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Justification for Class III Permit Modification April 2000, Solid Waste Management Unit 11, Operable Unit 1334, Round 9

Sandia National Laboratories/NM

Sandia National Laboratories

Justification for Class III Permit Modification

April 2000

ER Site 11
Radioactive Explosive Burial Mounds
Operable Unit 1334

NFA Originally Submitted September 24, 1997
RSI Originally Submitted September 1999

Environmental Restoration Project

United States Department of Energy
Albuquerque Operations Office

Justification for Class III Permit Modification

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Solid Waste Management Unit 11
Operable Unit 1334
Round 9

(RCRA Permit No. NM5890110518)

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Class III Permit Modification

April 2000

Solid Waste Management Unit 11
Operable Unit 1334
Round 9

NFA Originally Submitted September 24, 1997

PROPOSAL FOR
RISK-BASED NO FURTHER ACTION
ENVIRONMENTAL RESTORATION SITE 11
RADIOACTIVE EXPLOSIVE BURIAL MOUNDS
OPERABLE UNIT 1334
September 1997

Prepared by
Sandia National Laboratories/New Mexico
Environmental Restoration Project
Albuquerque, New Mexico

Prepared for
the U. S. Department of Energy

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
CEARP	Comprehensive Environmental Assessment and Response Program
COC	constituents of concern
DOU	Document of Understanding
EOD	Explosives Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FOP	field operating procedure
ft	foot (feet)
HE	high explosive(s)
HQ	Hazard Quotient
KAFB	Kirtland Air Force Base
MDL	method detection limit
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
mg/kg	milligram(s) per kilogram
NFA	no further action
NMED	New Mexico Environment Department
OB	Oversight Bureau
pCi/g	picocurie(s) per gram
PID	photoionization detector
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-trazine
RFI	RCRA Facility Investigation
RP	Radiation Protection
SVOC	semivolatile organic compound(s)
SWMU	solid waste management unit(s)
Th	thorium
TPH	total petroleum hydrocarbons
U	uranium
UXO	unexploded ordnance
VCM	Voluntary Corrective Measure
VOC	volatile organic compound(s)

1.0 INTRODUCTION

1.1 Description of ER Site 11

Environmental Restoration (ER) Site 11 is located on the north side of Isleta Road, approximately 800 feet (ft) east of the intersection of Lovelace Road and Isleta Road on the southern portion of Kirtland Air Force Base (KAFB) (Figure 1-1). This inactive site was identified as the Radioactive Explosive Burial Mounds in the Module IV Resource Conservation and Recovery Act (RCRA) Part B Permit (Hazardous and Solid Waste Amendments Module) and consisted of three fenced areas (FA-1, -2, and -3) enclosing a total of five debris mounds and associated surface depressions (Figure 1-2). The site encompasses approximately 1.56 acres enclosed by the three fenced areas.

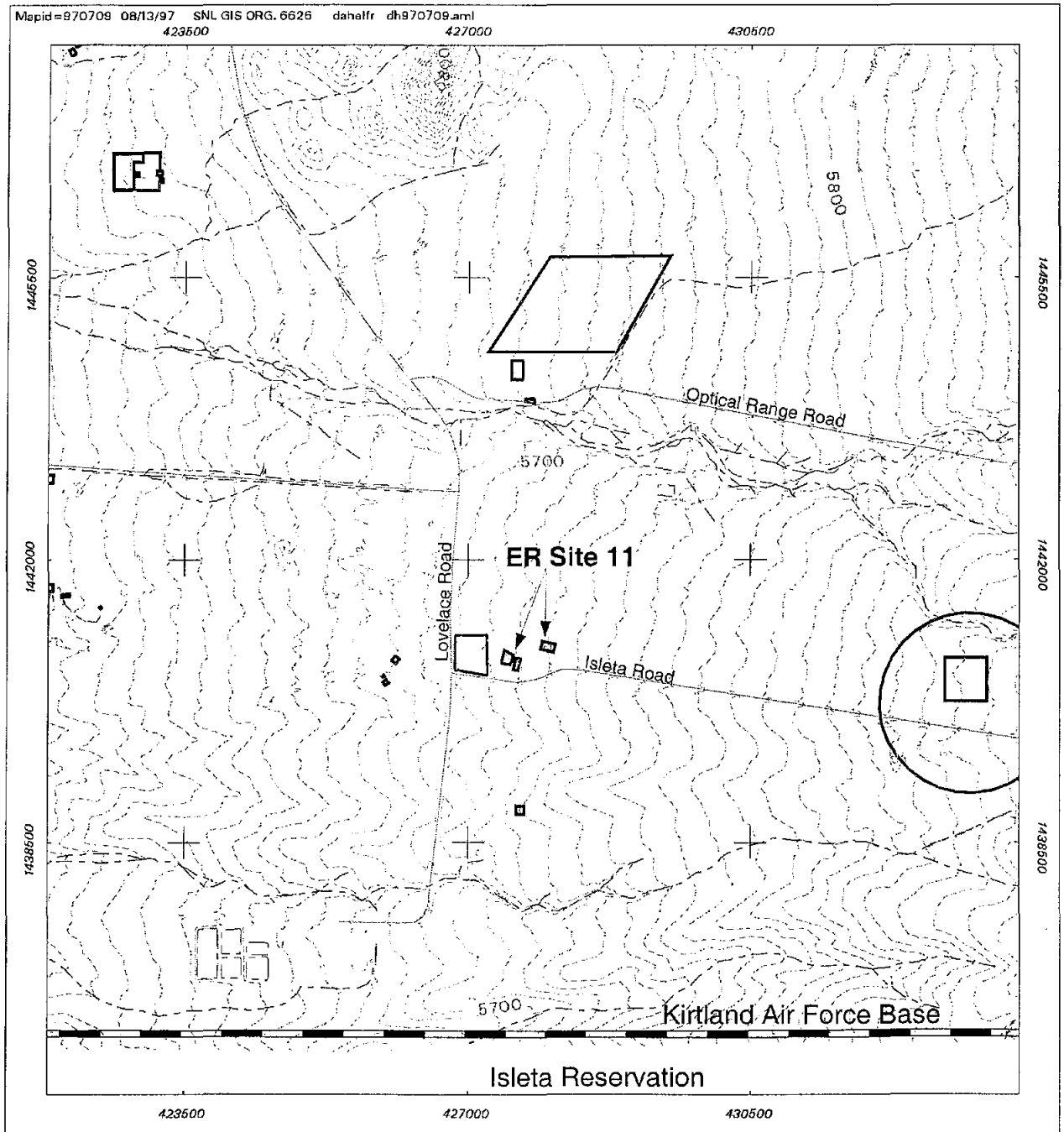
FA-1 (approximately 130 by 160 ft) contained two debris mounds and two surface depressions. An old, rusted signal box was on the west side of the fenced area. FA-2 (approximately 60 by 145 ft) contained two debris mounds; a surface depression is just to the east of the fence. FA-3 (approximately 170 by 100 ft) contained one large debris mound and an associated surface depression (Figure 1-2). The fences were posted with radiation and explosive hazard warning signs.

A Voluntary Corrective Measure (VCM) was performed at ER Site 11 between June and August 1996. All the debris mounds were carefully excavated and field screened for radioactivity and volatile organic compounds (VOC). All ordnance debris was removed and either cleared for waste disposal or destruction by the KAFB Explosives Ordnance Disposal (EOD) Unit. All fencing materials and other debris were removed from the site. The remaining soil was sampled, and following SNL/NM waste management approval, was graded back onto the site and the surface was seeded. Details of the ER Site 11 VCM are provided in Section 6.2 of this report.

ER Site 11 is on the alluvial fan deposits of the Mount Washington watershed that extent west from the Manzanita Mountains (IT Corporation 1994a). The site topography is flat with a gentle slope to the west, and it has a mean elevation ranging from 5,716 to 5,729 ft above mean sea level (amsl) (SNL/NM 1994a). The future site land use is industrial.

The geology of the site consists of alluvial deposits overlying bedrock. The alluvial deposits belong to the Tijeras gravelly fine sandy loam soil group (IT Corporation 1994a). Monitor well TRN-1, drilled to a depth of about 515 ft just north of FA-3 (Figure 1-2), penetrated about 160 ft of silts, gravels, and sands before entering a sequence of claystones, siltstones, and sandstones. A minor limestone bed was encountered at a depth of about 470 ft. Water was first encountered at a depth of about 82 ft below grade. The static water level is about 88 ft below grade (5642.33 amsl).

For a more detailed discussion regarding the local setting at ER Site 11, refer to the Draft RCRA Facility Investigation Work Plan for OU 1334, Central Coyote Test Area (SNL/NM 1994b).



Legend

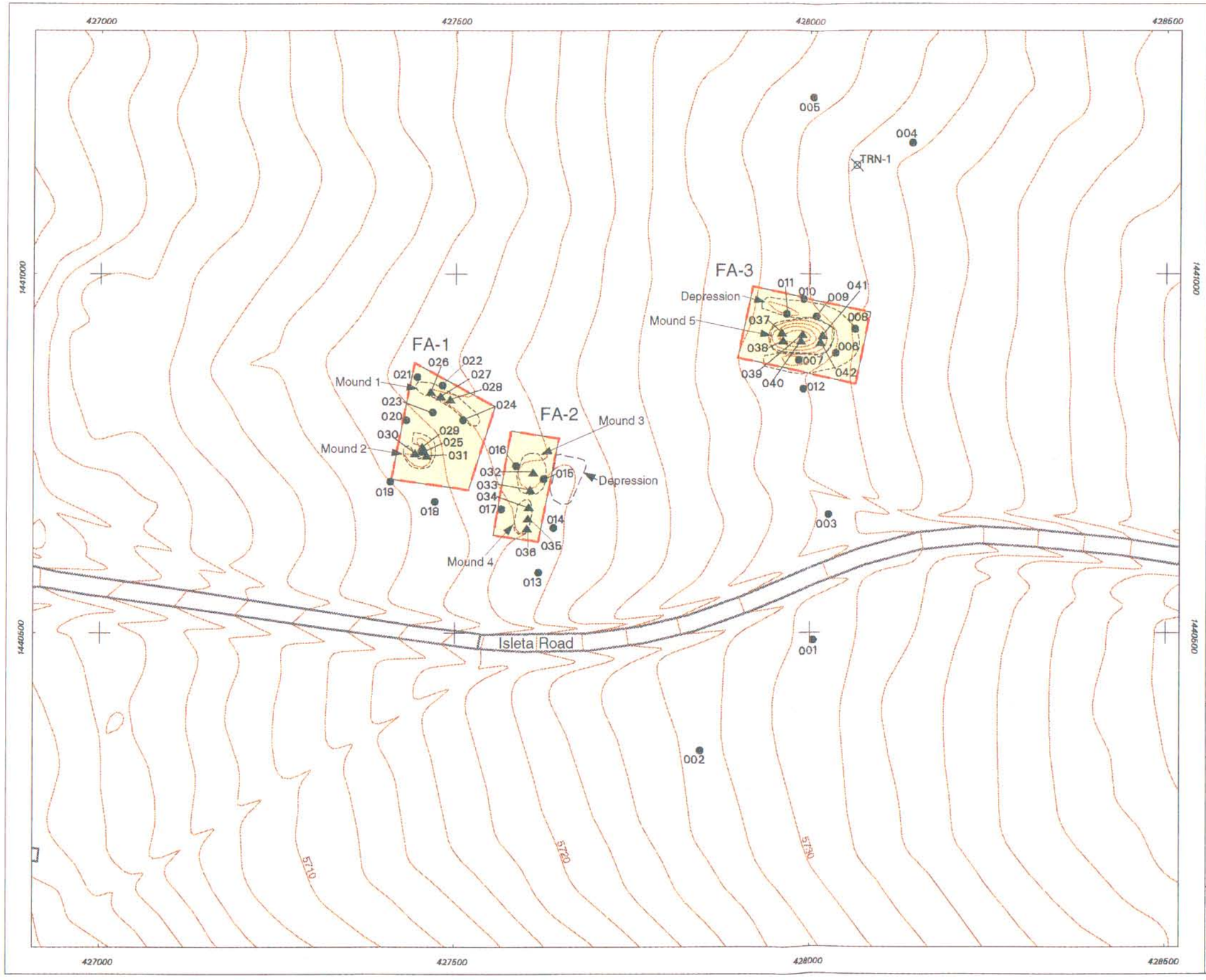
- Major Road
- 10 Foot Contour
- Surface Drainiage
- Other ER Site
- ER Site 11

Figure 1-1
Location of ER Site 11,
Radioactive Explosive Burial Mounds

0 1000 2000
Scale in Feet

0 240 480
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

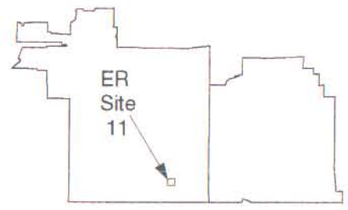


Legend

- Phase 1 RFI Sample May, 1996
- Phase 2 RFI Sample August, 1996
- Monitor Well TRN-1
- Road
- 2 Foot Contour
- Fence
- Mound & Depression Outline
- ER Site 11

0 150 300
Scale in Feet

0 40 80
Scale in Meters



Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Figure 1-2
Soil Sampling Locations at ER Site 11, Radioactive Explosive Burial Mounds

Transverse Mercator Projection, New Mexico State Plane Coordinate System, Central Zone, 1927 North American Horizontal Datum, 1929 North American Vertical Datum

	1:1800	MAPID=970664
Unclassified	DRAFT	SNL GIS ORG. 6682
dahelfr	dh970664.aml	07/23/97

1.2 No Further Action Basis

Review and analysis of all relevant data for ER Site 11 indicate that concentrations of constituents of concern (COC) are less than applicable risk-assessment action levels. Thus, ER Site 11 is being proposed for a no further action (NFA) decision based on VCM/confirmatory sampling data demonstrating that COCs that may have been released from this solid waste management unit (SWMU) into the environment pose an acceptable level of risk under current and projected future land use per NFA Criterion 5 of the ER Document of Understanding (DOU) (NMED 1996).

2.0 HISTORY OF ER SITE 11

2.1 Historical Operations

Interviews regarding activities at ER Site 11 are conflicting. Several interviewees reported that ER Site 11 was actually a burn test site for weapons components similar to, and predating operations at ER Site 68 to the east. However, none of the aerial photos reviewed show any evidence for this type of activity. Other sources report that artillery shells uncovered during the radial road construction at ER Site 71 to the east were buried in some of the debris mounds. One interviewee reported that one of the debris mounds was used as a target for vertical artillery shots fired from the nearby Workman Firing Site (ER Site 57A) (Lojek 1994). This report has not been confirmed by any other sources. Because ER Site 11 is located just east of (ER Site 57A), it was believed that unexploded ordnance (UXO) and high explosives (HE) debris cleared from the proximity fuze testing at Site 57A had been buried in the debris mounds (SNL/NM 1993). No historical records have been found to date, but two ER interviews (SNL/NM EORC 1994a, SNL/NM EORC 1994b) confirmed that UXO and dissociated debris materials had been disposed of in these mounds. Partially buried artillery shells were also visible on the surface of Mound 5 during site visits by ER personnel in 1996.

Available evidence suggests that the debris mounds were constructed prior to 1947. The debris mounds were already in place when the earliest ER Site 11 aerial photographs were taken in 1951 (USGS 1951). When interviewed, some SNL/NM employees reported that the mounds had been present for as long as they had worked at SNL/NM, with the earliest employment date going back to 1947 (SNL/NM EORC 1994a, SNL/NM EORC 1994b, SNL/NM EORC 1994c). Fencing around FA-2 and FA-3 was installed sometime after 1951 since it first appears in 1967 aerial photos (USGS 1967). Sometime in 1992 or 1993, FA-1 was fenced, and the fences around the other two areas were replaced (Lojek 1993). Later aerial photographs do not show any indications of further waste management activities, so it is likely the site has not been disturbed since 1967 (IT Corporation 1994b).

2.2 Previous Audits, Inspections, and Findings

ER Site 11 was identified during investigations conducted under the Comprehensive Environmental Assessment and Response Program (CEARP) (DOE 1987) and the RCRA Facility Assessment (EPA 1987). During both of these investigations, it was unclear whether radioactive material or UXO and/or HE debris was buried in the debris mounds at the site. Radioactive and explosive hazards signs were posted on the site fences at that time, but no one had verified if these hazards actually existed.

3.0 EVALUATION OF RELEVANT EVIDENCE

3.1 Unit Characteristics and Operating Practices

Even though the debris mounds and fences have been removed during a VCM, ER Site 11 is still posted as an ER site. All debris and fencing materials have been removed and disposed of. The debris mound soils have been regraded back onto the site, and the site has been revegetated with native grasses.

3.2 Results of SNL/NM ER Project Sampling/Surveys

3.2.1 Summary of Prior Investigations

The following sources of information, presented in chronological order, were used to evaluate ER Site 11:

- Historical aerial photographs (1951 through 1991)
- Interviews of SNL/NM personnel (1993 and 1994)
- UXO/HE and metal detector survey (1993)
- Surface radiation anomaly surveys (1987, 1992, and 1993)
- Results of an archeological/cultural resources survey (Hoagland and Dello-Russo 1995) and a sensitive or special status species or environments survey (IT Corporation 1995)
- SNL/NM scoping sampling of debris mound soils (June 1995)
- SNL/NM RCRA Facility Investigation (RFI) sampling of surface soils (May, August, and September, 1996)
- Removal of the debris mounds as a VCM (June through August 1996) and sampling of the screened soil piles (August and November 1996)
- Photographs and field notes collected at the site by SNL/NM staff.

3.2.2 UXO/HE Surveys

In December 1993, KAFB Explosives Ordnance Disposal (EOD) conducted a surface visual UXO/HE survey, a metal detector survey, and a radiation scan at ER Site 11. No radiation was detected above background activity, but UXO/HE debris was visible in the debris mounds, and

a considerable amount of subsurface metal was detected using the metal detector. KAFB EOD staff believed that UXO/HE was buried in the debris mounds. The results of the UXO/HE and radiation surveys conducted to date are consistent with the two ER interviews (SNL/NM EORC 1994a, SNL/NM EORC 1994b, SNL/NM EORC 1994c) that establish that the debris mounds were used for disposal of UXO/HE debris cleared from the Workman Site tests and that radioactive materials are probably absent.

3.2.3 Radiological Surveys

During the 1987 CEARP investigation, a SNL/NM surface radiation survey of the debris mounds did not measure any levels above background activity (DOE 1987, EPA 1987). In January 1992, SNL/NM RP personnel conducted another surface beta/gamma radiation survey at the site using a Geiger-Mueller detector with a pancake probe. At that time, FA-1 was not fenced, while FA-2 and FA-3 had fences in disrepair (Oldewage 1992). When FA-2 and FA-3 were surveyed around the perimeters and inside the fences, no readings above background activity were measured. The circular depression at FA-1 (which was not fenced at that time) was also surveyed, and no readings were measured above background activity (Havlena 1992, Oldewage February 1992). As stated above, the 1993 KAFB EOD radiation survey of the site also did not detect any activity above background levels.

3.2.4 Cultural-Resources Survey

No cultural-resource concerns were identified during the survey of ER Site 11 (Hoagland and Dello-Russo 1995).

3.2.5 Sensitive-Species Survey

Although the areas inside FA-1, -2, and -3 were not surveyed directly, the high degree of soil disturbance associated with construction of the mounds was thought to preclude the existence of sensitive species on the mounds themselves (IT Corporation 1995). Furthermore, no sensitive species were found in the relatively undisturbed grassland area around each mound further, reducing the possibility of such species within the fenced areas (IT Corporation 1995).

3.2.6 Scoping Sampling

On June 21, 1995, SNL/NM collected one soil sample at a depth of 0 to 6 inches from each of the five debris mounds. Each sample was analyzed for total petroleum hydrocarbons (TPH), HE, RCRA metals plus beryllium, gross alpha and beta, and gamma spectroscopy. Analyses were made at various SNL/NM on-site laboratories. No HE was detected. All metal analytes were non-detects except for barium (84 to 150 milligrams per kilogram [mg/kg]), and one chromium detection (7.0 J mg/kg) in the Mound 5 sample. No uranium (U)-238, -235, or -234 or thorium (Th)-234 were detected by gamma spectroscopy. TPH was apparently detected in the sample from Mound 4 at an estimated concentration between 10 and 100 parts per million using an immunoassay kit. The purpose of the scoping sampling effort was to obtain

preliminary analytical data to support ER Project site ranking and prioritization. No quality assurance/quality control samples were collected.

3.2.7 VCM Sampling

A VCM was conducted from June to August 1996 to remove the debris mounds at ER Site 11. The clean soil piles were sampled for the site-specific COCs. VCM activities and analytical results are discussed in Section 6.2, ER Site 11 VCM Report.

3.2.8 RFI Soil Sampling

Confirmatory soil sampling was conducted in two phases. Samples were collected during the first phase (May 1996) to establish site-specific background concentrations for metals and radionuclides. Samples were also collected from inside the fenced areas and from the surface depressions prior to their disturbance during the VCM. The second phase (August and September 1996) immediately followed the VCM and involved collecting soil samples directly beneath the former debris mound locations.

Soil samples were collected at depths of 0 to 6 and 6 to 12 inches below grade in accordance with ER Field Operating Procedure (FOP) 94-52 using standard equipment (stainless steel bowl, trowel, etc.) and standard decontamination procedures in accordance with ER FOP 94-57. The samples were managed in accordance with ER FOP 94-34. Samples were sent to both on-site and off-site laboratories for analysis. All semivolatile organic compounds (SVOC) samples and splits of 10 percent of the samples collected for HE, RCRA metals plus beryllium, and VOCs were sent off site to Quanterra Laboratories in Arvada, Colorado, for confirmational analysis. All isotopic uranium and thorium samples were sent to Quanterra Laboratories in St. Louis, Missouri, for analysis.

Sample analyses were conducted at both the on-site and off-site laboratories in accordance with standard U.S. Environmental Protection Agency (EPA) methods: EPA Method 8260 for VOCs, EPA Method 6010/7000 for RCRA metals plus beryllium, EPA Method 8330 or equivalent on-site High Pressure Liquid Chromatography for HE, and EPA Method 8270 for SVOCs (the latter analyzed off site only). Gamma spectroscopy analyses were performed at the SNL/NM RP Sample Diagnostics Laboratory. Isotopic uranium and thorium analyses were performed off site using alpha spectroscopy techniques. All samples were field-screened for organic compounds and radioactivity using both a photoionization detector (PID) and a beta-gamma (pancake) probe.

3.2.8.1 Phase I Sampling

Phase I samples were collected on May 20 and 21, 1996, from five site background locations, from the depressions, and from areas surrounding the debris mounds (Figure 1-2). A summary of the samples collected is provided in Table 3-1 below. Samples CCTA-11-GR-001 through -005 were collected in the vicinity of ER Site 11, away from any areas showing evidence of

Table 3-1
Summary of RFI Soil Samples Collected at ER Site 11

Site Area	Phase I			Phase II		
	Sample Locations	On-Site Analyses	Off-Site Analyses	Sample Locations	On-Site Analyses	Off-Site Analyses
Background	5 CCTA-11-GR-001 through CCTA-11-GR-005	Gamma spec, metals	Isotopic U/Th, metals	0	NA	NA
Mound 1	4 CCTA-11-GR-021 through CCTA-11-GR-024	Gamma spec, metals, HE	Metals, HE, SVOCs	3 CCTA-11-GR-026 through CCTA-11-GR-028	Gamma spec, metals, HE, VOCs	Metals, HE, SVOCs, VOCs, Isotopic U
Mound 2	4 CCTA-11-GR-018 through CCTA-11-GR-020 and CCTA-11-GR-025	Gamma spec, metals, HE	Metals, HE, SVOCs	3 CCTA-11-GR-029 through CCTA-11-GR-031	Gamma spec, metals, HE, VOCs	SVOCs, Isotopic U
Mound 3	3 CCTA-11-GR-015 through CCTA-11-GR-017	Gamma spec, metals, HE	Metals, HE, SVOCs	2 CCTA-11-GR-032 and CCTA-11-GR-033	Gamma spec, metals, HE, VOCs	Metals, HE, SVOCs, VOCs, Isotopic U
Mound 4	2 CCTA-11-GR-013 and CCTA-11-GR-014	Gamma spec, metals, HE	Metals, HE, SVOCs	3 CCTA-11-GR-034 through CCTA-11-GR-037	Gamma spec, metals, HE, VOCs	Metals, HE, SVOCs, VOCs, Isotopic U
Mound 5	7 CCTA-11-GR-006 through CCTA-11-GR-012	Gamma spec, metals, HE	Metals, HE, SVOCs	6[a] CCTA-11-GR-037 through CCTA-11-GR-042	Gamma spec, metals, HE, VOCs	Metals, HE, SVOCs, VOCs, Isotopic U

[a]A split of sample CCTA-11-GR-039 from beneath Mound 5 was collected for confirmatory isotopic uranium and HE analyses by an New Mexico Environment Department representative.
Gamma spec - Gamma spectroscopy.
HE - High explosives.
Isotopic U - Isotopic uranium
Isotopic U/Th - Isotopic uranium and thorium.
NA - Not applicable.
SVOCs - Semivolatile organic compounds.
VOCs - Volatile organic compounds.

disturbance, to serve as site-specific background samples. Samples CCTA-11-GR-006 through -012 were collected within FA-3 (surrounding Mound 5). Samples CCTA-11-GR-013 through -017 were collected from the vicinity of FA-2 (surrounding Mounds 3 and 4). The remaining samples (CCTA-11-GR-018 through -025) were collected near Mounds 1 and 2 in FA-1 (including one sample at the bottom of the Mound 2 pit).

3.2.8.2 Phase II Sampling

Phase II soil samples were collected from those areas beneath the former mound locations following the VCM. A summary of the samples collected is provided in Table 3-1. Samples CCTA-11-GR-026 through -028 were collected beneath former Mound 1. Samples CCTA-11-GR-029 through -031 were collected beneath former Mound 2. Samples CCTA-11-GR-032 and -033 were from beneath former Mound 3, while samples CCTA-11-GR-034 through -036 were from beneath Mound 4. The remaining samples (CCTA-11-GR-037 through -042) were collected beneath former Mound 5. Sample CCTA-11-GR-039 (from beneath Mound 5) was split with a representative from the New Mexico Environment Department (NMED) for confirmatory isotopic uranium and HE analyses. The SNL/NM sample from location -039 was submitted for the full suite of analyses (isotopic uranium, HE, RCRA metals plus beryllium, VOCs, and SVOCs).

3.2.9 RFI Analytical Results

Analytical results for both on-site and off-site laboratories are summarized in the following sections.

3.2.9.1 Organic Compounds (VOCs, SVOCs, HE)

On-site laboratory results for VOCs and HE analyses are shown in Table 3-2. Off-site laboratory results for VOCs, SVOC, and HE analyses are shown in Table 3-3.

No elevated PID readings were observed during collection and field-screening of the samples. No VOCs were detected in soil samples analyzed at the on-site laboratory. Methylene chloride (1.8 JB micrograms per kilogram [µg/kg]) was the only VOC detected in soil samples analyzed by the off-site laboratory in sample CCTA-11-GR-032-0.5-1.0 collected under the former Mound 3 location (Figure 1-2). Since methylene chloride was also detected along with 1.6 micrograms per liter (µg/L) of trichloroethene in the associated equipment blank, this detection probably represents laboratory contamination. Only two SVOCs were detected in off-site soil analyses. Di-n-butylphthalate (250 J to 610 µg/kg) was detected in the 0 to 0.5 ft samples at locations CCTA-11-GR-019 and -023 and in the 0 to 0.5 and 0.5 to 1.0 ft samples at location -025 (Table 3-3) near or around FA-1 (Figure 1-2). Di-n-octylphthalate (190 J µg/kg) was detected only in the 0.5 to 1.0 ft sample at location -026, under the former Mound 1 (Figure 1-2).

Table 3-2
Summary of Site 11 Soil Sampling On-Site Analytical Results; Volatile Organic Compounds (VOCs) and High Explosives

Sample Attributes				VOCs (EPA Method 8260) (ug/kg)	High Explosives (High-Pressure Liquid Chromatography) (ug/kg)				
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)		HMX	Nitroglycerine	PETN	RDX	TNT
029134-02	5/20/96	CCTA-11-GR-006-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029135-02	5/20/96	*CCTA-11-GR-006-0-0.5-SD (Duplicate Sample)*	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029516-02	5/20/96	CCTA-11-GR-006-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029517-02	5/20/96	CCTA-11-GR-007-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029518-02	5/20/96	CCTA-11-GR-007-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029519-02	5/20/96	CCTA-11-GR-008-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029520-02	5/20/96	CCTA-11-GR-008-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029521-02	5/20/96	CCTA-11-GR-009-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029522-02	5/20/96	CCTA-11-GR-009-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029523-02	5/20/96	CCTA-11-GR-010-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029524-02	5/20/96	CCTA-11-GR-010-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029525-02	5/20/96	CCTA-11-GR-011-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029526-02	5/20/96	CCTA-11-GR-011-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029527-02	5/20/96	CCTA-11-GR-012-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029528-02	5/20/96	CCTA-11-GR-012-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029529-02	5/20/96	*CCTA-11-GR-012-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029531-02	5/21/96	CCTA-11-GR-013-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029532-02	5/21/96	CCTA-11-GR-013-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029533-02	5/21/96	CCTA-11-GR-014-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029534-02	5/21/96	CCTA-11-GR-014-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029535-02	5/21/96	CCTA-11-GR-015-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029536-02	5/21/96	CCTA-11-GR-015-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029537-02	5/21/96	CCTA-11-GR-016-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029538-02	5/21/96	CCTA-11-GR-016-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029539-02	5/21/96	CCTA-11-GR-017-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029540-02	5/21/96	*CCTA-11-GR-017-0-0.5-SD (Duplicate Sample)*	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029541-02	5/21/96	CCTA-11-GR-017-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029542-02	5/21/96	CCTA-11-GR-018-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029543-02	5/21/96	CCTA-11-GR-018-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029544-02	5/21/96	*CCTA-11-GR-018-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76

Table 3-2 (Continued)
Summary of Site 11 Soil Sampling On-Site Analytical Results;
Volatile Organic Compounds (VOCs) and High Explosives

Sample Attributes				VOCs (EPA Method 8260) (ug/kg)	High Explosives (High-Pressure Liquid Chromatography) (ug/kg)				
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)		HMX	Nitroglycerine	PETN	RDX	TNT
029545-02	5/21/96	CCTA-11-GR-019-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029546-02	5/21/96	CCTA-11-GR-019-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029663-02	5/21/96	CCTA-11-GR-020-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029664-02	5/21/96	CCTA-11-GR-020-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029665-02	5/21/96	CCTA-11-GR-021-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029666-02	5/21/96	CCTA-11-GR-021-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029667-02	5/21/96	CCTA-11-GR-022-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029668-02	5/21/96	CCTA-11-GR-022-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029669-02	5/21/96	CCTA-11-GR-023-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029670-02	5/21/96	CCTA-11-GR-023-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029671-02	5/21/96	CCTA-11-GR-024-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029672-02	5/21/96	CCTA-11-GR-024-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029673-02	5/21/96	*CCTA-11-GR-024-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
029674-02	5/21/96	CCTA-11-GR-025-0-0.5-S	0.0-0.5	NA	< 100	< 30	< 150	< 150	< 76
029675-02	5/21/96	CCTA-11-GR-025-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030740-05	8/12/96	CCTA-11-GR-026-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030741-05	8/12/96	CCTA-11-GR-027-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030742-05	8/12/96	CCTA-11-GR-028-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030743-05	8/12/96	CCTA-11-GR-029-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030744-05	8/12/96	CCTA-11-GR-030-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030745-05	8/12/96	*CCTA-11-GR-030-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030746-05	8/12/96	CCTA-11-GR-031-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030747-05	8/12/96	CCTA-11-GR-032-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030748-05	8/12/96	CCTA-11-GR-033-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030749-05	8/12/96	CCTA-11-GR-034-0.5-1.0-S	0.5-1.0	ND	< 100	< 30	< 150	< 150	< 76
030751-05	8/13/96	CCTA-11-GR-035-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030752-05	8/13/96	*CCTA-11-GR-035-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030753-05	8/13/96	CCTA-11-GR-036-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030754-05	8/13/96	CCTA-11-GR-037-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030755-05	8/13/96	CCTA-11-GR-038-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030756-05	8/13/96	CCTA-11-GR-039-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76

Table 3-2 (Concluded)
Summary of Site 11 Soil Sampling On-Site Analytical Results; Volatile Organic Compounds (VOCs) and High Explosives

Sample Attributes				VOCs	High Explosives (High-Pressure Liquid Chromatography) (ug/kg)				
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)	(EPA Method 8260) (ug/kg)	HMX	Nitroglycerine	PETN	RDX	TNT
030757-05	8/13/96	*CCTA-11-GR-039-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030758-05	8/13/96	CCTA-11-GR-040-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030759-05	8/13/96	CCTA-11-GR-041-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
030760-05	8/13/96	CCTA-11-GR-042-0.5-1.0-S	0.5-1.0	NA	< 100	< 30	< 150	< 150	< 76
031400-001	9/4/96	CCTA-11-GR-035-0.5-1.0-S	0.5-1.0	ND	NA	NA	NA	NA	NA
031401-001	9/4/96	CCTA-11-GR-036-0.5-1.0-S	0.5-1.0	ND	NA	NA	NA	NA	NA
031402-001	9/4/96	CCTA-11-GR-037-0.5-1.0-S	0.5-1.0	ND	NA	NA	NA	NA	NA
031403-001	9/4/96	CCTA-11-GR-038-0.5-1.0-S	0.5-1.0	ND	NA	NA	NA	NA	NA
031404-001	9/4/96	CCTA-11-GR-039-0.5-1.0-S	0.5-1.0	ND	NA	NA	NA	NA	NA
031404-002	9/4/96	*CCTA-11-GR-039-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	ND	NA	NA	NA	NA	NA
031405-001	9/4/96	CCTA-11-GR-040-0.5-1.0-S	0.5-1.0	ND	NA	NA	NA	NA	NA
031406-001	9/4/96	CCTA-11-GR-041-0.5-1.0-S	0.5-1.0	ND	NA	NA	NA	NA	NA
031407-001	9/4/96	CCTA-11-GR-042-0.5-1.0-S	0.5-1.0	ND	NA	NA	NA	NA	NA
Quality Assurance/Quality Control Samples (all in ug/L)									
029530-02	5/20/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	NA	< 100	< 30	< 150	< 150	< 76
029676-02	5/21/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	NA	< 100	< 30	< 150	< 150	< 76
030750-05	8/12/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	ND	< 100 H	< 30 H	< 150 H	< 150 H	< 76 H
030761-05	8/13/96	CCTA-11-GR-000-EB (Aqueous. equipment blank)	N/A	NA	< 100 H	< 30 H	< 150 H	< 150 H	< 76 H
031408-001	9/4/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	ND	NA	NA	NA	NA	NA

H = Holding time for analyte was exceeded, estimated value.

N/A = Not applicable.

NA = Not analyzed.

ug/kg = Micrograms per kilogram.

ug/L = Micrograms per liter.

Table 3-3
Summary of Site 11 Soil Sampling Off-Site Laboratory Analytical Results; Volatile Organic Compounds, Semivolatile Organic Compounds, and High Explosives

Sample Attributes				Volatile Organic Compounds (EPA 8260) (ug/kg)		Semivolatile Organic Compounds (EPA 8270) (ug/kg)			High Explosives (EPA 8330) (ug/g)
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)	Methylene Chloride	Trichloroethene	Di-n-butyl-phthalate	bis(2-Ethylhexyl) phthalate	Di-n-octyl Phthalate	
029134-05	5/20/96	CCTA-11-GR-006-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029135-05	5/20/96	*CCTA-11-GR-006-0-0.5-SD (Duplicate Sample)*	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029516-05	5/20/96	CCTA-11-GE-006-0.5-1.0-S	0.5-1.0	NA	NA	< 710	< 710	< 710	NA
029517-05	5/20/96	CCTA-11-GR-007-0.0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029518-05	5/20/96	CCTA-11-GR-007-0.5-1.0-S	0.5-1.0	NA	NA	< 690	< 690	< 690	NA
029519-05	5/20/96	CCTA-11-GR-008-0-0.5-SS	0.0-0.5	NA	NA	< 670	< 670	< 670	ND1
029520-05	5/20/96	CCTA-11-GR-008-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029521-05	5/20/96	CCTA-11-GR-009-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029522-05	5/20/96	CCTA-11-GR-009-0.5-1.0-S	0.5-1.0	NA	NA	< 670	< 670	< 670	NA
029523-05	5/20/96	CCTA-11-GR-010-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029524-05	5/20/96	CCTA-11-GR-010-0.5-1.0-S	0.5-1.0	NA	NA	< 670	< 670	< 670	ND1
029525-05	5/20/96	CCTA-11-GR-011-0-0.5-S	0.0-0.5	NA	NA	< 680	< 680	< 680	NA
029526-05	5/20/96	CCTA-11-GR-011-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029527-05	5/20/96	CCTA-11-GR-012-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029528-05	5/20/96	CCTA-11-GR-012-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029529-05	5/20/96	*CCTA-11-GR-012-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	NA	< 690	< 690	< 690	NA
029531-05	5/21/96	CCTA-11-GR-013-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	ND1
029532-05	5/21/96	CCTA-11-GR-013-0.5-1.0-S	0.5-1.0	NA	NA	< 670	< 670	< 670	NA
029533-05	5/21/96	CCTA-11-GR-014-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029534-05	5/21/96	CCTA-11-GR-014-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029535-05	5/21/96	CCTA-11-GR-015-0-0.5-SS	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029536-05	5/21/96	CCTA-11-GR-015-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	ND1
029537-05	5/21/96	CCTA-11-GR-016-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029538-05	5/21/96	CCTA-11-GR-016-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029539-05	5/21/96	CCTA-11-GR-017-0-0.5-S	0.0-0.5	NA	NA	< 680	< 680	< 680	NA
029540-05	5/21/96	*CCTA-11-GR-017-0-0.5-SD (Duplicate Sample)*	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029541-05	5/21/96	CCTA-11-GR-017-0.5-1.0-S	0.5-1.0	NA	NA	< 670	< 670	< 670	NA
029542-05	5/21/96	CCTA-11-GR-018-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	ND1
029543-05	5/21/96	CCTA-11-GR-018-0.5-1.0-S	0.5-1.0	NA	NA	< 670	< 670	< 670	NA

Table 3-3 (Continued)
Summary of Site 11 Soil Sampling Off-Site Laboratory Analytical Results; Volatile Organic Compounds, Semivolatile Organic Compounds, and High Explosives

Sample Attributes				Volatile Organic Compounds (EPA 8260) (ug/kg)		Semivolatile Organic Compounds (EPA 8270) (ug/kg)			High Explosives (EPA 8330) (ug/g)
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)	Methylene Chloride	Trichloroethene	Di-n-butyl-phthalate	bis(2-Ethylhexyl) phthalate	Di-n-octyl Phthalate	
029544-05	5/21/96	*CCTA-11-GR-018-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	NA	< 670	< 670	< 670	NA
029545-05	5/21/96	CCTA-11-GR-019-0-0.5-S	0.0-0.5	NA	NA	410 J	< 660	< 660	NA
029546-05	5/21/96	CCTA-11-GR-019-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029663-05	5/21/96	CCTA-11-GR-020-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029664-05	5/21/96	CCTA-11-GR-020-0.5-1.0-S	0.5-1.0	NA	NA	< 670	< 670	< 670	ND1
029665-05	5/21/96	CCTA-11-GR-021-0-0.5-S	0.0-0.5	NA	NA	< 660	< 660	< 660	NA
029666-05	5/21/96	CCTA-11-GR-021-0.5-1.0-S	0.5-1.0	NA	NA	< 670	< 670	< 670	NA
029667-05	5/21/96	CCTA-11-GR-022-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029668-05	5/21/96	CCTA-11-GR-022-0.5-1.0-S	0.5-1.0	NA	NA	< 670	< 670	< 670	NA
029669-05	5/21/96	CCTA-11-GR-023-0-0.5-S	0.0-0.5	NA	NA	250 J	< 670	< 670	ND1
029670-05	5/21/96	CCTA-11-GR-023-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029671-05	5/21/96	CCTA-11-GR-024-0-0.5-S	0.0-0.5	NA	NA	< 670	< 670	< 670	NA
029672-05	5/21/96	CCTA-11-GR-024-0.5-1.0-S	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029673-05	5/21/96	*CCTA-11-GR-024-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	NA	< 680	< 680	< 680	NA
029674-05	5/21/96	CCTA-11-GR-025-0-0.5-S	0.0-0.5	NA	NA	610 J	< 690	< 690	NA
029675-05	5/21/96	CCTA-11-GR-025-0.5-1.0-S	0.5-1.0	NA	NA	450 J	< 740	< 740	ND1
030740-03	8/12/96	CCTA-11-GR-026-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	190 J	NA
030741- 02, 03, 05	8/12/96	CCTA-11-GR-027-0.5-1.0-S	0.5-1.0	< 5.0	< 5.0	< 330	< 330	< 330	ND
030742-03	8/12/96	CCTA-11-GR-028-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030743-03	8/12/96	CCTA-11-GR-029-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030744-03	8/12/96	CCTA-11-GR-030-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030745-03	8/12/96	*CCTA-11-GR-030-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030746-03	8/12/96	CCTA-11-GR-031-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030747-02, 03,05	8/12/96	CCTA-11-GR-032-0.5-1.0-S	0.5-1.0	1.8 J B	< 5.0	< 330	< 330	< 330	ND
030748-03	8/12/96	CCTA-11-GR-033-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030749-03	8/12/96	CCTA-11-GR-034-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030751-03	8/13/96	CCTA-11-GR-035-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030752-03	8/13/96	*CCTA-11-GR-035-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	NA	< 330	< 330	< 330	NA

Table 3-3 (Concluded)
Summary of Site 11 Soil Sampling Off-Site Laboratory Analytical Results; Volatile Organic Compounds, Semivolatile Organic Compounds, and High Explosives

Sample Attributes				Volatile Organic Compounds (EPA 8260) (ug/kg)		Semivolatile Organic Compounds (EPA 8270) (ug/kg)			High Explosives (EPA 8330) (ug/g)
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)	Methylene Chloride	Trichloroethene	Di-n-butyl-phthalate	bis(2-Ethylhexyl) phthalate	Di-n-octyl Phthalate	
030753-03	8/13/96	CCTA-11-GR-036-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030754-03	8/13/96	CCTA-11-GR-037-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030755-03	8/13/96	CCTA-11-GR-038-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	ND
030756-02, 03, 05	8/13/96	CCTA-11-GR-039-0.5-1.0-S	0.5-1.0	< 5.0	< 5.0	< 330	< 330	< 330	NA
030757-03	8/13/96	*CCTA-11-GR-039-0.5-1.0-SD (Sample Duplicate)*	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030758-03	8/13/96	CCTA-11-GR-040-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030759-03	8/13/96	CCTA-11-GR-041-0.5-1.0-S	0.5-1.0	NA	NA	< 330	< 330	< 330	NA
030760-02, 03, 05	8/13/96	CCTA-11-GR-042-0.5-1.0-S	0.5-1.0	< 5.0	< 5.0	< 330	< 330	< 330	ND
031404-003	9/4/96	CCTA-11-GR-039-0.5-1.0-S	0.5-1.0	< 5.0	< 5.0	NA	NA	NA	NA
Quality Assurance/Quality Control Samples (all in ug/L)									
029230-05	5/20/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	NA	NA	< 10	< 10	< 10	NA
029676-05	5/21/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	NA	NA	< 10	< 10	< 10	NA
030750-03, 06	8/12/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	3.0	1.6	< 11	0.52 J	< 11	NA
030761-02, 03, 05	8/13/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 1.0	< 1.0	< 9.6	< 9.6	< 9.6	ND
030761-06	8/13/96	CCTA-11-000-TB (Aqueous trip blank)	N/A	< 1.0	< 1.0	NA	NA	NA	NA
031408-003	9/4/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 1.0	< 1.0	NA	NA	NA	NA
031408-004	9/4/96	CCTA-11-000-TB (Aqueous trip blank)	N/A	< 1.0	< 1.0	NA	NA	NA	NA

J = Analyte detected above highest calibration standard or below the practical quantitation limit, estimated value.

N/A = Not applicable.

NA = Not analyzed.

ND = Analyte not detected above the laboratory method detection limit.

ND1 = Analyte not detected, estimated valued since laboratory outside quality control limits.

ug/kg = Micrograms per kilogram.

ug/L = Micrograms per liter.

No HE compounds were detected in either on-site or off-site soil analyses (Tables 3-2 and 3-3). Some of the off-site laboratory non-detects are qualified as estimated because the analysis was outside QC limits (Table 3-3). No HE compounds were seen in the split sample collected at location -039 by NMED for independent analysis (Section 6.3).

3.2.9.2 RCRA Metals and Beryllium

On-site laboratory analytical results for RCRA metals and beryllium analyses are shown in Table 3-4. Off-site analytical results are shown in Table 3-5.

Silver

Silver was detected in 16 soil samples at concentrations in excess of the NMED Oversight Bureau (NMED-OB) maximum recommended background concentration of <1 mg/kg (Tables 3-4 and 3-5). The highest concentration (15 mg/kg) was detected in the 0 to 0.5 ft sample at location -004 (Figure 1-2), one of the site-specific background sample locations.

Arsenic

Arsenic was detected at concentrations above the method detection limit (MDL) and in excess of the 5.6 mg/kg NMED-OB maximum recommended background concentration in eight soil samples analyzed by the on-site laboratory (Table 3-4). The highest concentration (78 J mg/kg) was detected in the 0 to 0.5 ft sample at location -012, just south of FA-3 (Figure 1-2). All five of the 0 to 0.5 ft samples at the site background sampling locations (-001 to -005) had arsenic concentrations ranging from 27 J to 67 J mg/kg (Table 3-4). The duplicate 0.5 to 1.0 ft sample from location -006 contained 27 J mg/kg arsenic. The off-site laboratory analysis of the 0 to 0.5 ft sample from location -008 detected 5.7 mg/kg of arsenic. This was the only off-site sample that exceed the NMED-OB maximum recommended concentration (Table 3-5).

Barium

Barium was detected at concentrations exceeding the NMED-OB maximum recommended background concentration of 130 mg/kg in 56 out of 75 on-site analyses and 7 of 14 off-site split-sample analyses (Tables 3-4 and 3-5). The highest concentration, 710 mg/kg, was detected in the 0.5 to 1.0 ft sample from location -029, the Phase II sample collected from the depression at the center of Mound 2 (Figure 1-2).

Beryllium

Beryllium was detected at concentrations exceeding the NMED-OB maximum recommended value of 0.65 mg/kg in seven soil samples analyzed on site. Three detections were in the samples collected under the former Mound 1 at locations -026, -027, and -028 (Figure 1-2).

Table 3-4
Summary of Site 11 Soil Sampling On-Site Laboratory Analytical Results; RCRA Metals Plus Beryllium

Sample Attributes				RCRA Metals (EPA 6010/7000) (mg/kg)								
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)	Ag	As	Ba	Be	Cd	Cr	Pb	Se	Hg
029124-01	5/20/96	CCTA-11-GR-001-0-0.5-S	0-0.5	1.8 J	50 J	84	<0.11	<2.1	<5	<3.4	<50	< 0.06
029125-01	5/20/96	CCTA-11-GR-001-0.5-1.0-S	0.5-1.0	<1.7	<26	110	<0.11	<2.1	<5	<3.4	<50	< 0.06
029126-01	5/20/96	CCTA-11-GR-002-0-0.5-S	0-0.5	1.8 J	67 J	77	<0.11	<2.1	<5	<3.4	<50	< 0.06
029127-01	5/20/96	CCTA-11-GR-002-0.5-1.0-S	0.5-1.0	7.8	<26	140	<0.11	<2.1	<5	<3.4	<50	< 0.06
029128-01	5/20/96	CCTA-11-GR-003-0-0.5-S	0-0.5	8.2	27 J	150	<0.11	<2.1	<5	<3.4	59 J	< 0.06
029129-01	5/20/96	CCTA-11-GR-003-0.5-1.0-S	0.5-1.0	7.7	<26	160	<0.11	<2.1	<5	<3.4	<50	< 0.06
029130-01	5/20/96	CCTA-11-GR-004-0-0.5-S	0-0.5	15	46 J	89	<0.11	<2.1	14 J	<3.4	<50	< 0.06
021931-01	5/20/96	CCTA-11-GR-004-0.5-1.0-S	0.5-1.0	<1.7	<26	180	<0.11	<2.1	6.8 J	<3.4	<50	< 0.06
029132-01	5/20/96	CCTA-11-GR-005-0-0.5-S	0-0.5	<1.7	<26	170	<0.11	<2.1	<5	<3.4	<50	< 0.06
029133-01	5/20/96	CCTA-11-GR-005-0.5-1.0-S	0.5-1.0	1.8 J	36 J	95	<0.11	<2.1	<5	<3.4	<50	< 0.06
029134-01	5/20/96	CCTA-11-GR-006-0-0.5-S	0-0.5	2 J	<26	160	<0.11	<2.1	<5	<3.4	<50	< 0.06
029135-01	5/20/96	*CCTA-11-GR-006-0-0.5-SD (Duplicate Sample)*	*0-0.5*	3 J	27 J	150	<0.11	<2.1	<5	<3.4	<50	< 0.06
029516-01	5/20/96	CCTA-11-GR-006-0.5-1.0-S	0.5-1.0	<1.7	<26	340	<0.11	<2.1	<5	<3.4	53 J	< 0.06
029517-01	5/20/96	CCTA-11-GR-007-0-0.5-S	0-0.5	<1.7	<26	190	<0.11	<2.1	5.7 J	6.1 J	<50	< 0.06
029518-01	5/20/96	CCTA-11-GR-007-0.5-1.0-S	0.5-1.0	<1.7	<26	230	<0.11	<2.1	9 J	4.1 J	<50	< 0.06
029519-01	5/20/96	CCTA-11-GR-008-0-0.5-S	0-0.5	<1.7	<26	200	<0.11	<2.1	10 J	<3.4	<50	< 0.06
029520-01	5/20/96	CCTA-11-GR-008-0.5-1.0-S	0.5-1.0	1.9 J	48 J	120	<0.11	<2.1	5.6 J	<3.4	<50	< 0.06
029521-01	5/20/96	CCTA-11-GR-009-0-0.5-S	0-0.5	2.3 J	<26	140	<0.11	<2.1	<5	<3.4	<50	< 0.06
029522-01	5/20/96	CCTA-11-GR-009-0.5-1.0-S	0.5-1.0	<1.7	<26	260	<0.11	<2.1	<5	<3.4	<50	< 0.06
029523-01	5/20/96	CCTA-11-GR-010-0-0.5-S	0-0.5	<1.7	<26	100	<0.11	<2.1	<5	<3.4	<50	< 0.06
029524-01	5/20/96	CCTA-11-GR-010-0.5-1.0-S	0.5-1.0	7.7	<26	180	<0.11	<2.1	<5	<3.4	75 J	< 0.06
029525-01	5/20/96	CCTA-11-GR-011-0-0.5-S	0-0.5	1.8 J	<26	160	<0.11	<2.1	7.1 J	<3.4	<50	< 0.06
029526-01	5/20/96	CCTA-11-GR-011-0.5-1.0-S	0.5-1.0	<1.7	<26	170	<0.11	<2.1	5.1 J	<3.4	<50	< 0.06
029527-01	5/20/96	CCTA-11-GR-012-0-0.5-S	0-0.5	2.2 J	78 J	80	<0.11	<2.1	<5	<3.4	<50	< 0.06
029528-01	5/20/96	CCTA-11-GR-012-0.5-1.0-S	0.5-1.0	1.7 J	<26	100	<0.11	<2.1	<5	<3.4	<50	< 0.06
029529-01	5/20/96	*CCTA-11-GR-012-0.5-1.0-SD (Duplicate Sample)*	*0.5-1.0*	7.6	<26	120	<0.11	<2.1	<5	<3.4	<50	< 0.06
029531-01	5/21/96	CCTA-11-GR-013-0-0.5-S	0-0.5	<1.7	<26	180	<0.11	<2.1	8 J	3.7 J	<50	< 0.06
029532-01	5/21/96	CCTA-11-GR-013-0.5-1.0-S	0.5-1.0	<1.7	<26	190	<0.11	<2.1	5.9 J	<3.4	<50	< 0.06
029533-01	5/21/96	CCTA-11-GR-014-0-0.5-S	0-0.5	<1.7	<26	170	<0.11	<2.1	5.1 J	<3.4	<50	< 0.06
029534-01	5/21/96	CCTA-11-GR-014-0.5-1.0-S	0.5-1.0	<1.7	<26	190	<0.11	<2.1	8.3 J	4.5 J	<50	< 0.06
029535-01	5/21/96	CCTA-11-GR-015-0-0.5-S	0-0.5	<1.7	<26	240	<0.11	<2.1	10 J	5.9 J	<50	< 0.06
Central Coyote Test Area Maximum Background Concentration (mg/kg)			N/A	<1	5.6	130	0.65	<1	17.3	21.4	<1	<0.25

Table 3-4 (Continued)
Summary of Site 11 Soil Sampling On-Site Laboratory Analytical Results; RCRA Metals Plus Beryllium

Sample Attributes				RCRA Metals (EPA 6010/7000) (mg/kg)								
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)	Ag	As	Ba	Be	Cd	Cr	Pb	Se	Hg
029536-01	5/21/96	CCTA-11-GR-015-0.5-1.0-S	0.5-1.0	<1.7	<26	230	<0.11	<2.1	8.8 J	3.4 J	<50	< 0.06
029537-01	5/21/96	CCTA-11-GR-016-0-0.5-S	0-0.5	<1.7	<26	200	<0.11	<2.1	6.3 J	3.4 J	<50	< 0.06
029538-01	5/21/96	CCTA-11-GR-016-0.5-1.0-S	0.5-1.0	<1.7	<26	180	<0.11	<2.1	6.5 J	<3.4	<50	< 0.06
029539-01	5/21/96	CCTA-11-GR-017-0-0.5-S	0-0.5	<1.7	<26	290	<0.11	<2.1	10 J	9.6 J	<50	< 0.06
029540-01	5/21/96	*CCTA-11-GR-017-0-0.5-SD (Duplicate Sample)*	0-0.5	<1.7	<26	280	<0.11	<2.1	9.3 J	12 J	<50	< 0.06
029541-01	5/21/96	CCTA-11-GR-017-0.5-1.0-S	0.5-1.0	<1.7	<26	180	<0.11	<2.1	<5	<3.4	<50	< 0.06
029542-01	5/21/96	CCTA-11-GR-018-0-0.5-S	0-0.5	<1.7	<26	190	<0.11	<2.1	7.7 J	<3.4	<50	< 0.06
029543-01	5/21/96	CCTA-11-GR-018-0.5-1.0-S	0.5-1.0	<1.7	<26	180	<0.11	<2.1	5.9 J	5.9 J	<50	< 0.06
029544-01	5/21/96	*CCTA-11-GR-018-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	<1.7	<26	190	<0.11	<2.1	5 J	<3.4	<50	< 0.06
029545-01	5/21/96	CCTA-11-GR-019-0-0.5-S	0-0.5	<1.7	<26	170	<0.11	<2.1	7.9 J	4.4 J	<50	< 0.06
029546-01	5/21/96	CCTA-11-GR-019-0.5-1.0-S	0.5-1.0	<1.7	<26	180	<0.11	<2.1	7.1 J	7.3 J	<50	< 0.06
029663-01	5/21/96	CCTA-11-GR-020-0-0.5-S	0-0.5	<1.7	<26	170	<0.11	<2.1	7.4 J	<3.4	<50	< 0.06
029664-01	5/21/96	CCTA-11-GR-020-0.5-1.0-S	0.5-1.0	<1.7	<26	170	<0.11	<2.1	7.5 J	<3.4	<50	< 0.06
029665-01	5/21/96	CCTA-11-GR-021-0-0.5-S	0-0.5	<1.7	<26	160	<0.11	<2.1	<5	6.9 J	<50	< 0.06
029666-01	5/21/96	CCTA-11-GR-021-0.5-1.0-S	0.5-1.0	<1.7	<26	180	<0.11	<2.1	<5	<3.4	<50	< 0.06
029667-01	5/21/96	CCTA-11-GR-022-0-0.5-S	0-0.5	7.7	<26	160	<0.11	<2.1	<5	<3.4	<50	< 0.06
029668-01	5/21/96	CCTA-11-GR-022-0.5-1.0-S	0.5-1.0	<1.7	<26	220	<0.11	<2.1	<5	<3.4	<50	< 0.06
029669-01	5/21/96	CCTA-11-GR-023-0-0.5-S	0-0.5	<1.7	<26	220	<0.11	<2.1	<5	<3.4	<50	< 0.06
029670-01	5/21/96	CCTA-11-GR-023-0.5-1.0-S	0.5-1.0	<1.7	<26	240	<0.11	<2.1	<5	<3.4	<50	< 0.06
029671-01	5/21/96	CCTA-11-GR-024-0-0.5-S	0-0.5	<1.7	<26	260	<0.11	<2.1	<5	<3.4	<50	< 0.06
029672-01	5/21/96	CCTA-11-GR-024-0.5-1.0-S	0.5-1.0	<1.7	<26	300	<0.11	<2.1	<5	<3.4	<50	< 0.06
029673-01	5/21/96	*CCTA-11-GR-024-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	<1.7	<26	300	<0.11	<2.1	<5	<3.4	<50	< 0.06
029674-01	5/21/96	CCTA-11-GR-025-0-0.5-S	0-0.5	<1.7	<26	280	<0.11	<2.1	9 J	11 J	<50	< 0.06
029675-01	5/21/96	CCTA-11-GR-025-0.5-1.0-S	0.5-1.0	<1.7	<26	270	<0.11	<2.1	9.2 J	16	<50	< 0.06
030740-01	8/12/96	CCTA-11-GR-026-0.5-1.0-S	0.5-1.0	<0.66	<4.8	96	1	<1	<1.8	5.3 J	<10	< 0.06 H
030741-01	8/12/96	CCTA-11-GR-027-0.5-1.0-S	0.5-1.0	<0.66	<4.8	180	1.1	<1	<1.8	7.6 J	<10	< 0.06 H
030742-01	8/12/96	CCTA-11-GR-028-0.5-1.0-S	0.5-1.0	<0.66	<4.8	120	1	<1	<1.8	<2.4	<10	< 0.06 H
030743-01	8/12/96	CCTA-11-GR-029-0.5-1.0-S	0.5-1.0	<0.66	<4.8	710	<0.11	<1	8	15	<10	< 0.06 H
Central Coyote Test Area Maximum Background Concentration (mg/kg)			N/A	<1	5.6	130	0.65	<1	17.3	21.4	<1	<0.25

Table 3-4 (Concluded)
Summary of Site 11 Soil Sampling On-Site Laboratory Analytical Results; RCRA Metals Plus Beryllium

Sample Attributes				RCRA Metals (EPA 6010/7000) (mg/kg)								
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft)	Ag	As	Ba	Be	Cd	Cr	Pb	Se	Hg
030744-01	8/12/96	CCTA-11-GR-030-0.5-1.0-S	0.5-1.0	<0.66	<4.8	210	0.8	<1	<1.8	<2.4	<10	< 0.06 H
030745-01	8/12/96	*CCTA-11-GR-030-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	<0.66	<4.8	350	<0.11	<1	9.1	19	<10	< 0.06 H
030746-01	8/12/96	CCTA-11-GR-031-0.5-1.0-S	0.5-1.0	<0.66	<4.8	400	0.9	<1	<1.8	<2.4	<10	< 0.06 H
030747-01	8/12/96	CCTA-11-GR-032-0.5-1.0-S	0.5-1.0	<0.66	<4.8	100	1.3	<1	<1.8	4.8 J	<10	< 0.06 H
030748-01	8/12/96	CCTA-11-GR-033-0.5-1.0-S	0.5-1.0	<0.66	<4.8	110	1.2	<1	<1.8	<2.4	<10	< 0.06 H
030749-01	8/12/96	CCTA-11-GR-034-0.5-1.0-S	0.5-1.0	<0.66	<4.8	240	<0.11	<1	12	14	<10	< 0.06 H
030751-01	8/13/96	CCTA-11-GR-035-0.5-1.0-S	0.5-1.0	<0.66	<4.8	130	<0.11	<1	12	7.9 J	<10	< 0.06 H
030752-01	8/13/96	*CCTA-11-GR-035-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	<0.66	<4.8	190	<0.11	<1	13	20	<10	< 0.06 H
030753-01	8/13/96	CCTA-11-GR-036-0.5-1.0-S	0.5-1.0	<0.66	<4.8	140	<0.11	<1	14	25	<10	< 0.06 H
030754-01	8/13/96	CCTA-11-GR-037-0.5-1.0-S	0.5-1.0	<0.66	<4.8	76	<0.11	<1	7.3	12	<10	< 0.06 H
030755-01	8/13/96	CCTA-11-GR-038-0.5-1.0-S	0.5-1.0	<0.66	<4.8	100	<0.11	<1	11	15	<10	< 0.06 H
030756-01	8/13/96	CCTA-11-GR-039-0.5-1.0-S	0.5-1.0	<0.66	<4.8	89	<0.11	<1	10	19	<10	< 0.06 H
030757-01	8/13/96	*CCTA-11-GR-039-.5-1.0-SD (Duplicate Sample)*	0.5-1.0	<0.66	<4.8	87	<0.11	<1	8.8	16	<10	< 0.06 H
030758-01	8/13/96	CCTA-11-GR-040-0.5-1.0-S	0.5-1.0	<0.66	<4.8	140	<0.11	<1	11	9 J	<10	< 0.06 H
030759-01	8/13/96	CCTA-11-GR-041-0.5-1.0-S	0.5-1.0	<0.66	<4.8	370	<0.11	<1	6.6 J	14	<10	< 0.06 H
030760-01	8/13/96	CCTA-11-GR-042-0.5-1.0-S	0.5-1.0	<0.66	<4.8	93	<0.11	<1	10	19	<10	< 0.06 H
Central Coyote Test Area Maximum Background Concentration (mg/kg)			N/A	<1	5.6	130	0.65	<1	17.3	21.4	<1	<0.25
Quality Assurance/Quality Control Samples (all in mg/L)												
029530-01	5/20/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	< 0.017	< 0.26	NA	< 0.0011	< 0.021	<0.05	< 0.034	<0.5	< 0.0002
029676-01	5/21/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	< 0.017	< 0.26	< 0.1	< 0.0011	< 0.021	<0.05	< 0.034	<0.5	< 0.0002
030750-01	8/12/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 0.005	< 0.012	< 0.022	< 0.001	<0.009	< 0.016	< 0.019	< 0.088	< 0.0002 H
030761-01	8/13/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	< 0.005	< 0.012	< 0.022	< 0.001	<0.009	< 0.016	< 0.019	< 0.088	< 0.0002 H

H = Holding time for anlayte exceeded, estimated value.
J = Analyte detected between the practical quantitation limit, estimated value.
N/A = Not applicable.
NA = Not analyzed.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

Table 3-5
Summary of Site 11 Soil Sampling Off-Site Laboratory Analytical Results; RCRA Metals Plus Beryllium

Sample Attributes				RCRA Metals (EPA 6010/7000) (mg/kg)								
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	Ag	As	Ba	Be	Cd	Cr	Pb	Se	Hg
029128-03	5/20/96	CCTA-11-GR-003-0-0.5-SS	0.0-0.5	<0.21	4.3	143	0.72 J	0.39 J	13.5	12.5	1.0 J	<0.10
029133-03	5/20/96	CCTA-11-GR-005-0-0.5-SS	0.0-0.5	<0.21	4.0	122	0.49 J	0.29 J	10.3	8.0	<0.62	<0.10
029519-05	5/20/96	CCTA-11-GR-008-0-0.5-SS	0.0-0.5	<0.20	5.7	142	0.89 J	0.26 J	15.6	12.3	1.2	<0.10
029524-05	5/20/96	CCTA-11-GR-010-0.5-1.0-S	0.5-1.0	<0.20	1.7 J	145	<0.20	<0.20	1.3 J	4.6	0.72 J	<0.10
029531-05	5/21/96	CCTA-11-GR-013-0-0.5-SS	0.0-0.5	<0.20	3.7	118	0.52 J	0.29 J	10.8	9.0	0.69 J	<0.10
029536-05	5/21/96	CCTA-11-GR-015-0.5-1.0-S	0.5-1.0	<0.21	3.4	178	0.47 J	0.77 J	9.4	9.4	0.90 J	<0.10
029542-05	5/21/96	CCTA-11-GR-018-0-0.5-SS	0.0-0.5	<0.20	4.9	127	0.59 J	0.43 J	11.6	10.3	<0.61	<0.10
029664-05	5/21/96	CCTA-11-GR-020-0.5-1.0-S	0.5-1.0	<0.20	3.5	95	0.41 J	0.34 J	8.9	6.7	<0.59	<0.10
029669-05	5/21/96	CCTA-11-GR-023-0-0.5-SS	0.0-0.5	<0.20	4.3	161	0.39 J	0.49 J	8.1	10.3	<0.59	<0.10
029675-05	5/21/96	CCTA-11-GR-025-0.5-1.0-S	0.5-1.0	<0.22	5.4	284	0.70 J	1.5	13.7	19.4	0.65 J	<0.11
030741-01	8/12/96	CCTA-11-GR-027-0.5-1.0-S	0.5-1.0	<1.0	3.4	191	0.35	<0.50	6.3 J1	5.9	<0.50 J1	<0.033
030747-01	8/12/96	CCTA-11-GR-032-0.5-1.0-S	0.5-1.0	<1.0	4.9	125	0.66	<0.50	11.8 J1	9.1	<0.50 J1	0.017 J
030756-01	8/13/96	CCTA-11-GR-039-0.5-1.0-S	0.5-1.0	<1.0	3.2	100	0.39	<0.50	9.2	7.1	<0.50	<0.033
030760-01	8/13/96	CCTA-11-GR-042-0.5-1.0-S	0.5-1.0	<1.0	3.4	110	0.45	<0.50	8.2	6.3	<0.50	<0.033
Central Coyote Test Area Maximum Background Concentration (mg/kg)			N/A	<1	5.6	130	0.65	<1	17.3	21.4	<1	<0.25
Quality Assurance/Quality Control Sample (all in mg/L)												
030750-01	8/12/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 0.010	< 0.010	< 0.0.10	< 0.002	< 0.005	< 0.010	0.0038	< 0.005	< 0.0002

J = Analyte detected below the practical quantitation limit, estimated value.

J1 = Laboratory outside quality control limits, estimated value.

N/A = Not applicable.

mg/kg = Milligrams per kilogram.

mg/L - Milligrams per liter.

Two samples collected under the former Mound 2 (-030, -031) and two samples under former Mound 3 (-032, -033) also contained beryllium concentrations over the recommended background value (Table 3-4). The highest beryllium concentration detected, 1.3 mg/kg, was in the sample from location -032. However, the off-site analysis of a split sample from location -032 only detected 0.66 mg/kg (Table 3-5). Elevated beryllium concentrations were reported for 4 of the 14 off-site split samples (Table 3-5).

Cadmium

No cadmium was detected in soil samples analyzed at the on-site laboratory (Table 3-4). However, the MDL was above the NMED-OB maximum recommended background value (<1 mg/kg) for the Phase I samples (locations -001 through -025). Cadmium was detected in 7 of the 14 samples analyzed by off-site laboratories (Table 3-5). Only the 1.5 mg/kg concentration in the sample at location -025 collected in the central depression of Mound 2 exceeded the NMED-OB maximum recommended value.

Chromium (total)

All chromium concentrations reported from both on-site and off-site analyses were below the NMED-OB maximum recommended background value of 17.3 mg/kg (Tables 3-4 and 3-5).

Lead

Except for a 25 mg/kg concentration reported for the on-site analysis of the sample from location -036 (Figure 1-2), all lead concentrations were below the NMED-OB maximum suggested background concentration of 21.4 mg/kg (Tables 3-4 and 3-5).

Selenium

Selenium was detected in three samples analyzed at the on-site laboratory at concentrations exceeding the NMED-OB maximum suggested background value of <1 mg/kg. A 59 J mg/kg selenium detection was reported for the 0 to 0.5 ft sample from location -003, a site-specific background location (Figure 1-2). Samples from locations -006 and -010 at FA-3 contained 53 J and 75 J mg/kg selenium respectively (Table 3-4). Off-site analytical results reported 1.0 J mg/kg for a split of the -003 location sample and 1.2 mg/kg for the 0 to 0.5 ft sample from location -008 (Table 3-5).

Mercury

Mercury (0.017 J mg/kg) was only detected in the off-site split sample from location -032. This concentration is below the NMED-OB maximum recommended background concentration of 0.25 mg/kg. The on-site non-detect reported for this sample analysis is qualified because the sample holding time was exceeded (Table 3-4).

3.2.9.3 Radionuclides

On-site laboratory analytical results for gamma spectroscopy analyses are shown in Table 3-6. Off-site analytical results for isotopic uranium and isotopic thorium analyses are shown in Table 3-7.

The anticipated radiologic contaminant of concern at ER Site 11 was depleted uranium (U-238). No U-238 concentrations or daughter product (Th-234) concentrations above Southwest Area Group background values were detected in these soil samples (Table 3-6). No elevated beta-gamma readings were observed using a Geiger-Mueller detector with a pancake probe to field screen samples, equipment, or personnel during field activities.

The minimum detectable activity for U-235 analyses was greater than the SNL/NM 95th percentile concentration of 0.16 picocuries per gram (pCi/g) (IT Corporation 1996) (for some analyses), but the absence of the U-238 above background, which would contain trace amounts of U-235, indicates that there are no elevated U-235 concentrations in these samples. The detected concentrations for Th-234, Th-232, radium-228, and cesium-137 were all below their respective SNL/NM 95th percentile concentration values (Table 3-6).

Off-site isotopic uranium and thorium analyses showed slightly elevated concentrations in sample CCTA-11-GR-027-05-1.0 (Table 3-7). The U-238 concentration (1.48 pCi/g) is slightly above the 1.4 pCi/g SNL/NM 95th percentile for the Southwest Area Group, but is within the 0.153 to 2.6 pCi/g range for the Canyons Area Background Group just to the east (IT Corporation 1996). The U-233/234 (2.64 pCi/g) and U-235/236 (0.62 pCi/g) concentrations are also slightly elevated for this sample (Table 3-7) but are within the ranges provided for the Canyons Background Study (IT Corporation 1996) and are not considered indicative of radiological contamination.

3.2.10 Site-Specific Background Sampling

Soil samples were collected and analyzed from locations -001 through -005 (Figure 1-2) to collect site-specific concentration data for RCRA metals and radionuclides. These locations were assumed to be away from any known sources of contamination or human activity.

The analytical results for silver, arsenic, barium, and selenium (Tables 3-4 and 3-5) indicate the area around ER Site 11 may have naturally-occurring elevated concentrations of RCRA metals. Gamma spectroscopy and isotopic analyses do not indicate the presence of radiological contamination (Tables 3-6 and 3-7).

3.2.11 Quality Assurance/Quality Control Results

Equipment rinsate blanks were collected every day prior to Phase I and II sampling to evaluate the effectiveness of the decontamination process. When VOC samples were being collected, a trip blank was included in every sample shipment. Except for a detection of methylene chloride

Table 3-6
Summary of Site 11 Soil Sampling On-Site Laboratory Analytical Results; Gamma Spectroscopy

Sample Attributes				Gamma Spectroscopy (pCi/mL)					
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	U-238	U-235	Th-234	Th-232	Ra-226	Cs-137
029124-07	5/20/96	CCTA-11-GR-001-0-0.5-S	0.0-0.5	< 1.04	< 0.157	0.742 +/- 0.285	0.603 +/- 0.325	0.714 +/- 0.244	< 0.0376
029125-07	5/20/96	CCTA-11-GR-001-0.5-1.0-S	0.5-1.0	< 0.911	< 0.117	< 0.333	0.642 +/- 0.308	0.669 +/- 0.158	0.0421 +/- 0.0154
029126-07	5/20/96	CCTA-11-GR-002-0-0.5-S	0.0-0.5	< 0.796	< 0.100	< 0.280	0.595 +/- 0.341	0.710 +/- 0.318	0.0827 +/- 0.0631
029127-07	5/20/96	CCTA-11-GR-002-0.5-1.0-S	0.5-1.0	1.21 +/- 1.28	< 0.152	0.931 +/- 0.331	0.684 +/- 0.357	0.628 +/- 0.204	0.0929 +/- 0.0313
029128-07	5/20/96	CCTA-11-GR-003-0-0.5-S	0.0-0.5	< 3.08	< 0.215	1.19 +/- 0.542	0.789 +/- 0.654	0.736 +/- 0.221	0.219 +/- 0.0479
029129-07	5/20/96	CCTA-11-GR-003-0.5-1.0-S	0.5-1.0	< 1.28	< 0.182	0.839 +/- 0.316	0.746 +/- 0.382	0.786 +/- 0.257	0.0804 +/- 0.0409
029130-07	5/20/96	CCTA-11-GR-004-0-0.5-S	0.0-0.5	< 1.10	< 0.167	1.11 +/- 0.301	0.782 +/- 0.399	0.600 +/- 0.258	0.184 +/- 0.0535
029131-07	5/20/96	CCTA-11-GR-004-0.5-1.0-S	0.5-1.0	< 1.19	< 0.174	1.21 +/- 0.341	0.822 +/- 0.427	0.786 +/- 1.30	< 0.0274
029132-07	5/20/96	CCTA-11-GR-005-0-0.5-S	0.0-0.5	< 1.12	< 0.171	0.881 +/- 0.296	0.776 +/- 0.411	< 0.151	0.197 +/- 0.0516
029133-07	5/20/96	CCTA-11-GR-005-0.5-1.0-S	0.5-1.0	< 3.11	0.0232 +/- 0.0208	1.03 +/- 0.355	0.576 +/- 0.284	0.709 +/- 0.254	0.0420 +/- 0.0220
029519-07	5/20/96	CCTA-11-GR-008-0-0.5-S	0.0-0.5	< 3.44	< 0.234	1.21 +/- 0.386	0.979 +/- 0.456	0.949 +/- 0.370	< 0.0366
029524-07	5/20/96	CCTA-11-GR-010-0.5-1.0-S	0.5-1.0	< 2.46	< 0.177	0.532 +/- 0.392	0.401 +/- 0.205	0.497 +/- 0.179	0.0883 +/- 0.0186
029531-07	5/21/96	CCTA-11-GR-013-0-0.5-S	0.0-0.5	< 1.11	< 0.163	0.974 +/- 0.326	0.750 +/- 0.399	0.668 +/- 0.256	0.0843 +/- 0.0414
029536-07	5/21/96	CCTA-11-GR-015-0.5-1.0-S	0.5-1.0	< 0.804	< 0.103	< 0.302	0.612 +/- 0.290	0.630 +/- 0.212	0.155 +/- 0.0309
029542-07	5/21/96	CCTA-11-GR-018-0-0.5-S	0.0-0.5	< 1.16	0.114 +/- 0.119	0.862 +/- 0.277	0.806 +/- 0.426	0.747 +/- 0.716	0.0758 +/- 0.0601
029664-07	5/21/96	CCTA-11-GR-020-0.5-1.0-S	0.5-1.0	< 0.843	< 0.103	< 0.300	0.665 +/- 0.306	0.672 +/- 0.154	0.0329 +/- 0.00827
029669-07	5/21/96	CCTA-11-GR-020-0-0.5-S	0.0-0.5	< 1.01	< 0.148	0.459 +/- 0.263	0.613 +/- 0.320	0.418 +/- 0.166	0.290 +/- 0.0891
029675-07	5/21/96	CCTA-11-GR-025-0.5-1.0-S	0.5-1.0	< 1.04	< 0.128	0.301 +/- 0.277	0.845 +/- 0.392	0.798 +/- 0.281	0.309 +/- 0.0495
030741-04	8/12/96	CCTA-11-GR-027-0.5-1.0-S	0.5-1.0	< 1.24	< 0.170	0.575 +/- 0.317	0.521 +/- 0.306	0.513 +/- 0.186	< 0.0354
030746-04	8/12/96	CCTA-11-GR-031-0.5-1.0-S	0.5-1.0	< 1.31	< 0.170	0.618 +/- 0.369	< 0.129	0.454 +/- 0.552	< 0.0333
030751-04	8/13/96	CCTA-11-GR-035-05.1.0-S	0.5-1.0	< 1.28	0.0763 +/- 0.0712	0.957 +/- 0.374	0.790 +/- 1.01	0.765 +/- 0.284	< 0.0356
030754-04	8/13/96	CCTA-11-GR-037-0.5-1.0-S	0.5-1.0	< 1.31	< 0.171	0.553 +/- 0.320	0.651 +/- 0.350	< 0.162	< 0.0337
031406-002	9/4/96	CCTA-11-GR-041-0.5-1.0-S	0.5-1.0	0.739 +/- 0.678	< 0.161	0.674 +/- 0.326	0.599 +/- 0.316	0.694 +/- 1.05	< 0.0305
030760-04	8/13/96	CCTA-11-GR-042-0.5-1.0-S	0.5-1.0	< 1.16	< 0.160	0.833 +/- 0.325	< 0.134	0.574 +/- 0.209	< 0.0318
SNL/NM 95th Percentile Upper Tolerance Limit (pCi/g)[1]			N/A	1.4	0.16	1.4	1.01	1.01	0.664

Table 3-6 (Concluded)
Summary of Site 11 Soil Sampling On-Site Laboratory Analytical Results; Gamma Spectroscopy

Sample Attributes				Gamma Spectroscopy (pCi/mL)					
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	U-238	U-235	Th-234	Th-232	Ra-226	Cs-137
Quality Assurance/Quality Control Samples (all in pCi/mL)									
029530-07	5/20/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	< 0.541	< 0.101	< 0.200	< 0.130	< 0.143	< 0.0259
029776-07	5/21/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	< 0.499	< 0.0977	< 0.227	< 0.114	< 0.156	< 0.0237
030750-04	8/12/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 0.738	< 0.118	< 0.307	< 0.152	< 0.137	<0.0278
030761-04	8/13/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 0.738	< 0.120	< 0.300	< 0.144	< 0.134	< 0.0238
031408-002	9/4/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 0.880	< 0.140	< 0.342	< 0.157	< 0.160	< 0.0291

N/A = Not applicable.

pCi/g = Picocuries per gram.

pCi/mL = Picocuries per milliliter.

Table 3-7
Summary of Site 11 Soil Sampling Off-Site Laboratory Analytical Results; Isotopic Uranium and Thorium

Sample Attributes				Isotopic Uranium and Thorium (pCi/g)					
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	Th-228	Th-230	Th-232	U-233/234	U-235/236	U-238
029124-06	5/20/96	CCTA-11-GR-001-0-0.5-S	0.0-0.5	0.904 +/- 0.097	0.762 +/- 0.082	0.833 +/- 0.087	0.607 +/- 0.098	0.041 +/- 0.026	0.654 +/- 0.10
029125-06	5/20/96	CCTA-11-GR-001-0.5-1.0-S	0.5-1.0	1.31 +/- 0.12	0.773 +/- 0.083	0.845 +/- 0.088	0.73 +/- 0.12	0.098 +/- 0.041	0.72 +/- 0.12
029126-06	5/20/96	CCTA-11-GR-002-0-0.5-S	0.0-0.5	1.18 +/- 0.16	0.90 +/- 0.13	1.04 +/- 0.14	0.69 +/- 0.11	0.064 +/- 0.032	0.75 +/- 0.11
029127-06	5/20/96	CCTA-11-GR-002-0.5-1.0-S	0.5-1.0	1.055 +/- 0.10	0.797 +/- 0.084	1.121 +/- 0.10	0.69 +/- 0.11	0.077 +/- 0.037	0.76 +/- 0.12
029128-06	5/20/96	CCTA-11-GR-003-0-0.5-S	0.0-0.5	1.12 +/- 0.16	0.85 +/- 0.12	0.99 +/- 0.14	0.479 +/- 0.093 F	0.063 +/- 0.033 F	0.68 +/- 0.11 F
029129-06	5/20/96	CCTA-11-GR-003-0.5-1.0-S	0.5-1.0	1.12 +/- 0.15	0.94 +/- 0.13	1.04 +/- 0.14	0.70 +/- 0.11	0.080 +/- 0.034	0.71 +/- 0.11
029130-06	5/20/96	CCTA-11-GR-004-0-0.5-S	0.0-0.5	1.03 +/- 0.13	0.83 +/- 0.11	0.94 +/- 0.12	0.62 +/- 0.11	0.072 +/- 0.036	0.611 +/- 0.10
029131-06	5/20/96	CCTA-11-GR-004-0.5-1.0-S	0.5-1.0	1.13 +/- 0.16	0.88 +/- 0.13	0.94 +/- 0.13	0.60 +/- 0.11	0.036 +/- 0.027	0.64 +/- 0.11
029132-06	5/20/96	CCTA-11-GR-005-0-0.5-S	0.0-0.5	1.01 +/- 0.11	0.892 +/- 0.094	0.997 +/- 0.10	0.69 +/- 0.11	0.056 +/- 0.030	0.574 +/- 0.099
029133-06	5/20/96	CCTA-11-GR-005-0.5-1.0-S	0.5-1.0	0.996 +/- 0.10	0.699 +/- 0.081	0.850 +/- 0.090	0.610 +/- 0.099 F	0.053 +/- 0.030 F	0.626 +/- 0.10 F
030741-07	8/12/96	CCTA-11-GR-027-0.5-1.0-S	0.5-1.0	NA	NA	NA	2.64 +/- 0.83	0.62 +/- 0.35	1.48 +/- 0.55
030746-07	8/12/96	CCTA-11-GR-031-0.5-1.0-S	0.5-1.0	NA	NA	NA	0.91 +/- 0.42	< 0.19	0.92 +/-0.42
030747-07	8/12/96	CCTA-11-GR-032-0.5-1.0-S	0.5-1.0	NA	NA	NA	0.91 +/- 0.45	< 0.22	0.88 +/- 0.44
030751-007	8/13/96	CCTA-11-GR-035-0.5-1.0-S	0.5-1.0	NA	NA	NA	0.80 +/- 0.39	< 0.34	0.70 +/- 0.37
030752-007	8/13/96	*CCTA-11-GR-035-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	NA	NA	0.49 +/- 0.33	< 0.48	0.65 +/- 0.38
030756-007	8/13/96	CCTA-11-GR-039-0.5-1.0-S	0.5-1.0	NA	NA	NA	0.64 +/- 0.37	< 0.32	0.66 +/- 0.37
030757-007	8/13/96	*CCTA-11-GR-039-0.5-1.0-SD (Duplicate Sample)*	0.5-1.0	NA	NA	NA	0.86 +/- 0.44	< 0.32	0.76 +/- 0.41
SNL/NM 95th Percentile Upper Tolerance Limit (pCi/g)[1]			N/A	1.01	1.6	1.01	1.6	0.16	1.4
Quality Assurance/Quality Control Samples (all in pCi/L)									
029530-06	5/20/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	< 0.15	0.031 +/- 0.041	0.049 +/- 0.049	0.117 +/- 0.063	0.034 +/- 0.035	0.027 +/- 0.029
030750-07	8/12/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	NA	NA	NA	< 0.061	< 0.075	< 0.0107
030761-007	8/13/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	NA	NA	NA	< 0.126	< 0.088	< 0.109

F = Full width half max exceeded acceptance limits.

N/A = Not applicable.

NA = Not analyzed.

pCi/g = Picocuries per gram.

pCi/L = Picocuries per liter.

[1] IT Corporation 1996.

(3.0 µg/L), trichloroethylene (1.6 µg/L), bis(2-ethylhexyl)phthalate (0.52 J µg/L), and lead (3.8 µg/L) in one equipment blank, no other analytes were detected.

All off-site data underwent a Level III data validation by IT Corporation, Albuquerque, New Mexico. The data were qualified accordingly, and any problems are identified in this report.

3.3 Gaps in Information

The original (pre-RFI/VCM) gaps in information for ER Site 11 included the lack of reliable data on the actual site activities and possible contaminants associated with them. The RFI focused on determining the nature and extent of possible contaminants in, adjacent to, and under the debris mounds. Additionally, samples were collected from the surrounding area to determine site-specific concentrations of metals and radionuclides for comparison. The debris mound soils were characterized during the VCM, and the absence of organic, metals, and radionuclide contamination at the site was determined. Thus, the question of types and distribution of possible contaminants was answered during the RFI and VCM sampling. The VCM report is presented in Section 6.2 of this report.

3.4 Risk Evaluation

ER Site 11 had minor contamination identified in either the RFI or VCM soil samples (Section 6.2) consisting of metals, SVOCs, and one HE compound (hexahydro-1,3,5-trinitro-1,3,5-trazine [RDX]). Because of the location of the site on KAFB, the designated industrial land-use scenario, and the nature of the contamination, the potential exposure pathways identified for this site included soil ingestion, as well as dust inhalation. Plant uptake was included as an exposure pathway for the residential land-use scenario for perspective only. Ecological risk was calculated for three potential receptors; a nonspecific perennial plant, the deer mouse, and the burrowing owl. The results are summarized below, and the detailed assessment parameters and assumptions are presented in Section 6.1.

3.4.1 Human Health Risk Assessment

ER Site 11 has been recommended for industrial land-use (DOE and USAF 1996). A complete discussion of the risk assessment process, results, and uncertainties is provided in Section 6.1. Due to the presence of several metals in concentrations above background levels, SVOCs, and one HE compound (RDX), it was necessary to perform a human health risk assessment for the site. Besides metals, any SVOC and HE compounds detected above their reporting limits and any radionuclide compounds either detected above background levels and/or minimum detectable activities were included in this assessment. The risk assessment process provides a quantitative evaluation of the potential adverse human health effects caused by constituents in the site's soil. The Risk Assessment Report calculated the Hazard Index and excess cancer risk for both an industrial land-use and residential land-use setting.

In summary, the Hazard Index calculated for ER Site 11 nonradiological COCs is 0.3 for the industrial land-use setting, which is less than the numerical standard of 1.0 suggested by risk assessment guidance (EPA 1989). Incremental risk is determined by subtracting risk associated with background from potential nonradiological COC risk. The incremental Hazard Index is 0.25. The excess cancer risk for ER Site 11 nonradiological COCs is $5x10^{-5}$ for an industrial land-use setting which is in the middle of the suggested range of acceptable risk of 10^{-4} to 10^{-6} (EPA 1989). The incremental excess cancer risk for ER Site 11 is $4.7x10^{-5}$.

The residential land-use scenarios for this site are provided only for comparison in the Risk Assessment Report (Section 6.1). The report concludes that ER Site 11 does not have significant potential to affect human health under an industrial land-use scenario.

3.4.2 Ecological Risk Assessment

Potential risks were indicated for three ecological receptors at ER Site 11; however, the use of the maximum measured soil concentration or maximum detection limit to evaluate risk provided a conservative exposure scenario for the risk assessment and may not reflect actual site conditions. Maximum measured soil concentrations for arsenic, barium, selenium, and silver exceeded their respective plant benchmark concentrations. Risk predictions using maximum measured soil concentrations for arsenic, barium, selenium, and RDX revealed potential risk to the deer mouse. Use of the maximum measured soil concentrations resulted in a Hazard Quotient (HQ) greater than 1.0 for the burrowing owl exposed to selenium. HQs based on 95 percent upper confidence limits of the mean would likely be lower and still serve as a conservative estimate of site conditions. When average site concentrations are compared against background concentrations, arsenic, chromium, lead, and silver are not found to be significantly greater than background. In addition, using the average concentration of barium measured in ER Site 11 soils would result in HQs less than unity for the plant and deer mice. Based on this information, ecological risks associated with ER Site 11 are expected to be low.

4.0 RATIONALE FOR NO FURTHER ACTION DECISION

Based on field investigation data and the human health risk assessment analysis, an NFA is being recommended for ER Site 11 for the following reasons:

- No VOCs or radionuclides were detected during the field-screening program.
- No significant VOCs were detected in the collected soil samples. Minor VOC detections by the off-site laboratory are probably the result of laboratory contamination.
- No significant SVOCs were detected in off-site soil analyses. The minor detections by the off-site laboratory are not clearly indicative of a release at ER Site 11.
- No HE compounds were detected in any of the RFI samples.
- Several metals were detected at concentrations exceeding NMED-OB recommended background concentrations. However, high concentrations were also detected in the site-specific background samples and indicate that elevated concentrations may be naturally occurring at ER Site 11.
- There is no indication of radiological contamination.
- A Voluntary Corrective Measure to excavate, characterize, and dispose of potentially hazardous materials and debris in the five mounds was completed in April 1997.
- Risk assessments for human health do not show adverse effects under the future industrial land-use scenario.
- Risk assessment for ecological receptors indicate some potential risk under a conservative scenario, but it is expected to be low.

Based on the evidence provided above, ER Site 11 is proposed for an NFA based on Criterion 5 of the DOU (NMED 1996).

5.0 REFERENCES

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USGS, see U.S. Geological Survey.

6.0 ANNEXES

6.1 Risk Assessment Report

6.2 ER Site 11 VCM Report

6.3 NMED Split Sample Analytical Results

Section 6.1
Risk Assessment Report

ER SITE 11: RISK ASSESSMENT ANALYSIS

I. Site Description and History

Sandia National Laboratories/New Mexico (SNL/NM) Environmental Restoration (ER) Site 11 is located on the north side of Isleta Road, approximately 800 feet east of the intersection of Lovelace Road and Isleta Road on the southern portion of Kirtland Air Force Base (KAFB). This inactive site was identified as the Radioactive Explosive Burial Mounds in the Hazardous and Solid Waste Amendments Module and consisted of three fenced areas (FA-1, -2, and -3) enclosing a total of five debris mounds and associated surface depressions. Available evidence suggests that the debris mounds were constructed prior to 1947. The fencing was installed around FA-2 and FA-3 sometime after 1951; FA-1 was fenced in 1961. Based on aerial photo interpretation, the site has remained undisturbed since 1967. The site encompasses approximately 1.56 acres enclosed by the three fenced areas.

No historical records have been found to date, but two ER interviews confirmed that unexploded ordnance (UXO) and related debris materials had been disposed of in the mounds. Partially buried artillery shells were visible on the surface of Mound 5 during site visits by ER personnel in 1996.

A Voluntary Corrective Measure (VCM) was performed at ER Site 11 between June and August 1996. All the debris mounds were carefully excavated and field screened for radioactivity and volatile organic compounds (VOC). All ordnance debris was removed and either cleared for waste disposal or for destruction by the KAFB Explosives Ordnance Disposal Unit. All fencing materials and other debris were removed from the site. The remaining soil was sampled, and following SNL/NM waste management approval, was graded back onto the site and the surface was seeded.

II. Human Health Risk Assessment Analysis

Risk assessment of this site includes a number of steps, which culminate in a quantitative evaluation of the potential adverse human health effects caused by constituents present at the site. The steps to be discussed include:

Step 1.	Site data are described that provide information on the potential constituents of concern (COC), as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways by which a representative population might be exposed to the COCs are identified.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The tiered approach includes screening steps, followed by potential intake calculations and a discussion or evaluation of the uncertainty in those calculations. Potential intake calculations are also applied to background screening data.
Step 4.	Data are described on the potential toxicity and cancer effects from exposure to the COCs and associated background constituents and subsequent intake.
Step 5.	Potential toxicity effects (specified as a Hazard Index) and cancer risks are calculated for COCs and background.

Step 6.	These values are compared with guidance established by the U.S. Environmental Protection Agency (EPA) to determine whether further evaluation, and potential site clean-up, is required. COC risk values are also compared to background risk so that an incremental risk may be calculated.
Step 7.	Uncertainties in the previous steps are discussed.

II.1 Step 1. Site Data

Site history and characterization activities are used to identify potential COCs. The identification of COCs and the sampling to determine the concentration levels of those COCs across the site are described in the ER Site 11 No Further Action Proposal. In order to provide conservatism in this risk assessment, the calculation uses only the maximum concentration value of each COC determined for the entire site. Chemicals that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment (EPA 1989). Since site history, field surveys, and soil samples indicated that there were no radioactive COCs at this site, it was not necessary to perform a radiological risk assessment. See Section 3.2.9.3 for further discussion. The only COCs evaluated were metals.

II.2 Step 2. Pathway Identification

ER Site 11 has been designated with an industrial future land-use scenario (DOE and USAF 1996) (see Appendix 1 for default exposure pathways and parameters). Because of the location and the characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion. The inhalation pathway is included because of the potential to inhale dust. No contamination at depth is suspected, and therefore, no pathways to groundwater are considered. Depth to groundwater at ER Site 11 is approximately 90 feet. Because of the lack of surface water or other significant mechanisms for dermal contact, the dermal exposure pathway is considered insignificant. No intake routes through plant, meat, or milk ingestion are considered appropriate for the industrial land-use scenario. However, plant uptake is considered for the residential land-use scenario.

PATHWAY IDENTIFICATION

Chemical Constituents
Soil ingestion
Inhalation (dust)
Plant uptake (residential only)

II.3 Steps 3-5. Calculation of Hazard Indices and Cancer Risks

Steps 3 through 5 are discussed in this section. These steps include the discussion of the tiered approach in eliminating potential COCs from further consideration in the risk assessment process and the calculation of intakes from all identified exposure pathways, the discussion of the toxicity information, and the calculation of the hazard indices and cancer risks.

The risks from the COCs at ER Site 11 were evaluated using a tiered approach. First, the maximum COC concentrations were compared to the SNL/NM background screening concentrations for this area (IT Corporation 1996), as modified during verbal discussions with representatives of New Mexico Environment Department (NMED).

The maximum concentration of each COC was used in order to provide a conservative estimate of the associated risk. If any COC concentrations were above the SNL/NM background screening levels, then all site COCs were considered in further risk assessment analyses.

Second, if any COC failed the initial screening step, the maximum concentration was compared with action levels calculated using methods and equations promulgated in the proposed Resource Conservation and Recovery Act (RCRA) Subpart S (40 CFR Part 264 1990) and Risk Assessment Guidance for Superfund (RAGS) (EPA 1989) documentation. If there were ten or fewer COCs and each had a maximum concentration less than one-tenth of the action level, then the site would be judged to pose no significant health hazard to humans. If there were more than ten COCs, the Subpart S screening procedure was skipped.

Third, hazard indices and risk due to carcinogenic effects were calculated using reasonable maximum exposure (RME) methods and equations promulgated in RAGS (EPA 1989). The combined effects of all COCs in the soils were calculated. The combined effects of the COCs at their respective upper tolerance limit (UTL) or 95th-percentile background concentration in the soil were also calculated. For toxic compounds, the combined effects were calculated by summing the individual hazard quotients for each compound into a total Hazard Index. This Hazard Index is compared to the recommended guideline of 1. For potentially carcinogenic compounds, the individual risks were summed. The total risk was compared to the recommended acceptable risk range of 10^{-4} to 10^{-6}.

II.3.1 Comparison to Background and Action Levels

ER Site 11 COCs are listed in Table 1. The table shows the associated 95th percentile or UTL background levels (IT Corporation 1996), as modified during verbal discussion with representatives of NMED. The SNL/NM background levels have not yet been approved by the EPA or the NMED but are the result of a comprehensive study of joint SNL/NM and U.S. Air Force data from KAFB. The values shown in Table 1 supersede the background values described in an interim background study report (IT Corporation 1994).

Several compounds have maximum measured values greater than background screening levels. Therefore, all COCs, with the exception of lead, were retained for further analysis. The maximum concentration value for lead is 77 milligrams per kilogram (mg/kg). The EPA intentionally does not provide any toxicological data on lead, and therefore no risk parameter values can be calculated. However, EPA guidance for the screening value for lead for an industrial land-use scenario is 2,000 mg/kg (EPA 1996a); for a residential land-use scenario, the EPA screening guidance value is 400 mg/kg (EPA 1994). The 77 mg/kg concentration for lead at this site is less than both of those screening values, and therefore lead is eliminated from further consideration in this risk assessment.

Table 1
COCs at ER Site 11 and Comparison to the Background Concentration Values

COC name	Maximum concentration (mg/kg)	SNL/NM 95th % or UTL Level (mg/kg)	Is maximum COC concentration less than or equal to the applicable SNL/NM background screening value?
Arsenic	78 J	5.6	No
Barium	710	130	No
Beryllium	1.3	0.65	No
Cadmium	1.5	<1^	No
Chromium, total*	18	NC	NA
Lead	77	21.4	No
Mercury	.056	<0.25^	NA
Selenium	75 J	<1^	No
Silver	7.7	<1^	No

* total chromium assumed to be chromium VI (most conservative).
^ - uncertainty due to detection limits.
J - estimated concentration.
NA - not applicable.
NC - not calculated.

Because several COCs had concentrations greater than their respective SNL/NM background 95th percentile or UTL, the site fails the background screening criteria, and all COCs proceed to the proposed Subpart S action level screening procedure. Because the ER Site 11 sample set had more than ten COCs that continued past the first screening level (including organics that did not have background screening concentrations), the proposed Subpart S screening process was skipped. All remaining COCs must have a Hazard Index value and cancer risk value calculated.

II.3.2 Identification of Toxicological Parameters

Table 2 shows the COCs that have been retained in the risk assessment and the values for the toxicological information available for those COCs.

II.3.3 Exposure Assessment and Risk Characterization

Section II.3.3.1 describes the exposure assessment for this risk assessment. Section II.3.3.2 provides the risk characterization, including the Hazard Index value and the excess cancer risk, for both the potential COCs and associated background for industrial and residential land-uses.

Table 2
Toxicological Parameter Values for ER Site 11 COCs

COC name	RfD_o (mg/kg/d)	RfD_{Inh} (mg/kg/d)	Confidence	SF_o (kg-d/mg)	SF_{inh} (kg-d/mg)	Cancer Class ^
Arsenic	0.0003	--	M	1.5	15.1	A
Barium	0.07	0.000143	M	--	--	D
Beryllium	0.005	--	L	4.3	8.4	B2
Cadmium	0.0005	0.0000571	H	--	6.3	B1
Chromium, total*	0.005	--	L	--	42	A
Mercury	0.0003	0.0000857	M	--	--	D
Selenium	0.005	--	H	--	--	D
Silver	0.005	--	L	--	--	D
Methylene Chloride	0.06	0.857	--	0.0075	0.00164	B2
di-n-Butyl phthalate	--	--	--	--	--	--
di-n-Octyl phthalate	0.02	--	--	--	--	--
HMX	0.05	--	--	--	--	--
NG	--	--	--	--	--	--
PETN	--	--	--	--	--	--
RDX	0.003	--	--	0.11	--	--
TNT	0.0005	--	M	0.03	--	C
bis(2-ethylhexyl) phthalate	0.02	--	--	0.014	--	B2

* total chromium assumed to be chromium VI (most conservative)
RfD_o - oral chronic reference dose in mg/kg-day
RfD_{inh} - inhalation chronic reference dose in mg/kg-day
Confidence - L = low, M = medium, H = high
SFo - oral slope factor in $(mg/kg\text{-}day)^{-1}$
SF_{inh} - inhalation slope factor in $(mg/kg\text{-}day)^{-1}$
^ EPA weight-of-evidence classification system for carcinogenicity:

A - human carcinogen
B1 - probable human carcinogen. Limited human data are available
B2 - probable human carcinogen. Indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - possible human carcinogen
D - not classifiable as to human carcinogenicity
E - evidence of noncarcinogenicity for humans

-- information not available

II.3.3.1 Exposure Assessment

Appendix 1 shows the equations and parameter values used in the calculation of intake values and the subsequent Hazard Index and excess cancer risk values for the individual exposure pathways. The appendix shows the parameters for both industrial and residential land-use scenarios. The equations are based upon RAGS (EPA 1989). The parameters are based on information from RAGS as well as other EPA guidance documents and reflect the RME approach advocated by RAGS.

Although the designated land-use scenario is industrial for this site, the risk values for a residential land-use scenario are also presented. These residential risk values are presented only to provide perspective on the potential for risk to human health under the more restrictive land-use scenario.

II.3.3.2 Risk Characterization

Table 3 shows that for the ER Site 11 COCs, the Hazard Index value is 0.3, and the excess cancer risk is 5×10^{-5} for the designated industrial land-use scenario. The numbers presented included exposure from soil ingestion and dust inhalation for the COCs. Table 4 shows that assuming the maximum background concentrations of the ER Site 11 associated background constituents, the Hazard Index is 0.02, and the excess cancer risk is 5×10^{-6} for the designated industrial land-use scenario.

Table 3 shows that for the ER Site 11 COCs, considering the residential land-use scenario, the Hazard Index value is 33, and the excess cancer risk is 9×10^{-4}. The numbers presented included exposure from soil ingestion, dust and volatile inhalation, and plant uptake. Although the EPA (1991) generally recommends that inhalation not be included in a residential land-use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and, subsequently, for dust to be present even in predominantly residential areas. Because of the nature of the local soil, other exposure pathways are not considered (see Appendix 1). Table 4 shows that for the ER Site 11 associated background constituents, the Hazard Index is 0.3, and the excess cancer risk is 7×10^{-5}.

II.4 Step 6. Comparison of Risk Values to Numerical Guidance.

The risk assessment analyses evaluates the potential for adverse health effects for both an industrial land-use scenario, the designated land-use scenario, and a residential land-use scenario.

For the industrial land-use scenario, the calculated Hazard Index calculated for the COCs is 0.3; this is much less than the numerical guideline of 1 suggested in RAGS (EPA 1989). The excess cancer risk is estimated at 5×10^{-5}. In RAGS, the EPA suggests that a range of values (10^{-6} to 10^{-4}) be used as the numerical guideline; the value calculated for this site is in the middle of the suggested acceptable risk range. This risk assessment also determined risks considering background concentrations of the potential COCs for both the industrial and residential land-use scenarios. For the industrial land-use scenario, the Hazard Index is 0.02.

Table 3
Risk Assessment Values for ER Site 11 COCs.

COC Name	Maximum concentration (mg/kg)	Industrial Land-Use Scenario		Residential Land-Use Scenario	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	78 J	0.25	5E-5	4.46	9E-4
Barium	710	0.01	--	0.11	--
Beryllium	1.3	0.00	2E-6	0.00	1E-5
Cadmium	1.5	0.00	6E-10	1.23	8E-10
Chromium, total*	18	0.00	5E-8	0.01	7E-8
Mercury	0.056	0.00	--	0.10	--
Selenium	75 J	0.01	--	26.39	--
Silver	7.7	0.00	--	0.32	--
bis(2-ethylhexyl) phthalate	0.52 J	0.00	3E-9	0.00	1E-8
di-n-Butyl phthalate	0.61 J	--	--	--	--
di-n-Octyl phthalate	0.55	0.00	--	0.00	--
HMX	0.050**	0.00	--	0.00	--
NG	0.015**	--	--	--	--
PETN	0.075**	--	--	--	--
RDX	0.45	0.00	2E-8	0.00	8E-8
TNT	0.038**	0.00	5E-10	0.00	2E-9
TOTAL		**0.3**	**5E-5**	**33**	**9E-4**

* total chromium assumed to be chromium VI (most conservative)
** concentrations are assumed to be one-half of the detection limit
J - estimated concentration
-- information not available

Table 4
Risk Assessment Values for ER Site 11 Background Constituents.

Constituent Name	Background concentration (mg/kg)	Industrial Land- Use Scenario		Residential Land- Use Scenario	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	5.6	0.02	4E-6	0.32	6E-5
Barium	130	0.00	--	0.02	--
Beryllium	0.65	0.00	1E-6	0.00	5E-6
Cadmium	<1	--	--	--	--
Chromium, total*	NC	--	--	--	--
Mercury	<0.25	--	--	--	--
Selenium	<1	--	--	--	--
Silver	<1	--	--	--	--
TOTAL		**0.02**	**5E-6**	**0.3**	**7E-5**

* total chromium assumed to be chromium VI (consistent with Table 3)
NC - not calculated
-- information not available

The excess cancer risk is estimated at 5×10^{-6}. 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 discussed within the text. The incremental Hazard Index is 0.25, and the incremental cancer risk is 4.7×10^{-5} for the industrial land-use scenario. These incremental risk calculations indicate acceptable contribution to human health risk from the COCs considering an industrial land-use scenario.

For the residential land-use scenario, the calculated Hazard Index for the COCs is 33, which is above the numerical guidance. The excess cancer risk is estimated at 9×10^{-4}; this value is above the suggested acceptable risk range. The Hazard Index for associated background for the residential land-use scenario is 0.3. The excess cancer risk is estimated at 7×10^{-5}. For the residential land-use scenario, the incremental Hazard Index is 32.3, and the incremental cancer risk is 8.5×10^{-4}. These incremental risk calculations indicate contributions to human health risk above regulatory guidelines considering a residential land-use scenario.

II.5 Step 7 Uncertainty Discussion

The analytical results from 67 soil samples were used to characterize ER Site 11, Radioactive Explosive Burial Mounds. The samples were collected at 37 locations around and under the five mounds. Samples were also collected a five other locations to provide site-specific background concentration data for metals and radionuclides. The COCs for the site were metals, VOCs, semivolatile organic compounds (SVOC), high explosives (HE), and depleted

uranium. All soil samples were analyzed for the eight RCRA metals and beryllium by EPA Method 6010, with mercury determined by EPA Method 7471. SVOC and HE analyses were performed on all samples, except those from the five background locations. SVOC analyses were by EPA Method 8270. HE analyses were by EPA Method 8330 (off-site laboratory) and by High-Pressure Liquid Chromatography in on-site laboratories. VOC samples, collected only under the burial mounds following their removal under a VCM, were analyzed by EPA Method 8260. Isotopic uranium and thorium samples were collected at the five background locations. At least one isotopic uranium sample was also collected under each former mound location. These analyses were performed off site using alpha-spectroscopy techniques. On-site gamma spectroscopy analyses were performed on 24 soil samples, including 10 from the background locations.

All of these off-site data underwent a Level III data validation by IT Corporation, Albuquerque, New Mexico. Any problems were identified and the data were qualified accordingly. This data are considered definitive and suitable for use in a risk assessment analysis.

Soil samples were collected for both on-site and off-site analysis from the five soil mounds excavated and field-screened during the VCM. Eleven samples and one duplicate were collected and analyzed on site for RCRA metals plus beryllium, VOCs, HE, SVOCs, and radionuclides (gamma spectroscopy) by the same methods described above. Six off-site splits were analyzed for RCRA metals, VOCs, SVOCs, and HE.

The conclusion from the risk assessment analysis is that for the industrial land-use scenario, the potential effects caused by ER Site 11 COCs on human health are within the acceptable range. Calculated incremental risk between the COCs and associated background indicate insignificant risk to human health from the COCs.

The potential effects on human health for the COCs are greater when considering the residential land-use scenario. Incremental risk between ER Site 11 COCs and associated background indicate an increased risk contribution. The increased effects are primarily the result of including the plant uptake exposure pathway. Constituents that pose little to no risk considering an industrial land-use scenario (some of which are below background screening levels) contribute a significant portion of the risk associated with the residential land-use scenario. These constituents bioaccumulate in plants. Because ER Site 11 is designated as an industrial land-use area, the likelihood of significant plant uptake in this area is highly unlikely. The uncertainty in this conclusion is considered to be small.

Because of the location, site history, and the future land-use, there is low uncertainty in the land-use scenario and the potentially affected populations that were considered in making the risk assessment analysis. Because the COCs are found in surface soils and because of the location and physical characteristics of the site, there is little uncertainty in the exposure pathways.

A RME approach was used to calculate the risk assessment values, which means that the parameter values used in the calculations were conservative and that the calculated intakes are likely overestimates. Maximum measured values of the concentrations of the COCs and minimum value of the 95th UTL or percentile background concentration value, as applicable, of

background concentrations associated with the COCs were used to provide conservative results.

Table 2 shows the uncertainties (confidence) in the toxicological parameter values. There is a mixture of estimated values and values from the Health Effects Assessment Summary Tables (HEAST) (EPA 1996b) and Integrated Risk Information System (IRIS) (EPA 1988, 1997b) databases. Where values are not provided, information is not available from HEAST, IRIS, or EPA regions. The constituents without toxicological parameters have low concentrations and are judged to be insignificant contributors to the overall risk. Because of the conservative nature of the RME approach, the uncertainties in the toxicological values are not expected to be of high enough concern to change the conclusion from the risk assessment analysis.

The risk assessment values are within the acceptable range for the industrial land-use scenario when compared to the established numerical guidance. Though the residential land-use Hazard Index and excess cancer risk is greater than the numerical guidelines, it has been determined that future land-use at this locality will not be residential (DOE and USAF 1996). The overall uncertainty in all of the steps in the risk assessment process is considered insignificant with respect to the conclusion reached.

II.6 Summary

ER Site 11, Radioactive Explosive Burial Mounds, had minor contamination consisting of some inorganic constituents. Because of the location of the site on KAFB, the designated industrial land-use scenario, and the nature of the contamination, the potential exposure pathways identified for this site included soil ingestion and dust and volatile inhalation. Plant uptake was included as an exposure pathway for the residential land-use scenario. This site is designated for industrial land use (DOE and USAF 1996); the residential land-use scenario is provided for perspective only.

Using conservative assumptions and employing a RME approach to the risk assessment, the calculations for the COCs show that for the industrial land-use scenario the Hazard Index (0.3) is significantly less than the accepted numerical guidance from the EPA. The estimated cancer risk (5×10^{-5}) is in the middle of the suggested acceptable risk range. The incremental Hazard Index is 0.25, and the incremental cancer risk is 4.7×10^{-5}. Incremental risk calculations indicate insignificant risk to human health from the COCs considering an industrial land-use scenario.

The uncertainties associated with the calculations are considered small relative to the conservativeness of the risk assessment analysis. It is therefore concluded that this site does not have significant potential to affect human health under an industrial land-use scenario.

III. Ecological Risk Assessment

III.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPEC) in soils from SNL/NM ER Site 11. The ecological risk assessment process performed for this site is a screening-level assessment that follows the methodology presented in IT Corporation (1997) and SNL/NM (1997). The methodology was based upon screening level guidance presented by the EPA (EPA, 1992; 1996c; 1997a) and by Wentsel, et al. (1996) and is consistent with a phased approach. This assessment utilizes conservatism in the estimation of ecological risks; however, ecological relevance and professional judgment are also incorporated as recommended by the EPA (1996c) and Wentsel et al., (1996) to ensure that the predicted exposures of selected ecological receptors reasonably reflect those expected to occur at the site.

III.2 Ecological Pathways

Prior to recent remedial activities, ER Site 11 consisted of five mounds of buried debris located about 300 meters (1,000 feet) east of Lovelace Road near ER Site 57A. All five of these mounds were fenced due to the potential hazard of UXO associated with the mounds. This area has not been directly surveyed for sensitive species due to the potential UXO hazards. However, the high degree of soil disturbance associated with the history of these mounds essentially precludes the existence of a sustainable grass/plant community on the mounds themselves. The area of relatively undisturbed grassland around each mound (within 30 meters [100 feet]) was surveyed for sensitive species on June 20, 1994. Results of this survey show that no sensitive species were found in this area, further reducing the possibility of such species being found within the fenced areas (IT Corporation 1995). Complete ecological pathways at this site, if they exist, occur through the exposure of plants and wildlife to COPECs in surface and subsurface soil.

III.3 Constituents of Potential Ecological Concern

The potential COCs at this site include RCRA metals, beryllium, VOC, SVOCs, and HE. Following the screening process used for the selection of potential COCs for the human health risk assessment, the inorganic COCs were screened against background UTL. Eight inorganic analytes were identified as COPECs at ER Site 11: arsenic, barium, beryllium, cadmium, chromium (total), lead, mercury, selenium, and silver. Cadmium was not detected in either surface or subsurface samples; however, the detection limit exceeded the UTLs of the background soil concentrations, and therefore, this analyte was not excluded from the list of COPECs. Chemicals that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment per EPA guidance (EPA 1989). With regard to organics, only RDX, bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, and di-n-octyl phthalate were detected and therefore considered COPECs. Although HE compounds other than RDX were not detected, they were carried through the ecological risk

assessment due to high associated detected limits. No radionuclides were found to be greater than background concentrations.

III.4 Receptors and Exposure Modeling

A nonspecific perennial plant was used as the receptor to represent plant species at the site. Two wildlife receptors (deer mouse and burrowing owl) were used to represent wildlife use of the site. Exposure modeling for the wildlife receptors was limited to the food ingestion pathway. Inhalation and dermal contact were considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water was also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse was modeled as an omnivore (50 percent of its diet is plants and 50 percent is soil invertebrates), and the burrowing owl was modeled as a strict predator on small mammals (100 percent of its diet is deer mice). Both were modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 5 presents the species-specific factors used in modeling exposures in the wildlife receptors. Although home range is also included in this table, exposures for this screening-level assessment were modeled using an area use factor of 1, implying that all food items and soil ingested are from the site being investigated.

The maximum measured COPEC concentrations from soil samples were used to conservatively estimate potential exposures and risks to plants and wildlife at this site. One-half the detection limit from the on-site laboratory was used for cadmium, which was not otherwise detected but was retained due to the high detection limit.

Table 6 presents the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 7 presents the maximum concentrations or one-half the detection limit of COPECs in soil, the derived concentrations in the various food-chain elements, and the modeled dietary exposures for each of wildlife receptor species.

III.5 Toxicity Benchmarks

Benchmark toxicity values for the plant and wildlife receptors are presented in Table 8. For plants, the benchmark soil concentrations are based on the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based on the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Insufficient toxicity information was found to estimate the LOAELs or NOAELs for some COCs for terrestrial plant life and the burrowing owl, respectively (see Table 9 for COC-specific information).

III.6 Risk Characterization

Either the maximum soil concentration or one-half the detection limit (in the case of cadmium) and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. The results of these comparisons are presented in Table 9. Hazard quotients

Table 5
Exposure Factors for Ecological Receptors at
Environmental Restoration Site 11,
Sandia National Laboratories, New Mexico

Receptor species	Class/ Order	Trophic level	Body weight (kg)[a]	Food intake rate (kg/d)[b]	Dietary Composition[c]	Home range (acres)
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Omnivore	0.0239[d]	0.00372	Plants: 50% Invertebrates: 50% (+ Soil at 2% of intake)	0.27[e]
Burrowing owl (*Speotyto cunicularia*)	Aves/ Strigiformes	Carnivore	0.155[f]	0.0173	Rodents: 100% (+ Soil at 2% of intake)	34.6[g]

[a]Body weights are in kilograms wet weight.
[b]Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kilograms dry weight per day.
[c]Dietary compositions are generalized for modeling purposes. Default soil intake value of 2 percent of food intake.
[d]From Silva and Downing (1995).
[e]From EPA (1993), based on the average home range measured in semi-arid shrubland in Idaho.
[f]From Dunning (1993).
[g]From Haug et al. (1993).

Table 6
Transfer Factors Used in Exposure Models for Constituents of Potential Ecological Concern at Environmental Restoration Site 11, Sandia National Laboratories, New Mexico

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Arsenic	4.00×10^{-2} [a]	1.00×10^{0} [b]	2.00×10^{-3} [a]
Barium	1.50×10^{-1} [a]	1.00×10^{0} [b]	2.00×10^{-4} [c]
Beryllium	1.00×10^{-2} [a]	1.00×10^{0} [b]	1.00×10^{-3} [c]
Cadmium	5.50×10^{-1} [a]	6.00×10^{-1} [d]	5.50×10^{-4} [a]
Chromium (Total)	4.00×10^{-2} [c]	1.30×10^{-1} [e]	3.00×10^{-2} [c]
Lead	9.00×10^{-2} [c]	4.00×10^{-2} [d]	8.00×10^{-4} [c]
Mercury	1.00×10^{0} [c]	1.00×10^{0} [b]	2.50×10^{-1} [a]
Selenium	5.00×10^{-1} [c]	1.00×10^{0} [b]	1.00×10^{-1} [c]
Silver	1.00×10^{0} [c]	2.50×10^{-1} [d]	5.00×10^{-3} [c]
HMX	2.74×10^{1} [f]	1.36×10^{1} [g]	3.42×10^{-8} [f]
PETN	2.78×10^{-1} [f]	2.02×10^{1} [g]	1.25×10^{-4} [f]
RDX	1.22×10^{1} [f]	1.45×10^{1} [g]	1.46×10^{-7} [f]
2,4,6-trinitrotoluene	4.60×10^{0} [f]	1.58×10^{1} [g]	8.28×10^{-7} [f]
Nitroglycerin	4.48×10^{0} [f]	1.59×10^{1} [g]	8.68×10^{-7} [f]
Di-n-butyl phthalate	8.38×10^{-2} [f]	2.24×10^{1} [g]	1.06×10^{-3} [f]
Di-n-octyl phthalate	3.72×10^{-2} [f]	2.40×10^{1} [g]	4.54×10^{-3} [f]
bis(2-ethylhexyl)phthalate	5.78×10^{-2} [f]	2.31×10^{1} [g]	2.07×10^{-3} [f]

[a] From Baes et al. (1984).
[b] Default value.
[c] From NCRP (1989).
[d] From Stafford et al. (1991).
[e] From Ma (1982).
[f] From equations developed in Travis and Arms (1988).
[g] Estimated as described in Connell and Markwell (1990).

Table 7
Media Concentrations (mg/kg)[a] for Constituents of Potential Ecological Concern at Environmental Restoration Site 11, Sandia National Laboratories, New Mexico

Constituent of Potential Ecological Concern	Soil (maximum)	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Arsenic	7.80×10^{1}	3.12×10^{0}	7.80×10^{1}	2.63×10^{-1}
Barium	7.10×10^{2}	1.07×10^{2}	7.10×10^{2}	2.64×10^{-1}
Beryllium	1.30×10^{0}	1.30×10^{-2}	1.30×10^{0}	2.13×10^{-3}
Cadmium	1.5×10^{0}	8.25×10^{-1}	9.00×10^{-1}	1.53×10^{-3}
Chromium (Total)	1.80×10^{1}	7.20×10^{-1}	2.34×10^{0}	1.77×10^{-1}
Lead	7.70×10^{1}	6.93×10^{0}	3.08×10^{0}	1.64×10^{-2}
Mercury	5.6×10^{-2}	5.60×10^{-2}	5.60×10^{-2}	4.46×10^{-2}
Selenium	7.50×10^{1}	3.75×10^{1}	7.50×10^{1}	1.80×10^{1}
Silver	7.70×10^{0}	7.70×10^{0}	1.93×10^{0}	7.76×10^{-2}
HMX	5.00×10^{-2}	1.37×10^{0}	6.78×10^{-1}	1.09×10^{-7}
PETN	7.50×10^{-2}	2.08×10^{-2}	1.51×10^{0}	3.00×10^{-4}
RDX	4.50×10^{-1}	5.47×10^{0}	6.54×10^{0}	2.74×10^{-6}
2,4,6-trinitrotoluene	3.80×10^{-2}	1.75×10^{-1}	6.01×10^{-1}	1.01×10^{-6}
Nitroglycerin	1.50×10^{-2}	6.73×10^{-2}	2.38×10^{-1}	4.14×10^{-7}
Di-n-butyl phthalate	6.10×10^{-1}	5.11×10^{-2}	1.36×10^{1}	2.28×10^{-2}
Di-n-octyl phthalate	5.50×10^{-1}	2.05×10^{-2}	1.32×10^{1}	9.39×10^{-2}
bis(2-ethylhexyl)phthalate	5.2×10^{-1}	3.00×10^{-2}	1.20×10^{1}	3.90×10^{-2}

[a]Milligrams per kilogram. All are based on dry weight of the media.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Product of the average concentration in food times the food-to-muscle transfer factor times the wet weight-dry weight conversion factor of 3.125 (from EPA 1993).

Table 8
Toxicity Benchmarks for Ecological Receptors at Environmental Restoration Site 11, Sandia National Laboratories, New Mexico

		Mammalian NOAELs			Avian NOAELs		
Constituent of Potential Ecological Concern	Plant Benchmark[a]	Mammalian Test Species[b]	Test Species NOAEL[c]	Deer Mouse NOAEL[d]	Avian Test Species[e]	Test Species NOAEL[e]	Burrowing Owl NOAEL[f]
Arsenic	10	Lab mouse	0.126	0.133	Mallard	5.14	5.14
Barium	500	Lab rat[g]	5.1	9.98	Chicks	20.8	20.8
Beryllium	10	Lab rat	0.66	1.29	---[h]	---	---
Cadmium	3	Lab rat[i]	0.008	0.0156	Mallard	1.45	1.45
Chromium (Total)	1	Lab rat	2737	5354	Black Duck	1.0	1.0
Lead	50	Lab rat	8	15.7	American kestrel	3.85	3.85
Mercury	0.3	Lab rat	0.032	0.0626	Mallard	0.0064	0.0064
Selenium	1	Lab rat	0.2	0.391	Screech owl	0.44	0.44
Silver	2	Lab rat[j]	17.8[j]	34.8	---	---	---
HMX	---	Lab rat	10[j]	19.6	---	---	---
PETN	---	Lab mouse	5870[j]	6210	---	---	---
RDX	---	Lab rat	0.3[j]	0.587	Ring-necked pheasant	0.18	0.18
2,4,6-trinitrotoluene	---	Lab rat	1.6[k]	3.13	Chicken	14.5	14.5
Nitroglycerin	---	Lab rat	9.72[j]	19.0	---	---	---
Di-n-butyl phthalate	---	Lab mouse	550	582	Ringed dove	0.11	0.11
Di-n-octyl phthalate	---	Lab rat	734	1440	---	---	---
bis(2-ethylhexyl) phthalate	---	Lab mouse	18.3[j]	19.37	Ringed dove	1.1	1.1

[a] From Will and Suter (1995).
[b] From Sample et al. (1996), except where noted. Body weights (in kilograms) for no-observed-adverse-effect level (NOAEL) conversion are: lab mouse, 0.030; lab rat, 0.350 (except where noted).
[c] From Sample et al. (1996), except where noted.
[d] Based on NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.239 kilograms and a mammalian scaling factor of 0.25.
[e] From Sample et al. (1996).
[f] Based on 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.
[g] Body weight of 0.435 kg was used for NOAEL conversion (Sample et al. 1996).
[h] --- designates insufficient toxicity data.
[i] Body weight of 0.303 kg was used for NOAEL conversion (Sample et al. 1996).
[j] From EPA (1997b).
[k] From Ryon (1987).

Table 9
Comparisons to Toxicity Benchmarks for
Ecological Receptors at
Environmental Restoration Site 11,
Sandia National Laboratories, New Mexico

Constituent of Potential Ecological Concern	Plant Hazard Quotient[a]	Deer Mouse Hazard Quotient	Burrowing Owl Hazard Quotient
Arsenic	**7.80×10^{0}**	**4.92×10^{1}**	3.95×10^{-2}
Barium	**1.42×10^{0}**	**6.24×10^{0}**	7.75×10^{-2}
Beryllium	1.30×10^{-1}	8.23×10^{-2}	---[b]
Cadmium	5.00×10^{-1}	7.36×10^{-2}	2.42×10^{-3}
Chromium (total)	**1.80×10^{1}**	5.49×10^{-5}	5.99×10^{-2}
Lead	**1.54×10^{0}**	6.51×10^{-2}	4.51×10^{-2}
Mercury	1.87×10^{-1}	1.42×10^{-1}	7.97×10^{-1}
Selenium	**7.50×10^{1}**	**2.30×10^{1}**	**4.95×10^{0}**
Silver	**3.85×10^{0}**	2.22×10^{-2}	---
HMX	---	8.15×10^{-3}	---
PETN	---	1.92×10^{-5}	---
RDX	4.50×10^{-3}	**1.60×10^{0}**	---
2,4,6-trinitrotoluene	1.27×10^{-3}	1.98×10^{-2}	---
Nitroglycerin	---	2.33×10^{-4}	---
Di-n-butyl phthalate	---	1.83×10^{-3}	3.55×10^{-2}
Di-n-octyl phthalate	---	7.17×10^{-4}	---
bis(2-ethylhexyl)phthalate	---	4.85×10^{-2}	5.01×10^{-3}

[a] **Bold** text indicates hazard quotient exceeds unity.
[b] --- designates insufficient toxicity data available for risk estimation purposes.

(HQ) are used to quantify the comparison with the benchmarks for plants and wildlife exposure. Maximum measured soil concentrations for arsenic, barium, chromium (total), lead, selenium, and silver exceeded their respective plant benchmark concentrations. With respect to the deer mouse, HQs exceeded unity for arsenic (HQ = 49.2), barium (HQ = 6.24), selenium (HQ = 23.0), and RDX (HQ = 1.6). For the burrowing owl, only the HQ for selenium (HQ = 4.95) exceeded unity.

III.7 Uncertainties

Many uncertainties are associated with the characterization of ecological risks at ER Site 11. These uncertainties result in the use of assumptions in estimating risk that may lead to an overestimation or underestimation of the true risk present at a site. For this screening-level risk assessment, assumptions are made that are more likely to overestimate risk rather than to underestimate it. These conservative assumptions are used to be more protective of the

ecological resources potentially affected by the site. Conservatisms incorporated into this risk use earthworm-based transfer factors or a default factor of 1.0 for modeling COPECs into soil invertebrates in the absence of insect data, and the use of 1.0 as the area use factor for wildlife receptors regardless of seasonal use or home range size.

III.8 Summary

Potential risks were indicated for all three ecological receptors at ER Site 11; however, the use of the maximum measured soil concentration or maximum detection limit to evaluate risk provided a conservative exposure scenario for the risk assessment and may not reflect actual site conditions. Maximum measured soil concentrations for arsenic, barium, selenium, and silver exceeded their respective plant benchmark concentrations. Risk predictions using maximum measured soil concentrations for arsenic, barium, selenium, and RDX revealed potential risk to the deer mouse. Use of the maximum measured soil concentrations resulted in an HQ greater than 1.0 for the burrowing owl exposed to selenium. HQs based on 95 percent upper confidence limits of the mean would likely be lower and still serve as a conservative estimate of site conditions. When average site concentrations are compared against background concentrations, arsenic, chromium, lead, mercury, and silver are not found to be significantly greater than background. In addition, using the average concentration of barium measured in ER Site 11 soils would result in HQs less than unity for plant and deer mice. Based on this information, ecological risks associated with ER Site 11 are expected to be low.

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APPENDIX 1.

Sandia National Laboratories Environmental Restoration Program

EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

BACKGROUND

Sandia National Laboratories (SNL) proposes that a default set of exposure routes and associated default parameter values be 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 would be invoked for risk assessments unless site-specific information suggested other parameter values. Because many SNL/NM ER sites have similar types of contamination and physical settings, SNL believes that the risk assessment analyses at these sites can be similar. A default set of exposure scenarios and parameter values will facilitate the risk assessments and subsequent review.

The default exposure routes and parameter values suggested are those that SNL views as resulting in a Reasonable Maximum Exposure (RME) value. Subject to comments and recommendations by the USEPA Region VI and NMED, SNL proposes that these default exposure routes and parameter values be used in future risk assessments.

At SNL/NM, all Environmental Restoration sites exist within the boundaries of the Kirtland AFB. Approximately 157 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/ER draft Environmental Assessment (DOE 1996) presents a summary of the hydrogeology of the sites, the biological resources present and proposed land use scenarios for the SNL/NM ER sites. At this time, all SNL/NM ER sites have been tentatively designated for either industrial or recreational future land use. The NMED has also requested that risk calculations be performed based on a residential land use scenario. 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, risk and dose values. EPA (EPA 1989a) 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 shell fish;
- 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), and;

- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water and exposure from ground surfaces with photon-emitting radionuclides).

Based on the location of the SNL ER sites 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 ER sites, there does not presently occur any consumption of fish, shell fish, 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 ER site:

- Ingestion of contaminated fish and shell fish;
- Ingestion of contaminated fruits and vegetables;
- Ingestion of contaminated meat, eggs, and dairy products; and
- Ingestion of contaminated surface water while swimming.

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

For the residential land-use scenario, we will include ingestion of contaminated fruits and vegetables because of the potential for residential gardening.

Based on this evaluation, for future risk assessments, the exposure routes that will be considered are shown in Table 1. Dermal contact is included as a potential exposure pathway in all land use scenarios. However, the potential for dermal exposure to inorganics is not considered significant and will not be included. In general, the dermal exposure pathway is generally considered to not be significant relative to water ingestion and soil ingestion pathways but will be considered for organic components. Because of the lack of toxicological parameter values for this pathway, the inclusion of this exposure pathway into risk assessment calculations may not be possible and may be part of the uncertainty analysis for a site where dermal contact is potentially applicable.

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	Dermal contact	Dermal contact
External exposure to penetrating radiation from ground surfaces	External exposure to penetrating radiation from ground surfaces	Ingestion of fruits and vegetables
		External exposure to penetrating radiation from ground surfaces

EQUATIONS AND DEFAULT PARAMETER VALUES FOR IDENTIFIED EXPOSURE ROUTES

In general, SNL/NM 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 equations for calculating potential intakes via these routes are shown below. The equations are from the Risk Assessment Guidance for Superfund (RAGS): Volume 1 (EPA 1989a and 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). Also shown are the default values SNL/NM ER suggests for use in Reasonable Maximum Exposure (RME) risk assessment calculations for industrial, recreational, and residential scenarios, based on 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).

Generic Equation for Calculation of Risk Parameter Values

The equation used to calculate the risk parameter values (i.e., Hazard Quotient/Index, excess cancer risk, or radiation total effective dose equivalent [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.

The total risk/dose (either cancer risk or hazard index) is the sum of the risks/doses for all of the site-specific exposure pathways and contaminants.

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 range of 10^{-4} to 10^{-6}. The evaluation of the noncarcinogenic health hazard produces a quantitative estimate (i.e., the Hazard Index) 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 Hazard Index of unity (1). The evaluation of the health hazard due to radioactive compounds produces a quantitative estimate of doses resulting from the COCs present at the site.

The specific equations used for the individual exposure pathways can be found in RAGS (EPA 1989a) and the RESRAD Manual (ANL 1993). Table 2 shows the default parameter values suggested for used by SNL at ER sites, based on the selected land use scenario. References are given at the end of the table indicating the source for the chosen parameter values. The intention of SNL is to use default values that are consistent with regulatory guidance and consistent with the RME approach. Therefore, the values chosen will, in general, provide a conservative estimate of the actual risk parameter. These parameter values are

Table 2. Default Parameter Values for Various Land Use Scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure frequency (d/y)	***	***	***
Exposure duration (y)	30[a,b]	30[a,b]	30[a,b]
Body weight (kg)	70[a,b]	56[a,b]	70 adult[a,b] 15 child
Averaging Time (days) for carcinogenic compounds (=70 y x 365 d/y)	25550[a]	25550[a]	25550[a]
for noncarcinogenic compounds (=ED x 365 d/y)	10950	10950	10950
Soil Ingestion Pathway			
Ingestion rate	100 mg/d[c]	6.24 g/y[d]	114 mg-y/kg-d[a]
Inhalation Pathway			
Inhalation rate (m^3/yr)	5000[a,b]	146[d]	5475[a,b,d]
Volatilization factor (m^3/kg)	chemical specific	chemical specific	chemical specific
Particulate emission factor (m^3/kg)	1.32E9[a]	1.32E9[a]	1.32E9[a]
Water Ingestion Pathway			
Ingestion rate (L/d)	2[a,b]	2[a,b]	2[a,b]
Food Ingestion Pathway			
Ingestion rate (kg/yr)	NA	NA	138[b,d]
Fraction ingested	NA	NA	0.25[b,d]
Dermal Pathway			
Surface area in water (m^2)	2[b,e]	2[b,e]	2[b,e]
Surface area in soil (m^2)	0.53[b,e]	0.53[b,e]	0.53[b,e]
Permeability coefficient	chemical specific	chemical specific	chemical specific

*** The exposure frequencies for the land use scenarios are often integrated into the overall contact rate for specific exposure pathways. When not included, the exposure frequency for the industrial land use scenario is 8 h/d for 250 d/y; for the recreational land use, a value of 2 hr/wk for 52 wk/y is used (EPA 1989b); for a residential land use, all contact rates are given per day for 350 d/y.

[a] RAGS, Vol 1, Part B (EPA 1991).

[b] Exposure Factors Handbook (EPA 1989b)

[c] EPA Region VI guidance.

[d] For radionuclides, RESRAD (ANL 1993) is used for human health risk calculations; default parameters are consistent with RESRAD guidance.

[e] Dermal Exposure Assessment (EPA 1992).

suggested for use for the various exposure pathways based on 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 proposes the described default exposure routes and parameter values for use 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 ER sites, but this scenario has been requested to be considered by the NMED. For sites designated as industrial or recreational land-use, SNL will provide risk parameter values based on 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 Sandia ER sites. The parameter values are based on EPA guidance and supplemented by information from other government sources. The values are generally consistent with those proposed by Los Alamos National Laboratory, with a few minor variations. If these exposure routes and parameters are acceptable, SNL will use them in risk assessments for all sites where the assumptions are consistent with site-specific conditions. All deviations will be documented.

References

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Section 6.2
ER Site 11 VCM Report

ER SITE 11: VOLUNTARY CORRECTIVE MEASURE

This report presents the details and results of the Voluntary Corrective Measure (VCM) conducted at ER Site 11, Radioactive Explosive Burial Mounds. This VCM involved the excavation, field-screening, and sampling of the ordnance debris mounds at the site.

1.1 Site Location and Description

ER Site 11 is a former test and disposal area in the southeastern portion of Central Coyote Test Area. The site consisted of five debris mounds and several associated surface depressions near the intersection of Lovelace Road and Isleta Road. For a detailed presentation regarding the local setting and operational history of ER Site 11, refer to the appropriate sections of the No Further Action (NFA) proposal, and to the Draft RCRA Facility Investigation Work Plan for OU 1334, Central Coyote Test Area (SNL/NM October 1994). Specific details regarding the five debris mounds removed during the VCM are presented below. A site map showing the debris mounds and soil sampling locations is presented in Figure 1-2 of the ER Site 11 NFA proposal. The total volume of the debris mounds is approximately 77,600 cubic feet (2,874 cubic yards), as summarized in Table 1-1.

Table 1-1
Approximate Volumes of ER Site 11 Debris Mounds

Debris Mound	Mound Description	Dimensions	Volume
1	Elongate and slender	100' long x 5' wide x 3' high	1,500 ft^3
2	Surrounds a circular depression	30' diameter by 2' high mound, surrounding a 25' diameter depression	1,700 ft^3
3	Elongate	60' long x 30' wide x 4' high	7,200 ft^3
4	Elongate	60' long x 30' wide x 4' high	7,200 ft^3
5	Elongate and surrounded by horseshoe-shaped depression	100' long x 60' wide x 10' high	60,000 ft^3
		Total	**77,600 ft^3**

1.2 Voluntary Corrective Measure Basis

The rationale for performing the VCM was to provide safe working conditions to conduct the RCRA Facility Investigation (RFI) sampling, and to remediate possible hazardous or radioactive contamination in the mounds as the result of previous site activities. The presence of unexploded ordnance (UXO) and possible radioactive materials in the mounds were threats to

ER site workers and the public requiring permanent mitigation. The VCM was designed to reduce immediate and long-term risk to human health and the environment by removal, segregation, and characterization of the debris mounds using special UXO excavation methods.

The potential risks to human health and the environment present at ER Site 11 included physical injury by UXO detonation and the potential release of possible contaminants to surface and subsurface soils. The potential contaminants of concern (COCs) included high explosives (HE), fuel and solvent compounds (volatile and semivolatile organics), and radioactive materials (depleted uranium, U-238). Removal of the source materials (i.e., the debris mounds) would eliminate any current or possible future releases to the environment.

1.2.1 VCM Field Protocol

The VCM field work included excavation, field-screening, and segregation of ordnance debris and soil at ER Site 11. Detailed procedures and field protocol were developed in the *Field Operations Plan For Removal of Ordnance Debris Mounds at Environmental Restoration Site 11* (June 1996), which also includes the project Health and Safety Plan (Annex I), Waste Management Plan (Annex II), City of Albuquerque Topsoil Disturbance Permit (Annex III), and all SNL/NM operating procedures; including: ER Field Operating Procedures (FOPs - Appendix A); Radiation Protection Operating Procedures (RPOPs - Appendix B); and UXO procedures (Appendix C).

Because UXO was potentially present in the debris mounds, special precautions were taken to ensure UXO detonation would not occur during mound excavation and sorting activities. Aggressive radiation and chemical monitoring were also incorporated into the removal action to provide preliminary characterization data for health and safety, as well as waste management purposes. During the course of the VCM project, field-screening and sampling and analysis activities ensured the appropriate segregation and handling of ordnance material, metal fragments, debris, and soil removed from the debris mounds.

1.2.2 Debris Mound Excavation and Field-Screening

The excavation and field-screening protocol for debris mound excavation and segregation proceeded according to a methodical, step-by-step process. This process, described in detail in the Field Operations Plan, is summarized below.

For each debris mound, a specific working face was chosen by the backhoe operator and field team before starting excavation. The debris mound was then systematically excavated in 4-inch deep "lifts" following the defined step-by-step procedure summarized below:

1. Prior to excavating, a magnetometer survey was performed over the working face. Any anomalies (metal objects) identified were hand-excavated prior to using the backhoe to remove a 4-inch lift. The magnetometer survey and hand excavation/removal of metal objects was performed by UXO specialists using UXO excavation procedures (Appendix C of Field Operations Plan). Metal fragments and scrap less than 4-inches in size were not

removed from the soil unless they posed some type of hazard. The UXO specialists also performed a visual inspection for HE and any other signs of potential soil contamination.

2. Immediately following any hand excavation work, the excavated area was field-screened with a Photoionization Detector (PID) by the Site Safety Officer (SSO). The SSO also performed a visual inspection for potential soil contamination.

3. The working face of the debris mound was also 100 percent surface-surveyed for gamma radiation using NaI detectors operated by two trained SNL/NM technicians (hereinafter referred to as "radiation technicians").

4. After field-screening was completed, the UXO specialist would supervise the removal of a 4-inch lift from the working surface of the mound by the backhoe operator. The excavated soil would be pulled down in front of the debris mound and spread out, where a second field-screening, described in step 5 below, took place. The backhoe operator would leave the exclusion zone during the second field-screening.

5. The second field-screening of the spread soil, and the first screening of the newly exposed working surface proceeded as follows:

   a. UXO specialists checked the spread soil for metal objects with magnetometers.

   b. UXO specialists then proceeded to screen the newly exposed mound working surface area, performing hand excavation, if necessary (repeat of Step 1).

6. As soon as Steps 5.a-b were completed, the SSO and radiation technicians proceeded to field-screen the excavated soil and the newly exposed mound surface with a PID and NaI detector.

Note: Any soil determined by field-screening to be potentially contaminated was segregated and placed into 55-gallon drums.

7. After completion of Step 6, the process returned to Step 4. Steps 4 through Step 6 were repeated until the mound was excavated to original grade.

8. After excavating each debris mound to grade, a confirmatory trench or trenches were excavated under the former mound location to an approximate depth of 3 feet.

A final magnetometer, PID and NaI detector survey was performed in the trenches. If no visible signs of contamination were present and no ordnance debris, organic vapors, and radioactivity (above background) were detected, the trenches were backfilled and excavation for that mound was considered complete.

The above procedure is slightly modified from the Field Operations Plan, which specified radiation surveys immediately following soil excavation and spreading. In the field it was determined that the UXO magnetometer survey should precede the radiation screening, based on the Health and Safety rationale that a missed live shell in the spread soil would pose a

greater potential hazard than some radioactive contamination. This change was incorporated and documented according to the Field Change Control procedure (FOP 94-68).

1.3 Site Controls and Health and Safety

A project-specific HASP was developed in conjunction with, and included within, the Field Operations Plan. The HASP defined specific training requirements for site workers, monitoring requirements, and detailed the potential hazards associated with each field task and how they would be mitigated. The potential presence of UXO was the most likely hazard and was specifically addressed in the HASP. Explosive Ordnance Disposal (EOD)-trained contractor UXO specialists were integrated into the field team to perform the magnetometer surveys, hand excavate any suspected ordnance material, and to properly characterize and handle this material. Kirtland AFB EOD personnel provided a back-up resource in the event that UXO was identified. Due to the Department of Energy (DOE) Radioactive Materials Management Area (RMMA) classification of the site and the potential presence of subsurface radioactive contamination implied by the posted radiation warning signs, all site workers were required to be in compliance with DOE Radiological Worker II training requirements.

To reduce personnel exposure, real-time monitoring with NaI meters (gamma radiation) and a PID was performed during the VCM excavation work. In addition, all personnel performed a self frisk with a Geiger-Mueller detector equipped with a pancake beta-gamma probe prior to exiting the exclusion zone according to RPOP-811. Air monitoring was performed within the exclusion zone and at the exclusion zone boundary with a MiniRam™ total dust monitor.

1.4 City of Albuquerque Topsoil Disturbance Permit

The City of Albuquerque required a Topsoil Disturbance Permit because more than 0.75 acres of land were being prepared for excavation work. Most of the disturbed areas resulted from the grading of equipment access roads, a firebreak around the work areas, and an area for the support zone. Additional grading was conducted to clear areas for a temporary sandbag bunker, an above-ground diesel fuel tank, and a connecting access road. A copy of the permit is included in Annex III of the Field Operations Plan.

1.5 Equipment Calibration and Maintenance

Site-specific gamma radiation background levels were measured on a daily basis with the NaI detector according to RPOP-08-810. The Geiger-Mueller beta-gamma detector was source-checked each day using a cesium-137 source according to RPOP-811. Calibration checks of the PID were performed twice each working day according to FOP-94-28. The MiniRam™ total dust monitor was checked each day. All factory and daily calibration checks/source checks were documented.

1.6 Decontamination

Equipment decontamination was conducted at the end of the field work. Hand excavation and heavy equipment were washed until free of visible dirt at the exclusion zone exit point with potable water from the water trailer. All field-screening data, soil sampling and analysis data, and radioactive contamination release survey data of material leaving the exclusion zone indicated no contamination was present at the site. Rinse water was discharged to the surface in the exclusion zone due to lack of any detectable contamination.

1.7 Temporary Bunker

A temporary sandbag bunker was constructed approximately 800 feet north of the exclusion zones to store UXO or suspect UXO, or any inert ordnance material that required secure storage. The bunker was constructed with double-sandbag walls, 4-feet high, with an "L-shaped" shielded entrance; and approved by SNL/NM Safety Engineering, Department 7732, prior to use. The internal dimensions of the bunker were 9 feet by 10 feet. A locking, 6-foot high, chain-link fence was installed around the bunker, which was connected to the work areas by an access road. The bunker area and the road were surveyed and cleared with magnetometers prior to being graded. Because no UXO was found during the VCM project, only intact, inert ordnance requiring demilitarization was stored in the temporary bunker.

2.1 Exceptions to the VCM Plan

The summary VCM Plan was submitted for regulatory review on December 4, 1995. The final VCM Plan addressed the details requested in the regulatory comments regarding soil and debris sampling, waste characterization analysis, QA/QC procedures, and material disposition. Specifically, VOCs analyses for VCM soil pile characterization and RFI samples collected under the former debris mounds were added in this version.

2.2 VCM Excavation Results

The following sections present the results of the VCM excavation work for each ordnance debris mound. Table 1-2 provides an overall summary, by mound, of the excavation field work. The table, as with the following sections, presents the VCM results by mound and in chronological order. ER Site 11 was defined as three fenced areas surrounding a total of five mounds prior to the VCM. The two western-most fenced areas included mounds 1 through 4, and were grouped together into one work area for the VCM. Mound 5 was located in a separate fenced area approximately 300 feet to the east. A separate work area was established for mound 5 due to its size and more distant location from the other mounds. Each work area included an exclusion zone boundary fence and a contamination reduction zone, which provided the only access to and from the exclusion zone.

Table 1-2
ER Site 11 VCM Excavation Summary By Mound

Mound No.	Date Started	Date Completed	Total Days	Number of Lifts	Pounds of Scrap	Material Description	Comments
3	7/11/96	7/17/96	4.5	20 (plus one trench) -- Lifts 1-7: Mound only; Lifts 8-13: Mound and hand excavation of depression; Lifts 1-7: Depression only	300 lbs scrap, 150 lbs inert shells	11 x 3-inch shells, 1 x 5-inch shell, various fuze boosters, significant scrap	Yellow soil associated with 5-in shell fragment; verification trench; half debris from depression
4	7/17/96	7/19/96	2.5	19 (plus 2 trenches)	5	Nails, wire, minor fragments; No UXO	2 trenches through middle
2	7/22/96	7/24/96	2.5	11 (incl. extended excavation in pit)	20	Minor frag, wire; No UXO	Lift 11 included excavation of pit until no mag anomalies
1	7/24/96	7/24/96	1	3 (plus one trench)	10	Ordnance scrap near surface	Exploratory trench through middle
5	7/25/96	8/1/96	5.5	24 (plus one trench)	120 lbs inert shells, 40 lbs scrap	Minor frag, empty cans, pipe bomb piece, 3 x 5-inch empty shells	Exploratory trench through middle

Excavation work started on mounds 3 and 4. They were selected first based on their intermediate size; making them ideal for practicing excavation procedures. Mounds 1 and 2 were excavated afterwards due to the large number of small (less than 2-inch size), metal fragments on the surface in the immediate vicinity of the mounds. Mound 5 was excavated last to be assured that the excavation and field-screening protocols were well established since mound 5 represented approximately 80 percent of the total soil which would be excavated.

Analytical results for the verification sampling of the mound soil piles are presented in Section 3.4. Analytical results for confirmatory (RFI) soil sampling beneath the mounds are presented in the ER Site 11 NFA proposal, earlier in this document.

2.2.1 Waste Management

No RCRA hazardous, radioactive, or mixed waste was generated during the VCM excavation work. Based on field-screening and visual observation all excavated material was free of obvious contamination. The excavated and screened soil from each mound was individually stockpiled and then sampled to confirm the field-screening results. The verification sampling and analysis work is described in section 2.3.

All materials, including ordnance projectiles, ordnance fragments, metal scrap, and equipment, were surveyed for radioactive contamination by an RPO technician prior to release from the site according to RPOP-04-411. No radioactive contamination was detected during these release surveys. This information was submitted to the SNL/NM RMMA Program, Department 7577, along with gamma spectroscopy soil analytical results. On September 27, 1996 the ER Site 11 RMMA status was formally abolished.

All ordnance material was inspected and characterized by both the contractor UXO specialists and representatives from KAFB EOD, who made the official determination on whether material was potentially explosive. All material was determined to be non-explosive, and therefore not RCRA characteristic waste. Ordnance fragments and scrap that did not require demilitarization were placed in a SNL/NM Reapplications metal scrap bin for bulk recycling after radioactive contamination release surveys were performed by RPO. All intact projectiles and fuzes were determined by the UXO specialists and KAFB EOD personnel to require demilitarization. This material was stored in the fenced and locked temporary sandbag bunker at the site until it was moved to a locked storage building at the Environmental Restoration Field Office (ERFO) on September 3, 1996. The material requiring demilitarization included: 1) intact, inert projectiles: eleven 3-inch diameter and three 5-inch diameter projectiles, 2) approximately 18 base fuzes, and 3) various ordnance material, including other fuze or projectile fragments. The ordnance debris was destroyed by Kirtland AFB EOD on April 23, 1997.

Other material removed from the exclusion zone (old concrete forms from the original fence lines, old signs, and barbed wire fencing) was released after RPO performed radioactive contamination surveys. The concrete blocks were given to the KAFB Installation Restoration Program for use as rip-rap to stabilize a section of the Tijeras Arroyo channel.

2.3 Verification and Confirmatory Sampling

The screened soil piles were sampled for site-specific contaminants of concern, including volatiles (EPA Method 8260), semivolatiles (EPA Method 8270), metals (EPA Method 6010 and 7000), HE compounds (EPA Method 8330 or equivalent HPLC method), and radionuclides (gamma spectroscopy). The number of verification soil samples collected was proportional to the size of the soil pile. Table 1-3 shows the number of samples per soil pile, along with offsite versus onsite analyses. These samples were collected from the upper-central portion of each pile using the spade-and-scoop method (FOP 94-52).

Table 1-3
VCM Verification Soil Sampling/Analysis

Mound	Number of On-site Samples	Number of Off-site Samples
Mound 1 Soil Pile	1	1
Mound 2 Soil Pile	1	1
Mound 3 Soil Pile	3	1
Mound 4 Soil Pile	2	1
Mound 5 Soil Pile	4 (plus 1 duplicate)	1 (plus one duplicate)

Note: On-site analyses include volatiles (EPA Method 8260), metals (EPA Method 6010 and 7000), HE compounds (HPLC method), and gamma spectroscopy. Off-site analyses include: volatiles (EPA Method 8260), semivolatiles (EPA Method 8270), RCRA metals (EPA Method 6010 and 7000), and HE compounds (EPA Method 8330).

2.3.1 On-site Laboratory Analytical Results

The on-site laboratory analytical results for RCRA metals plus beryllium, HE and VOCs are presented in Table 1-4. On-site radiological (gamma spectroscopy) analyses are presented in Table 1-5. No VOCs or HE compounds were detected.

Barium concentrations in 8 of the 12 soil samples exceeded the Central Coyote Test Area NMED Oversight Bureau (NMED OB) maximum recommended background concentration of 130 mg/kg. However, the results of the RFI site-specific background sampling for ER Site 11 indicate that elevated barium concentrations are probably naturally-occurring in this area. Chromium (18 mg/kg) was detected in one of the Mound 4 samples at a concentration slightly exceeding the NMED OB recommended concentration of 17.3 mg/kg. Lead was detected in one sample from Mound 3 and one from Mound 5 at concentrations exceeding the NMED OB recommended concentration of 21.4 mg/kg. The 77 mg/kg detection in the Mound 5 sample is probably due to the inclusion of a small lead fragment in the sample.

The anticipated radiologic contaminant of concern at ER Site 11 was depleted uranium (U-238). No U-238 concentrations, or daughter product (Th-234) concentrations above Central Coyote Test Area background values were detected in these soil samples (Table 1-5). No elevated beta-gamma readings were observed using a Geiger-Mueller detector with a pancake probe to field-screen samples, equipment, or personnel during field activities.

The Minimum Detectable Activity (MDA) for U-235 analyses was greater than the SNL/NM 95th percentile concentration of 0.16 pCi/g (IT Corporation 1996) (for most analyses), but the absence of the U-238 above background, which would contain trace amounts of U-235, indicates that there are no elevated U-235 concentrations in these samples. The detected concentrations for Th-234, Th-232, Ra-228, and Cs-137 were all below their respective SNL/NM 95th percentile concentration values (Table 1-5).

Table 1-4
Summary of Site 11 VCM Soil Sampling On-Site Laboratory Analytical Results; RCRA Metals Plus Beryllium, High Explosives, and Volatile Organic Compounds (VOCs)

Sample Attributes				RCRA Metals Plus Beryllium (EPA 6010/7000) (mg/kg)									High Explosives (HPCL) (ug/kg)					VOCs (EPA 8260) (ug/kg)	
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	Ag	As	Ba	Be	Cd	Cr	Pb	Se	Hg	HMX	Nitro-glycerine	PETN	RDX	TNT		
N/A	8/12/96	CCTA-11-VCM-DM1-1	N/A	< 0.66	< 4.8	140	< 0.11	< 1.0	7.4	16	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM2-1	N/A	< 0.66	< 4.8	94	< 0.11	< 1.0	11	11	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM3-1	N/A	< 0.66	< 4.8	140	< 0.11	< 1.0	8.9	24	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM3-2	N/A	< 0.66	< 4.8	170	< 0.11	< 1.0	9.1	18	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM3-3	N/A	< 0.66	< 4.8	160	< 0.11	< 1.0	12	17	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM4-1	N/A	< 0.66	< 4.8	240	0.11 J	< 1.0	18	14	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM4-2	N/A	< 0.66	< 4.8	120	< 0.11	< 1.0	9.2	15	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM5-1	N/A	< 0.66	< 4.8	100	< 0.11	< 1.0	14	77	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM5-2	N/A	< 0.66	< 4.8	130	< 0.11	< 1.0	11	16	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM5-3	N/A	< 0.66	< 4.8	160	< 0.11	< 1.0	7.5	20	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	*CCTA-11-VCM-DM5-3D (Duplicate Sample)*	N/A	< 0.66	< 4.8	180	< 0.11	< 1.0	9.3	5.9 J	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
N/A	8/12/96	CCTA-11-VCM-DM5-4	N/A	< 0.66	< 4.8	130	< 0.11	< 1.0	7.4	7.4 J	< 10	< 0.06 H	< 100	< 30	< 150	< 150	< 76	ND H	ND [1]
Central Coyote Test Area Maximum Background Concentration (mg/kg)			N/A	< 1	5.6	130	0.65	< 1	17.3	21.4	< 1	< 0.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Quality Assurance/Quality Control Samples (all in ug/L)																			
N/A	11/22/96	CCTA-11-VCM-EB (Aqueous Equipment Blank)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND
N/A	11/22/96	CCTA-11-VCM-TB (Aqueous Trip Blank)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND

mg/kg = Milligrams per kilogram.

ug/kg = Micrograms per kilogram.

ug/L = Micrograms per liter.

[1] Resamples collected 11/22/96.

N/A = Not applicable.

ND = Analyte not detected above the laboratory method detection limit.

H = Analysis exceeded holding time, value is an estimated concentration.

HPLC = High -pressure liquid chromatography.

Table 1-5
Summary of Site 11 VCM Soil Sampling On-Site Laboratory Analytical Results; Gamma Spectroscopy

Sample Attributes				Gamma Spectroscopy (pCi/g)					
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	U-238	U-235	Th-234	Th-232	Ra-226	Cs-137
031108-03	8/12/96	CCTA-11-VCM-DM1-1	N/A	< 1.17	< 0.159	< 0.478	0.673 +/- 0.395	0.633 +/- 0.237	0.0540 +/- 0.0275
031107-03	8/12/96	CCTA-11-VCM-DM2-1	N/A	< 1.26	< 0.0842	< 0.533	0.721 +/- 0.382	0.661 +/- 0.264	< 0.0361
031109-03	8/12/96	CCTA-11-VCM-DM3-1	N/A	< 1.30	< 0.174	0.772 +/- 0.282	0.706 +/- 0.388	0.812 +/- 0.315	0.139 +/- 0.0353
N/A	8/12/96	CCTA-11-VCM-DM3-2	N/A	< 2.77	< 0.193	< 0.655	0.589 +/- 0.283	0.552 +/- 0.349	0.134 +/- 0.0323
N/A	8/12/96	CCTA-11-VCM-DM3-3	N/A	< 3.04	< 0.212	0.939 +/- 0.343	0.589 +/- 0.289	0.719 +/- 0.284	0.332 +/- 0.0670
031110-03	8/12/96	CCTA-11-VCM-DM4-1	N/A	< 1.27	< 0.172	<0.552	0.735 +/- 0.370	0.713 +/- 0.203	0.0719 +/- 0.0486
N/A	8/12/96	CCTA-11-VCM-DM4-2	N/A	< 2.73	< 0.193	0.774 +/- 0.347	0.647 +/- 0.411	0.661 +/- 0.198	0.146 +/- 0.0338
N/A	8/12/96	CCTA-11-VCM-DM5-1	N/A	< 2.73	< 0.191	0.599 +/- 0.333	0.546 +/- 0.309	0.421 +/- 0.164	< 0.0285
N/A	8/12/96	CCTA-11-VCM-DM5-2	N/A	< 2.70	< 0.189	0.606 +/- 0.265	0.556 +/- 0.273	0.597 +/- 0.158	0.0807 +/- 0.0247
031111-03	8/12/96	CCTA-11-VCM-DM5-3	N/A	< 1.12	< 0.153	0.517 +/- 0.247	0.563 +/- 0.279	< 0.143	0.0252 +/- 0.00716
N/A	8/12/96	CCTA-11-VCM-DM5-4	N/A	< 2.95	< 0.205	< 0.683	0.542 +/- 0.446	0.623 +/- 0.190	< 0.0315
SNL/NM 95th Percentile Upper Tolerance Limit (pCi/g)			N/A	1.4	0.16	1.4	1.01	1.01	0.664

N/A = Not applicable.

pCi/g = Picocuries per gram.

2.3.2 Offsite Laboratory Analytical Results

Off-site analytical results for organic compounds (VOCS, SVOCs, HE) are presented in Table 1-6. Analytical results for RCRA metals are presented in Table 1-7.

The VOCs acetone and methylene chloride were detected in most samples. Both were detected in laboratory and/or field blanks and are considered to be the result of laboratory contamination. SVOCs (phthalates) were detected in three samples; one detection is the result of laboratory contamination. All the other SVOC detections are only slightly above method detection limits. HE compounds were detected in only one soil sample. The sample from Mound 3 contained RDX at a concentration of 0.45 µg/g, slightly above the method detection limit of 0.25 µg/g.

Barium was detected in 3 of the 6 off-site samples at concentrations exceeding the NMED OB maximum recommended background concentration of 130 mg/kg. As mentioned above, elevated barium concentrations are probably naturally-occurring at ER Site 11. All other metal concentrations were either below method reporting limits or the NMED OB maximum recommended concentrations (Table 1-7).

3.1 VCM Results and Conclusions

In conclusion, the voluntary corrective measure at the radioactive explosive ordnance disposal mounds, ER Site 11, was conducted safely and according to approved plans and documentation.

Based on field-screening results, none of the excavated soil was contaminated. The excavated and screened soil from each mound was individually stockpiled and then sampled to confirm the field-screening results. In April, 1997, after sample results were received from the laboratory, the site was regraded and revegetated according to the topsoil disturbance permit requirements for restoring the site with native grasses (East-side mix #18032). The detailed results of the site assessment, an interpretation of the analytical data collected, an assessment of the nature and extent of contamination, and an analysis of the risks posed to human health and the environment are provided in the body of the NFA proposal for ER Site 11.

Table 1-6
Summary of Site 11 VCM Soil Sampling Off-Site Laboratory Analytical Results; Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), and High Explosives (HE)

Sample Attributes				VOCs (EPA 8260) (ug/kg)		SVOCs (EPA 8270) (ug/kg)			HE (EPA 8330) (ug/g)
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	Acetone	Methylene Chloride	Di-n-butylphthalate	bis(2-Ethylhexyl) phthalate	Di-n-octylphthalate	RDX
031108-01, 02	8/12/96	CCTA-11-VCM-DM1-1	N/A	5.1 J,B	1.4 J	440	< 330	< 330	< 0.25
031107-01, 02	8/12/96	CCTA-11-VCM-DM2-1	N/A	11 B	2.1 J	< 330	520 B	550	< 0.25
031109-01, 02	8/12/96	CCTA-11-VCM-DM3-1	N/A	16 B	1.9 J	< 330	< 330	< 330	0.45
031110-01, 02	8/12/96	CCTA-11-VCM-DM4-1	N/A	8.8 J,B	< 5.0	< 330	< 330	< 330	< 0.25
031111-01, 02	8/12/96	CCTA-11-VCM-DM5-3	N/A	9.0 J,B	1.4 J	< 330	< 330	< 330	< 0.25
031112-01, 02	8/12/96	*CCTA-11-VCM-DM5-3D (Duplicate Sample)*	N/A	8.1 J,B	< 5.0	< 330	< 330	< 330	< 0.25
Quality Assurance Quality Control Samples									
031113-01	8/12/96	CCTA-11-VCM-TB (Aqueous trip blank, in ug/L)	N/A	not received[a]	not received[a]	N/A	N/A	N/A	N/A
031114-01, 02, 03, 04	8/12/96	CCTA-11-VCM-EB (Aqueous equipment blank, in mg/L)	N/A	4.6 B	< 1.0	< 9.5	< 9.5	< 9.5	< 0.25
031181-01	8/12/96	CCTA-11-VCM-TB (Soil trip blank, in ug/kg)	N/A	32 B	3.4 J	NA	NA	NA	NA

[a]Trip blank was not submitted as indicated on chain-of-custody form.

B = Analyte detected in the laboratory method blank.

J = Analyte detected below reporting limit, estimated value.

mg/L = Milligrams per liter.

NA = Not analyzed.

N/A = Not applicable.

ug/g = Micrograms per gram.

ug/kg = Micrograms per kilogram.

ug/L = Micrograms per liter.

Table 1-7
Summary of Site 11 VCM Soil Sampling Off-Site Laboratory Analytical Results; RCRA Metals

Sample Attributes				RCRA Metals (EPA 6010A/7000) (mg/kg)							
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	Ag	As	Ba	Cd	Cr	Pb	Se	Hg
031108-01, 02	8/12/96	CCTA-11-VCM-DM1-1	N/A	< 1.0	4.0	163	< 0.50	8.0	7.2	< 0.50	0.013 J
031107-01, 02	8/12/96	CCTA-11-VCM-DM2-1	N/A	< 1.0	3.5	120	< 0.50	10.7	9.3	0.64	0.010 J
031109-01, 02	8/12/96	CCTA-11-VCM-DM3-1	N/A	< 1.0	3.4	140	< 0.50	9.9	8.5	0.55	0.056
031110-01, 02	8/12/96	CCTA-11-VCM-DM4-1	N/A	< 1.0	4.3	129	< 0.50	11.9	9.1	< 0.50	0.011 J
031111-01, 02	8/12/96	CCTA-11-VCM-DM5-3	N/A	< 1.0	4.6	161	< 0.50	7.7	6.4	< 0.50	0.011 J
031112-01, 02	8/12/96	*CCTA-11-VCM-DM5-3D (Duplicate Sample)*	N/A	< 1.0	3.9	161	< 0.50	8.6	6.9	< 0.50	0.0088 J
Central Coyote Test Area Maximum Background Concentration (mg/kg)			N/A	< 1	5.6	130	< 1	17.3	21.4	< 1	0.25
Quality Assurance Quality Control Sample (in mg/L)											
031114-01, 02, 03, 04	8/12/96	CCTA-11-VCM-EB (Aqueous equipment blank)	N/A	< 0.010	< 0.010	0.0054 J	< 0.005	< 0.010	< 0.003	< 0.005	< 0.0002

J = Analyte detected below reporting limit, estimated value.

mg/kg = Milligrams per kilogram.

mg/L = Milligrams per liter.

N/A = Not applicable.

Section 6.3
NMED Split Sample Analytical Results

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

October 15, 1996

Beth Oms, POC/KAO
U. S. Department of Energy
Kirtland Area Office
P. O. Box 5400
Albuquerque, NM 87185-5400

RE: **Analytical Results of Soil Samples Collected from Sandia National Laboratories' (SNL) ER Site 11, August 13, 1996**

Dear Ms. Oms:

DOE Oversight Bureau personnel collected replicate soil samples with SNL representatives at Environmental Restoration (ER) Site 11 on August 13, 1996. The samples were collected after the Voluntary Corrective Measure had been completed. Attached are the laboratory analytical results for these samples.

If there are any questions, please contact Mr. William P. Moats of my staff at 845-5824.

Sincerely,

Ronald A. Kern, POC/SNL/ITRI
DOE Oversight Bureau

RK/WPM/wpm

Enclosure

cc with enclosure: Warren Cox, SNL, ER Proj. Manager, 6681
cc without enclosure: Neil Weber, NMED, Chief, DOE OB

File: ER Site 11

File:\\doc9

OCT 21

American Environmental Network, Inc.

CLIENT	: NMED-DOE OVERSIGHT BUREAU	DATE RECEIVED	: 08/13/96
PROJECT #	: (NONE)		
PROJECT NAME	: (NONE)	REPORT DATE	: 09/05/96

AEN ID: 608323

	AEN ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	608323-01	MDS SITE 39A	NON-AQ	08/13/96
02	608323-02	MDS SITE 39B	NON-AQ	08/13/96

ER Site II wpm 10/15/96

---TOTALS---

MATRIX	#SAMPLES
NON-AQ	2

AEN STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ISOTOPIC URANIUM RESULTS SUMMARY

Lab Name: Paragon Analytics, Inc.

Date Collected: 08/13/96

Client Name: AEN-NM

Date Analyzed: 08/21/96

Client Project ID : NMED

Sample Matrix: Soil

Lab Workorder Number : 96-08-082

Count Duration: 400 Min.

Analyzed By: JH

Client Sample ID	Lab Sample ID	U-234 (pCi/gram	U-235 (pCi/gram	U-238 (pCi/gram
Md5 Site 39b	08-082-02	0.47 ± 0.08	0.01 ± 0.01	0.43 ± 0.08

Reported activities are the calculated net activities, not truncated or censored by an *a priori* detection limit estimate. Sample results should be compared to the decision level calculated from the appropriate blank.

Reported Uncertainty is the Estimated Total Propagated Uncertainty (2σ). See PAI SOP 743FC for details of TPU determinations.

These samples were prepared using PAI SOP721FC and PAI SOP718FC and analyzed using PAI SOP714FC.

JOH

ALPHA SPECTROMETRY RESULTS SUMMARY

Lab Name: Paragon Analytics, Inc.

Date Collected: 08/13/96

Client Name: AEN-NM

Date Analyzed : 08/21/96

Lab Sample ID: 96-08-082-02

Sample Matrix : Soil

Client Sample ID: Md5 Site 39b

Chemical Recovery: 0.888

Nuclide	Activity (pCi/gram)	% Uncertainty
U-234	0.468 ± 0.083	17.64
U-235	0.011 ± 0.015	133.38
U-238	0.428 ± 0.078	18.31

Reported activities are the calculated net activities, not truncated or censored by an a priori detection limit estimate. Sample results should be compared to the decision level calculated from the appropriate blank.

Reported Uncertainty is the Estimated Total Propagated Uncertainty (2σ). See PAI SOP 743FC for details of TPU determinations.

JDH

NITROAROMATICS AND NITRAMINES

Modified Method 8330

		Sample ID
Lab Name:	Analytical Technologies, Inc.	
Client Name:	AEN-NM	Md5 Site 39a
Client Project ID:	NMED 608323	Date Collected: 08-13-96
Lab Sample ID:	96-08-082-01	Date Extracted: 08-19-96
Sample Matrix:	Soil	Date Analyzed: 08-20-96
Cleanup:	N/A	Sample Weight(g): 2
		Final Volume(mL): 20

Results based on wet weight.

Analyte	Conc. (mg/kg)	Detection Limit (mg/kg)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ND	2.0
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ND	1.0
1,3,5-Trinitrobenzene (1,3,5-TNB)	ND	0.25
1,3-Dinitrobenzene (1,3-DNB)	ND	0.25
Nitrobenzene (NB)	ND	0.26
2,4,6-Trinitrotoluene (2,4,6-TNT)	ND	0.25
2-Amino-4,6-DNT	ND	0.25
2,4-Dinitrotoluene (2,4-DNT)	ND	0.25
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ND	0.65
4-Amino-2,6-DNT	ND	0.25
2,6-Dinitrotoluene (2,6-DNT)	ND	0.26
o-Nitrotoluene (2-NT)	ND	0.25
p-Nitrotoluene (4-NT)	ND	0.25
m-Nitrotoluene (3-NT)	ND	0.25

SURROGATE RECOVERY

Analyte	% Recovery	% Rec Limits
1,2 Dinitrobenzene	102	50-150

EN

ND = Not detected or below detection limits.

FORM-I

PARAGON ANALYTICS, INC.

Justification for
Class III Permit Modification

April 2000

Solid Waste Management Unit 11
Operable Unit 1334
Round 9

RSI Originally Submitted September 1999

Site-Specific Comments

OU 1334

ER Site 11, Radioactive Explosives Burial Mounds

ER Site 11 may be appropriate for NFA petition, pending review and approval of the information requested below:

1. **Figure 1-2—This sample location map is labeled "draft". See general comment 1.**

   Response: Figure 1-2 has been revised to remove "draft" from the figure. The final version of Figure 1-2 is provided in Attachment A.

2. **Table 3-1—On this table, sample identification numbers (CCTA-11-GR-0) 34-37 and 37-42 presumably refer to samples collected from Mound 4 (Phase II) and Mound 5 (Phase II), respectively. It would appear that the sample identification numbers for Mound 5 should actually be 38-42. DOE/SNL must provide a table with corrected sample identification numbers.**

   Response: Samples CCTA-11-GR-034 through 036 refer to Mound 4 and CCTA-11-GR-037 through 042 refer to Mound 5. Table 3-1 has been revised and is provided in Attachment B.

3. **Table 3-2—DOE/SNL must provide summary tables showing the results of VOC analyses. See general comments 2-4.**

   Response: All volatile organic compounds analyses were nondetects. The method detection limits for all volatile organic compounds analytes are provided in Table 3-2A, Attachment C.

4. **Table 3-3—DOE/SNL must provide summary tables showing the results of VOC, SVOC, and HE analyses. See general comment 2-4.**

   Response: The requested analyte lists and associated method detection limits for volatile organic compounds, semivolatile organic compounds, and high explosives analyses are provided in Attachment D as Tables 3-3A, 3-3B, and 3-3C, respectively.

5. **Table 3-6—The unit of measurement for the soil samples should likely be pCi/g, not pCi/L. Also, for the quality assurance/quality control samples, should the units actually be pCi/L? DOE/SNL must provide a revised table with the correct units of measurement.**

   Response: The units for the soil samples in Table 3-6 are correctly reported as pCi/g. However, the units for the quality assurance/quality control samples should have been reported as pCi/mL. A revised table is provided in Attachment E.

6. **Table 1-4—DOE/SNL must provide summary tables showing the results of VOC analyses. See general comments 2-4. Also, DOE/SNL must state how long the holding times were exceeded for the VOC analyses.**

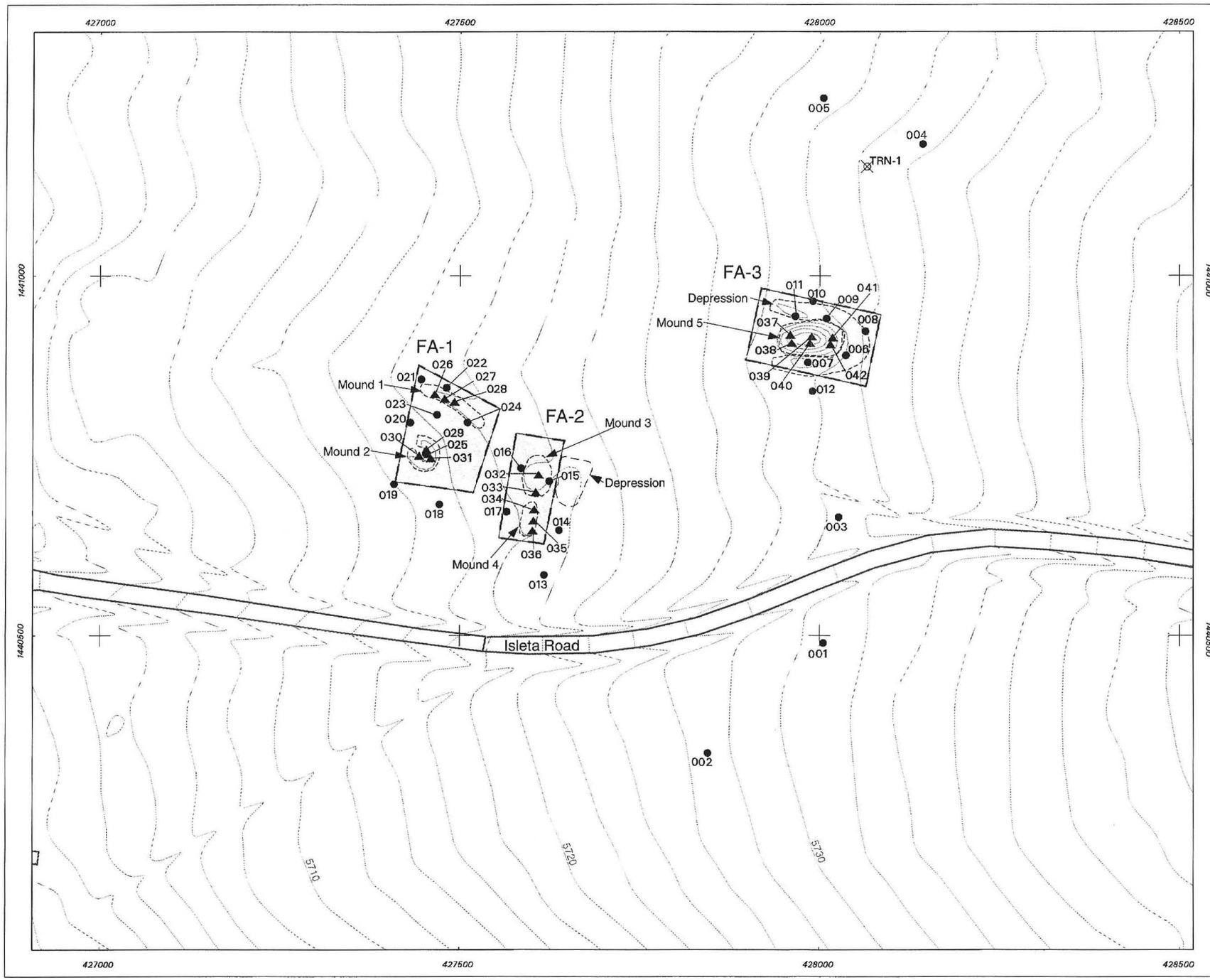
   Response: All volatile organic compounds analyses for the November 1996 resampling were nondetects. The method detection limits for all volatile organic compounds analytes are provided in Table 1-4A, Attachment F. Holding times for the August 1996 sampling were exceeded by 2 to 4 days.

7. **DOE/SNL must state whether the radiological point source near debris mound 1 was removed.**

   Response: Mr. William P. Moats of the New Mexico Environment Department Hazardous and Radioactive Materials Bureau was contacted for clarification on this question because no radiological point source has ever been identified or reported near Debris Mound 1. Because this question apparently references another site, Sandia National Laboratories/New Mexico will state that any anthropogenic radiological point source discovered during surveys by either Kirtland Air Force Base or RUST/MACTECH would have been removed and disposed of as radiological waste.

ATTACHMENT A

ER SITE 11
REVISED FIGURE 1-2

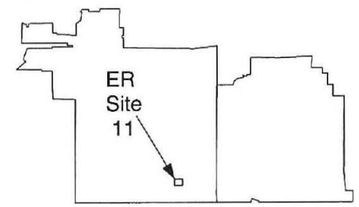


Legend

- Phase 1 RFI Sample May, 1996
- Phase 2 RFI Sample August, 1996
- Monitor Well TRN-1
- Road
- 2 Foot Contour
- Fence
- Mound & Depression Outline
- ER Site 11

0 150 300
Scale in Feet

0 40 80
Scale in Meters



Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Figure 1-2
Soil Sampling Locations at ER Site 11, Radioactive Explosive Burial Mounds

Transverse Mercator Projection, New Mexico State Plane Coordinate System, Central Zone, 1927 North American Horizontal Datum, 1929 North American Vertical Datum

Unclassified	1:1800	MAPID=970664
dh970664a.pri		SNL GIS ORG. 6804
dahelfr	dh970664.aml	07/23/97

ATTACHMENT B

ER SITE 11
REVISED TABLE 3-1

Site-Specific Comments

Table 3-1
Summary of RFI Soil Samples Collected at ER Site 11

Site Area	Phase I			Phase II		
	Sample Locations	On-Site Analyses	Off-Site Analyses	Sample Locations	On-Site Analyses	Off-Site Analyses
Background	5 CCTA-11-GR-001 through CCTA-11-GR-005	Gamma spec, metals	Isotopic U/Th, metals	0	NA	NA
Mound 1	4 CCTA-11-GR-021 through CCTA-11-GR-024	Gamma spec, metals, HE	Metals, HE, SVOCs	3 CCTA-11-GR-026 through CCTA-11-GR-028	Gamma spec, metals, HE, VOCs	Metals, HE, SVOCs, VOCs, Isotopic U
Mound 2	4 CCTA-11-GR-018 through CCTA-11-GR-020 and CCTA-11-GR-025	Gamma spec, metals, HE	Metals, HE, SVOCs	3 CCTA-11-GR-029 through CCTA-11-GR-031	Gamma spec, metals, HE, VOCs	SVOCs, Isotopic U
Mound 3	3 CCTA-11-GR-015 through CCTA-11-GR-017	Gamma spec, metals, HE	Metals, HE, SVOCs	2 CCTA-11-GR-032 and CCTA-11-GR-033	Gamma spec, metals, HE, VOCs	Metals, HE, SVOCs, VOCs, Isotopic U
Mound 4	2 CCTA-11-GR-013 and CCTA-11-GR-014	Gamma spec, metals, HE	Metals, HE, SVOCs	3 CCTA-11-GR-034 through CCTA-11-GR-036	Gamma spec, metals, HE, VOCs	Metals, HE, SVOCs, VOCs, Isotopic U
Mound 5	7 CCTA-11-GR-006 through CCTA-11-GR-012	Gamma spec, metals, HE	Metals, HE, SVOCs	6[a] CCTA-11-GR-037 through CCTA-11-GR-042	Gamma spec, metals, HE, VOCs	Metals, HE, SVOCs, VOCs, Isotopic U

[a]A split of sample CCTA-11-GR-039 from beneath Mound 5 was collected for confirmatory isotopic uranium and HE analyses by a New Mexico Environment Department representative.
Gamma spec - Gamma spectroscopy.
HE - High explosives.
Isotopic U - Isotopic uranium
Isotopic U/Th - Isotopic uranium and thorium.
NA - Not applicable.
SVOCs - Semivolatile organic compounds.
VOCs - Volatile organic compounds.

ATTACHMENT C

ER SITE 11
SUPPLEMENTAL TABLE 3-2A

Table 3-2A
VOC Method Detection Limits (EPA Method 8260[a]) for ER Site 11
Confirmatory Sampling, August and September 1996
(On-Site Laboratory)

Analyte	Soil MDL (µg/kg)	Aqueous MDL (µg/L)
Acetone	5–25	5
Benzene	0.5–5	0.5
Bromodichloromethane	0.5–5	0.5
Bromoform	2.5–25	2.5
Bromomethane	NA	5
2-butanone	5–25	5
Carbon disulfide	5–25	5
Carbon tetrachloride	0.5–5	0.5
Chlorobenzene	0.5–5	0.5
Chlorodibromomethane	0.5–5	0.5
Chloroethane	NA	5
Chloroform	0.5–5	0.5
Chloromethane	NA	5
1,1-dichloroethane	0.5–5	0.5
1,2-dichloroethane	0.5–5	0.5
1,1-dichloroethene	5–25	5
cis-1,2-dichloroethene	0.5–5	0.5
trans-1,2-dichloroethene	0.5–5	0.5
1,2-dichloropropane	0.5–5	0.5
cis-1,3-dichloropropene	0.5–5	0.5
trans-1,3-dichloropropene	0.5–5	0.5
Ethylbenzene	0.5–5	0.5
2-hexanone	5–25	0.5–5
Methylene chloride	1–5	1
4-methyl-2-pentanone	5–25	0.5–5
Styrene	0.5–5	0.5
1,1,2,2-tetrachloroethane	0.5–5	0.5
Tetrachloroethene	1–5	1
Toluene	0.5–5	0.5
1,1,1-trichloroethane	0.5–5	0.5
1,1,2-trichloroethane	0.5–5	0.5
Trichloroethene	0.5–5	0.5
Vinyl chloride	5–25	5
O-Xylene	0.5–5	0.5
P/M Xylenes	1–10	1

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not analyzed for soil samples.
VOC = Volatile organic compound.

ATTACHMENT D

ER SITE 11
SUPPLEMENTAL TABLES 3-3A, 3-3B, AND 3-3C

Table 3-3A
VOC Method Detection Limits (EPA Method 8260[a]) for ER Site 11
Confirmatory Sampling, August and September 1996
(Off-Site Laboratory)

Analyte	Soil MDL (µg/kg)	Aqueous MDL (µg/L)
Acetone	3.98	1.0
Benzene	0.75	0.49
Bromodichloromethane	0.59	0.42
Bromoform	1.13	0.41
Bromomethane	4.43	0.52
2-butanone	2.23	1.8
Carbon disulfide	1.33	0.42
Carbon tetrachloride	1.06	0.47
Chlorobenzene	0.86	0.54
Chloroethane	2.52	0.61
Chloroform	0.93	0.28
Chloromethane	1.49	0.47
Dibromochloromethane	1.26	0.42
1,1-dichloroethane	2.45	0.54
1,2-dichloroethane	2.45	0.51
1,1-dichloroethene	0.95	0.54
1,2-dichloroethene	1.19	0.53
1,2-dichloropropane	0.82	0.49
cis-1,3-dichloropropene	1.20	0.47
trans-1,3-dichloropropene	0.80	0.43
Ethylbenzene	0.84	0.55
2-hexanone	3.31	0.80
Methylene chloride	1.32	0.53
4-methyl-2-pentanone	4.33	1.3
Styrene	0.78	0.52
1,1,2,2-tetrachloroethane	2.14	0.47
Tetrachloroethene	1.03	0.47
Toluene	1.01	0.51
1,1,1-trichloroethane	0.71	0.43
1,1,2-trichloroethane	0.73	0.47
Trichloroethene	2.59	0.48
Vinyl acetate	4.42	1.4
Vinyl chloride	1.56	0.77
Xylenes	2.71	0.55

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
VOC = Volatile organic compound.

Table 3-3B
Summary of SVOC Reporting Limits[a] (EPA Method 8270[b])
for ER Site 11 Confirmatory Sampling, May and August 1996
(Off-Site Laboratories)

Analyte	Soil RL (µg/kg)	Aqueous RL (µg/L)
Acenaphthene	330–740	9.1–11
Acenaphthylene	330–740	9.1–11
Anthracene	330–740	9.1–11
Benzo(a)anthracene	330–740	9.1–11
Benzo(b)fluoranthene	330–740	9.1–11
Benzo(k)fluoranthene	330–740	9.1–11
Benzo(g,h,i)perylene	330–740	9.1–11
Benzo(a)pyrene	330–740	9.1–11
Benzoic acid	1600–3700	45–54
Benzyl alcohol	330–1500	9.1–21
4-bromophenyl phenyl ether	330–740	9.1–11
Butylbenzylphthalate	330–740	9.1–11
Carbazole	330–740	9.1–11
4-chloro-3-methylphenol	330–1500	11–21
4-chloroaniline	330–1500	11–21
Bis(2-chloroethoxy) methane	330–740	9.1–11
Bis(2-chloroethyl) ether	330–740	9.1–11
Bis(2-chloroisopropyl) ether	330–740	9.1–11
2-chloronaphthalene	330–740	9.1–11
2-chlorophenol	330–740	9.1–11
4-chlorophenyl phenyl ether	330–740	9.1–11
Chrysene	330–740	9.1–11
Dibenzo(a,h)anthracene	330–740	9.1–11
Dibenzofuran	330–740	9.1–11
1,2-dichlorobenzene	330–740	9.1–11
1,3-dichlorobenzene	330–740	9.1–11
1,4-dichlorobenzene	330–740	9.1–11
3,3-dichlorobenzidine	660–1500	18–22
2,4-dichlorophenol	330–740	9.1–11
Diethylphthalate	330–740	9.1–11
2,4-dimethylphenol	330–740	9.1–11
Dimethylphthalate	330–740	9.1–11
Di-n-butylphthalate	330–740	9.1–11
Di-n-octylphthalate	330–740	9.1–11
4,6-dinitro-2-methylphenol	1600–3700	45–54
2,4-dinitrophenol	1600–3700	45–54
2,4-dinitrotoluene	330–740	9.1–11
2,6-dinitrotoluene	330–740	9.1–11
Bis(2-ethylhexyl)phthalate	330–740	9.1–11
Fluoranthene	330–740	9.1–11
Fluorene	330–740	9.1–11
Hexachlorobenzene	330–740	9.1–11

Refer to footnotes at end of table.

Table 3-3B (Concluded)
Summary of SVOC Reporting Limits[a] (EPA Method 8270[b])
for ER Site 11 Confirmatory Sampling, May and August 1996
(Off-Site Laboratories)

Analyte	Soil RL (µg/kg)	Aqueous RL (µg/L)
Hexachlorobutadiene	330–740	9.1–11
Hexachlorocyclopentadiene	330–740	9.1–11
Hexachloroethane	330–740	9.1–11
Indeno(1,2,3-cd)pyrene	330–740	9.1–11
Isophorone	330–740	9.1–11
2-methylnaphthalene	330–740	9.1–11
2-methylphenol	330–740	9.1–11
4-methylphenol	330–740	9.1–11
Naphthalene	330–740	9.1–11
2-nitroaniline	1600–3700	45–54
3-nitroaniline	1600–3700	45–54
4-nitroaniline	1600–3700	18–54
Nitrobenzene	330–740	9.1–11
2-nitrophenol	330–740	9.1–11
4-nitrophenol	1600–3700	45–54
N-nitroso-di-n-propylamine	330–740	9.1–11
N-nitrosodiphenylamine	330–740	9.1–11
Pentachlorophenol	1600–3700	45–54
Phenanthrene	330–740	9.1–11
Phenol	330–740	9.1–11
Pyrene	330–740	9.1–11
1,2,4-trichlorobenzene	330–740	9.1–11
2,4,5-trichlorophenol	660–1600	9.1–54
2,4,6-trichlorophenol	330–740	9.1–11

[a]Method detection limits were not available for all data; therefore, reporting limits are provided here instead.
[b]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
RL = Reporting limit.
SVOC = Semivolatile organic compound.

Table 3-3C
Summary of HE Reporting Limits[a] (EPA Method 8330[b])
for ER Site 11 Confirmatory Sampling, May and August 1996
(Off-Site Laboratories)

Analyte	Soil RL (µg/g)	Aqueous RL (µg/L)
HMX	0.25–2.5	0.25
RDX	0.25–1.1	0.25
1,3,5-trinitrobenzene	0.25–0.28	0.25
1,3-dinitrobenzene	0.25–0.28	0.10
Tetryl	0.50–0.73	0.50
Nitrobenzene	0.25–0.29	0.25
2,4,6-trinitrotoluene	0.25–0.26	0.10
4-amino-2,6-dinitrotoluene	0.25–0.26	0.10
2-amino-4,6-dinitrotoluene	0.25–0.26	0.10
2,6-dinitrotoluene	0.25–0.26	0.25
2,4-dinitrotoluene	0.25–0.29	0.10
2-nitrotoluene	0.25–0.26	0.25
3-nitrotoluene	0.25–0.26	0.25
4-nitrotoluene	0.25–0.26	0.25

[a]Method detection limits were not available for all data; therefore, reporting limits are provided here instead.
[b]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
HE = High explosive.
HMX = Cyclotetramethylene tetranitramine.
µg/g = Microgram(s) per gram.
µg/L = Microgram(s) per liter.
RDX = Cyclo-1,3,5-trimethylene-2,4,6-trinitramine.
RL = Reporting limit.
Tetryl = 2,4,6-trinitrophenylmethylnitramine.

ATTACHMENT E

ER SITE 11
REVISED TABLE 3-6

Table 3-6
Summary of ER Site 11 Soil Sampling On-Site Laboratory Analytical Results; Gamma Spectroscopy

Sample Attributes				Gamma Spectroscopy (pCi/gm)					
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	U-238	U-235	Th-234	Th-232	Ra-228	Cs-137
029124-07	5/20/96	CCTA-11-GR-001-0-0.5-S	0.0-0.5	< 1.04	< 0.157	0.742 +/- 0.285	0.603 +/- 0.325	0.714 +/- 0.244	< 0.0376
029125-07	5/20/96	CCTA-11-GR-001-0.5-1.0-S	0.5-1.0	< 0.911	< 0.117	< 0.333	0.642 +/- 0.308	0.669 +/- 0.158	0.0421 +/- 0.0154
029126-07	5/20/96	CCTA-11-GR-002-0-0.5-S	0.0-0.5	< 0.796	< 0.100	< 0.280	0.595 +/- 0.341	0.710 +/- 0.318	0.0827 +/- 0.0631
029127-07	5/20/96	CCTA-11-GR-002-0.5-1.0-S	0.5-1.0	1.21 +/- 1.28	< 0.152	0.931 +/- 0.331	0.684 +/- 0.357	0.628 +/- 0.204	0.0929 +/- 0.0313
029128-07	5/20/96	CCTA-11-GR-003-0-0.5-S	0.0-0.5	< 3.08	< 0.215	1.19 +/- 0.542	0.789 +/- 0.654	0.736 +/- 0.221	0.219 +/- 0.0479
029129-07	5/20/96	CCTA-11-GR-003-0.5-1.0-S	0.5-1.0	< 1.28	< 0.182	0.839 +/- 0.316	0.746 +/- 0.382	0.786 +/- 0.257	0.0804 +/- 0.0409
029130-07	5/20/96	CCTA-11-GR-004-0-0.5-S	0.0-0.5	< 1.10	< 0.167	1.11 +/- 0.301	0.782 +/- 0.399	0.600 +/- 0.258	0.184 +/- 0.0535
029131-07	5/20/96	CCTA-11-GR-004-0.5-1.0-S	0.5-1.0	< 1.19	< 0.174	1.21 +/- 0.341	0.822 +/- 0.427	0.786 +/- 1.30	< 0.0274
029132-07	5/20/96	CCTA-11-GR-005-0-0.5-S	0.0-0.5	< 1.12	< 0.171	0.881 +/- 0.296	0.776 +/- 0.411	< 0.151	0.197 +/- 0.0516
029133-07	5/20/96	CCTA-11-GR-005-0.5-1.0-S	0.5-1.0	< 3.11	0.0232 +/- 0.0208	1.03 +/- 0.355	0.576 +/- 0.284	0.709 +/- 0.254	0.0420 +/- 0.0220
029519-07	5/20/96	CCTA-11-GR-008-0-0.5-S	0.0-0.5	< 3.44	< 0.234	1.21 +/- 0.386	0.979 +/- 0.456	0.949 +/- 0.370	< 0.0366
029524-07	5/20/96	CCTA-11-GR-010-0.5-1.0-S	0.5-1.0	< 2.46	< 0.177	0.532 +/- 0.392	0.401 +/- 0.205	0.497 +/- 0.179	0.0883 +/- 0.0186
029531-07	5/21/96	CCTA-11-GR-013-0-0.5-S	0.0-0.5	< 1.11	< 0.163	0.974 +/- 0.326	0.750 +/- 0.399	0.668 +/- 0.256	0.0843 +/- 0.0414
029536-07	5/21/96	CCTA-11-GR-015-0.5-1.0-S	0.5-1.0	< 0.804	< 0.103	< 0.302	0.612 +/- 0.290	0.630 +/- 0.212	0.155 +/- 0.0309
029542-07	5/21/96	CCTA-11-GR-018-0-0.5-S	0.0-0.5	< 1.16	0.114 +/- 0.119	0.862 +/- 0.277	0.806 +/- 0.426	0.747 +/- 0.716	0.0758 +/- 0.0601
029664-07	5/21/96	CCTA-11-GR-020-0.5-1.0-S	0.5-1.0	< 0.843	< 0.103	< 0.300	0.665 +/- 0.306	0.672 +/- 0.154	0.0329 +/-
029669-07	5/21/96	CCTA-11-GR-020-0-0.5-S	0.0-0.5	< 1.01	< 0.148	0.459 +/- 0.263	0.613 +/- 0.320	0.418 +/- 0.166	0.290 +/- 0.0891
029675-07	5/21/96	CCTA-11-GR-025-0.5-1.0-S	0.5-1.0	< 1.04	< 0.128	0.301 +/- 0.277	0.845 +/- 0.392	0.798 +/- 0.281	0.309 +/- 0.0495
030741-04	8/12/96	CCTA-11-GR-027-0.5-1.0-S	0.5-1.0	< 1.24	< 0.170	0.575 +/- 0.317	0.521 +/- 0.306	0.513 +/- 0.186	< 0.0354
030746-04	8/12/96	CCTA-11-GR-031-0.5-1.0-S	0.5-1.0	< 1.31	< 0.170	0.618 +/- 0.369	< 0.129	0.454 +/- 0.552	< 0.0333
030751-04	8/13/96	CCTA-11-GR-035-05.1.0-S	0.5-1.0	< 1.28	0.0763 +/- 0.0712	0.957 +/- 0.374	0.790 +/- 1.01	0.765 +/- 0.284	< 0.0356
030754-04	8/13/96	CCTA-11-GR-037-0.5-1.0-S	0.5-1.0	< 1.31	< 0.171	0.553 +/- 0.320	0.651 +/- 0.350	< 0.162	< 0.0337
031406-002	9/4/96	CCTA-11-GR-041-0.5-1.0-S	0.5-1.0	0.739 +/- 0.678	< 0.161	0.674 +/- 0.326	0.599 +/- 0.316	0.694 +/- 1.05	< 0.0305
030760-04	8/13/96	CCTA-11-GR-042-0.5-1.0-S	0.5-1.0	< 1.16	< 0.160	0.833 +/- 0.325	< 0.134	0.574 +/- 0.209	< 0.0318
SNL/NM 95th Percentile Upper Tolerance Limit (pCi/g)[1]			N/A	1.4	0.16	1.4	1.01	1.01	0.664

Table 3-6 (Concluded)
Summary of ER Site 11 Soil Sampling On-Site Laboratory Analytical Results; Gamma Spectroscopy

Sample Attributes				Gamma Spectroscopy					
Sample Number	Sample Date	ER Sample ID	Sample Depth (ft.)	U-238	U-235	Th-234	Th-232	Ra-228	Cs-137
Quality Assurance/Quality Control Samples (all in pCi/mL)									
029530-07	5/20/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	< 0.541	< 0.101	< 0.200	< 0.130	< 0.143	< 0.0259
029776-07	5/21/96	CCTA-11-GR-000-EB (Aqueous equipment blank)	N/A	< 0.499	< 0.0977	< 0.227	< 0.114	< 0.156	< 0.0237
030750-04	8/12/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 0.738	< 0.118	< 0.307	< 0.152	< 0.137	<0.0278
030761-04	8/13/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 0.738	< 0.120	< 0.300	< 0.144	< 0.134	< 0.0238
031408-002	9/4/96	CCTA-11-000-EB (Aqueous equipment blank)	N/A	< 0.880	< 0.140	< 0.342	< 0.157	< 0.160	< 0.0291

N/A = Not applicable.

pCi/g = Picocuries per gram.

pCi/mL = Picocuries per milliliter.

ATTACHMENT F

ER SITE 11
SUPPLEMENTAL TABLE 1-4A

Table 1-4A
VOC Method Detection Limits (EPA Method 8260[a]) for ER Site 11
VCM Soil Sampling, August and November 1996
(On-Site Laboratory)

Analyte	Soil MDL (µg/kg)	Aqueous MDL (µg/L)
Acetone	5	5
Benzene	1	0.5
Bromodichloromethane	1	0.5
Bromoform	5	2.5
Bromomethane	NA	5
2-butanone	5	5
Carbon disulfide	5	5
Carbon tetrachloride	1	0.5
Chlorobenzene	1	0.5
Chlorodibromomethane	1	0.5
Chloroethane	NA	5
Chloroform	1	0.5
Chloromethane	NA	5
1,1-dichloroethane	1	0.5
1,2-dichloroethane	1	0.5
1,1-dichloroethene	5	5
cis-1,2-dichloroethene	1	0.5
trans-1,2-dichloroethene	1	0.5
1,2-dichloropropane	1	0.5
cis-1,3-dichloropropene	1	0.5
trans-1,3-dichloropropene	1	0.5
Ethylbenzene	1	0.5
2-hexanone	5	NA
Methylene chloride	1	1
4-methyl-2-pentanone	5	NA
Styrene	1	0.5
1,1,2,2-tetrachloroethane	1	0.5
Tetrachloroethene	1	1
Toluene	1	0.5
1,1,1-trichloroethane	1	0.5
1,1,2-trichloroethane	1	0.5
Trichloroethene	1	0.5
Vinyl chloride	5	5
O-xylene	1	0.5
P/M xylenes	2	1

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not analyzed for that medium.
VCM = Voluntary corrective measure.
VOC = Volatile organic compound.