from the area of concrete removal. The remaining three cesium-137 samples were surface samples from other locations. The cesium-137 background value for surface soils is 0.664 picocuries per gram (pCi/g) and all of the cesium-137 results were below this surface background activity. In addition, cesium-137 background values at SNL/NM ranges from 0.079 pCi/g to 0.908 pCi/g and the on-site cesium-137 results are well within the range of background at SNL/NM. In addition, all of the onsite debris was swiped for radiological contamination prior to removal from the site and the results did not reveal any evidence of radiological contamination and there is no on-site source for cesium-137 contamination. Therefore, additional characterization for cesium-137 should not be necessary.

On November 23, 2009, the NMED agreed that the additional soil sampling for cesium-137 is not needed and therefore, is no longer required (Attachment 5).

Attachment 1
Cable Debris Site Cadmium and Thallium Sample Location Figure



Legend

- TAL Metals and HE Sampling Location
- Unpaved Road
- 10-ft. Countour
- Surface Drainage
- Edge of Depression
- Outfall (buried portion dashed)
- Historical Gravel / Fill Mix Debris Pile
- Historical Metal Mix Debris Pile
- Historical Concrete Rubble Debris Pile

Figure 1
TA-III Cable Debris Area
Cadmium and Thallium
Re-Sampling Locations

0 40 80
Scale in Feet

0 6.6 19.2
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Attachment 2
Cadmium and Thallium Analytical Results

Table 1
Summary of LTES Site 1
NOD Soil Sampling, Cadmium and Thallium Analytical Results

Sample Attributes			Metals (mg/kg)[a]	
Record Number[b]	ER Sample ID	Sample Depth(ft)	Cadmium	Thallium
612440	CDSRS-A3-0003-SS	0-0.5	0.296	ND (0.33)
611998	CDSRS-A3-0006-SS	0-0.5	0.309	ND (0.34)
611998	CDSRS-A3-006D-SS	0-0.5	0.294	ND (0.33)
611998	CDSRS-A3-0007-SS	0-0.5	0.547 J	ND (0.34)
611998	CDSRS-A3-0010-SS	0-0.5	0.299	ND (0.34)
611998	CDSRS-A3-0012-SS	0-0.5	0.741 J	ND (0.34)
611998	CDSRS-A3-0012D-SS	0-0.5	0.661 J	ND (0.33)
611998	CDSRS-A3-0013-SS	0-0.5	**2.13 J**	ND (0.33)
611998	CDSRS-A3-0014-SS	0-0.5	0.56 J	ND (0.34)
611998	CDSRS-A3-0015-SS	0-0.5	0.317	ND (0.34)
611998	CDSRS-A3-0016-SS	0-0.5	0.594	0.257
611998	CDSRS-A3-0017-SS	0-0.5	0.472	0.252
611998	CDSRS-A3-0018-SS	0-0.5	0.843	0.33
611998	CDSRS-A3-0018D-SS	0-0.5	0.818	0.305
611998	CDSRS-A3-0019-SS	0-0.5	0.375	0.2
611998	CDSRS-A3-0020-SS	0-0.5	0.427	0.167 J
611998	CDSRS-A3-0021-SS	0-0.5	0.288	0.13 J
611998	CDSRS-A3-0022-SS	0-0.5	0.677	0.22
611998	CDSRS-A3-0023-SS	0-0.5	0.233	0.108 J
611998	CDSRS-A3-0024-SS	0-0.5	0.874	0.329
611998	CDSRS-A3-0025-SS	0-0.5	0.765	0.286
Background concentration – Southwest Area Supergroup[c]			<1	<1.1
New Mexico Environment Department Residential Soil Screening Level (mg/kg)			79.9	5.16
Quality Assurance/Quality Control Samples (all in mg/L)				
611998	CDSRS-A3-EB1	NA	ND (<0.11)	ND (2.1)

Note: Values in **bold** exceed background soil concentrations.

[a]EPA November 1986.

[b]Analysis request/chain-of-custody record.

[c]Dinwiddie September 1997.

A3 = Technical Area III
CDSRS = Cable Debris Site Re-Sample
D = Duplicate
EB = Equipment Blank
EPA = U.S. Environmental Protection Agency.
ft = Foot (feet).
ID = Identification.
J = Analytical result was qualified as an estimated value.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
mg/L = Milligram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
SS = Surface soil sample.

Attachment 3
ARCOC and DV Report

Internal Lab

Batch No.

SMO Use

ARCOC **612440**

Dept. No./Mail Stop:	4131 MS 1042	Date Samples Shipped:		Project/Task No.:	96750/01.03.04 ☐
Project/Task Manager	S. Salinas	Carrier/Waybill No.		SMO Authorization:	Send Preliminary/Copy Report to:
Project Name:	TS - Cable Debris Site	Lab Contact:	E. Kent	Contract #	691436
Record Center Code:		Lab Destination:	GEL	Send Report to SMO:	☐ Validation Required
Service Order No.:	CF 093-10	SMO Contact/Phone:	W. Palencia		☐ Released by COC No.:
Location	Tech Area				Bill to: Sandia National Laboratories (Accounts Payable);
Building	Room				P.O. Box 5800, MS-0154; Albuquerque, NM 87185-0154

Sample No.-Fraction	Sample Location Detail	Beginning Depth (ft)	Non GW & WW Spatial Coordinates Easting (X)	Northing (Y)	Date/Time(hr) Collected	Sample Matrix	Container Type	Vol	Preser-vative	Collect Method	Sample Type	F (filtered) NF (non)	Parameter & Method Requested	Lab Sample Id
087784-001	CDSRS-A3-0003-SS	N/A	N/A	N/A	11/10/2009 10:00	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087785-001	CDSRS-A3-0006-SS	N/A	N/A	N/A	11/10/2009 9:56	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087786-001	CDSRS-A3-006D-SS	N/A	N/A	N/A	11/10/2009 9:56	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087787-001	CDSRS-A3-0007-SS	N/A	N/A	N/A	11/10/2009 9:54	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087788-001	CDSRS-A3-0010-SS	N/A	N/A	N/A	11/10/2009 9:52	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087789-001	CDSRS-A3-0012-SS	N/A	N/A	N/A	11/10/2009 9:33	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087790-001	CDSRS-A3-0012D-SS	N/A	N/A	N/A	11/10/2009 9:33	S	G	500ml	N	C	DU	N/A	Cadmium and Thallium	
087791-001	CDSRS-A3-0013-SS	N/A	N/A	N/A	11/10/2009 9:36	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087792-001	CDSRS-A3-0014-SS	N/A	N/A	N/A	11/10/2009 9:39	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087793-001	CDSRS-A3-0015-SS	N/A	N/A	N/A	11/10/2009 9:49	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	

RMMA	☐ ✓	Ref. No.	**Sample Tracking** SMO Use	**Special Instructions/QC Requirements:**	Abnormal Conditions on Receipt
Sample Disposal	☐ Return to Client	✓ Disposal by lab	Date Entered:	EDD Yes ✓ No ☐	
Turnaround Time	☐ 7 Day *	☐ 15 Day *	✓ 0 Day	Entered by:	Level D Package Yes ☐ No ✓
Return Samples By:		☐ **Negotiated TAT**	QC inits.	***Send/e-mail report to:**	

TAL EPA Method 6010/6020

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	Gilbert Quintana			SNL/4133/845-2507
	Danielle Nieto			SNL/4133/845-7706

Please list as separate report.

Lab Use

1. Relinquished by	Org.	Date	Time	3. Relinquished by	Org.	Date	Time
1. Received by	Org.	Date	Time	3. Received by	Org.	Date	Time
2. Relinquished by	Org.	Date	Time	4. Relinquished by	Org.	Date	Time
2. Received by	Org.	Date	Time	4. Received by	Org.	Date	Time

*Prior confirmation with SMO required for 7 and 15 day TAT

CONTRACT LABORATORY

Analysis Request And Chain Of Custody (Continuation)

AR/COC- 612440

Project Name:	#REF!	Project/Task Manger:	S. Salinas	Project/Task No.:	#REF!
Location	Tech Area				
Building	Room				

Reference LOV (available at SMO)

Sample No-Fraction	Sample Location detail	Beginning Depth (ft)	Non GW Spatial Coordinates Easting	Northing	Date/Time (hr) Collected	Sample Matrix	Container Type	Volume	Preser-vative	Collection Method	Sample Type	F(Filtered) NF (Non)	Parameter & Method Requested	Lab use Lab Samp ID
087794-001	CDSRS-A3-0016-SS	N/A	N/A	N/A	11/10/2009 9:46	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087795-001	CDSRS-A3-0017-SS	N/A	N/A	N/A	11/10/2009 9:44	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087796-001	CDSRS-A3-0018-SS	N/A	N/A	N/A	11/10/2009 9:41	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087797-001	CDSRS-A3-0018D-SS	N/A	N/A	N/A	11/10/2009 9:41	S	G	500ml	N	C	DU	N/A	Cadmium and Thallium	
087798-001	CDSRS-A3-0019-SS	N/A	N/A	N/A	11/10/2009 9:23	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087799-001	CDSRS-A3-0020-SS	N/A	N/A	N/A	11/10/2009 9:26	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087800-001	CDSRS-A3-0021-SS	N/A	N/A	N/A	11/10/2009 9:29	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087801-001	CDSRS-A3-0022-SS	N/A	N/A	N/A	11/10/2009 9:21	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087802-001	CDSRS-A3-0023-SS	N/A	N/A	N/A	11/10/2009 9:12	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087803-001	CDSRS-A3-0024-SS	N/A	N/A	N/A	11/10/2009 9:15	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087804-001	CDSRS-A3-0025-SS	N/A	N/A	N/A	11/10/2009 9:19	S	G	500ml	N	C	SA	N/A	Cadmium and Thallium	
087805-001	CDSRS-A3-EB1	N/A	N/A	N/A	11/10/2009 9:05	W	P	500ml	HNO3	G	EB	N/A	Cadmium and Thallium	

Abnormal Conditions on Receipt **LAB USE**

Recipient Initials_____

ANALYTICAL QUALITY ASSOCIATES, INC.

616 Maxine NE
Albuquerque, NM 87123
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Memorandum - Revised

DATE: February 1, 2010 (revision)

TO: File

FROM: Marcia Hilchey (revision)

SUBJECT: Inorganic Data Review and Validation - SNL
Site: TS Cable Debris Site
AR/COC: 612440
SDG: 240902, 240903, and 240905
Laboratory: GEL
Project/Task No: 96750.01.03.04

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

Summary

The samples were prepared and analyzed with accepted procedures using method EPA 6020 (ICP-MS). Problems were identified with the data package that result in the qualification of data.

ICP-MS Analysis (Batch 923531):

Blanks: Tl was detected in the continuing calibration blank (CCB) at a concentration > the method detection limit (MDL) but < the practical quantitation limit (PQL). All associated sample results were detects <5X the CCB concentration and will be qualified "U,B3" at 5X the normalized CCB value.

ICS A: For samples 240902-004, -006, -007, -008, and -009, the sample Ca concentrations were > the ICS A Ca concentration and the ICS A result for Cd was > the MDL. All associated Cd results were detects <50X the ICS A result and will be qualified "J+,CK2."

ICP-MS Analysis (Batch 923539):

Blanks: Tl was detected in the CCB at a concentration > the MDL but < the PQL. The associated result of sample 240905-001 was a detect <5X the CCB concentration and will be qualified "U,B3" at 5X the value of the CCB (mg/l).

Data are acceptable. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

ICP-MS Analyses (All Batches): All samples were analyzed within the prescribed holding times and properly preserved.

ICP-MS Instrument Tune

ICP-MS Analyses (All Batches): All instrument tune requirements were met.

Calibration

ICP-MS Analyses (All Batches): All initial and continuing calibration QC acceptance criteria were met.

Reporting Limit Verification

ICP-MS Analyses (All Batches): All CRI recoveries met QC acceptance criteria.

Blanks

ICP-MS Analysis (Batch 923531): No target analytes were detected in the blanks, except as noted above in the summary section.

ICP-MS Analysis (Batch 923534): No target analytes were detected in the blanks.

ICP-MS Analysis (Batch 923539): No target analytes were detected in the blanks, except as noted above in the summary section. It should be noted that the Tl detect result of the equipment blank (EB) (sample 240905-001) was qualified "U" (ND) due to CCB contamination and, therefore, cannot affect other field samples.

ICP-MS Internal Standards

ICP-MS Analyses (All Batches): All ICP-MS internal standards intensities met QC acceptance criteria.

Matrix Spike (MS)

ICP-MS Analysis (Batch 923539): No MS analysis was performed because the batch sample was the EB. No sample data will be qualified as a result.

ICP-MS Analyses (Other Batches): All MS QC acceptance criteria were met.

Laboratory Replicate

ICP-MS Analysis (Batch 923539): No laboratory replicate analysis was performed. The LCSD was used as a measure of laboratory precision. No sample data will be qualified as a result.

ICP-MS Analyses (Other Batches): All laboratory replicate QC acceptance criteria were met.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

ICP-MS Analysis (Batch 923539): All LCS/LCSD QC acceptance criteria were met.

ICP-MS Analyses (Other Batches): All LCS QC acceptance criteria were met.

Detection Limits/Dilutions

ICP-MS Analyses (All Batches): All detection limits were properly reported. All samples were diluted 2X due to the nature of the matrix. All associated batch QC samples were diluted at dilution factors that resulted in relative dilution factors to the samples that were ≤5X. No sample data will be qualified as a result. No other samples required dilution.

ICP Interference Check Sample (ICS A and AB)

ICP-MS Analysis (Batch 923531): All ICS A and AB QC acceptance criteria were met, except as noted above in the summary section.

ICP-MS Analyses (Other Batches): Results of the ICS A and AB analyses were not evaluated because the concentrations of Al, Ca, Fe, and Mg in the samples were < those in the ICS solutions. No sample data will be qualified as a result.

ICP Serial Dilution

ICP-MS Analyses (All Batches): The serial dilution analysis met all QC acceptance criteria.

Other QC

ICP-MS Analyses (All Batches): No field blanks (FBs) were submitted on the AR/COCs. All relative percent differences (RPDs) of the field duplicates (samples 240902-003 and -007 and 240903-004) were <35%. No criteria for the evaluation of FDs is currently in place.

No other specific issues that affect data quality were identified.

Attachment 4
Revised Investigation Report and Proposal for Corrective Action Complete for Long Term Environmental Stewardship (LTES) Site 1 – Cable Debris Site (SNL/NM, March 2009)
(page changes only)

Revised Table 3.3.2-1
Summary of LTES Site 1
Confirmatory Soil Sampling, Metals Analytical Results

Sample Attributes			Metals (EPA Method SW846 3005/SW846 3050) (mg/kg)[a]										
Record Number[b]	ER Sample ID	Sample Depth(ft)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead
612009	CDS-A1-0001-SS	0-0.5	8160 B J	0.907 J (0.967)	1.49	64.2	0.385	0.207	6.8 J	2.81	5.46	6710	9.27 J
612009	CDS-A1-0002-SS	0-0.5	8160 B J	1.21	1.57	62.8	0.366	0.212	7.08 J	2.79	6.25	6660	8.22 J
611998	CDS-A1-0003-S	0-0.5	13400 J	**ND (22) J**	2.41	94	0.546	**ND (120)**	10.9	4.12	8.17	11100	7.62
612009	CDS-A1-0004-SS	0-0.5	9170 B J	1.48	2.35	93.2	0.424	0.269	7.75 J	3.33	6.25	7560	12.4 J
612009	CDS-A1-0005-SS	0-0.5	7940 B J	1.35	1.65	71.5	0.376	0.26	7.24 J	2.94	5.97	6960	13.7 J
611998	CDS-A1-0006-SS	0-0.5	13000 J	1.42J	3.87	**140**	0.519	**ND (120)**	12.2	4.61	**21.6**	11800	**149**
611998	CDS-A1-006D-SS	0-0.5	13300 J	ND (1.18) J	4.41	**151**	0.558	**ND (120)**	13.4	4.59	**15.8**	12600	**2000**
611998	CDS-A1-0007-SS	0-0.5	15400 J	1.54	3.59	**151**	0.598	**ND (120)**	13.6	**5.42**	**15.8**	12500	**545**
612009	CDS-A1-0008-SS	0-0.5	12600 B J	1.59	2.92	129	0.538	0.471	10.2 J	4.27	9.57	9430	**98.4 J**
612009	CDS-A1-0009-SS	0-0.5	11900 B J	3.1	2.45	105	0.491	0.555	10.8 J	3.9	10.3	8900	**94 J**
611998	CDS-A1-0010-SS	0-0.5	12200 J	1.15	2.94	124	0.509	**ND (120)**	10.2	3.79	7.85	10600	**50.1**
612009	CDS-A1-0011-SS	0-0.5	8080 B J	0.892 J (0.962)	2.43	126	0.365	0.235	7.57 J	4.02	5.91	7500	8.77 J
611998	CDS-A1-0012-SS	0-0.5	19500 J	0.592 J (0.975)	4.13	**187**	**0.709**	**ND (120)**	16.2	**5.86**	13.5	15100	**90**
611998	CDS-A1-0012D-SS	0-0.5	19400 J	0.599 J (0.975)	4.15	**189**	**0.736**	**ND (120)**	17.6	**6.06**	**261**	26900	**169**
611998	CDS-A1-0013-SS	0-0.5	18100 J	0.578 J (0.978)	3.97	**190**	**0.707**	**ND (120)**	15.6	**5.58**	12.9	14700	**169**
611998	CDS-A1-0014-SS	0-0.5	15400 J	1.08	3.62	**169**	0.615	**ND (120)**	13.7	4.97	10.9	13000	**154**
611998	CDS-A1-0015-SS	0-0.5	21900 J	ND (0.306)	4.37	**221**	**0.852**	**ND (120)**	18.9	**6.91**	**15.5**	17100	**117**
611998	CDS-A1-0016-SS	0-0.5	23000 J	2.15	**4.62**	**217**	**0.812**	**ND (120)**	20	**6.66**	**16.5**	20400	**166**
611998	CDS-A1-0017-SS	0-0.5	25700	2.73 J (4.87)	**5.35 J**	**239**	**1.13**	**ND (120)**	20.8 J	**8.59**	**24.3 J**	21900	**527 J**
611998	CDS-A1-0018-SS	0-0.5	20400	ND (0.306)	**4.8 J**	**194**	**0.958**	**ND (120)**	16.3 J	**6.79**	**18.5 J**	18100	**37.4 J**
611998	CDS-A1-0018D-SS	0-0.5	25400	2.25 J (4.96)	**6.06 J**	**245**	**1.12**	**ND (120)**	**22.6 J**	**8.91**	**27.5 J**	22500	**61.7 J**
611998	CDS-A1-0019-SS	0-0.5	13900	0.404 J (0.986)	3.68 J	**140**	0.641	**ND (120)**	11.3 J	4.99	10 J	12200	15.3 J
611998	CDS-A1-0020-SS	0-0.5	14600	0.486 J (0.984)	3.51 J	**156**	**0.724**	**ND (120)**	12.6 J	**5.21**	21.3 J	12600	**57 J**
611998	CDS-A1-0021-SS	0-0.5	9880	0.568 J (0.988)	2.86 J	126	0.554	**ND (120)**	8.42 J	3.88	7.37 J	9340	9.32 J
611998	CDS-A1-0022-SS	0-0.5	16600	ND (0.307)	3.86 J	**171**	**0.843**	**ND (120)**	13.5 J	**5.83**	11.5 J	13500	**53.5 J**
611998	CDS-A1-0023-SS	0-0.5	13100	3.59	3.32 J	**137**	0.641	**ND (120)**	12 J	4.84	13.9 J	11600	**120 J**
611998	CDS-A1-0024-SS	0-0.5	12000	0.971 J (0.977)	2.79 J	130	**0.672**	**ND (120)**	13.9 J	4.3	10 J	10800	**109 J**
611998	CDS-A1-0025-SS	0-0.5	13500	1.79	3.08 J	**140**	**0.668**	**ND (120)**	10.7 J	4.67	11.2 J	11200	**203 J**
Background concentration – Southwest Area Supergroup[d]			69,957[e]	3.9	4.4	130	0.65	<1	21.8	5.2	15.4	NA	21.4
Quality Assurance/Quality Control Samples (all in mg/L)													
611998	CDS-A1-EB1	NA	ND (0.005)	ND (0.0005)	ND (0.0015)	ND (0.0005)	ND (0.0001)	0.0239	0.00165 J (0.003)	ND (0.0001)	0.00117	0.08	ND (0.0005)
612009	CDS-A1-EB2	NA	0.0772	ND (0.0005)	ND (0.0015)	0.000917 J (0.002)	ND (0.0001)	0.0189	ND (0.0015)	ND (0.0001)	0.000401 J (0.001)	ND (0.078)	ND (0.0005)

Revised Table 3.3.2-1 (continued)
Summary of LTES Site 1
Confirmatory Soil Sampling, Metals Analytical Results

Sample Attributes			Metals (EPA Method SW846 3005/SW846 3050/SW846 7470/SW846 7471) (mg/kg)[a]							
Record Number[b]	ER Sample ID	Sample Depth(ft)	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
612009	CDS-A1-0001-SS	0-0.5	157	ND (0.025)	5.89	ND (0.498) J	ND (0.0984)	ND (0.22)	11.8 J	29.9
612009	CDS-A1-0002-SS	0-0.5	168	ND (0.025)	5.81	ND (0.486) J	ND (0.0982)	ND (0.22)	12.2 J	27.9
611998	CDS-A1-0003-S	0-0.5	160	0.0102 J	8.78	ND (0.499)	ND (0.0998)	ND (~~2.4~~0.24)	**22.7**	46.7
612009	CDS-A1-0004-SS	0-0.5	173	ND (0.025)	7.17	ND (0.486) J	ND (0.0994)	ND (0.22)	14.8 J	27.6
612009	CDS-A1-0005-SS	0-0.5	196	ND (0.025)	6.02	ND (0.491)	ND (0.0994)	ND (0.22)	11.8 J	27.4
611998	CDS-A1-0006-SS	0-0.5	312	0.0144	9.72	ND (0.492)	ND (0.0996)	ND (0.24~~2.4~~)	**22.1**	**99.4**
611998	CDS-A1-006D-SS	0-0.5	291	0.0145	9.94	ND (0.498)	ND (0.0994)	ND (0.24~~2.4~~)	**21.8**	**103**
611998	CDS-A1-0007-SS	0-0.5	286	0.0149	10.8	ND (0.497)	ND (0.0998)	ND (0.24~~2.4~~)	**22.5**	**93.8**
612009	CDS-A1-0008-SS	0-0.5	300	ND (0.025)	9.42	ND (0.492) J	ND (0.099)	ND (0.22)	17.4 J	**93.9**
612009	CDS-A1-0009-SS	0-0.5	238	ND (0.025)	8.38	ND (0.486) J	ND (0.0982)	ND (0.22)	16.1 J	**108**
611998	CDS-A1-0010-SS	0-0.5	212	0.0126	8.36	ND (0.487)	ND (0.099)	ND (0.24~~2.4~~)	**22**	55.1
612009	CDS-A1-0011-SS	0-0.5	149	ND (0.025)	8.02	ND (0.497) J	ND (0.096)	ND (0.22)	17.3 J	30.8
611998	CDS-A1-0012-SS	0-0.5	303	0.0243	**13.2**	ND (0.489)	ND (0.0975)	ND (0.24~~2.4~~)	**27.5**	**816**
611998	CDS-A1-0012D-SS	0-0.5	374	0.0247	**14.2**	ND (0.491)	ND (0.0975)	ND (0.24~~2.4~~)	**28.4**	**250**
611998	CDS-A1-0013-SS	0-0.5	315	0.0262	**12.8**	ND (0.486)	ND (0.0978)	ND (0.24~~2.4~~)	**27**	**148**
611998	CDS-A1-0014-SS	0-0.5	297	0.0177	10.9	ND (0.485)	ND (0.0977)	ND (0.24~~2.4~~)	**24**	**126**
611998	CDS-A1-0015-SS	0-0.5	397	0.0253	**15.6**	ND (0.484)	ND (0.0988)	ND (0.24~~2.4~~)	**29.9**	**189**
611998	CDS-A1-0016-SS	0-0.5	351	0.0311	**16**	ND (0.498)	ND (0.0982)	ND (0.24~~2.4~~)	**30.5**	**645**
611998	CDS-A1-0017-SS	0-0.5	460	0.0335	**19.4**	ND (0.484) J	ND (0.487)	ND (0.24~~2.4~~)	**31.5**	**147**
611998	CDS-A1-0018-SS	0-0.5	344	0.0256	**15.6**	ND (0.494) J	ND (0.493)	ND (0.24~~2.4~~)	**26.9**	**112**
611998	CDS-A1-0018D-SS	0-0.5	428	0.0325	**20.3**	ND (0.495) J	ND (0.496)	ND (0.24~~2.4~~)	**33.2**	**150**
611998	CDS-A1-0019-SS	0-0.5	257	0.013	10.8	ND (0.484) J	ND (0.0986)	ND (0.24~~2.4~~)	**21.6**	48.3
611998	CDS-A1-0020-SS	0-0.5	282	0.0203	11.3	ND (0.496) J	ND (0.0984)	ND (0.24~~2.4~~)	**21.4**	**64.5**
611998	CDS-A1-0021-SS	0-0.5	174	0.0086 J (0.0114)	7.81	ND (0.497) J	ND (0.0988)	ND (0.24~~2.4~~)	18.5	31.6
611998	CDS-A1-0022-SS	0-0.5	289	0.0189	**12.7**	ND (0.486) J	ND (0.099)	ND (0.24~~2.4~~)	**24.4**	**62.8**
611998	CDS-A1-0023-SS	0-0.5	270	0.0147	10.2	ND (0.494) J	ND (0.0984)	ND (0.24~~2.4~~)	20.4	**97.9**
611998	CDS-A1-0024-SS	0-0.5	278	0.0173	9.91	ND (0.484) J	ND (0.0977)	ND (0.24~~2.4~~)	17.8	**69.4**
611998	CDS-A1-0025-SS	0-0.5	268	0.0154	9.89	ND (0.486) J	ND (0.0996)	ND (0.24~~2.4~~)	20.3	**92.7**
Background concentration– Southwest Area Supergroup[d]			831[e]	<0.25	11.5	<1	<1	<1.1	20.4	62
Quality Assurance/Quality Control Samples (all in mg/L)										
611998	CDS-A1-EB1	NA	ND (0.001)	ND (0.00003)	ND (0.0005)	ND (0.001)	ND (0.0002)	0.000475 J (0.001)	ND (0.003)	ND (0.014)
612009	CDS-A1-EB2	NA	0.00147 J (0.005)	ND (0.00003)[UJ]	ND (0.0005)	ND (0.001)	ND (0.0002)	0.000611 J (0.001)	ND (0.003)	ND (0.13)

Note: Values in **bold** exceed background soil concentrations.

[a]EPA November 1986.

[b]Analysis request/chain-of-custody record.

[c]Samples were used for waste characterization and disposal only

[d]Dinwiddie September 1997.

[e]From USGS (1994) NURE Data Program.

J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.

J = Analytical result was qualified as an estimated value.

MDL = Method detection limit.

mg/kg = Milligram(s) per kilogram.

Mg/L = Milligram(s) per liter.

EPA = U.S. Environmental Protection Agency.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
SS = Surface soil sample.

Revised Investigation Report Page Changes

3.3.2 Soil Sampling Results

Analytical results for the final confirmatory soil samples that represent post-VCA conditions (28 samples including 3 duplicates) are presented and discussed in this section.

TAL Metals

TAL metals results for the 28 confirmation soil samples collected from the LTES Site 1 are summarized in Table 3.3.2-1. Method detection limit (MDL) for the metals in soil analyses are presented in Table 3.3.2-2. The following detections above background were reported:

- Four samples contained elevated arsenic levels ranging from 4.62 to 6.06J milligram per kilogram (mg/kg), above the background concentration of 4.4 mg/kg.
- Seventeen samples contained elevated barium levels ranging from 137 to 245 mg/kg, above the background concentration of 130 mg/kg.
- Twelve samples contained elevated beryllium levels ranging from 0.688 to 1.13 mg/kg, compared to a background concentration of 0.65 mg/kg.
- One sample contained elevated chromium at 22.6J mg/kg, compared to a background concentration of 21.8 mg/kg.
- Eleven samples contained elevated cobalt levels ranging from 5.21 to 8.91 mg/kg, compared to a background concentration of 5.2 mg/kg.
- Nine samples contained elevated copper levels ranging from 15.5 to 261 mg/kg, compared to a background concentration of 15.4 mg/kg.
- Twenty samples contained elevated lead levels ranging from 37.4J to 2000 mg/kg, compared to a background concentration of 21.4 mg/kg.
- Nine samples contained elevated nickel levels ranging from 12.7 to 20.3 mg/kg, compared to a background concentration of 11.5 mg/kg.
- Seventeen samples contained elevated vanadium levels ranging from 21.8 to 33.2 mg/kg, compared to a background concentration of 20.4 mg/kg.
- Nineteen samples contained elevated zinc levels ranging from 62.8 to 816 mg/kg, compared to a background concentration of 62 mg/kg.

The MDLs for antimony, and cadmium~~, and thallium~~ were above their respective background concentrations due to analytical sample dilution. There are no available background values for iron.

Revised Investigation Report Metals Data Validation

Analytical Quality Associates, Inc.
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Memorandum - Revised

DATE: February 1, 2010 (revision)

TO: File

FROM: Marcia Hilchey (revision)

SUBJECT: Inorganic Data Review and Validation - SNL
Site: Cable Debris Site Sampling
AR/COC: 611998
SDG: 215227/215230/215231/215232
Laboratory: GEL
Project/Task No: 96750.01.03.06

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03 Rev 2.

Summary

The samples were prepared and analyzed with accepted procedures using methods EPA6010 (ICP), EPA6020 (ICP-MS) and EPA7470A/7471A (CVAA). Problems were identified with the data package that result in the qualification of data.

ICP Analysis:

Blanks: Sb of Batch 791944 was detected in the initial calibration blank (ICB), continuing calibration blank (CCB), and method blank (MB) at concentrations > the method detection limit (MDL) but < the practical quantitation limit (PQL). The associated result of sample 215230-001 was a detect <5X the highest calibration blank concentration and <5X the MB concentration and will be qualified "U,B,B3" at 5X the value of the normalized ICB value (highest blank value).

MS: The MS percent recovery (%R) for Sb of Batch 791944 was <75% but >30%. The associated result of sample 215230-002 was a detect and will be qualified "J-,MS3"; the associated results of samples -001 and -003 were non-detects (NDs) and will be qualified "UJ,MS3." It should be noted that the result of sample -001 was qualified "U" (ND) due to blank contamination and will be further qualified "UJ" due to the low MS %R, as shown on the sample findings summary.

ICP-MS Analysis:

Blanks: Ca of Batch 791975 was detected in the MB at a concentration > the MDL but < the PQL. The associated result of sample 215232-001 was a detect <5X the MB concentration and will be qualified "0.10U,B" at 5X the value of the MB (mg/l).

Blanks: Zn of Batch 791975 was detected in the MB at a concentration > the MDL but < the PQL. The associated result of sample 215232-001 was a detect <5X the MB concentration and will be qualified "0.014U,B" at 5X the value of the MB (mg/l).

Blanks: Cd was detected in the equipment blank (EB) (sample 215232-001) at a concentration > the MDL but < the PQL. All associated sample results were detects <5X the EB concentration and will be qualified "U,B2" at 5X the normalized EB value.

Blanks: Tl was detected in the EB (sample 215232-001) at a concentration > the MDL but < the PQL. All associated sample results were detects <5X the EB concentration and will be qualified "U,B2" at 5X the normalized EB value.

Blanks: Na was detected in the EB (sample 215232-001) at a concentration > the MDL but < the PQL. The associated results of samples 215227-006, -007, -011, -012, -014, -015, -017, -019, -021, -022, -023, and 215230-001 were detects <5X the EB concentration and will be qualified "U,B2" at 5X the normalized EB value.

MS: The MS %R for Se of Batch 792306 was <75% but >30%. The associated result of sample 215230-002 was a detect and will be qualified "J-,MS3"; all other associated sample results were NDs and will be qualified "UJ,MS3."

MS: The MS %R for As of Batch 792306 was >125%. All associated sample results were detects and will be qualified "J+,MS2."

MS: The MS %R for Cr of Batch 792306 was >125%. All associated sample results were detects and will be qualified "J+,MS2."

MS: The MS %R for Cu of Batch 792306 was >125%. All associated sample results were detects and will be qualified "J+,MS2."

Serial Dilution: The serial dilution percent difference (%D) for Al of Batch 792301 was >10%. All associated sample results were detects and will be qualified "J,D1."

Serial Dilution: The serial dilution %D for Mg of Batch 792301 was >10%. All associated sample results were detects and will be qualified "J,D1."

Serial Dilution: The serial dilution %D for Pb of Batch 792306 was >10%. All associated sample results were detects and will be qualified "J,D1."

CVAA Analysis:

Blanks: Hg of Batch 791848 was detected in the ICB and CCB at negative concentrations with absolute values > the MDL but < the PQL. The associated result of sample 215230-002 was a ND and will be qualified "UJ,B4."

Data are acceptable. QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

All Analyses: All samples were analyzed within the prescribed holding times and properly preserved.

ICP-MS INSTRUMENT TUNE

ICP-MS Analysis: The instrument tune data were not reported and could not be evaluated. No sample data should be qualified as a result.

Calibration

All Analyses: All initial and continuing calibration QC acceptance criteria were met, except for the following. Initial calibration y-intercept values and correlation coefficients (R^2) values for target analytes were not reported and could not be evaluated. No sample data should be qualified as a result.

Reporting Limit Verification

ICP-MS Analysis: All CRI recoveries met QC acceptance criteria, except the following. The CRI %R for Al of Batch 792301 was <30% and the %R for Mg of Batch 792301 was <70% but >30%. However, all associated sample results were detects >5X the PQL and will not be qualified.

All Other Analyses: All CRA/CRI recoveries met QC acceptance criteria.

Blanks

ICP Analysis: No target analytes were detected in the blanks, except the following. Sb of Batch 791944 was detected in the ICB, CCB, and MB at concentrations > the MDL but < the PQL. However, the associated result of sample 215230-002 was a detect >5X the highest calibration blank value and >5X the MB value and will not be qualified; the associated result of sample -003 was ND and will not be qualified.

ICP-MS Analysis: No target analytes were detected in the blanks, except as noted above in the summary section and the following. Fe, Al, Be, Co, Mg, Cr, Cu, Cd, Ca, Tl, Zn, Na, Sb, and As were detected in one or more of the blanks at concentrations > the MDL but < the PQL. However, all associated sample results, except the results qualified above in the summary section, were either NDs or detects >5X the highest calibration blank concentration and/or MB concentration and/or EB concentration and will not be qualified. It should be noted that the EB detect results for Ca and Zn were qualified "U" (ND) by MB contamination and, therefore, can not affect other field samples.

CVAA Analysis: No target analytes were detected in the blanks, except as noted above in the summary section and the following. Hg of Batch 791848 was detected in the ICB and CCB at negative concentrations with absolute values > the MDL but < the PQL. However, the associated results of samples 215230-001 and -003 were detects >5X the MDL and will not be qualified. Hg of Batch 791843 was detected in the CCB at a negative concentration with an absolute value > the MDL but < the PQL. However, all associated sample results were detects >5X the MDL and will not be qualified.

ICP-MS INTERNAL STANDARDS

ICP-MS Analysis: Internal standards data were not reported and could not be evaluated. No sample data should be qualified as a result.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

ICP Analysis: All MS (PS) QC acceptance criteria were met, except as noted above in the summary section.

The MSD analysis was assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

ICP-MS Analysis: All MS (PS) QC acceptance criteria were met, except as noted above in the summary section. The MSD analysis was not assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

CVAA Analysis: All MS (PS) QC acceptance criteria were met. The MSD analysis was not assessed because the laboratory replicate analysis was used as a measure of precision. No sample data should be qualified as a result.

Laboratory Replicate

ICP Analysis: All replicate QC acceptance criteria were met.

ICP-MS Analysis: All replicate QC acceptance criteria were met. It should be noted that the laboratory replicate relative percent difference (RPD) for Mg of Batch 792306 was >20% but <35%, which is the acceptable limit for samples of soil matrix. No sample data should be qualified as a result. No laboratory replicate analysis was performed for Batch 791975 but the LCSD analysis was used as a measure of precision. No sample data should be qualified as a result.

CVAA Analysis: All replicate QC acceptance criteria were met. No laboratory replicate analysis was performed for Batch 791857 but the LCSD analysis was used as a measure of precision. No sample data should be qualified as a result.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

ICP Analysis: All LCS QC acceptance criteria were met. No LCSD analyses were performed. The laboratory replicate analyses were used as measures of laboratory precision. No sample data will be qualified as a result.

ICP-MS/CVAA Analyses: All LCS/LCSD QC acceptance criteria were met.

Detection Limits/Dilutions

All Analyses: All detection limits were properly reported. All samples of Batches 792301, 792306, were diluted the standard 2X soils dilution for all ICP-MS analytes, except 10X dilutions for various analytes of the following samples that were performed to bring over-range target analyte concentrations into the linear calibration range of the instrument and due to high internal standard native concentration: samples 215227-001, -002, -003, -004, -005, -006, -008, -010, -011, -012, -018, -019, 020,-021,-022, and -023, and samples 215230-001, -002, and -003. Samples 215227-014, -015, -017 were diluted 20X for Ca and ample 215230-002 was diluted 100X for Cu and Fe due to over-range concentrations of the target analytes. Sample 215227-015 was diluted 5X for Ag to minimize matrix suppression. Samples 215227 -014 and -017 were diluted 5X for Sb and Ag due to the affects of high Ca concentrations. All associated batch QC samples were diluted at dilution factors that resulted in relative dilution factors to the samples that were ≤5X. No sample data will be qualified as a result. No other samples required dilution.

ICP Interference Check Sample (ICS A and AB)

ICP-MS Analysis: The ICS A and ICS AB raw data were not reported and could not be evaluated. No sample data should be qualified as a result. It should be noted that all ICS AB recoveries still met QC acceptance criteria. No sample data should be qualified as a result.

ICP SERIAL DILUTION

ICP Analysis: The serial dilution analysis met all QC acceptance criteria.

ICP-MS Analysis: The serial dilution analysis met all QC acceptance criteria, except as noted above in the summary section.

Other QC

No field blanks (FBs) were submitted on the AR/COC. All RPDs of the field duplicates (FDs) (samples 215227-007 and -017 were <35%, except for the following analytes: Cu, Pb, Fe, and Zn. No QC acceptance criteria for the evaluation of FDs are currently in place.

No other specific issues were identified which affect data quality.

Attachment 5
Denial: Request For Extension for Long-Term Environmental Stewardship (LTES) Site 1 - Cable Debris Site, November 2, 2009 Sandia National Laboratories, EPA ID# NM5890110518 HWB-SNL-08-014

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

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Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
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BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary

JON GOLDSTEIN
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

November 23, 2009

Kimberly A. Davis
Acting Manager
Sandia Site Office/NNSA
U.S. Department of Energy
P.O. Box 5400, MS 0184
Albuquerque, NM 87185-5400

Fran B. Nimick
Deputy Director
Nuclear Energy & Global Security Technologies
Sandia Corporation
P.O. Box 5800, MS 0701
Albuquerque, NM 87185

RE: DENIAL: REQUEST FOR EXTENSION FOR LONG-TERM ENVIRONMENTAL STEWARDSHIP (LTES) SITE 1 – CABLE DEBRIS SITE, NOVEMBER 2, 2009 SANDIA NATIONAL LABORATORIES, EPA ID# NM5890110518 HWB-SNL-08-014

Dear Ms. Davis and Mr. Nimick:

The New Mexico Environment Department (NMED) has reviewed the subject document dated November 2, 2009, in which the U. S. Department of Energy on behalf of itself and Sandia Corporation (collectively the "Permittees") requested an extension to complete the required sampling and analysis of soil for cadmium and thallium at the Cable Debris Site. The Permittees did not provide a reason for the extension request. NMED does not find good cause for the request and therefore denies it.

Additionally, the Permittees indicate in the letter that although the results of the four soil samples analyzed for Cesium-137 exceeded the background level for subsurface soil, the results should have been compared to the background level for surface soil. Upon reevaluation of the data, the activity levels of all four soil samples are indicative of background conditions. NMED agrees additional soil sampling for Cesium-137 is not needed and, therefore, is no longer required.

If you have any questions regarding this matter, please contact Mr. Brian L. Salem of my staff at (505) 222-9576.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

JPB:bls

cc: J. Kieling, NMED HWB
W. Moats, NMED HWB
B. Salem, NMED HWB
T. Skibitski, NMED DOE OB
D. Pellegrino, DOE NNSA/SSO, MS 0184
L. King, EPA Region 6 (6PD-N)
File: SNL 2009
SNL-08-014

LTES 1
Cable Debris Site

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL8500

Site History

- Long-Term Environmental Stewardship 1 (LTES 1), the Cable Debris Site, is an approximately 1.5 acres site located in the southeast portion of Technical Area III.

  The operational history of the site is unknown. However, based on the available information, this location has never been an active test site and the contamination is limited to the surface debris (i.e., solid waste) that was probably transported to the area from various test areas.

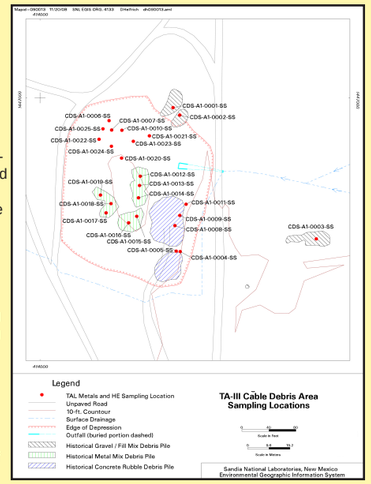
  Five debris piles were located in a topographic basin; five additional smaller piles were located directly east of the basin. Three of the basin debris piles were primarily composed of metal cables with other metal debris, including rebar, steel pipes, tubes, weldments, welded steel fixtures, spent rocket motors and powder actuated cable cutters. The other two basin piles were comprised of concrete rubble and rebar. The five smaller piles (east of the basin) were comprised of small cobbles, fill dirt, and some minor solid waste that included paper, plastic, and small metal debris. Based on visual inspection, there was no indication of soil staining or other visible signs of contamination.

Depth to Groundwater

- The regional aquifer is approximately 500 feet below ground surface.

Constituents of Concern (COC)

- Total Metals
- Radionuclides
- High Explosives



Summary of Investigations

- A voluntary Corrective Action (VCA) was completed for the site in January 2009. The VCA focused on debris segregation, sizing, and final disposition. The debris was processed to a manageable size, segregated based on material types (metal, concrete, and other assorted solid wastes) and managed either through recycling or waste disposal paths.

- Twenty-eight confirmatory soil samples (including three duplicate samples) were collected following the VCA. Sample locations were biased to the areas where the debris was located. The samples were analyzed for target analyte list (TAL) metals, high explosives (HE) and radionuclides.

- Analytical results revealed elevated levels of 10 metals, no detections of HE, and the presence of Cesium-137 above the approved New Mexico Environment Department (NMED) backgound values.

Debris Type	Approximate Quantity	Unit	Disposition
Metal	5	1 roll off container (30 cubic yards)	Recycled offsite
Concrete Rubble	150	Tons	Recycled
Lead Fragments	1000-1500	Pounds	SNL/NM Lead Bank
General Solid Waste	10	Cubic Yards	Sanitary Landfill
Wood	400	Pounds	Recycled
Electric Cable	400	Pounds	Recycled

Summary of Investigations

- The NMED issued a Notice of Deficiency (NOD) due to the elevated metals (cadmium and thallium) and Cesium-137 values; additional samples were required.

- A review of the confirmatory sampling results revealed an analytical laboratory error in the reporting of the cadmium and thallium results. The SNL/NM personnel responses to the NOD detailed the error and presented the corrected information. The cadmium detection limits were significantly below the soil screening level and the thallium values were below corresponding background values. The Cesium-137 value for the subsurface sample did exceed the subsurface background value, but was well within the range of overall background values.

- The NMED accepted the NOD comments and did not require any further action at the site.

- Following all the VCA activities, the site was graded and reseeded.

Summary of Data Used for No Further Action (NFA) Justification

- Data that was used for the NFA justification and the final risk assessment included the confirmatory soil sample results collected following the VCA.

Recommended Future Land Use

- Industrial land use is established for this site.

Results of Risk Analysis

- Risk assessment results for the residential scenario are calculated per NMED risk assessment guidance in 2003 as presented in the "Supplemental Risk Document Supporting Class 3 Permit Modification Process" (SNL/NM October 2004).

- Because COCs were present in concentration or activities greater than background-screening levels or because consituents were present that did not have background-screening levels, it was necessary to perform a risk assessment for the site. The risk assessment analysis evaluated the potential for adverse health effects for the residential land-use scenario.

- The maximum concentration value for lead was 2,000 mg/kg; this value exceeds the background value. The EPA intentionally does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. However, the NMED guidance for lead screening concentrations for construction and industrial land use scenarios is 800 mg/kg (NMED December 2008). The EPA screening guidance value for a residential land use scenario is 400 mg/kg (EPA 2008). The 95% upper confidence level (UCL) of the mean concentration for all three land use scenarios at the site are less than the screening values; therefore, lead is eliminated from further consideration in the human health risk assessment.

- The total human Health Index (HI) was 0.08 for the industrial land-use scenario, which is less than the NMED guideline of 1. The total estimated excess cancer risk was 4E-6 for the industrial land-use scenario, which is less than the NMED guideline of 1E-5.

- The total human HI was 1.01 for the residential land-use scenario, which is greater than the NMED guideline of 1. The total estimated excess cancer risk was 2E-5 for the residential land-use scenario, which is greater than the NMED guideline of 1E-5. Using the UCLs of the mean concentrations for the main contributors to risk (arsenic and iron), the total HI was reduced to 0.5 and the total estimated excess cancer risk was reduced to 1.1E-8.

- The human health incremental Total Effective Dose Equivalent (TEDE) for an industrial land-use scenario was 9E-3 millirem per year (mrem/yr) due to radionuclides, which is significantly lower than the EPA numerical guideline of 15 mrem/yr but less than the DOE guideline of 25 mrem/yr. The human health incremental TEDE for a residential land-use scenario was 2.3E-2 mrem/yr, which is significantly below the EPA numerical guideline of 75 mrem/yr. Therefore, LTES 1 is eligible for unrestricted radiological release.

- Using the SNL ecological risk assessment methodology, the ecological risk for LTES 1 is predicted to be low.

- In conclusion, human health and ecological risks are acceptable per NMED guidance under a residential land-use scenario. Thus, LTES 1 is proposed for Corrective Action Closure without institutional controls.

Risk Assessment Values for LTES 1 Nonradiological COCs

COC	Maximum Concentration (All Samples) (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a] (Maximum Concentration)		Residential Land-Use Scenario[a] (UCL Concentration)	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	6.06 J/**3.8**	0.02	3.8E-6	0.28	1.6E-5	Below Background[b]	Below Background[b]
Barium	245	0.00	–	0.02	–	0.02	–
Beryllium	1.13	0.00	4.9E-10	0.01	1.0E-9	0.01	1.0E-9
Chromium, total	22.6 J	0.00	–	0.00	–	0.00	–
Cobalt	8.91	0.00	4.5E-9	0.01	9.6E-9	0.01	9.6E-9
Copper	261	0.01	–	0.09	–	0.09	–
Iron	26900/**14830**	0.04	–	0.49	–	0.27	–
Nickel	20.3	0.00	–	0.01	–	0.01	–
Vanadium	33.2	0.00	–	0.06	–	0.06	–
Zinc	816	0.00	–	0.04	–	0.04	–
Total		0.08	3.8E-6	**1.01**	**1.6E-5**	0.50	1.1E-8

[a]EPA 1989.
[b]UCL concentration was below background and therefore risk was not calculated.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Concentration was qualified as an estimated value.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
UCL = Upper Confidence Limit.
– = Information not available or not applicable.

LTES 1 prior to VCA

For More Information Contact

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