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Petition to Perform Class III Modifications to Remove Solid Waste Management Units 19, 47, 48, 63, 64, 108, 157, 158, 159, 167 and 168 from the White Sands Missile Range RCRA Part B Permit HSWA Module, Identification No. NM2750211235

White Sands Missile Range, New Mexico

March 2010

ARCADIS

Kimberly Golden
Principal Scientist

Laurie W. Rodriguez
Certified Project Manager/Geologist

Richard W. Collins
Project Director

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White Sands Missile Range
New Mexico

Prepared for:
U.S. Army, White Sands Missile Range
Directorate of Public Works –
Environment Division
White Sands Missile Range, New Mexico

Prepared by:
ARCADIS
1717 West 6th Street, Ste. 210
Austin
Texas, 78703
Tel 512.451.1188
Fax 512.451.2930

Our Ref.:
GP08WSMR.0CAC.QC001

Date:
March 2010

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List of Acronyms/Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
2,4,5-T	2,4,5-Trichlorophenoxyacetic acid
2,4-D	2,4-Dichlorophenoxyacetic acid
2,4-DB	4-(2,4-Dichlorophenoxy)butyric acid
ACA	Accelerated Correction Action
ACM	Asbestos-containing Material
amsl	Above Mean Sea Level
AST	Aboveground Storage Tank
ATEC	Army Test and Evaluation Command
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CFR	Code of Federal Regulations
cm	centimeter
CMI	Corrective Measures Implementation
CO_2	carbon dioxide
COCs	constituents of concern
COPC	Contaminants of potential concern
COPEC	Constituents of Potential Ecological Concern
cu yd.	cubic yard
DAF	Dilution Attenuation Factor
DDD	(1,1-bis(chlorophenyl)-2,2-dichloroethane)
DDE	(1,1-bis(chlorophenyl)-2,2-dichloroethene)
DDT	(1,1-bis(chlorophenyl)-2,2,2-trichloroethane)
DEHP	bis(2-ethylhexyl)phthalate
DERP	Defense Environmental Restoration Program
DMN	N-Nitrodimethylamine
DRO	Diesel Range Organics
ECOPCs	Ecological contaminants of potential concern
EIB	New Mexico Environmental Improvement Board
EPA	U.S. Environmental Protection Agency
ERA	Ecological risk assessment
ft	feet
GAC	Granular activated carbon
gal	gallons

GPS	Global Positioning System
GRO	Gasoline Range Organics
HELSTF	High Energy Laser System Test Facility
HHSSL	Human health soil screening level
HQ	hazard quotient
HRMB	Hazardous and Radioactive Materials Bureau (of NMED)
HSWA	Hazardous and Solid Waste Amendments (to RCRA)
HWB	Hazardous Waste Bureau
IDW	Investigation-derived waste
IRFNA	Inhibited Red Fuming Nitric Acid
IRP	Installation restoration program
ITC	International Technology Corporation
km	kilometer
LC	Launch Complex
LOAELs	Lowest observed adverse effects levels
MAR	Multi-Array Radar
MCL	maximum contaminant level
MEK	methyl ethyl ketone (2-butanone)
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
MTBE	Methyl tert butyl ether
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NDMH	N-Nitrosodimethylamine
NEPA	National Environmental Policy Act
NFA	No Further Action
NHPA	National Historic Preservation Act
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NOD	Notice of Deficiency
NPS	National Park Service
ORC	Oscura Range Center
ORM	Ordinance-related Material
OSHA	Occupational Safety and Health Administration
OSWER	EPA Office of Solid Waste and Emergency Response
OWS	Oil/Water Separator
PAH	Polynuclear aromatic hydrocarbon

PCB	polychlorinated biphenyl
PCE	Tetrachloroethene
PECOPCs	Preliminary ecological contaminants of potential concern
PELs	Permissible Exposure Limits
PID	Photo-ionization detector
ppbv	Parts per billion by volume
ppm	Parts per million
PR/VSI	Preliminary Review/Visual Site Inspection (of RFA)
PRGs	Preliminary Remediation Goals
RBC	Risk Based Concentration
RBDMP	Risk Based Decision Making Process
RBSL	Risk Based Screening Level
RCRA	Resource Conservation and Recovery Act
RESV	Recommended Ecological Screening Value
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
ROC	Receptors of concern
SEI	Sverdrup Environmental, Inc.
SGS	Soil Gas Survey
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SSL	Soil Screening Level
STP	Sewage Treatment Plant
Subpart S	40 CFR 264, Subpart S
SVE	Soil vapor extraction
SVOC	semi-volatile organic compound
SVS	Soil-Vapor Survey
SWMU	Solid Waste Management Unit
TCA	Trichloroethane
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TOC	Top of casing
TPH	total petroleum hydrocarbons
TRVs	Toxicity reference values
TTF	Temperature Test Facility
UCL	Upper confidence limit
UDMH	Unsymmetrical Dimethylhydrazine

µg/L	Micrograms per liter
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
UTL	Upper tolerance limits
UTS	Universal Treatment Standards
UXO	unexploded ordnance
VCA	Voluntary Corrective Action
VOC	volatile organic compound
VSI	Visual Site Inspection (of RFA)
WQCC	Water Quality Control Commission
WSMR	White Sands Missile Range
WSNM	White Sands National Monument
WTS	White Sands Technical Services, LLC

Executive Summary

The purpose of this document is to formally request a Class 3 modification to the White Sands Missile Range (WSMR) Resource Conservation and Recovery Act (RCRA) Part B permit (Hazardous Waste Permit No. NM2750211235) pursuant to Title 40 of the Code of Federal Regulations, Part 270.42 (40 CFR §270.42) and Title 20 of the New Mexico Administrative Code, Chapter 4.1 (20 NMAC 4.1) for the closure of 11 Solid Waste Management Units (SWMUs). The WSMR RCRA permit was renewed in December 2009. The Administrative Authority for the White Sands permit is the New Mexico Environment Department (NMED), which was granted HSWA authority on January 1, 1996. The SWMUs included in this document are listed in Appendices 4 and 8 to the WSMR RCRA Permit.

A summary of the SWMUs addressed by this document, the section of the petition where the discussion of each SWMU is located, and the corresponding applicable NMED No Further Action (NFA) Proposal Criteria for closure is provided in Table ES-1. The Appendices containing the pertinent figures and/or photographs, analytical data summary tables, and regulatory correspondence for a SWMU are located at the back of the section addressing that SWMU.

This petition to remove SWMUs from the White Sands RCRA Part B permit, provides the rationale and criterion necessary to support No Further Action status for each SWMU, as outlined in the NMED Hazardous and Radioactive Materials Bureau Standard Operating (HRMB) Procedures Manual, Volume 1 (NMED, 1998). This petition is submitted to the Administrative Authority in partial fulfillment of the HSWA requirements for a Class III modification. Public participation in the decision to remove the SWMUs is required and will be solicited by White Sands in accordance with 40 CFR §270.24.

Table ES-1 – Summary of SWMUs Proposed for Closure

SWMU Designation	SWMU Description	Section in Petition	NMED Closure Criterion
19 (formerly 19 & 20)	Steam Wash Pad & Oil/water Separator @ Building 1753	2	5
47	North Oscura Peak Landfill	3	5
48 (formerly 48 & 49)	North Oscura Peak Landfills	3	5
63	Main Post Landfill 1A	4	1
64	Main Post Landfill 2A	5	1
108	Vapor Extraction Well at TTF	6	5
157	Former Oscura Range Center Landfill-A	7	5
158	Former Oscura Range Center Landfill	7	5
159	Former Oscura Range Center Landfill-C	7	5
167	Malpais Site	8	5
168	Lance Missile Impact @ White Sands National Monument	9	5

1. Introduction

White Sands Missile Range (WSMR) proposes to remove twelve (12) Solid Waste Management Units (SWMUs) from the Hazardous and Solid Waste Amendments (HSWA) module of the Resource Conservation and Recovery Act (RCRA) Part B Hazardous Waste Management Permit. The results of previous investigations and/or waste removal actions demonstrate that No Further Action is required for these sites.

Previous investigations and findings at each SWMU are summarized below and a criterion justifying removal of the SWMU from the HSWA module of the permit is provided. This application to remove each SWMU is submitted to New Mexico Environmental Department (NMED) in partial fulfillment of the requirements for permit modification promulgated in 40 CFR §270.42.

1.1 Setting – Physical Geography and Facility Description

WSMR is located in south-central New Mexico in a geological province known as the Tularosa Basin. It is located on land contained within five New Mexico counties: Dona Ana, Sierra, Socorro, Lincoln, and Otero. The WSMR Main Post area is 20 miles east of Las Cruces, New Mexico, 50 miles southwest of Alamogordo, New Mexico, and 45 miles north of El Paso, Texas. WSMR boundaries extend almost 100 miles north to south by 40 miles east to west. At almost 3,200 square miles (2,048,000 acres), WSMR is the largest military installation in the country. In addition to the main installation, there are two extension areas located adjacent to the north and west boundaries, and several joint-use land areas. These areas add more than 3.8 million acres to the installation. WSMR is partially bordered on the east by Holloman Air Force Base and on the south by Fort Bliss Military Reservation. U.S. Highway 70 crosses WSMR from east to west and serves as the main access to the Main Post area. There are no other populated areas located within the boundaries of the facility (Figure 1-1, Appendix 1A, pg. 1A-1).

WSMR is an active installation serving as the U.S. Army's largest rocket and missile development, firing, and testing facility. It is a major center for the testing of new missile systems. WSMR performs applied research, field trials of new missile types, and new applications of existing missile systems. The installation also hosts inter-forces training of troops in a desert environment using tactical exercises for the North Atlantic Treaty Organization (NATO) and Allied Forces. The current configuration of WSMR includes launch sites, impact areas, instrumentation sites, and support facilities

required to develop and test missiles and rockets. WSMR is designated as a National Range focused on the support of missile development and test programs for the Army, Navy, Air Force, National Aeronautics and Space Administration (NASA), and other U.S. and foreign governmental agencies. Thousands of missile firings, airdrops, and static tests have been conducted as part of this mission.

WSMR was established in 1945 for the development of a missile defense program that started with the testing of captured German V-2 rockets. The Range, formerly known as White Sands Proving Ground, was formed from privately held grazing land that was either donated to the government or condemned for the use of the government. WSMR has been active since its establishment with no decrease in land holdings.

1.2 Land Use

1.2.1 Current Land Use

WSMR is withdrawn public domain land controlled by the Department of Defense. For safety and security reasons, access to WSMR is restricted to authorized military and civilian personnel. Residential areas are limited to concentrated tracts at the Main Post and several uprange command and control centers. The land on the missile range is predominantly used to stage tests of aerial weapons systems. Although much of the weapons testing occurs in the airspace above the range, designated support, launch, and impact areas have been established. The SWMUs included in this Class III permit modification request are located in an industrial setting and public access is restricted by fences and military police.

1.2.2 Future Land Use

The Department of Defense will continue the primary mission at WSMR for the foreseeable future. Public access to the approximately 3,200 square miles (8,300 square kilometers [km]) of land comprising the missile range will continue to be restricted.

1.3 Climatology

Average annual precipitation measured at a gauging station in the Tularosa Basin, southeast of the White Sands Main Post, is 10.8 inches (27.4 centimeters [cm]) per year. About 50 percent of the annual precipitation falls in the months of July through

September in southern New Mexico. The average high temperature in the summer is about 92 degrees Fahrenheit (°F) (33 degrees Celsius [°C]) with the lows reaching 65°F (18°C). During the winter months the average high is about 57°F (14°C) and the average low is about 36°F (2°C). Average annual humidity readings are only 37 percent. Wind is a climatic factor at WSMR from February through May. Westerly winds can reach about 40 miles per hour (65 km per hour).

1.4 WSMR Regional Physiography and Ecology

1.4.1 Geology

WSMR lies within the Mexican Highland Section of the Basin and Range Province. This province is characterized by a series of tilted fault blocks forming longitudinal, asymmetric ridges, or mountains, and broad intervening basins. The geology of WSMR consists predominantly of the Tularosa Basin and surrounding mountain ranges. The San Andres Mountains, San Augustin, and Oscura Mountains border the Tularosa Basin on the west while the Sacramento Mountains form the eastern border. A narrow region of north-south-trending, large-displacement normal faulting separates the mountains from the basin resulting in the change in relief across the missile range (Figure 1-2, Appendix 1A, pg. 1A-2). The average elevation of the Tularosa Basin is 4,000 feet (ft) above mean sea level (amsl). The majority of WSMR property including most test facilities is located within the Tularosa Basin (WSMR, 1998).

The Tularosa Basin contains thick sequences of Tertiary and Quaternary age alluvial and bolson fill deposits. These sediments, more than 5,000 ft thick in some areas, consist mainly of silt, sand, gypsum and clay weathered from the surrounding mountain ranges. The average elevation of the basin floor is 4,000 ft amsl and surface features consist of flat sandy areas, sand dunes, basalt flows, and playas (dry lake beds).

The nature of the bolson-fill deposits varies both laterally and vertically throughout the Tularosa Basin. Coarse-grained, poorly sorted sediments deposited near mountain fronts grade into fine-grained, well sorted sediments towards the center of the basin (Kelly, 1973). Sediments further from the mountain fronts also contain a greater percentage of clay and gypsum. Vertically, the sediments are reported to become finer-grained and more consolidated until reaching a laterally continuous clay unit at about 1,000 ft below ground surface (bgs). (Kelly and Hearne, 1976).

In general, the stratigraphy is represented by unconsolidated to partially consolidated, fine to medium-grained sand with subordinate amounts of clay. Caliche is present as discrete layers and nodules throughout the stratigraphic section. Although no faults within the basin fill are mapped within the immediate area, Quaternary faulting is known to exist within the region. These faults are reported to occur within the unconsolidated bolson sediments, trend north to south, and are most common near the mountain fronts. Orr and Myers (1986) divide the Tularosa Basin fill deposits into 5 distinct mappable units which include:

- Coarse to fine-grained deposits occur in gently sloping alluvial fans along the basin margin. The alluvial fans spread outward from the surrounding mountain slopes and coalesce into flat alluvial plains toward the basin interior. These fan deposits interfinger with lacustrine (lake) and alluvial deposits of the central part of the Tularosa Basin.

- Fine-grained sediments formed from lacustrine deposition extend throughout most of the Tularosa Basin. These deposits consist mainly of clay and evaporites with minor sand beds and occur near surface in the northern part of the basin and at depth in the southern part of the basin.

- Fluvial-eolian sand, gravel, and clay deposits occur in the southern part of the basin, near Fort Bliss, extending from the Organ and Franklin Mountains and south to the Hueco Mountains.

- Gypsiferous evaporite deposits of the Lake Lucero-White Sands area occupy the White Sands National Monument (WSNM) and areas administered by WSMR including the Lake Lucero area and the alkali flats north of Lake Lucero. These deposits occur as dense recrystallized gypsum, gypsum sand dunes, and alluvial deposits. Hard caliche (cemented with recrystallized gypsum) is present at or near surface in the dry lake gypsum deposits of the central portion of the basin.

- The last depositional unit is described as composed of coarse-grained deposits saturated with saline water in the central portion of the Tularosa Basin.

The Main Post is situated on the distal portion of the alluvial fan complex eroded from the Organ Mountains to the west. Deposits expected to be encountered at the Main Post correspond to the first mappable units described above. The predominant slope

across the area causes runoff water to flow east towards the center of the Tularosa Basin. Coincidentally, the prevailing wind direction is from the west and southwest. Wind and water currents winnow fine-grained particles and disperse them eastward, while coarser (and very dense) material remains behind as sediment.

1.4.2 Surface Hydrology

Very little surface water exists at WSMR due to low annual precipitation, high evapotranspiration rates, and high infiltration characteristics of the soils. During the summer season, when thunderstorm activity is most common, playas within the basin may contain standing water. Arroyos which drain the surrounding mountains usually contain water only following heavy precipitation events. The Tularosa Basin is a closed basin with no surface water drainage outside of WSMR.

1.4.3 Geohydrology

The WSMR Main Post obtains its potable water supply from an aquifer in the upper bolson deposits (Figure 1-3, Appendix 1A, pg. 1A-3). The majority of the ground water recharge to this bolson aquifer occurs through the coarse, unconsolidated Tertiary/Quaternary alluvial fan deposits and arroyos along the eastern flank of the Organ, San Augustin and San Andres Mountains. This aquifer consists of a wedge-shaped belt of potable water more than 30 miles long from north to south, and 3 to 5 miles east from the mountain front. Ground water in the vicinity of the Main Post is of sufficient quality (less than 1,000-milligrams per liter [mg/L] total dissolved solids [TDS]) for human consumption. McClean (1970) reported this freshwater zone extends down to about 1,800 ft bgs.

Recharge to the regional aquifer is from precipitation falling on the mountain ranges and alluvial fans, which border the bolson on the west (WSMR, 1993). This precipitation infiltrates the unconsolidated, relatively coarse deposits of the alluvial fans, and the resultant ground water flows toward the center of the Tularosa Basin, generally to the east-southeast. To the east, ground water becomes more mineralized, primarily with sulfate and chloride, most likely due to the slow lateral migration rate of ground water from recharge to discharge areas in the presence of readily soluble minerals in the bolson sediments. However, ground water flow direction within the western Tularosa Basin region is presumed to discharge to the south as underflow into the contiguous, northern Hueco Basin of western Texas. No surface expressions of ground water discharge have been reported within the western Tularosa Basin.

1.5 Ecology

1.5.1 Flora

The vegetation matrix typical to WSMR is defined as climax dune vegetation typically consisting of honey mesquite (*Prosopus glandulosa*), four-winged saltbush (*Atriplex canescens*), soaptree yucca (*Yucca elata*), sand dropseed (*Sporobolis cryptandrus*), broom snakeweed (*Gutierrezia sarothrae*), and annuals. [Blowouts and wind-sifted actively moving sand dunes with little inter-dunal vegetation comprise dune land.] Competition for moisture by mesquite limits grasses in this habitat. Grasses that sporadically occur include spike dropseed (*Sporobolus contractus*), mesa dropseed (*Sporobolus flexuosus*), and alkali sacatone (Sporobolus airoides).

WSMR lists Scheer's pincushion cactus (*Coryphantha scheeri*) as a species of concern that infrequently occurs in this habitat type. A more comprehensive list of vegetation occurring in the Main Post Area is provided below.

Vegetation

Atriplex canescens-Fourwing Saltbush	Chilopsis linearis-Desert Willow
Gutierrezia sarothrae-Broom Snakeweed	Larrea tridentata-Creosotebush
Muhlenbergia porteri-Bush Muhly	Opuntia imbricata-Tree Cholla
Opuntia phaeacantha-Engelman's Prickly Pear	Opuntia violaceae-Purple Prickly Pear
Prosopis glandulosa-Honey Mesquite	Sporobolus ariodies-Alkali Sacatone
Sporobolus contractus-Spike Dropseed	Sporobolus cryptandrus-Mesa Dropseed
Sporobolus flexuosus-Sand Dropseed	Yucca elata-Soaptree Yucca

1.5.2 Fauna

Black-tailed jackrabbits (Lepus californicus) and desert cottontail rabbits (Sylvilagus audubonii) occur in the WSMR Main Post area with high frequency. Oryx (Oryx gazella), mule deer (Odocoileus hemionus), mourning dove (Zenaida macroura), and scaled quail (Callipepla squamata) also occur in the area. Non-game wildlife sited around the Main Post includes raptors such as red-tailed hawks (Buteo jamaicensis), Swainson's hawks (Buteo swainsoni), and American kestrels (Falco sparverius).

Songbirds common around Main Post include black-throated sparrows (Amphispiza bilineata), house finches (Carpodacus mexicanus), and Say's phoebes (Sayornis saya).

The Texas horned lizard (Phrynosoma cornutum) does occur in this habitat. This species is not listed as threatened or endangered, but is a New Mexico candidate (2C) species. The Texas horned lizard is very common and widespread throughout suitable habitats on WSMR. Herpetologists for the New Mexico Department of Game and Fish have recommended that the Texas horned lizard be removed from the State candidate list. A more comprehensive list of wildlife species occurring in the Main Post Area is provided below.

Avians

Amphispiza bilineata-Black-throated Sparrow	Buteo jamaicensis-Red-tailed Hawk
Buteo swainsoni-Swainson's Hawk	Callipepla squamata-Scaled Quail
Carpodacus mexicanus-House Finch	Corvus cryptoleucus-Chihuahuan raven
Falco sparverius-American Kestrel	Geococcyx californianus-Greater Roadrunner
Lanius ludovicianus-Loggerhead Shrike	Mimus polyglottos-Mockingbird
Sayornis saya-Say's Phoebe	Zenaida asiatica-White-winged Dove
Zenaida macroura-Mourning Dove	Zonotrichia leucophrys-White Crowned Sparrow

Invertebrates

Acrididae–Grasshopper (2 species)	Anthophoridae–Carpenter Bee
Ceribicidae–Longhorn Beetle	Coccinelidae–Lady Beetle
Formicidae–Red, Black, and Harvester Ants (3 species)	
Halictidae–Sweat Bee	Lycosidae–Wolf Spider
Mantidae–Praying Mantis	Pieridae–Moth
Simuliidae–Gnats	Termitidae–Termite
Tenebrionidae–Tenebrionid Beetle	

Mammals

Canis latrans–Coyote	Lepus californicus–Black-tailed Jackrabbit
Odocoileus hemionus–Mule Deer	Oryx gazella–Oryx
Sylvilagus audubonii–Desert Cottontail	Thomomys botae–Gopher

Reptiles

Cnemidophorus tigris–Western Whiptail	Crotalus atrox–Western Diamondback Rattlesnake
Gambelia wislizinii–Leopard Lizard	Masticophis flagellum–Coachwhip
Pituophis melanoleucas–Gopher Snake	Uta stansburiana–Side-blotched Lizard

Appendices

Appendix 1A - Figures

Appendix 1A

Introduction
Figures

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: TR:
Project (Project #)
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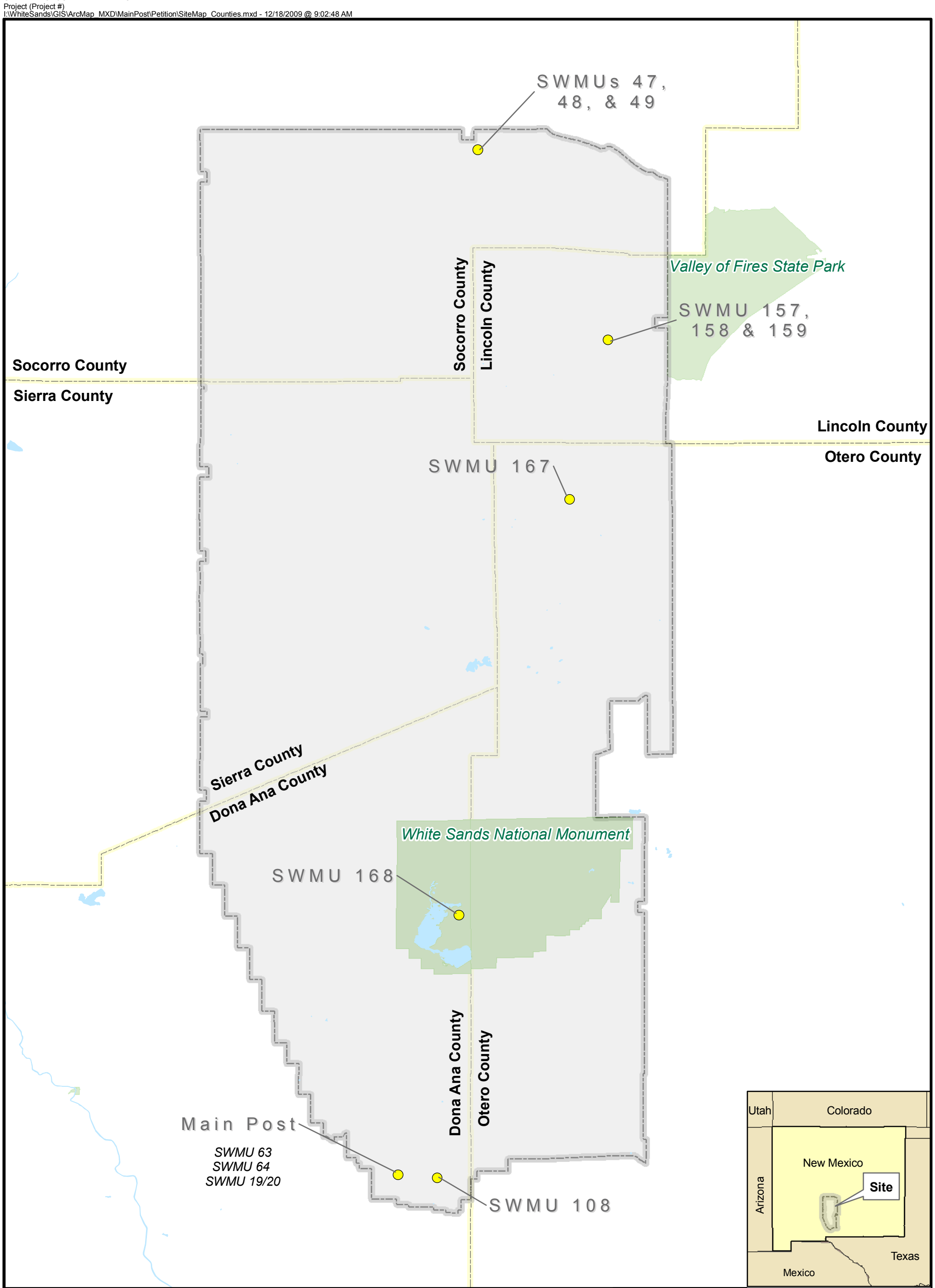


Legend

- County Boundary
- White Sands Missile Range Boundary
- Water Body
- National Park or Forest
- State Park or Forest

N

0 7 14 Miles

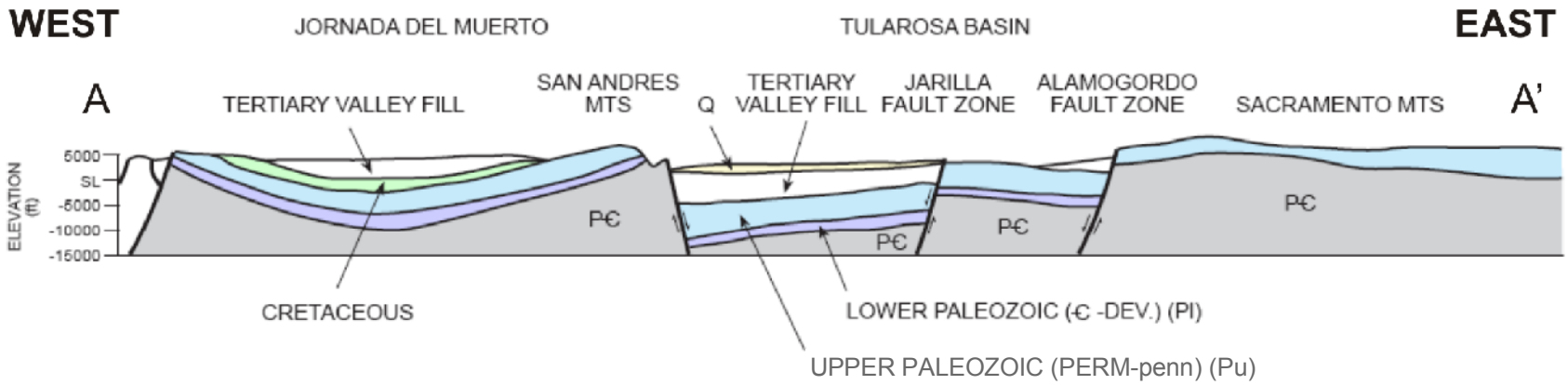
GRAPHIC SCALE

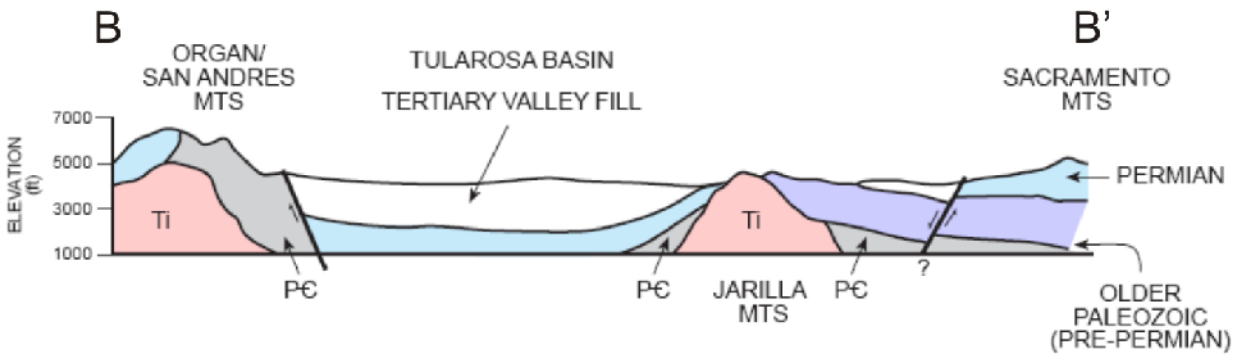
WHITE SANDS MISSILE RANGE
NEW MEXICO

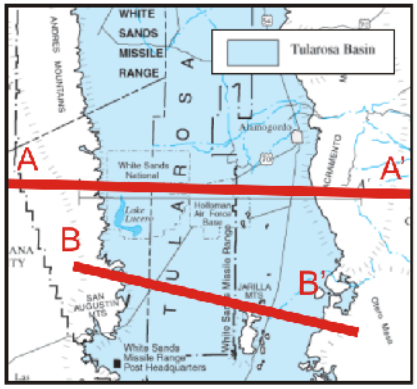
SWMU LOCATION

ARCADIS

FIGURE
1-1







LEGEND

- QUATERNARY (TULAROSA ONLY)
- VALLEY FILL (TERTIARY)
- TERTIARY INTRUSIVES
- MESOZOIC
- PERMIAN
- PALEOZOIC EXCLUDING PERMIAN
- PRECAMBRIAN

NOTES:
CROSS SECTIONS AS SHOWN IN FRYBERGER (2008).

0 10 20
MILES

WHITE SANDS MISSILE RANGE
NEW MEXICO

GEOLOGIC CROSS SECTIONS OF THE TULAROSA BASIN AND SURROUNDING RANGES

ARCADIS

FIGURE
1-2

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: TR:
Project (Project #)
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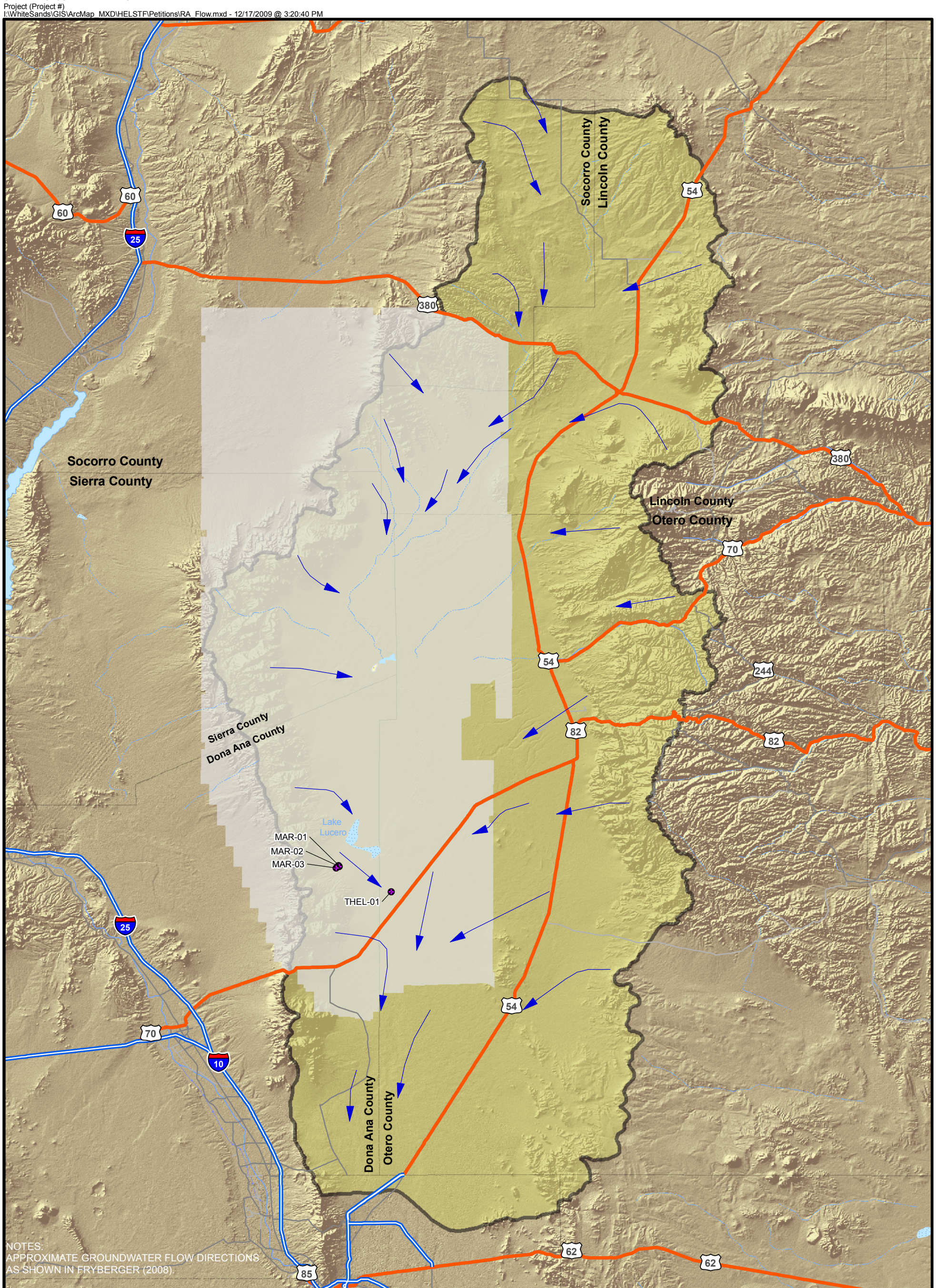


LEGEND

- WATER SUPPLY WELLS
- APPROXIMATE GROUNDWATER FLOW DIRECTION

ROADS
- LIMITED ACCESS
- HIGHWAY
- MAJOR ROAD
- MINOR ROAD
- STREAM
- INSTALLATION BOUNDARY
- COUNTY BOUNDARY
- TULAROSA BASIN

N

0 10 20 Miles
GRAPHIC SCALE

WHITE SANDS MISSILE RANGE
NEW MEXICO

REGIONAL AQUIFER GROUNDWATER FLOW DIRECTIONS TULAROSA-HUECO AQUIFER SYSTEM

ARCADIS

FIGURE
1-3

2. SWMU 19: Steam Wash Pad, Drains, and Oil/Water Separator

2.1 Summary

CCWS-01 (formerly WSMR-80) consists of a wash pad and drain, and an oil/water separator (OWS) (SWMU 19) located immediately north of Building 1753 in the southern part of the Main Post (Figure 2-1, Appendix 2A, pg. 2A-1). The OWS was formerly designated SWMU 20. In 1999, the NMED and WSMR agreed that SWMUs 19 and 20 could be combined as one unit under the designation SWMU 19 (MEVATEC, 2000b), and it has been combined in the facility's December 2009 RCRA permit. This site is active and used for spray washing vehicles. The wash pad and OWS have been active since approximately 1968 and 1984, respectively. Due to reported releases of wash water prior to 1988, these sites were included in the WSMR RCRA Facility Assessment (RFA) and RCRA Facility Investigations (RFIs). The site was characterized by soil vapor and soil sampling and found to be minimally affected by the unit.

A *RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report* (Kearney, 1988) described SWMUs 19 and 20 (now SWMU 19) and determined that there was no history of release from either site. There was no evidence of release noted during the Visual Site Inspection (VSI), and the RFA concluded that release potential to environmental media was low.

The WSMR *Final RCRA Facility Investigation Report Appendix II, III, and IV Sites* (IT Corporation (ITC), 1992) included a 10-point Soil Vapor Survey (SVS) to detect contaminants from past or present releases that may have occurred (Appendix 2A, Figure 2-2, pg. 2A-2). The SVS detected no target compounds, methane, or elevated carbon dioxide in the immediate vicinity of the site. Although, the Phase I RFI report concluded that no release had occurred at the site based on the SVS, it included recommendations for the drilling and sampling of soil borings to evaluate the possible release of heavy-end hydrocarbons and metals.

The WSMR *Phase-II RCRA Facility Investigation, Appendix I, II, III and IV Sites* (Sverdrup Environmental Inc. (SEI), 1994) included the collection of 11 soil samples from three soil borings (Appendix 2A, Figure 2-2, pg. 2A-2). The soil samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and RCRA 8 metals. The analytical results of the collected soil samples confirmed the Phase I SVS findings (i.e., there

was no evidence of a release based on the analytical results). The Phase II RFI recommended that the investigation of SWMUs 19 and 20 be discontinued since no significant release of contaminants was identified.

WSMR received Notices of Deficiency (NODs) from the USEPA (1995) (Appendix 2C, Page 2C-1) following review of the Phase II RFI. However, both NODs stated that no constituents related to the operational history of SWMUs 19 and 20 were found and that WSMR should submit a request for a Class III Permit Modification delisting the SWMUs from further investigation under the RFI/CMS process (Appendix 2C, Page 2C-12).

In January 2000, WSMR submitted the *Petition to Perform Class III Modifications to Remove Solid Waste Management Units 10, 11, 16, 17, 19, 20, 80, 132, 140, 150 and 156 from the White Sands Missile Range RCRA Part B Permit* (MEVATEC, 2000a) to the NMED. On October 13, 2000, the NMED responded with a letter stating that the petition document was incomplete. It stated that the analytical summary data tables and analytical reporting results were incomplete (NMED, 2000). On March 11, 2002, the NMED responded again with a letter indicating that this petition and two other petitions were administratively incomplete. Specifically, the NMED indicated that SWMUs 19 and 20 required ecological risk assessments (NMED, 2002).

A human health and ecological risk assessment was conducted in November 2009 using the data previously collected at the site for SMWUs 19 and 20 (now identified as SWMU 19). The human health risk assessment evaluated current and future exposures to soils and vapor from soils. This assessment indicated that constituents associated with SWMU 19 are unlikely to adversely affect human health. The ecological risk assessment evaluated constituents in soils (including bioaccumulative constituents) and food chain modeling. The ecological risk assessment determined that there were no adverse environmental impacts associated with SWMU 19.

2.2 Site Description and Operational History

2.2.1 Site Description

The Steam Wash Pad and Drains and the associated OWS (SWMU 19) are located immediately north of Building 1753 in the southern Main Post area. The site plan of SWMU 19 is shown in Figure 2-1 (Appendix 2A, pg. 2A-1). The concrete wash pad (Photograph 2-1, Appendix 2A, pg. 2A-3) is 50 ft by 15 ft with an interconnected

network of three drains located approximately 15 ft apart along the center of the wash pad. Wastewater collected in the drains discharges, via underground pipes, to the concrete, 500-gallon OWS located approximately 40 ft southeast of the wash pad.

2.2.2 Operational History

The Steam Wash Pad and Drain have been active since approximately 1968, and the OWS has been active since 1984. The concrete pad has always been used for spray washing of vehicles. The current OWS replaced an earlier version that was undersized. The OWS is constructed of concrete, it is vented, and it is covered by a metal plate. Oil and debris are separated from the wash water by gravity in the OWS. This material is periodically removed and deposited into the Waste Oil Tank (SWMU 8). Wastewater leaving the OWS enters the sanitary sewer collection system for treatment at the Main Post Sewage Treatment Plant (STP).

2.3 Land Use

2.3.1 Current

SWMU 19 is currently active and receives wastewater from the spray washing of heavy equipment and vehicles. This SWMU is located in an industrial area of the Main Post at WSMR. WSMR Headquarters and most installation support activities are currently located at the Main Post area.

2.3.2 Future/Proposed

No change in the usage of SWMU 19 is proposed or anticipated, and the industrial use in this area of the Main Post is anticipated to continue. WSMR is an integral part of the defense system of the United States; therefore, the Range will remain active for the foreseeable future.

2.4 Investigative Activities

2.4.1 Summary

SWMU 19 was included in three RCRA assessments/investigations. During these investigations, SWMU 19 was identified as SWMUs 19 and 20. The RFA (Kearney, 1988), Phase I RFI (IT Corp, 1992), and Phase II RFI (SEI, 1994) are summarized

below. The investigations indicated that no further action is warranted, as no evidence of a release of contamination was discovered.

2.4.2 Investigation #1: RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report (Kearney, 1988)

2.4.2.1 *Non-Sampling data Collection*

The RFA included a search of White Sands' files regarding SWMUs 19 and 20, and a visual inspection of the sites. No records of historic contaminant releases from SWMUs 19 and 20 and no visible evidence of a release were reported during the RFA.

2.4.2.2 *Sampling Data Collection*

No environmental sampling was conducted for the RFA. No record of historical sampling was reported in the RFA.

2.4.2.3 *Data Gaps*

No data gaps were identified.

2.4.2.4 *Results and Conclusions*

The RFA stated that there was no record or visual evidence that a release was discovered. Additionally, the potential for a release to soil, groundwater, surface water, and air, as well as the potential for the generation of subsurface gas, was determined to be low.

2.4.3 Investigation #2: Final RCRA Facility Investigation (RFI) Report Appendix II, III, and IV Sites (IT Corp, 1992)

2.4.3.1 *Non-Sampling data Collection*

No additional non-sampling data was collected for the RFI report. This report relied on sampling data collected during the Phase I RFI and information from the RFA report to draw conclusions.

2.4.3.2 *Sampling Data Collection*

The RFI sampling consisted of the collection of soil vapor samples from 10 locations (Figure 2-2, Appendix 2A, pg. 2A-2). Samples were collected at 5-7 ft bgs. Three vapor samples were collected along the eastern edge of the wash pad and drains (SWMU 19), where the underground pipes exit the pad toward the OWS, and seven samples were taken around the perimeter of the OWS (SWMU 20). The samples were analyzed for the presence of VOCs.

2.4.3.3 *Data Gaps*

The RFI noted that soil vapor sampling would not detect heavy-end hydrocarbons and metals. Therefore, soil sampling for TPH, metals, and SVOCs adjacent to SMWUs 19 and 20 was recommended.

2.4.3.4 *Results and Conclusions*

The SVS detected no target compounds or methane, nor elevated carbon dioxide (CO_2) in the immediate vicinity of the SWMUs. Increasing CO_2 concentrations were detected northeast of the SWMUs, indicating a separate source. The SVS results are provided in the Summary of Analytical Results Table (Appendix 2B, pg. 2B-1). Additional soil borings around the SWMUs were recommended, as metals and heavy-end hydrocarbons could not be detected by the soil vapor sampling.

2.4.4 Investigation #3: Phase-II RCRA Facility Investigation, Appendix I, II, III and IV Sites (SEI, 1994)

2.4.4.1 *Non-Sampling data Collection*

No additional non-sampling data was collected for the Phase II RFI report. This report relied on sampling data collected during the Phase I and II RFIs and information from the RFA report to draw conclusions.

2.4.4.2 *Sampling Data Collection*

The Phase II RFI sampling consisted of drilling and sampling three 10-ft deep soil borings (Figure 2-2, Appendix 2A, pg. 2A-2). Soil samples were collected at 2-foot intervals to a total depth of 10 ft bgs. One boring was advanced on the east side of

the wash pad (SWMU 19), one was advanced on the west side of the wash pad (SWMU 19), and the third boring was advanced north of the OWS (SWMU 20). The samples were analyzed for the presence of VOCs, SVOCs, TPH, and RCRA 8 metals (Table 2-1, Appendix 2B, pg. 2B-2).

2.4.4.3 *Data Gaps*

Poor sample recovery was noted in boring 1920SB01, resulting in no sample being collected from the 0-2 ft interval in that boring.

2.4.4.4 *Results and Conclusions*

As shown on Table 2-1 (Appendix 2B, pg. 2B-2), no VOCs or SVOCs were detected in soil samples collected. TPH were detected in several samples, with a maximum concentration of 234 mg/kg in the surface soil sample from SWMU 19 SB-02. All other TPH concentrations were less than 140 mg/kg. All TPH concentrations were below the soil remediation level of 1,000 milligrams per kilogram (mg/kg), established by the New Mexico Environmental Improvement Board (EIB) in 20 NMAC 9.1, Subpart VII.708 (NMED, 1995), and in effect at the time of the Phase II RFI. The following metals were detected in some or all of the samples collected: barium, cadmium, lead, mercury, and silver. All detected concentrations of these metals were below respective USEPA Region 9 residential Preliminary Remediation Goals (PRGs) in 1994. The Phase II RFI concluded that no further investigation was necessary as there was no evidence of a release from SWMUs 19 and 20. The Phase II RFI report also recommended that a Class III modification be performed to remove SWMUs 19 and 20 from the HSWA module of the permit.

In May 1995, the USEPA issued a NOD following review of the Phase II RFI (USEPA, 1995). However, the NOD stated that no constituents related to the operational history of SWMUs 19 and 20 were found. Comments indicated that WSMR should submit a request for a Class III Permit Modification delisting the SWMUs for no further investigation under the RFI/CMS process (Appendix 2C, pg. 2C-1).

In September 1996, the NMED issued a NOD following review of the Phase II RFI (NMED, 1996). The site specific comments provided in the NOD stated that no constituents related to the operational history of these SWMUs were found during the RFI. The comments indicated that NMED concurs with WSMR's conclusion and recommends no further action at this SWMU. Further, the NMED stated that WSMR

may propose a Class III permit modification to remove these SWMUs from its permit (Appendix 2C, pg. 2C-4).

In January 2000, WSMR submitted the *Petition to Perform Class III Modifications to Remove Solid Waste Management Units 10, 11, 16, 17, 19, 20, 80, 132, 140, 150 and 156 from the White Sands Missile Range RCRA Part B Permit* to the NMED (MEVATEC, 2000a). On October 13, 2000, the NMED responded with a letter stating that the petition document was incomplete. It stated that the analytical summary data tables and analytical reporting results were incomplete (NMED, 2000). On March 11, 2002, the NMED responded again with a letter indicating that this petition, as well as two others, was administratively incomplete (Appendix 2C, pg. 2C-13). Specifically, the NMED indicated that SWMUs 19 and 20 required ecological risk assessments (NMED, 2002).

2.5 Site Conceptual Model

2.5.1 Nature and Extent of Contamination

No VOCs were detected during the SVS event. In addition, no VOCs or SVOCs were detected in soil samples collected at SWMU 19and 20 (now SWMU 19). TPH and metals were detected in soils; however, all concentrations are below applicable standards and did not indicate that there had been a release from these units.

2.5.2 Environmental Fate

TPH concentrations were slightly elevated in one shallow soil sample adjacent to SWMU 19. TPH concentrations are likely to naturally attenuate due to low source area concentrations, adsorption to soils, and biodegradation in oxygenated soils. Metals concentrations detected in soils did not exceed regulatory standards and are not likely to migrate vertically, due to low constituent concentrations and low infiltration rates at the site. Metals concentrations generally decrease with depth in the vicinity of these SWMUs, demonstrating relatively low migration potential.

2.6 Site Assessments

2.6.1 Human Health Screening and Risk Assessments

The purpose of this risk assessment is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil samples collected from SWMU 19 (formerly identified as SWMUs 19 and 20). The risk assessment approach is described in Appendix 2D (pg. 2D-1).

In accordance with NMED guidance (NMED, 2009a), constituent concentrations in surface soil, and in combined surface and subsurface soil were compared to health-based screening levels and the calculated ratios summed and multiplied by 1x10-5 for carcinogens or by 1 for non-carcinogens. The total screening risk for carcinogenic effects could not be calculated because no carcinogens were detected in soil at SWMU 19. The total screening hazard indices were equal to or less than the NMED target hazard index of 1. The results of this data screening process indicate that after comparison to health-based soil screening levels for industrial worker exposure, residential exposure, and construction worker exposure, no contaminants of potential concern (COPCs) were selected for surface soil, or for combined surface and subsurface soil at SWMU 19. This demonstrates that the constituent concentrations in surface soil and in combined surface and subsurface soil at SWMU 19 are unlikely to result in adverse health impacts to the following potential receptors via direct contact exposure (i.e., ingestion, inhalation of vapor/dust, dermal):

- Current and future site workers;
- Future residents (adults and children); and
- Future construction workers.

2.6.1.1 *Vapor Intrusion Scenarios*

No VOCs were detected in total soil; therefore, no COPCs were identified for the vapor intrusion evaluation at SWMU 19. This demonstrates that the constituent concentrations in soil at SWMU 19 are unlikely to result in adverse health impacts to the following potential receptors via inhalation of indoor air:

- Future site workers; and

- Future residents (adults and children).

2.6.2 Overall HHRA Summary

The results of this data screening process indicate that after comparison to health-based soil screening levels for industrial worker exposure, residential exposure, and construction worker exposure, no COPCs were selected for surface soil, or for combined surface and subsurface soil at SWMU 19. This demonstrates that the constituent concentrations in surface soil and in combined surface and subsurface soil at SWMU 19 are unlikely to result in adverse health impacts to the identified current and potential future receptors. Additionally, no VOCs were detected in soil, indicating that vapor intrusion is unlikely to result in adverse health impacts. Based on these results, additional human health risk assessment is not warranted for SWMU 19.

2.6.3 Ecological Screening and Risk Assessments

The purpose of the ecological risk assessment (ERA) is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil and combined surface and subsurface soil at SWMU 19 (formerly identified as SWMUs 19 and 20). The ERA was conducted in a manner consistent with NMED and USEPA guidance for ecological risk assessment (NMED, 2008; USEPA 2001a; 2000a; 1997). This ERA is intended to provide input for risk management decision-making for SWMU 19, while maintaining a conservative approach protective of wildlife populations and communities.

In accordance with USEPA guidance, this ERA is comprised of a screening level ecological risk assessment (SLERA) and a baseline ecological risk assessment (BERA) (NMED, 2008; USEPA, 2000a; 1997). The SLERA evaluates the potential risk to terrestrial ecological receptors exposed to constituents in surface and subsurface soil. The SLERA provides a conservative estimate of potential ecological risks and compensates for uncertainty by incorporating numerous conservative assumptions. The purpose of the SLERA is to determine whether or not there is a high probability that there are no ecologically significant risks that would merit additional evaluation as provided by a BERA (USEPA, 2000a; 1997). If the results of the SLERA warrant a BERA, the information developed in the SLERA is used to help focus the BERA. The BERA is more complex than the SLERA and uses more realistic and site-specific information about potential exposures and effects in order to evaluate potential

ecological risks. A detailed description of the methodologies used for the ecological risk assessment is provided in Appendix 2D (pg. 2D-9)

A SLERA and BERA were completed for SWMU 19 to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil and subsurface soil, and to conduct food chain modeling for the Constituents of Potential Ecological Concern (COPECs) identified as bioaccumulative. The results of the SLERA and BERA for direct contact exposure and for food chain modeling indicate there is adequate information to conclude that adverse impacts are unlikely to occur for ecological receptors potentially exposed to constituents in soil. Therefore, no further ecological evaluations at SWMU 19 are warranted.

Based on the results of the HHRA and ERA, there are no adverse environmental impacts associated with SWMU 19 as a result of historical site activities, and no restrictions need to be applied to current or potential future land use at the site.

2.6.4 Other Applicable Assessments

A screening assessment for soil erosion potential at the site was conducted according to the procedure developed by the NMED Surface Water Quality Bureau. The erosion potential survey found that the risk of contaminant migration to storm water is low (the site scored 15.6 on a scale of 100). The screening assessment was included in Appendix A of the initial petition to remove SWMUs 19 and 20 from the RCRA permit (MEVATEC, 2000a) and is provided in Appendix 2D (pg. 2D-79).

2.7 No Further Action Proposal

2.7.1 Rationale

No VOCs were detected in soil vapor samples collected in the vicinity of SWMU 19 during the Phase I RFI. No VOCs or SVOCs were detected in soil samples collected during the Phase II RFI, and only low concentrations of TPH and metals were detected in soils to a maximum depth of 8 ft bgs. All TPH and metals concentrations were below appropriate action levels. Based on the results of the Phase I and II RFIs, WSMR proposed No Further Action (NFA) for these SWMUs. The NMED and USEPA concurred with the proposed NFA and indicated that WSMR should submit a petition for Class III Permit Modification delisting the SWMUs for no further investigation under the RFI process (Appendix 2C, pg 2C-12). The human health risk assessment

demonstrated that there are no current or future risks associated with environmental conditions at SWMU 19. In addition, the results of the SLERA and BERA for direct contact exposure and for food chain modeling indicate there is adequate information to conclude that adverse impacts are unlikely to occur for ecological receptors potentially exposed to constituents in soil at SWMU 19.

There are no adverse environmental impacts associated with SWMU 19 as a result of historical site activities and no restrictions need to be applied to current or potential future land use at the site. Accordingly, the site is recommended for no further action and should be closed out of the RCRA process.

Based on these results, application is hereby made to perform a Class III modification to remove SWMU 19 from the White Sands HSWA permit in accordance with 40 CFR §264.514 and §270.42, and 20 NMAC 4.1.

2.7.2 Criterion

The criterion applied to this site is NFA Criterion 5 as described by the NMED: The SWMU has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

Appendices

Appendix 2A – Figures and Photographs

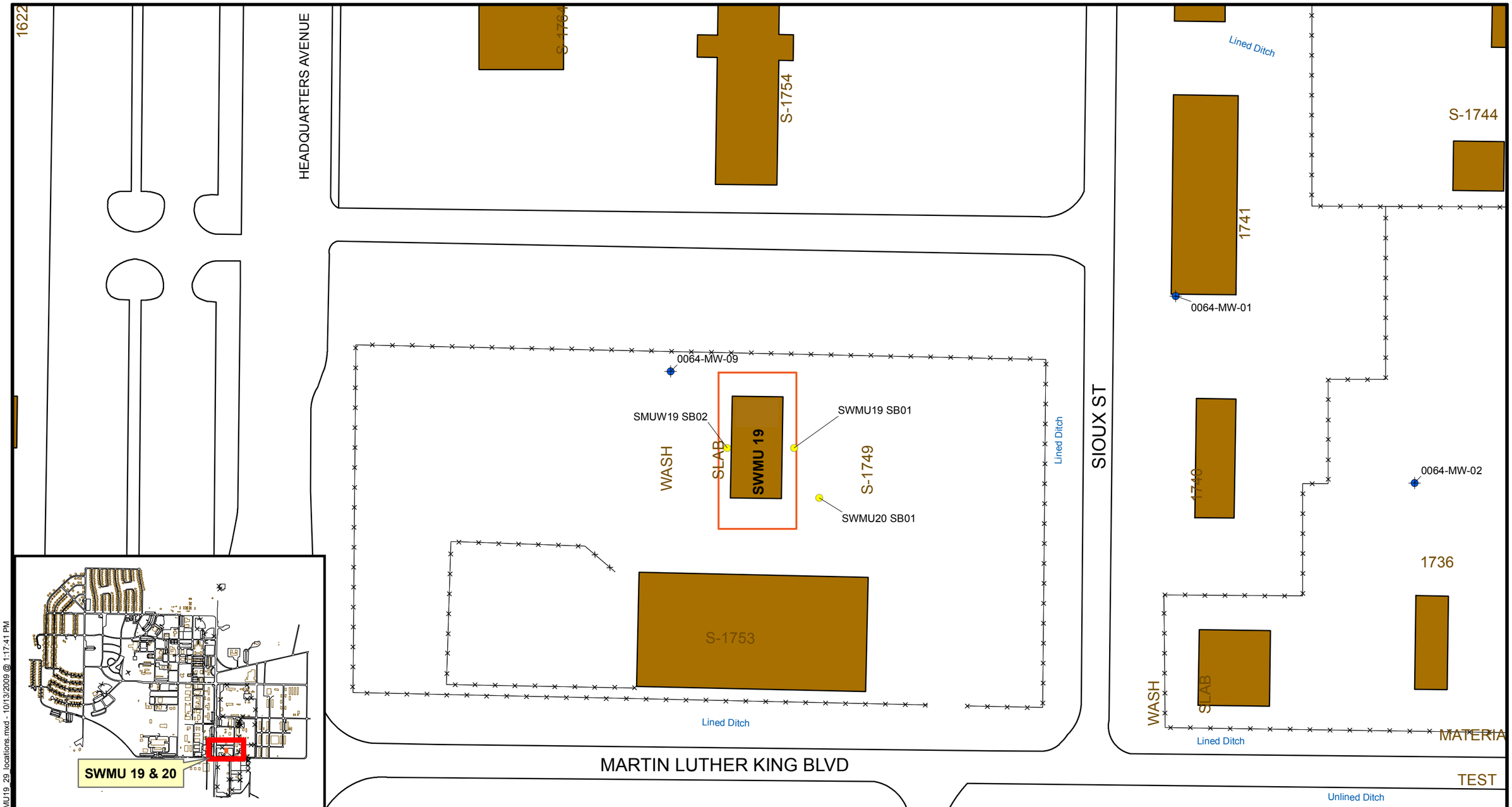
Appendix 2B – Analytical Results Tables

Appendix 2C – Correspondence

Appendix 2D – Other Applicable Assessments

Appendix 2A

SWMU 19
Figures and Photographs



LEGEND

- Well Location
- Boring Location
- Streets
- Fence
- Buildings

Note:
SWMUs 19 and 20 were combined as SWMU 19 on the December 2009 WSMR RCRA Permit

N

0 75 150 Feet

GRAPHIC SCALE

WHITE SANDS MISSLE RANGE
NEW MEXICO

MAIN POST
SWMU 19

ARCADIS

FIGURE
2-1

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: TR:
Project (Project #)
I:\WhiteSands\GIS\ArcMap_MXD\MainPost\SWMU19_29_locations.mxd - 10/13/2009 @ 1:17:41 PM

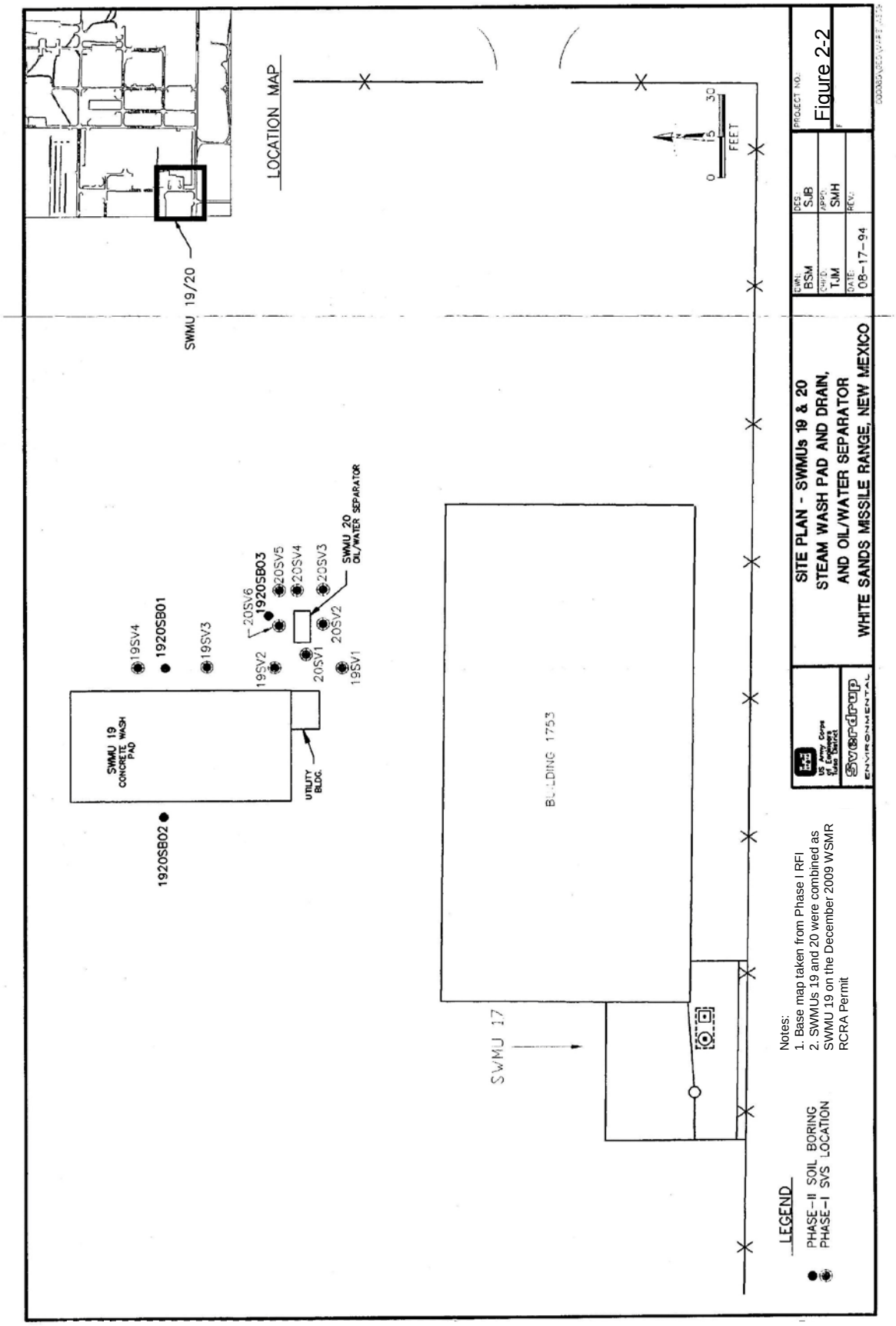


Figure 2-2 Soil Vapor Sampling Locations for SWMUs 19
Source: SEI, 1994

Photograph 2-1 View of the Steam Wash Pad and Oil/Water Separator (SWMU 19) at Bldg. 1753

Appendix 2B

SWMU 19
Analytical Results Tables

SUMMARY OF ANALYTICAL RESULTS
WASH PAD & OIL/WATER SEPERATOR
SWMUs 19 & 20
WSMR SOIL VAPOR SURVEY
APPENDIX II, III, & IV RFI SITES
42-1671

Sample No.	Run	Methane	Carbon dioxide	Run	Benzene	Toluene	Ethylbenzene	m-Xylene	p-Xylene	o-Xylene
		g/m3	g/m3		mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3
19SV1	660	<.02	13	542	<3	<4	<4	<4	<4	<4
19SV2	707	<.02	16	586	<3	<4	<4	<4*	<4	<4*
19SV3	706	<.02	15	585	<3	<4	<4	<4	<4	<4*
19SV4	703	<.02	29	582	<3	<4	<4	<4	<4	<4
20SV1	623	<.02	19	512	<3	<4	<4	<4	<4	<4
20SV2	704	<.02	24	583	<3	<4	<4	<4*	<4	<4*
20SV3	621	<.02	23	510	<3	<4	<4	<4	<4	<4
20SV4	620	<.02	22	509	<3	<4	<4	<4	<4	<4
20SV5	708	<.02	24	587	<3	<4	<4	<4	<4	<4*
20SV6	622	<.02	22	511	<3	<4	<4	<4*	<4	<4

Notes:
* Constituents were detected below the noted Quantifiable Limit
SWMUs 19 and 20 were combined as SWMU 19 on the December 2009 WSMR RCRA Permit

ARCADIS
Table 2-1. Summary of Analytical Data
White Sands Missile Range, New Mexico
Source: SEI, 1994

	Location		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02
	Sample ID		0019SB01(000.0)	0019SB01(004.0)	0019SB01(004.0)QC	0019SB01(008.5)	0019SB02(000.0)	0019SB02(002.0)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		0	4	4	8.5	0	2
	Ending Depth (feet)		0	4	4	8.5	0	2
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of				0019SB01(004.0)			
CAS	Analyte	Units						
VOCs								
71-55-6	1,1,1-TRICHLOROETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
79-34-5	1,1,2,2-TETRACHLOROETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
79-00-5	1,1,2-TRICHLOROETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
75-34-3	1,1-DICHLOROETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
75-35-4	1,1-DICHLOROETHYLENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
96-18-4	1,2,3-TRICHLOROPROPANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
107-06-2	1,2-DICHLOROETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
78-87-5	1,2-DICHLOROPROPANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
764-41-0	1,4 DICHLORO-2-BUTENE	mg/kg	<0.0101	<0.0101	<0.01	<0.0105	<0.0101	<0.0101
78-93-3	2-BUTANONE	mg/kg	<0.0202	<0.0201	<0.02	<0.0211	<0.0202	<0.0203
110-75-8	2-CHLOROETHYL VINYL ETHER	mg/kg	<0.0101	<0.0101	<0.01	<0.0105	<0.0101	<0.0101
108-10-1	4-METHYL-2-PENTANONE(MIBK)	mg/kg	<0.0202	<0.0201	<0.02	<0.0211	<0.0202	<0.0203
67-64-1	ACETONE	mg/kg	<0.0202	<0.0201	<0.02	<0.0211	<0.0202	<0.0203
107-02-8	ACROLEIN	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
107-13-1	ACRYLONITRILE	mg/kg	<0.0101	<0.0101	<0.01	<0.0105	<0.0101	<0.0101
71-43-2	BENZENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
39638-32-9	BIS(2-CHLOROISOPROPYL)ETHER	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
75-27-4	BROMODICHLOROMETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
74-83-9	BROMOMETHANE	mg/kg	<0.0101	<0.0101	<0.01	<0.0105	<0.0101	<0.0101
75-15-0	CARBON DISULFIDE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
56-23-5	CARBON TETRACHLORIDE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
75-69-4	CFC-11	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
108-90-7	CHLOROBENZENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
124-48-1	CHLORODIBROMOMETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
75-00-3	CHLOROETHANE	mg/kg	<0.0101	<0.0101	<0.01	<0.0105	<0.0101	<0.0101
67-66-3	CHLOROFORM	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
74-87-3	CHLOROMETHANE	mg/kg	<0.0101	<0.0101	<0.01	<0.0105	<0.0101	<0.0101

ARCADIS
Table 2-1. Summary of Analytical Data
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Source: SEI, 1994

	Location		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02
	Sample ID		0019SB01(000.0)	0019SB01(004.0)	0019SB01(004.0)QC	0019SB01(008.5)	0019SB02(000.0)	0019SB02(002.0)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		0	4	4	8.5	0	2
	Ending Depth (feet)		0	4	4	8.5	0	2
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of				0019SB01(004.0)			
CAS	Analyte	Units						
156-59-2	CIS-1,2-DICHLOROETHENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
10061-01-5	CIS-1,3-DICHLOROPROPENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
74-95-3	DIBROMOMETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
75-09-2	DICHLOROMETHANE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
97-63-2	ETHYL METHACRYLATE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
100-41-4	ETHYLBENZENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
74-88-4	IODOMETHANE	mg/kg	<0.0101	<0.0101	<0.01	<0.0105	<0.0101	<0.0101
591-78-6	METHYL N-BUTYL KETONE	mg/kg	<0.0202	<0.0201	<0.02	<0.0211	<0.0202	<0.0203
108-88-3	METHYLBENZENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
91-20-3	NAPHTHALENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
100-42-5	STYRENE (MONOMER)	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
127-18-4	TETRACHLOROETHENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
156-60-5	TRANS-1,2-DICHLOROETHENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
10061-02-6	TRANS-1,3-DICHLOROPROPENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
79-01-6	TRICHLOROETHYLENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
108-05-4	VINYL ACETATE	mg/kg	<0.0202	<0.0201	<0.02	<0.0211	<0.0202	<0.0203
75-01-4	VINYL CHLORIDE	mg/kg	<0.0101	<0.0101	<0.01	<0.0105	<0.0101	<0.0101
1330-20-7	XYLENES	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
SVOCs								
120-82-1	1,2,4-TRICHLOROBENZENE	mg/kg	<0.333	<1.61	<0.33	<0.348	<0.334	<0.335
218-01-9	1,2-BENZPHENANTHRACENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
95-50-1	1,2-DICHLOROBENZENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
122-66-7	1,2-DIPHENYLHYDRAZINE	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
106-46-7	1,4-DICHLOROBENZENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
90-13-1	1-CHLORONAPHTHALENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
95-95-4	2,4,5-TRICHLOROPHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
88-06-2	2,4,6-TRICHLOROPHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
120-83-2	2,4-DICHLOROPHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335

ARCADIS
Table 2-1. Summary of Analytical Data
White Sands Missile Range, New Mexico
Source: SEI, 1994

	Location		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02
	Sample ID		0019SB01(000.0)	0019SB01(004.0)	0019SB01(004.0)QC	0019SB01(008.5)	0019SB02(000.0)	0019SB02(002.0)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		0	4	4	8.5	0	2
	Ending Depth (feet)		0	4	4	8.5	0	2
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of				0019SB01(004.0)			
CAS	Analyte	Units						
105-67-9	2,4-DIMETHYLPHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
51-28-5	2,4-DINITROPHENOL	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
91-58-7	2-CHLORONAPHTHALENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
95-57-8	2-CHLOROPHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
534-52-1	2-METHYL-4,6-DINITROPHENOL	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
91-57-6	2-METHYLNAPHTHALENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
95-48-7	2-METHYLPHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
88-74-4	2-NITROANILINE	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
88-75-5	2-NITROPHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
91-94-1	3,3'-DICHLOROBENZIDINE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
78-59-1	ONE	mg/kg	<0.333	<1.61	<0.33	<0.348	<0.334	<0.335
99-09-2	3-NITROANILINE	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
101-55-3	4-BROMOPHENYL PHENYL ETHER	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
59-50-7	4-CHLORO-3-METHYLPHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
7005-72-3	4-CHLOROPHENYL PHENYL ETHER	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
106-44-5	4-METHYL PHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
100-02-7	4-NITROPHENOL	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
83-32-9	ACENAPHTHENE	mg/kg	<0.333	<1.61	<0.33	<0.348	<0.334	<0.335
208-96-8	ACENAPHTHYLENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
120-12-7	ANTHRACENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
92-87-5	BENZIDINE	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
56-55-3	BENZO(A)ANTHRACENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
50-32-8	BENZO(A)PYRENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
205-99-2	BENZO(B)FLUORANTHENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
191-24-2	BENZO(G,H,I)PERYLENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
207-08-9	BENZO(K)FLUORANTHENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
65-85-0	BENZOIC ACID	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
100-51-6	BENZYL ALCOHOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335

ARCADIS

Table 2-1. Summary of Analytical Data

White Sands Missile Range, New Mexico

Source: SEI, 1994

	Location		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02
	Sample ID		0019SB01(000.0)	0019SB01(004.0)	0019SB01(004.0)QC	0019SB01(008.5)	0019SB02(000.0)	0019SB02(002.0)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		0	4	4	8.5	0	2
	Ending Depth (feet)		0	4	4	8.5	0	2
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of				0019SB01(004.0)			
CAS	Analyte	Units						
85-68-7	BENZYL BUTYL PHTHALATE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
111-91-1	BIS (2-CHLOROETHOXY) METHANE	mg/kg	<0.333	<1.61	<0.33	<0.348	<0.334	<0.335
111-44-4	BIS(2-CHLOROETHYL) ETHER	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
53-70-3	DIBENZ(A,H)ANTHRACENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
132-64-9	DIBENZOFURAN	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
84-66-2	DIETHYL PHTHALATE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
131-11-3	DIMETHYL PHTHALATE	mg/kg	<0.333	<1.61	<0.33	<0.348	<0.334	<0.335
84-74-2	DI-N-BUTYL PHTHALATE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
117-84-0	DI-N-OCTYL PHTHALATE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
122-39-4	DIPHENYLAMINE	mg/kg	<1.01	<1.01	<1	<1.05	<1.01	<1.01
206-44-0	FLUORANTHENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
86-73-7	FLUORENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
87-68-3	HEXACHLORO-1,3-BUTADIENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
118-74-1	HEXACHLOROBENZENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
77-47-4	HEXACHLOROCYCLOPENTADIENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
67-72-1	HEXACHLOROETHANE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
193-39-5	INDENO(1,2,3-CD)PYRENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
541-73-1	M-DICHLOROBENZENE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
621-64-7	N-NITROSODI-N-PROPYLAMINE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
86-30-6	N-NITROSODIPHENYLAMINE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
106-47-8	P-CHLOROANILINE	mg/kg	<0.00504	<0.00504	<0.005	<0.00527	<0.00506	<0.00507
87-86-5	PENTACHLOROPHENOL	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
85-01-8	PHENANTHRENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
108-95-2	PHENOL	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335
100-01-6	P-NITROANILINE	mg/kg	<1.61	<1.61	<1.6	<1.69	<1.62	<1.62
129-00-0	PYRENE	mg/kg	<0.333	<0.332	<0.33	<0.348	<0.334	<0.335

ARCADIS

Table 2-1. Summary of Analytical Data

White Sands Missile Range, New Mexico

Source: SEI, 1994

CAS	Analyte	Units	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02
	Location		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02
	Sample ID		0019SB01(000.0)	0019SB01(004.0)	0019SB01(004.0)QC	0019SB01(008.5)	0019SB02(000.0)	0019SB02(002.0)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		0	4	4	8.5	0	2
	Ending Depth (feet)		0	4	4	8.5	0	2
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of				0019SB01(004.0)			
EXPLOSIVES								
121-14-2	2,4-DINITROTOLUENE	mg/kg	<0.333	<1.61	<0.33	<0.348	<0.334	<0.335
606-20-2	2,6-DINITROTOLUENE	mg/kg	<0.333	<1.61	<0.33	<0.348	<0.334	<0.335
98-95-3	NITROBENZENE	mg/kg	<0.333	<1.61	<0.33	<0.348	<0.334	<0.335
TPHs								
TPH	TPH	mg/kg	79.6	<30.2	--	<31.6	234	136
METALS								
7440-38-2	ARSENIC	mg/kg	<2.74	<2.74	--	<2.74	<2.74	<2.74
7440-39-3	BARIUM	mg/kg	<25.2	27.2	--	<26.4	<25.3	193
7440-43-9	CADMIUM	mg/kg	<5.04	<5.04	--	<5.27	<5.06	38.5
7440-47-3	CHROMIUM	mg/kg	<23.63	<23.63	--	<23.63	<23.63	<23.63
7439-92-1	LEAD	mg/kg	23.7	6.19	--	8.49	44.7	22.2
7439-97-6	MERCURY	mg/kg	0.0706	0.0403	--	0.0211	0.644	0.355
7782-49-2	SELENIUM	mg/kg	<2.77	<2.77	--	<2.77	<2.77	<2.77
7440-22-4	SILVER	mg/kg	<25.2	<25.2	--	<26.4	<25.3	59.8

ARCADIS
Table 2-1. Summary of Analytical Data
White Sands Missile Range, New Mexico
Source: SEI, 1994

	Location		SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
	Sample ID		0019SB02(004.0)	0019SB02(008.0)	0020SB01(000.0)_1445	0020SB01(000.0)_1453	0020SB01(004.0)	0020SB01(008.5)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		4	8	0	2	4	8.5
	Ending Depth (feet)		4	8	0	2	4	8.5
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of							
CAS	Analyte	Units						
VOCs								
71-55-6	1,1,1-TRICHLOROETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
79-34-5	1,1,2,2-TETRACHLOROETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
79-00-5	1,1,2-TRICHLOROETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
75-34-3	1,1-DICHLOROETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
75-35-4	1,1-DICHLOROETHYLENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
96-18-4	1,2,3-TRICHLOROPROPANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
107-06-2	1,2-DICHLOROETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
78-87-5	1,2-DICHLOROPROPANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
764-41-0	1,4 DICHLORO-2-BUTENE	mg/kg	<0.0102	<0.0101	<0.0101	<0.0102	<0.0102	<0.0103
78-93-3	2-BUTANONE	mg/kg	<0.0204	<0.0201	<0.0202	<0.0204	<0.0203	<0.0206
110-75-8	2-CHLOROETHYL VINYL ETHER	mg/kg	<0.0102	<0.0101	<0.0101	<0.0102	<0.0102	<0.0103
108-10-1	4-METHYL-2-PENTANONE(MIBK)	mg/kg	<0.0204	<0.0201	<0.0202	<0.0204	<0.0203	<0.0206
67-64-1	ACETONE	mg/kg	<0.0204	<0.0201	<0.0202	<0.0204	<0.0203	<0.0206
107-02-8	ACROLEIN	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
107-13-1	ACRYLONITRILE	mg/kg	<0.0102	<0.0101	<0.0101	<0.0102	<0.0102	<0.0103
71-43-2	BENZENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
39638-32-9	BIS(2-CHLOROISOPROPYL)ETHER	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
75-27-4	BROMODICHLOROMETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
74-83-9	BROMOMETHANE	mg/kg	<0.0102	<0.0101	<0.0101	<0.0102	<0.0102	<0.0103
75-15-0	CARBON DISULFIDE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
56-23-5	CARBON TETRACHLORIDE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
75-69-4	CFC-11	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
108-90-7	CHLOROBENZENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
124-48-1	CHLORODIBROMOMETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
75-00-3	CHLOROETHANE	mg/kg	<0.0102	<0.0101	<0.0101	<0.0102	<0.0102	<0.0103
67-66-3	CHLOROFORM	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
74-87-3	CHLOROMETHANE	mg/kg	<0.0102	<0.0101	<0.0101	<0.0102	<0.0102	<0.0103

ARCADIS
Table 2-1. Summary of Analytical Data
White Sands Missile Range, New Mexico
Source: SEI, 1994

	Location		SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
	Sample ID		0019SB02(004.0)	0019SB02(008.0)	0020SB01(000.0)_1445	0020SB01(000.0)_1453	0020SB01(004.0)	0020SB01(008.5)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		4	8	0	2	4	8.5
	Ending Depth (feet)		4	8	0	2	4	8.5
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of							
CAS	Analyte	Units						
156-59-2	CIS-1,2-DICHLOROETHENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
10061-01-5	CIS-1,3-DICHLOROPROPENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
74-95-3	DIBROMOMETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
75-09-2	DICHLOROMETHANE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
97-63-2	ETHYL METHACRYLATE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
100-41-4	ETHYLBENZENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
74-88-4	IODOMETHANE	mg/kg	<0.0102	<0.0101	<0.0101	<0.0102	<0.0102	<0.0103
591-78-6	METHYL N-BUTYL KETONE	mg/kg	<0.0204	<0.0201	<0.0202	<0.0204	<0.0203	<0.0206
108-88-3	METHYLBENZENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
91-20-3	NAPHTHALENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
100-42-5	STYRENE (MONOMER)	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
127-18-4	TETRACHLOROETHENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
156-60-5	TRANS-1,2-DICHLOROETHENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
10061-02-6	TRANS-1,3-DICHLOROPROPENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
79-01-6	TRICHLOROETHYLENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
108-05-4	VINYL ACETATE	mg/kg	<0.0204	<0.0201	<0.0202	<0.0204	<0.0203	<0.0206
75-01-4	VINYL CHLORIDE	mg/kg	<0.0102	<0.0101	<0.0101	<0.0102	<0.0102	<0.0103
1330-20-7	XYLENES	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
SVOCs								
120-82-1	1,2,4-TRICHLOROBENZENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
218-01-9	1,2-BENZPHENANTHRACENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
95-50-1	1,2-DICHLOROBENZENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
122-66-7	1,2-DIPHENYLHYDRAZINE	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
106-46-7	1,4-DICHLOROBENZENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
90-13-1	1-CHLORONAPHTHALENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
95-95-4	2,4,5-TRICHLOROPHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
88-06-2	2,4,6-TRICHLOROPHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
120-83-2	2,4-DICHLOROPHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34

ARCADIS
Table 2-1. Summary of Analytical Data
White Sands Missile Range, New Mexico
Source: SEI, 1994

	Location		SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
	Sample ID		0019SB02(004.0)	0019SB02(008.0)	0020SB01(000.0)_1445	0020SB01(000.0)_1453	0020SB01(004.0)	0020SB01(008.5)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		4	8	0	2	4	8.5
	Ending Depth (feet)		4	8	0	2	4	8.5
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of							
CAS	Analyte	Units						
105-67-9	2,4-DIMETHYLPHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
51-28-5	2,4-DINITROPHENOL	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
91-58-7	2-CHLORONAPHTHALENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
95-57-8	2-CHLOROPHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
534-52-1	2-METHYL-4,6-DINITROPHENOL	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
91-57-6	2-METHYLNAPHTHALENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
95-48-7	2-METHYLPHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
88-74-4	2-NITROANILINE	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
88-75-5	2-NITROPHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
91-94-1	3,3'-DICHLOROBENZIDINE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
78-59-1	ONE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
99-09-2	3-NITROANILINE	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
101-55-3	4-BROMOPHENYL PHENYL ETHER	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
59-50-7	4-CHLORO-3-METHYLPHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
7005-72-3	4-CHLOROPHENYL PHENYL ETHER	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
106-44-5	4-METHYL PHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
100-02-7	4-NITROPHENOL	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
83-32-9	ACENAPHTHENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
208-96-8	ACENAPHTHYLENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
120-12-7	ANTHRACENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
92-87-5	BENZIDINE	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
56-55-3	BENZO(A)ANTHRACENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
50-32-8	BENZO(A)PYRENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
205-99-2	BENZO(B)FLUORANTHENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
191-24-2	BENZO(G,H,I)PERYLENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
207-08-9	BENZO(K)FLUORANTHENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
65-85-0	BENZOIC ACID	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
100-51-6	BENZYL ALCOHOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34

ARCADIS
Table 2-1. Summary of Analytical Data
White Sands Missile Range, New Mexico
Source: SEI, 1994

	Location		SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
	Sample ID		0019SB02(004.0)	0019SB02(008.0)	0020SB01(000.0)_1445	0020SB01(000.0)_1453	0020SB01(004.0)	0020SB01(008.5)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		4	8	0	2	4	8.5
	Ending Depth (feet)		4	8	0	2	4	8.5
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of							
CAS	Analyte	Units						
85-68-7	BENZYL BUTYL PHTHALATE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
111-91-1	BIS (2-CHLOROETHOXY) METHANE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
111-44-4	BIS(2-CHLOROETHYL) ETHER	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
53-70-3	DIBENZ(A,H)ANTHRACENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
132-64-9	DIBENZOFURAN	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
84-66-2	DIETHYL PHTHALATE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
131-11-3	DIMETHYL PHTHALATE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
84-74-2	DI-N-BUTYL PHTHALATE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
117-84-0	DI-N-OCTYL PHTHALATE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
122-39-4	DIPHENYLAMINE	mg/kg	<1.02	<1.01	<1.01	<1.02	<1.02	<1.03
206-44-0	FLUORANTHENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
86-73-7	FLUORENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
87-68-3	HEXACHLORO-1,3-BUTADIENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
118-74-1	HEXACHLOROBENZENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
77-47-4	HEXACHLOROCYCLOPENTADIENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
67-72-1	HEXACHLOROETHANE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
193-39-5	INDENO(1,2,3-CD)PYRENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
541-73-1	M-DICHLOROBENZENE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
621-64-7	N-NITROSODI-N-PROPYLAMINE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
86-30-6	N-NITROSODIPHENYLAMINE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
106-47-8	P-CHLOROANILINE	mg/kg	<0.0051	<0.00503	<0.00504	<0.0051	<0.00508	<0.00515
87-86-5	PENTACHLOROPHENOL	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
85-01-8	PHENANTHRENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
108-95-2	PHENOL	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
100-01-6	P-NITROANILINE	mg/kg	<1.63	<1.61	<1.61	<1.63	<1.63	<1.65
129-00-0	PYRENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34

ARCADIS

Table 2-1. Summary of Analytical Data

White Sands Missile Range, New Mexico

Source: SEI, 1994

CAS	Analyte	Units	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
	Location		SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
	Sample ID		0019SB02(004.0)	0019SB02(008.0)	0020SB01(000.0)_1445	0020SB01(000.0)_1453	0020SB01(004.0)	0020SB01(008.5)
	Date Collected		12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993	12/4/1993
	Starting Depth (feet)		4	8	0	2	4	8.5
	Ending Depth (feet)		4	8	0	2	4	8.5
	Sample Area		Main Post	Main Post	Main Post	Main Post	Main Post	Main Post
	Sample Replicate of							
EXPLOSIVES								
121-14-2	2,4-DINITROTOLUENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
606-20-2	2,6-DINITROTOLUENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
98-95-3	NITROBENZENE	mg/kg	<0.336	<0.332	<0.333	<0.336	<0.335	<0.34
TPHs								
TPH	TPH	mg/kg	39.8	<30.2	99.8	68.3	65	<30.9
METALS								
7440-38-2	ARSENIC	mg/kg	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74
7440-39-3	BARIUM	mg/kg	26.5	<25.2	<25.2	<25.5	<25.4	<25.7
7440-43-9	CADMIUM	mg/kg	<5.1	<5.03	<5.04	<5.1	<5.08	<5.15
7440-47-3	CHROMIUM	mg/kg	<23.63	<23.63	<23.63	<23.63	<23.63	<23.63
7439-92-1	LEAD	mg/kg	10.8	4.79	46.2	27.8	12.1	4.46
7439-97-6	MERCURY	mg/kg	0.0826	<0.0201	0.0706	0.0612	0.0406	<0.0206
7782-49-2	SELENIUM	mg/kg	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77
7440-22-4	SILVER	mg/kg	<25.5	<25.2	<25.2	<25.5	<25.4	<25.7

Appendix 2C

SWMUs 19
Correspondence

May, 1995

USEPA
Phase II RFI Report Notice of Deficiency Letter

LR.

Pls response to DES-E.

WSMR Environment & Safety Tech Lib
2 8800 00025050 7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

necessary by Suspense.
200-IR N105-NOD
T.A, 1995

Brigadier General Jerry L. Laws
Commander
U.S. Army White Sands Missile Range
White Sands Missile Range, NM 88002-5000

RE: Notice of Deficiencies, Phase II RCRA Facility Investigation (RFI) Report for Appendices I - IV SWMUs, White Sands Missile Range (WSMR) Hazardous and Solid Waste Amendments (HSWA) Permit EPA I.D. No. NM2750211235.

Dear General Laws:

On December 19, 1995 the U.S. Environmental Protection Agency (EPA) received your Phase II RFI Report of Appendices I - IV SWMU's. EPA has completed the review of the Phase II RFI Report and identified a number of deficiencies enumerated on the enclosed Notice of Deficiencies. The deficiencies must be corrected before the Phase II RFI Report for Appendices I - IV SWMU's can be approved.

The revised RFI Report shall be submitted to the EPA within one-hundred and twenty days (120) days of receipt of this letter. If you have any questions concerning the listed deficiencies, please contact me at (214) 665-6770 or have your staff contact Mr. James Harris at (214) 665-8302.

Sincerely yours,

William K. Honker, Chief
RCRA Permits Branch

Enclosure

cc: Mr. Thomas A. Ladd (w/enclosure)
Mr. Hector Magallanes (w/enclosure)
Mr. Benito Garcia (w/enclosure)
Mr. Dave Morgan (w/enclosure)

Received 23 May 95.

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ENCLOSURE I

Phase II RFI Report Notice of Deficiencies

GENERAL COMMENTS:

1. The latest publication for "Current and Proposed National Primary and Secondary Drinking Water Regulations and Health Advisories for Other Contaminants" is dated July 29, 1994.

2. Clean up levels will be determined by EPA.

SPECIFIC COMMENTS:

1. SWMUs 8 and 9 - Waste Oil Tank and Sump

   Removal actions were taken by WSMR. Confirmatory sampling should be collected to verify closure requirements. Once approved WSMR shall submit a request for delisting the units from the Corrective Measure Study (CMS) phase via the Class III permit modification process.

2. SWMUs 10 and 11 - Vehicle Wash Pad and Drains, Sump and Oil/Water Separator.

   EPA concurs that WSMR may request delisting the units. Institutional controls should be initiated to prevent any future discharges off of the wash pad, drains and sump.

3. SWMUs 12 and 13 - Vehicle Wash Pad and Drains, Sump and Oil/Water Separator.

   Has the source of the high chromium levels at the 9.5 foot interval of soil boring 1213SB03(009.5) been identified?

4. SWMUs 14 and 15 - Used battery Accumulation Areas

   Item 2 of Section 6.4.4 "Conclusions and Recommendations" identifies elevated lead levels from sediments upgradient of SWMUs 14-15, the SWMUs are no longer in use and there may be another lead source. Several alternate sources are suggested. Consequently the SWMUs have not been adequately delineated to confirm the source of the high lead levels. Further sampling should be performed to determine the source as well as extent of contamination.

5. SWMU 16 - Heavy Equipment Wash Pad and Drain

The upgradient background sample is higher than the downgradient surface soil sample concentrations. Also state Land Disposal Standards have been exceeded. The upgradient drainage ditch should be further characterized to determine the sources contributing to the high TPH values.

6. SWMU 17 - Waste Underground Injection Pipe

No constituents related to the SWMUs operational history were found. WSMR should submit a request for a Class III Permit Modification delisting the SWMU for no further investigation under the RFI/CMS process.

7. SWMUS 19 and 20 - Steam Wash Pad and Drain, and Oil/Water Separator

No constituents related to the SWMUs operational history were found. WSMR should submit a request for a Class III Permit Modification delisting the SWMU for no further investigation under the RFI/CMS process.

8. SWMU 21 - Former Fire Fighting Training Area (FFTA)

EPA concurs with WSMRs recommendation the unit go through a CMS to remove the above ground storage tanks and the soil around and under the ASTs.

9. SWMU 22 - Abandoned Pit Near FFTA

EPA concurs with WSMRs recommendation that the unit go through the CMS process to remove the pile and surrounding perimeter including the soils in the shallow ditch.

10. SWMUs 27-30 HELSTF Sewage Treatment Lagoons

Analytical data indicate a release at HMW-1 (lead), chromium (HMW-12, 16), 1,1-dichloroethene (HMW-4, 16), 1,1-dichloroethene and 1,1-dichlorethane (HMW-12).

HMW 4, 12 and 16 are upgradient from SWMUs 143 and 152 and consequently downgradient from SWMUs 27-30. This suggest a release is occurring in the vicinity of SWMUs 27-30 and/or the former unlined sewage lagoons which pre-date SWMUs 27-30 or undetermined sources in the area.

September 4, 1996

NMED
Phase II RFI Report Notice of Deficiency Letter

WSMR Environment & Safety Tech Lib
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200-1R N105-COR 1996

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous & Radioactive Materials Bureau
2044 Galisteo
P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-1557
Fax (505) 827-1544

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

September 4, 1996

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Thomas A. Ladd, Director
Directorate of the Environment & Safety
U.S. Army White Sands Missile Range (WSMR)
White Sands Missile Range, NM 88002-5048

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has reviewed the Phase II RCRA Facility Investigation (RFI) Report for Appendix I, II, III, and IV sites, dated December 1994, as well as the following associated correspondence: the Environmental Protection Agency's (EPA) May 23, 1996 notice of deficiency (NOD) regarding the above referenced report, and WSMR's October 11, 1995 response to the EPA's NOD. NMED approves the investigative data within the Phase II RFI Report except where specified in the attached NOD.

As the next phase of the environmental restoration process, and in conformance with WSMR's Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Wastes Amendments (HSWA) permit, NMED requests the following items within the prescribed time frames:

1. A comprehensive report regarding all contaminant releases and the associated risks at the High Energy Laser System Test Facility (HELSTF). NMED requires submittal of this report 180 days after WSMR's receipt of this correspondence.

2. A base-line risk assessment for all Solid Waste Management Units (SWMUs) identified in the above referenced report as having contaminant concentrations that exceed appropriate screening levels and where WSMR proposes not to remediate the SWMU to those screening levels. NMED requires submittal of the assessment 120 days after WSMR's receipt of this correspondence.

3. A proposal to the Hazardous and Radioactive Materials Bureau (HRMB) to perform a class III permit modification to remove the appropriate SWMUs from WSMR's RCRA/HSWA permit.

4. A phase III RFI workplan to complete the determination of

4. A phase III RFI workplan to complete the determination of the nature and extent of contamination at the appropriate SWMUs as identifies in the NOD. NMED requires submittal of the workplan within 180 days of WSMR's receipt of this correspondence.

5. A SWMU assessment report as outlined in WSMR's HSWA permit for those potential new contaminant sources identified in the Phase II RFI Report or stipulated in the attached comments. NMED requires submittal of the report 90 days after WSMR's receipt of this correspondence.

6. An addendum to the Phase II RFI Report responding to the attached NOD. NMED requires submittal of the addendum in 60 days of WSMR's receipt of this correspondence.

If you require further information or have questions, please contact Mr. Steve Pullen or Mr. Phillip Solano at (505) 827-1558 regarding RCRA technical or permitting issues respectively, or myself.

Sincerely,

for Ed Kelley, Director
Water and Waste Management Division

Attachment

xc: Benito Garcia, Chief, NMED HRMB (w/encl)
Marcy Leavitt, Chief, GWQB NMED (w/encl)
Gerald Silva, Chief, SWB NMED (w/encl)
Barbara Hoditschek, NMED HRMB (w/encl)
Steve Pullen, HRMB NMED (w/encl)
David Neleigh, EPA (w/encl)
Hector Magallanes, WSMR (w/encl)

ATTACHMENT
Notice of Deficiency (NOD)

General Comments:

1. The following is an explanation of the six (I-VI) documents referenced on the attached cover letter.

I. WSMR must provide to the Administrative Authority (AA) of their Resource Conservation and Recovery Act (RCRA) permit, the New Mexico Environment Department (NMED), a comprehensive report regarding all contaminant releases and the associated risks at the High Energy Laser System Test Facility (HELSTF).

Contaminant migration via groundwater transport has commingled plumes from multiple release sources under HELSTF. Petroleum hydrocarbons from the systemic diesel release site, intermingled with chromium contamination from Solid Waste Management Unit (SWMU) 143, is one example. Additionally, the Phase II RFI Report's SWMU specific reporting approach has provided little information regarding the source of groundwater contaminant releases below the Waste Lagoons (SWMUs 27-30), the Construction Landfill (SWMUs 38 and 39), Test Cell 4 Lagoon (SWMU 145), and the MAR Waste Stabilization Pond (SWMU 148). The report regularly states that "there is no apparent connection between the contaminants detected in the ---- and those found in the underlying groundwater ...".

NMED envisions a HELSTF facility wide report that provides contaminant concentration maps juxtaposed upon all possible release sources, identifies potentially threatening human and ecological risks and identifies all data gaps. NMED believes that little additional investigation should have to take place and that this will simply be a more logical reporting of current knowledge.

This report will be a prerequisite to regulatory concurrence on removing any HELSTF SWMUs from the Hazardous and Solid Waste Amendments (HSWA) module of WSMR's RCRA permit.

II. WSMR must provide a base-line risk assessment for all SWMUs identified in this report as having contaminant concentrations that exceed appropriate screening levels. NMED currently accepts EPA Region 3 Risk Based Concentration (RBCs) as the appropriate screening levels, and risk assessments performed according to EPA's Risk Assessment Guidance for

Superfund (RAGS). WSMR does have the option to remediate any SWMU to screening levels if it chooses to not perform a risk assessment.

III. WSMR should provide a proposal to the Hazardous and Radioactive Materials Bureau (HRMB) of the NMED to perform a class III permit modification to remove the appropriate SWMUs from WSMR's HSWA permit. Those SWMUs include the following: 10/11, 16, 17, 19/20, 62, 80, 132, 140,s 150, and 156.

IV. WSMR must provide a phase III RFI workplan to complete the determination of the nature and extent of contamination at the following SWMUs: 8/9, 14/15, 21, 63, 64, 65, 66-78, 82/83, 85, 94, and 148.

V. WSMR must provide a SWMU assessment report, as outlined in WSMR's HSWA permit, for those potential new contaminant release sources identified in the Phase II RFI Report, or stipulated in the attached comments.

VI. WSMR must provide an addendum to the Phase II RFI Report responding to the attached comments and concerns, particularly for SWMUs: 8/9, 27-30, 38/39, 63, 89, and 94.

2. NMED has established the precedent of disallowing continued contamination of the groundwater in the Tularosa Basin, regardless of its inherent poor quality. To implement this principle, existing contaminant plumes must be adequately characterized and monitor wells in those plumes must be sampled often enough to determine if a release source still exists. If contaminants at any point in a plume increase significantly in concentration, or if additional contaminants are discovered, further investigation may be required to locate and remove the source. This NMED policy was described in a letter to WSMR from Dr. Ed Kelley dated May 15, 1995.

3. Remediation of existing groundwater contamination will not be required by NMED at White Sands Missile Range in groundwaters that exceed the State protection standard of 10,000 mg/L TDS, unless a situation is present where a human or ecological receptor is exposed to unacceptable risk from contact with the contaminated groundwater. However, additional groundwater contamination will not be acceptable, regardless of groundwater quality, and the Environment Department will insist on remediation of any groundwater contamination resulting from current or future activities at White Sands Missile Range.

WSMR RFI Phase II Rpt.
Attachment
September 4, 1996

4. Besides HELSTF, a general comment applies to several SWMUs in other areas at WSMR: the State of New Mexico has a regulatory interest not only in the SWMUs themselves but in the ground water contamination beneath these areas, whatever its source. The RFI report recommends no further action at several SWMUs based on a conclusion that observed ground water contamination did not originate at the SWMU in question. This conclusion may well be true, but NMED cannot support termination of the investigation at the site, nor removal of these sites from WSMR's permit, without adequate commitment on WSMR's part to adequately investigate, monitor and report on all contamination. This comment applies to SWMUs 14/15, 16, 63, 64, 65, 82/83.

5. WSMR must submit a separate report that provides a more comprehensive evaluation of contamination at the HELSTF. This report should contain at a minimum the following items; an assessment of the risks at all sites, detailed contaminant iso-concentration maps for all environmental media including the various perched aquifers, a fate and transport model for all contaminants, an identification of all potential contaminant source areas and a list of all data gaps. (Reference general comment #1)

One of the uses of this information will be to establish a baseline of current contaminant concentrations to be used with future sampling information to determine if a contaminant source exists.

6. An additional comment applies to SWMUs 144 (LSTC Wastewater Discharge Point) and 146 (Dry Pond): the ongoing discharges at these locations have measured concentrations of hazardous constituents that, at a minimum, violate the environmental anti-degradation policy of this department. A worst case scenario is that hazardous constituent concentrations measured in ground water monitoring wells associated with these SWMUs suggests that hazardous wastes have been discharged in violation of statutorily mandated land disposal restrictions (LDRs). WSMR must immediately comply with NMED anti-degradation policy by stopping the discharge of hazardous constituents to the environment, must submit an Notice of Intent (NOI) to the NMED Ground Water Quality Bureau (GWQB), and abide by the requirements of the Waste Analysis Plan (WAP) in WSMR's RCRA permit.

7. WSMR's Module VIII of their RCRA Permit (HSWA Corrective Action), Section I (RCRA Facility Investigation Report and Summary), requires that a final RFI Report discuss "actual or potential receptors" of contamination and "contain adequate

information to support further corrective action decisions". NMED policy for RCRA regulated sites is that if a site exceeds action levels or regulatory standards, a facility has the option to cleanup to those levels or the facility may provide a complete baseline risk assessment (RA) as outlined in the EPA's Risk Assessment Guidance for Superfund (RAGS).

Therefore, NMED will not grant NFA at any site where an action level has been attained or exceeded without appropriate risk justification. (Reference general comment #1)

If a New Mexico Water Quality Control groundwater standard is exceeded in protected waters, and WSMRs wishes to not cleanup to that standard, the facility will have to petition the Water Quality Control Commission for a variance.

8. Additionally, NMED requires that WSMR quantify risk at all SWMUs using the standard EPA default parameters for a residential exposure scenario. This requirement will stay in effect until there can be an agreement between the facility and the regulatory agencies about future land use of individual sites. For your information, NMED believes that current land use is an appropriate estimation of future land use at WSMR. However, should risk based cleanup concentrations at a site be something less than those determined through the most conservative exposure scenario (i.e. residential), there must be mechanisms in place that would ensure a re-evaluation of the risk should land use change.

9. An ecological risk assessment will be required for all SWMUs where contaminant concentrations exceed action levels. If WSMR wishes to forego an ecological assessment at some SWMUs, rationale must be provided.

10. If a site is contaminated above action levels, and a risk assessment suggests there are no unacceptable risks at the site based on less than the most conservative exposure scenario (i.e. residential), and the appropriate regulatory agencies agree with the assessment, WSMR should be prepared to survey the contaminated area and enter the results of the risk assessment, along with all its qualifiers, into a deed restriction for the particular site. This action is a state requirement for regulator concurrence on no-further-action (NFA) proposals.

11. For future reference, Subpart S action levels stipulated in FR072790 may not be determined with the most currently accepted toxicological/epidemiological information used to calculate reference doses or carcinogenic slope factors. The NMED, and EPA Region 6, prefer the more current "Risk Based Concentration (RBC)

Table" which is guidance published by the EPA Region III. This table may be obtained by telephoning 215-597-3179.

12. NMED requires that in the future WSMR be more systematic about how it reports contaminant concentration exceedances at its HSWA corrective action sites. The priority of concern is as follows; first - regulatory standards (i.e. Maximum Contaminant Levels (MCLs) or state groundwater standards), second - screening action levels, third-background concentrations, fourth - any facility specific standards.

Exceedances of a toxicity characteristic (TC) for soils is only relevant to the HSWA corrective action process if these soils are proposed to be land disposed at an alternate location. All analytical data to be used to determine risk at a SWMU must be reported as a "total" value.

13. NMED considers the delineation of the extent of contamination complete, as required by a RFI, when a responsible party has investigated out to "action levels" in all directions. However, should a risk analysis determine that the action level concentration represents an unacceptable risk, delineation within the particular environmental medium must continue until concentrations are diminished to an acceptable level. Please evaluate in an addendum to the Phase II Report all SWMUs for completeness of delineation considering this criterion.

14. WSMR is encouraged to perform a removal action in lieu of investigating and evaluating risk at a site. WSMR will be held responsible for confirming and documenting both complete removal and proper disposal of the contaminated media.

15. WSMR is proposing to land dispose of various types of contaminated media, including soils, that would not be considered hazardous waste. The NMED Solid Waste Bureau (SWB) has on file a WSMR NOI to dispose of the special waste "sludge". WSMR has not previously submitted a NOI to dispose of the special wastes "petroleum" or "chemical" contaminated soils. Disposal of new solid waste may require a permit. Please clarify this with the SWB at (505) 827-0197 prior to disposing of any soils.

16. Table 3.0-1 and Section 3.5 reference New Mexico land disposal standards from the "New Mexico Solid Waste Management Regulations" 1991, the current and applicable regulations are the 1994 edition. Page 98 of the 1994 edition specifies a disposal restriction on soils with benzene concentration greater than 10 mg/Kg, not the 100 mg/Kg stated in Section 3.5.

WSMR RFI Phase II Rpt.
Attachment
September 4, 1996

17. Closed or otherwise inoperable non-hazardous landfills must be closed at a minimum according to the New Mexico Solid Waste Management Regulations (SWMRs) in place at the time of closure. In addition, landfills closed after October 9, 1991 need to meet the final cap requirements as described in section 501.K of the current SWMRs (EIB/SWMR-4). The following list identifies the reference number and date of implementation of the four sequential regulations:

EIB/SWMR-1	April	1974
EIB/SWMR-2	April	1989
EIB/SWMR-3	Dec	1991
EIB/SWMR-4	July	1994

NMED would prefer the 1994 regulation guidance be conformed to due to it being the most protective. Please contact the Department if any of the above mentioned regulations are needed.

18. WSMR's RCRA Part B Module VIII (HSWA) Permit, Section E requires notification of any newly identified SWMUs. WSMR must submit documentation, including historical photographs and personnel interviews, that resulted in the identification of the new SWMUs. Numerous new potential landfills have been identified that must undergo the reporting requirements. (Reference general comment #1)

19. Confirmatory sampling and an associated report will be required at SWMUs undergoing voluntary corrective measures or closure.

Site specific comments:

SWMUs 8/9, Waste Oil Tank and Sump: A removal action was taken by WSMR at this site. Please clarify in an addendum to the Phase II Report the extent to which discrete soil samples were collected directly below the former UST. If additional sampling is necessary, WSMR shall provide a Phase III RFI workplan to the AA.

See general comments: 7, 12, 13, 19

SWMUs 10/11, Vehicle Wash Pad and Drains, Sump and Oil/Water Separator: No contaminate concentrations were discovered during the RFI that exceed action levels. Furthermore, institutional controls are in place to prevent any future discharges off of the wash pad, drains and sump. The Administrative Authority agrees with WSMR's conclusions and recommends no further action at these SWMUs.

WSMR RFI Phase II Rpt.
Attachment
September 4, 1996

SWMUs 14/15, Used Battery Accumulation Areas: The report indicates considerable uncertainty about the source and the extent of lead and other contamination in this area. It may be true that these SWMUs as defined are not the source of the contamination, but New Mexico Water Quality Control Commission regulations, among others, focus on the presence of contaminants rather than on specific SWMUs. Under these regulations WSMR's responsibility is to determine the source and extent of contamination, even if this requires broadening the area of investigation beyond an individual SWMU. Enough additional investigation must be done to ensure that serious contamination is not present in the ditches, around the above-ground storage tanks (ASTs), or in other areas adjacent to the areas investigated already.

The AA concurs with WSMR's suggestion to properly dispose of the sludges from this site. The AA does not believe a Corrective Measure Study (CMS) is an appropriate process to investigate a source and the extent of contamination. WSMR may either submit a SWMU assessment report for the ASTs to determine if a new SWMU should be established, or perform a phase III investigation. If WSMR shows that there is an alternate source of contamination and commits to investigate that source, WSMR may propose a permit modifications to remove this SWMU from its permit.

See general comments: 10, 13, 18

SWMU 16, Heavy Equipment Wash Pad and Drain: The RFI analytical data provides no indication of a source other than the asphalt ditch liner for the total petroleum hydrocarbon (TPH) levels. Therefore, WSMR may propose a Class III permit modification to remove this SWMU from its HSWA permit.

SWMU 17, Waste Underground Injection Pipe: No constituents related to the operational history of this SWMU were found during the RFI. The AA concurs with WSMR's conclusion and recommends no further action at this SWMU. WSMR may propose a Class III permit modification to remove this SWMU from its HSWA permit.

SWMUs 19 and 20, Steam Wash Pad and Drain, and Oil/Water Separator: No constituents related to the operational history of this SWMU were found during the RFI. The AA concurs with WSMR's conclusion and recommends no further action at this SWMU. WSMR may propose a Class III permit modification to remove this SWMU from its HSWA permit.

SWMU 21, Former Fire Fighting Training Area (FFTA): Contaminated soils at this site were excavated and WSMR has not provided any

March 11, 2002

NMED
Petition for Class III Modifications

NMED correspondence file
Jose's Copy

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

March 11, 2002

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: **THREE (3) PETITIONS FOR CLASS III MODIFICATIONS**
(JANUARY 2000 / HWB-WSMR-99-004)
(SEPTEMBER 20000 / HWB-WSMR-01-007)
(JUNE 2000 / HWB-WSMR-99-009)
WHITE SANDS MISSILE RANGE
EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has received the three (3) No Further Action (NFA) petitions *Petition to Perform Class III Modifications to Remove Solid Waste Management Units 10, 11, 16, 17, 19, 20, 80, 132, 140, and 156 from the White Sands Missile Range RCRA Part B Permit* (January 2000), *Petition to Perform Class III Modifications to Remove Solid Waste Management Units 27, 28, 29, 30, 66, 67, 85, 144, and 146 from the White Sands Missile Range RCRA Part B Permit* (September 2001), and *Petition to Perform Class III Modifications to Remove Solid Waste Management Units 8, 9, 12, 13, 14, 15, 21, 22, 145, 147, and 148 from the White Sands Missile Range RCRA Part B Permit* (June 2001) . Although NMED has not completed a detailed technical review of the documents, NMED has made the determination that the documents are administratively incomplete.

NMED has determined that these documents are incomplete because not all required elements for an acceptable NFA petition have been submitted for each Solid Waste Management Unit (SWMU) by WSMR.

NMED is providing WSMR with Attachment 1 to assist WSMR with the additional information required for each SWMU. NMED is also including guidance in Attachments 2, 3, and 4 to aid WSMR with the additional information required to complete the NFA process.

If you have any questions regarding this letter, please call me at (505) 428-2550.

Sincerely,

Cheryl Frischkorn
WSMR Project Manager
Permits Management Program

CAF:caf

cc: Gene Forsythe, WSMR

cc w/out attachments:
James Bearzi, NMED HWB
David Cobrain, NMED HWB
Glenn von Gonten, NMED HWB
Julie Jacobs, NMED HWB
Laurie King, EPA Region 6
Reading File and WSMR 2002 Red File

ATTACHMENT 1

SWMU ID	COMMENTS	WHAT'S REQUIRED
10 * Vehicle Wash Pad	Phase I & II RFIs (RCRA Facility Investigation) indicates no HWCs (Hazardous Waste Constituents) above NMSSLs (New Mexico Soil Screening Levels)--no significant contamination from this unit. Located in the Main Post Area near building 1778.	Eco-risk assessment required. Phase II RFI approved in NMED's letter dated 9/4/96.
11 * Oil/ Water Separator	Phase I & II RFIs show no HWCs above NMSSLs--no significant contamination from this unit. Located in the Main Post Area near building 1778.	Eco-risk assessment required. Phase II RFI approved in NMED's letter dated 9/4/96.
16 * Heavy Equipment Wash Pad & Drain	Arsenic detected at 7.9 mg/kg (Phase II RFI) NMSSL for arsenic is 3.9 mg/kg. Located in the southern section of the Main Post near building 1736.	Eco-risk assessment required. Phase II RFI approved in NMED's letter dated 9/4/96. Background soil study needed to rule out arsenic as a contaminant from the unit.
17 * Waste Underground Injection Pipe	Arsenic detected at 4.7 mg/kg (Phase II RFI). NMSSL for arsenic is 3.9 mg/kg. Located in the Main Post Area.	Eco-risk assessment required. Phase II RFI approved in NMED's letter dated 9/4/96. Background soil study needed to rule out arsenic as a contaminant from the unit.
19 * Steam Wash Pad & Drain	Phase I & II RFIs show no HWCs above NMSSLs--no significant contamination from this unit. Located in the Main Post area near building 1753.	Eco-risk assessment required. Phase II RFI approved in NMED's letter dated 9/4/96.
20 * Oil/Water Separator	Phase I & II RFIs show no HWCs above NMSSLs--no significant contamination from this unit. Located in the Main Post area near building 1753.	Eco-risk assessment required. Phase II RFI approved in NMED's letter dated 9/4/96.
80 * Main Post STP Waste Pile	All sludge & 2 feet of soil removed from the unit--Confirmation sampling?? Located about 2 miles east of the Main Post. No eco risk completed for this site.	Eco-risk assessment Final RFI Report required including results from the confirmation sampling. Background soil study if needed.
132 * Orogrande Waste Stabilization Pond	Located on Ft. Bliss property near the extreme SE corner of WSMR. Phase I RFI--no HWC above NMSSLs--no Phase II RFI was conducted.	?

SWMU ID	COMMENTS	WHAT'S REQUIRED
140 * LC-37 Paint Dump	Phase II RFI--lead above NMSSLs (674 mg/kg) & arsenic above NMSSLs (22.9 mg/kg)--since then soil has been removed. Located 12 miles east of the Main Post.	Final RFI Report required including results from the confirmation sampling & an eco-risk assessment. Background soil study may be needed if lead and/or arsenic are still detected at concentrations above the NMSSL after soil excavation.
150 * MAR Dump Site	Phase I RFIs show no HWCs above NMSSLs--no significant contamination from this unit--No Phase II RFI performed.	Final RFI Report required including eco-risk assessment.
156 * Pesticide Storage Shed	Phase I & II RFIs show no HWCs above NMSSLs--no significant contamination from this unit Located about 0.5 miles northeast of HELSTF.	Eco-risk assessment required. Phase II RFI approved in NMED's letter dated 9/4/96.
27-30 ** HELSTF Waste Water Treatment Ponds	The 20 X rule was applied to the total concentrations from the sludge samples and all were below the values in Table 1 of 40 CFR 261.24. No soil samples taken since ponds are lined.	Active units with the GWQB, discharge permit #297--ponds lined. Final RFI Report required including an eco-risk assessment.
66 ** MP STP influent pipe	Located about 3 miles east of the Main Post.	Active unit with the GWQB, discharge permit #976. Final RFI Report required including an eco-risk assessment.
67 ** bar screen & grinder	Located about 3 miles east of the Main Post.	Active unit with the GWQB, discharge permit #976. Final RFI Report required including an eco-risk assessment.
85 ** STP Playa Lake Davies Tank	Located 5 miles east of the Main Post STP. Many soil samples exceeded the NMSSL for arsenic (Phase II RFI).	Active units with the GWQB, discharge permit #976. Detection limits must be lower values than that of the NMSSL (or any other standards). Final RFI Report required including an eco-risk assessment. A background soil study may be needed to rule out arsenic as a contaminant released the unit.
144 ** HELSTF WW discharge point	Arsenic detected (4.2 mg/kg) in soil and lead detected in ground water (0.057 mg/L) (Phase I RFI). Arsenic detected in soil (7.41 mg/kg and 15.7 mg/kg)--some organics and metals detected above standards in the GW. (Phase II RFI)	Active units with the GWQB, discharge permit #297. Final RFI Report required including an eco-risk assessment, a background soil study to rule out arsenic as a soil contaminant released from the unit, and data showing that ground water contamination is clearly from another source.

SWMU ID	COMMENTS	WHAT'S REQUIRED
146 ** HELSTF Dry Pond	HELSTF Located about 400 feet SW of HELSTF. Arsenic detected (8.3 mg/kg) (Phase I RFI) Arsenic exceeded NMSSLs during Phase II RFI (highest at 13.4 mg/kg) Arsenic and selenium exceeded WQCC standards in ground water at the site.	Active unit with the GWQB, discharge permit #297. Final RFI Report required including an eco-risk assessment, a background soil study to rule out arsenic as a soil contaminant released from the unit, and data showing that ground water contamination is clearly from another source.
8 *** Waste Oil Tank	Soil was excavated in these areas and confirmation sampling showed no contaminants above NMSSLs	Final RFI Report required including an eco-risk assessment and results of the confirmation soil sampling.
9 *** Sump		Final RFI Report required including an eco-risk assessment and results of the confirmation soil sampling.
12 *** Vehicle Wash Ramp & Drains	Arsenic was detected above NMSSLs (7.7 mg/kg).	Final RFI Report required including an eco-risk assessment and a background soil study to rule out arsenic as a soil contaminant from the unit.
13 *** Sump & Oil/Waste Separator		
14 *** Used Battery Area	Phase II RFI—Pb detected (409 mg/kg) Arsenic detected (9.3 mg/kg) Soil excavated at these sites. May be able to redo the 1997 Close-Out Report and organize it as a RFI Report.	WSMR needs to submit a Final RFI Report to sum up results after the soil was excavated. Eco-risk must be included in Final RFI Report. May need to collect background soil samples for comparison of some metals (Pb and As).
15 *** Used Battery Area		
21 *** FFFTA	Located immediately south of the Main Post. No target parameters were detected after soil excavation, although the excavated soil was returned to the site—p.68 of NFA Petition	Excavated soil returned to pit—need a Final RFI Report including an eco-risk assessment. The report must show that the soil was clean before it was returned to the pit.
22 *** FFTA Abandoned Pit	Located immediately south of the Main Post. No target parameters were detected after excavation of the soil stockpile. Excavated soil was returned to the pit.	Excavated soil returned to pit—need a Final RFI Report including an eco-risk assessment. The report must show that the soil was clean before it was returned to the pit.
145 *** Test Cell 4 Lagoon	Located at HELTSF, west of the wastewater treatment lagoons. When liner was removed, 2 feet of soil was also removed. Confirmation sampling showed no constituents were above	A Final RFI Report is required including an eco-risk assessment.

SWMU ID	COMMENTS	WHAT'S REQUIRED
	NMSSLs.	
147 *** Decontamination Pad & Waste Tank	Located adjacent to building 26131 at HELSTF. Total metals analysis were not conducted and several VOCs and SVOCs were detected during the Phase I and Phase II RFIs.	This unit requires further investigation due to the contamination (metals and organics) detected during the Phase I and II RFI investigations.
148 *** MAR Waste Stabilization Pond	Located at HELSTF—unit used to be old WW treatment lagoon. Area has since been paved over when HELSTF was being constructed.	A Final RFI Report is required, including an eco-risk assessment.

DOCUMENTS REVIEWED

* Petition to Perform Class III Modifications to Remove Solid Waste Management Units 10, 11, 16, 17, 19, 20, 80, 132, 140, 150, and 156 From the White Sands Missile Range RCRA Part B Permit, January 2000

** Petition to Perform Class III Modifications to Remove Solid Waste Management Units 27, 28, 29, 30, 66, 67, 85, 144, and 146 From the White Sands Missile Range RCRA Part B Permit, September 2001

*** Petition to Perform Class III Modifications to Remove Solid Waste Management Units 8, 9, 12, 13, 14, 15, 21, 22, 145, 147, and 148 From the White Sands Missile Range RCRA Part B Permit, June 2001

PREVIOUSLY SUBMITTED NFA DOCUMENTS

- Petition to Perform Class III Modifications to Remove Solid Waste Management Units 10, 11, 16, 17, 19, 20, 80, 132, 140, and 156 from the White Sands Missile Range RCRA Part B Permit, November 1998
- Petition to Perform Class III Modifications to Remove Solid Waste Management Units 8, 9, 12, 13, 14, 15, 21, 22, 145, 147, and 148 from the White Sands Missile Range RCRA Part B Permit, September 1999

- Petition to Perform Class III Modifications to Remove Solid Waste Management Units 8, 9, 12, 13, 14, 15, 21, 22, 145, 147, and 148 from the White Sands Missile Range RCRA Part B Permit, January 2000

- Petition to Perform Class III Modifications to Remove Solid Waste Management Units 27, 28, 29, 30, 66-78, 85,144, and 146 from the White Sands Missile Range RCRA Part B Permit, January 2000

NOTE ---- The ecological risk assessment required for each SWMU shall be conducted in accordance to "*Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment", New Mexico Environment Department Hazardous and Radioactive Material Bureau, March 2000.* If WSMR does not have this document, please notify the NMED project leader and a copy will be forwarded.

Appendix 2D

Other Applicable Assessments

Risk Assessment for SWMU 19 and 20 – Main Post Steam Wash Pad and Drain and Oil/Water Separator
March 2010

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Risk Assessment for SWMU 19

Main Post Steam Wash Pad and Drain and
Oil/Water Separator

March 5, 2010

ARCADIS

Risk Assessment for SWMU 19

Main Post Steam Wash Pad and Drain and Oil/Water Separator

Rebecca W. Heslep
Human Health Risk Assessment Task Manager

Christopher H. Day
Risk Assessment Project Manager

Prepared for:
U.S. Army

Prepared by:
ARCADIS U.S., Inc.
1717 West 6th Street
Suite 210
Austin
Texas 78703
Tel 512.451.1188
Fax 512.451.2930

Our Ref.:
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March 5, 2010

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A Site Photographs

B Risk Assessment Datasets for SWMU 19-20

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1.0 Introduction

The purpose of this report is to evaluate current and reasonably anticipated future risks to human health and ecological receptors from exposure to constituents detected in environmental media at Solid Waste Management Unit 19 (SWMU 19) located within the Main Post of the White Sands Missile Range (WSMR). SWMUs 19 and 20 were combined as SWMU 19 on the December 2009 WSMR Resource Conservation and Recovery Act (RCRA) permit.

The risk assessment for SWMU 19 was conducted in a manner consistent with current New Mexico Environmental Department (NMED) guidance and the United States Environmental Protection Agency (USEPA) Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1989), and in compliance with RCRA.

2.0 SWMU 19

2.1 Site Description and History

The Steam Wash Pad and Drains and the associated Oil/Water Separator (OWS) (SWMU 19) are located immediately north of Building 1753 in the southern Main Post area. The SWMUs and associated borings cover an area of approximately 0.2 acre. The area surrounding the SWMUs is covered in gravel and concrete. There are three drains along the center of the wash pad which collect wastewater. The drains discharge, via underground pipes, to a concrete, 500 gallon OWS located approximately 40 feet southeast of the wash pad. Photographs of SWMU 19 were taken during the site reconnaissance in March 2009 and are provided in Attachment A.

The Steam Wash Pad has been active since approximately 1968, and the OWS has been active since approximately 1984. The concrete pad collects wastewater from the spray washing of vehicles. The current separator replaced an earlier version that was undersized. Oil and debris are separated from the wash water by gravity. This material is periodically removed and deposited into the Waste Oil Tank. Wastewater leaving the OWS enters the sanitary sewer collection system for treatment.

2.2 Risk Assessment Data Set Evaluation

Soil data generated from the site characterization activities were used in the risk assessment. Saturated vadose zone soil water was not encountered beneath SWMU 19 and regional groundwater is located more than 300 feet below this area of the Main

Post. Therefore, soil is the only medium of concern evaluated for the site. The risk assessment data sets (Attachment B) for soil were evaluated following USEPA guidance for risk assessments (USEPA, 1989; 1992; 2002a). The data evaluation guidelines are summarized as follows:

- All soil sample types (i.e., hand auger, continuous core, direct-push technique) were considered usable for the risk assessment.

- Analytical results from soil samples collected from different depths at the same sampling location during the same sampling event were evaluated as independent samples.

- Constituents that were not detected in a medium and have sample quantitation limits (SQLs) below screening levels were not included in the data evaluation for that medium. Constituents that were not detected and have SQLs above screening levels were further evaluated.

- Analytical results reported as detected or estimated values were considered to be present at the reported value. Analytical results that are “U” or “UB” qualified were considered non-detect. Analytical results rejected during the data validation process (i.e., “R” qualified), or where the chemical identity is uncertain (i.e., “N” qualified) were not qualitatively or quantitatively evaluated.

- For duplicate samples (or constituents measured using two methods on the same sample [e.g., naphthalene via USEPA Methods 8260 and 8270]), the result to be used in the risk assessments was selected as follows: (1) if both samples reported positive detects, the higher measured analytical concentration was used, (2) if only one result was a positive detect, that concentration was used, or (3) if both samples reported non-detects, the lower SQL was used as the proxy concentration. The lower SQL was used because it is not reasonable to use the higher SQL when the duplicate analysis for the sample indicated that the constituent was not present at the lower SQL.

For purposes of the risk assessment, the soil data were divided by sample depth interval based on the exposure pathways identified for the Main Post. In brief, the soil data were categorized as follows:

- Surface soil data, including soil samples collected from depths of 0 to 2 feet (ft) below ground surface (bgs), were used to evaluate potential exposure of human (current/future site worker; hypothetical future resident) and ecological receptors;

- Surface and subsurface soil data (0 to 10 ft bgs) were used to evaluate potential exposure of human (future construction worker) and ecological receptors that could be exposed to subsurface soil (e.g., burrowing wildlife); and

- Total soil data were used to evaluate potential exposure of human receptors through the vapor intrusion exposure pathway.

The risk assessment data sets summarize the following: the number of detects, number of samples, frequency of detection (FOD), minimum and maximum detected concentrations, location of maximum detected concentration, minimum and maximum reporting limits, and upper confidence limit on the mean, and are presented in the attached Tables Data-1 (surface soil 0 to 2 ft bgs), Data-2 (combined surface and subsurface soil 0 to 10 ft bgs), and Data-3 (total soil).

2.2.1 Surface Soil (0 to 2 ft bgs)

Five soil samples were collected in the 0 to 2 foot depth interval as part of the 1993 investigation. Analytical results for these soil samples are summarized in Table Data-1. Surface soil was analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), explosives and inorganics. TPH and five inorganics were detected within this data set.

2.2.2 Combined Surface and Subsurface Soil (0 to10 ft bgs)

Eleven soil samples were collected in the 0 to 10 foot depth interval as part of the 1993 investigation. Analytical results for these soil samples are summarized in Table Data-2. Combined surface and subsurface soil was analyzed for VOCs, SVOCs, PAHs, TPH, explosives and inorganics. TPH and five inorganics were detected within this data set.

2.2.3 Total Soil (0 to 8.5 ft bgs)

Eleven soil samples were collected in the total soil depth interval as part of the 1993 investigation. Because samples were collected no deeper than 8.5 ft bgs, the total soil

data set is the same as the combined surface and subsurface sol data set. Analytical results for these soil samples are summarized in Table Data-3. Surface and subsurface soil was analyzed for VOCs, SVOCs, PAHs, TPH, explosives and inorganics. TPH and five inorganics were detected within this data set.

2.3 Human Health Risk Assessment

The purpose of this human health risk assessment (HHRA) is to evaluate the potential current and future risks and hazards to human health associated with constituents detected in soil samples collected from SWMU 19 (formerly identified as SWMUs 19 and 20). Methods and parameters used in the HHRA are in compliance with NMED and USEPA guidance for risk assessments (NMED, 2009a; 2009b; USEPA, 1989; 1991a,b; 1992a,b; 1993; 1999; 2002a,b; 2003; 2005a,b).

2.3.1 Selection of Constituents of Potential Concern

The selection of constituents of potential concern (COPCs) is based primarily on the magnitude of the measured concentrations in the relevant environmental media, in relation to the appropriate screening level. Detected constituents for which a screening level is not available are also considered in the screening process. Non-detected constituents with SQLs exceeding their screening levels are identified during the screening process and discussed in the uncertainty section.

COPCs in soil were identified by comparing maximum detected concentrations to the NMED (2009a,b) Soil Screening Levels (SSLs) for residential soil, industrial soil, and construction worker soil (Table HHRA-1). In the event that the NMED guidance does not have a screening level for a given constituent, the USEPA Regional Screening Levels (RSLs) (USEPA, 2009a) for residential soil and industrial soil were used. The NMED SSLs are based on a carcinogenic target risk level of 1×10^{-5} and non-carcinogenic target hazard quotient of 1. The USEPA (2009a) RSLs are based on a carcinogenic target risk level of 1×10^{-6} and a non-carcinogenic target hazard quotient of 1. To be consistent with NMED guidance and target risk level of 1×10^{-5}, the carcinogenic USEPA (2009a) RSLs were adjusted upward by a factor of 10. The data screening tables for soil present residential, industrial, and construction worker screening levels. This was done because the current land use on-site includes industrial use and future hypothetical land use on-site may include construction activity, as well as residential use per the unrestricted land use scenario.

For screening data at sites with multiple constituents, the following procedure was followed in accordance with NMED guidance (NMED, 2009a): separate the constituents by carcinogens and non-carcinogens, take the site-specific constituent concentration [represented by the maximum reported concentration], and divide by the screening level concentration for each constituent. For multiple constituents, simply add the ratio for each constituent and multiply by $1x10^{-5}$ for carcinogens or multiply by 1 for non-carcinogens. If the total screening risk is greater than the target risk level of 1×10^{-5} for carcinogens and/or greater than the target hazard index of 1 for non-carcinogens, then the concentrations at the site warrant further, site-specific evaluation in a risk assessment. Screening risk and hazard indices less than the target levels indicate that the concentrations at the site are unlikely to result in adverse health impacts (NMED, 2009a).

2.3.1.1 Surface Soil

Surface soil COPCs were selected by comparing the analytical data with the appropriate screening level as presented in Table HHRA-1 and applying the NMED screening method as described above. Table HHRA-2 presents the results of the screening process.

The maximum concentrations of constituents in surface soil (0 to 2 ft bgs) at SWMU 19 were compared to the residential and industrial SSLs. The total screening risk for carcinogenic effects could not be calculated because no carcinogens were detected at SWMU 19. The total screening hazard indices for non-carcinogenic effects were 1 and 0.3 for residential and industrial scenarios, respectively. These total hazard indices are equal to or less than the NMED target hazard index of 1.

As summarized in Table HHRA-2, no COPCs were identified for surface soil at SWMU 19. This indicates that the constituent concentrations in surface soil at SWMU 19 are unlikely to result in adverse health impacts to current and future site workers, and to hypothetical future residents. Therefore, potential exposure to surface soil at SWMU 19 is not evaluated further in this HHRA.

2.3.1.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPCs were selected by comparing the analytical data with the appropriate screening levels as presented in Table HHRA-1 and applying the NMED screening method. Table HHRA-3 presents the selection of the combined surface and subsurface soil COPCs for the HHRA.

The maximum concentrations of constituents in surface and subsurface soil (0 to 10 feet bgs) at SWMU 19 were compared to the construction worker SSLs. The total screening risk for carcinogenic effects could not be calculated because no carcinogens were detected in combined surface and subsurface soil at SWMU 19. The total screening hazard index for non-carcinogenic effects was 0.2 for the construction worker scenario. This total hazard index is less than the NMED target hazard index of 1.

As summarized in Table HHRA-3, no COPCs were identified for combined surface and subsurface soil at SWMU 19. This indicates that the constituent concentrations in surface and subsurface soil at SWMU 19 are unlikely to result in adverse health impacts to future construction workers. Therefore, potential exposure to surface and subsurface soil at SWMU 19 is not evaluated further in this HHRA.

2.3.1.3 Total Soil

As summarized in Table HHRA-4, no VOCs were detected in total soil; therefore no COPCs were identified for the vapor intrusion evaluation at SWMU 19. Additional evaluation of the potential for soil to represent a concern via vapor intrusion is not necessary in this HHRA.

2.3.2 Summary of Selected Constituents of Potential Concern

No COPCs were selected for surface soil, combined surface and subsurface soil, or total soil at SWMU 19.

2.3.3 Uncertainties in the HHRA

The risk estimates presented herein are a conservative estimate of potential risks associated with exposure to constituents detected in soil at SWMU 19. Each of the three basic building blocks for risk assessment (monitoring data, exposure scenarios, and toxicity values) contributes uncertainties. Each of the uncertainties is accounted for by using conservative assumptions wherever site-specific data are unavailable.

This risk assessment is based on the assumption that the available monitoring data adequately describe the occurrence of constituents in media at the site. Environmental sampling itself introduces uncertainty. This source of uncertainty can be reduced through a well-designed sampling plan, use of appropriate sampling techniques, and implementation of laboratory data validation and quality assurance and quality control

(QA/QC). The data utilized in this report meet QA/QC requirements and are appropriate for use in a risk assessment.

Uncertainty is also associated with constituent mixtures. Information on the toxicity of specific mixtures is rarely available. The procedure generally applied to a potential event of simultaneous exposure to multiple constituents from a variety of sources assumes dose additivity, although it is possible that the interaction of multiple constituents could be synergistic or antagonistic.

Potential exposure scenarios contribute uncertainty to the risk assessment as well. The hypothetical future residential scenarios, which assumes that receptors will be exposed to site soil is highly unrealistic since the site will most likely never be used for residential use. Exposure scenarios were developed based on site-specific information, NMED and USEPA exposure guidance documents, and professional judgment. Although uncertainty is inherent in the exposure assessment, and the exposure assumptions also were chosen to err on the side of conservatism, this uncertainty could lead to an overestimation or underestimation of potential risk.

One SVOC (benzidine) was not detected in the surface and subsurface soil, but had some SQLs greater than the screening value. Because benzidine was not detected in any sample collected from SWMU 19, it is not possible to conduct a quantitative evaluation. However, it is unlikely that its presence would have a significant effect on the overall outcome of the risk assessment.

2.3.4 Human Health Risk Summary

2.3.4.1 Soil Exposure Scenarios

In accordance with NMED guidance (NMED, 2009a), constituent concentrations in surface soil, and in combined surface and subsurface soil were compared to health-based screening levels and the calculated ratios summed and multiplied by 1x10-5 for carcinogens or by 1 for non-carcinogens. The total screening risk for carcinogenic effects could not be calculated because no carcinogens were detected in soil at SWMU 19. The total screening hazard indices were equal to or less than the NMED target hazard index of 1. The results of this data screening process indicate that after comparison to health-based soil screening levels for industrial worker exposure, residential exposure, and construction worker exposure, no COPCs were selected for surface soil, or for combined surface and subsurface soil at SWMU 19. This demonstrates that the constituent concentrations in surface soil and in combined

surface and subsurface soil at SWMU 19 are unlikely to result in adverse health impacts to the following potential receptors via direct contact exposure (i.e., ingestion, inhalation of vapor/dust, dermal):

- Current and future site workers;
- Future residents (adults and children); and
- Future construction workers.

2.3.4.2 Vapor Intrusion Scenarios

No VOCs were detected in total soil; therefore, no COPCs were identified for the vapor intrusion evaluation at SWMU 19. This demonstrates that the constituent concentrations in soil at SWMU 19 are unlikely to result in adverse health impacts to the following potential receptors via inhalation of indoor air:

- Future site workers; and
- Future residents (adults and children).

2.3.5 Overall HHRA Summary

The results of this data screening process indicate that after comparison to health-based soil screening levels for industrial worker exposure, residential exposure, and construction worker exposure, no COPCs were selected for surface soil, or for combined surface and subsurface soil at SWMU 19. This demonstrates that the constituent concentrations in surface soil and in combined surface and subsurface soil at SWMU 19 are unlikely to result in adverse health impacts to the identified current and potential future receptors. Additionally, no VOCs were detected in soil, indicating that vapor intrusion is unlikely to result in adverse health impacts. Based on these results, additional human health risk assessment is not warranted for SWMU 19.

2.4 Ecological Risk Assessment

The purpose of the ecological risk assessment (ERA) is to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil and combined surface and subsurface soil at SWMU 19 (formerly identified as SWMUs 19 and 20). The ERA was conducted in a manner consistent

with NMED and USEPA guidance for ecological risk assessment (NMED, 2008; USEPA 2001a; 2000a; 1997). This ERA is intended to provide input for risk management decision-making for SWMU 19, while maintaining a conservative approach protective of wildlife populations and communities.

In accordance with USEPA guidance, this ERA is comprised of a screening level ecological risk assessment (SLERA) and a baseline ecological risk assessment (BERA) (NMED, 2008; USEPA, 2000a; 1997). The SLERA evaluates the potential risk to terrestrial ecological receptors exposed to constituents in surface and subsurface soil. The SLERA provides a conservative estimate of potential ecological risks and compensates for uncertainty by incorporating numerous conservative assumptions. The purpose of the SLERA is to determine whether or not there is a high probability that there are no ecologically significant risks that would merit additional evaluation as provided by a BERA (USEPA, 2000a; 1997). If the results of the SLERA warrant a BERA, the information developed in the SLERA is used to help focus the BERA. The BERA is more complex than the SLERA and uses more realistic and site-specific information about potential exposures and effects in order to evaluate potential ecological risks.

The approach used to assess ecological risks associated with SWMU 19 is based on the USEPA eight-step process (USEPA, 2001a; 2000a; 1997), as summarized in Figure 2-1. An expanded view of the USEPA eight-step process is provided in Figure 2-2. As illustrated on Figure 2-2, the USEPA paradigm divides Step 3 into two pieces, Step 3a and Step 3b (USEPA, 2000a). Step 3a allows for a more refined analysis of available information, while Steps 3b and beyond focus on further evaluation(s) for only those receptors, media, and constituents that are identified in previous steps. According to the USEPA (2000a), “for the majority of sites, ERA activities will cease after the completion of Step 3a.” The details of each step and how they relate to the site ERA are described in this section.

The ERA process culminates in clearly defined scientific management decision points (SMDPs). The SMDPs represent critical steps where risk management decision-making occurs. Generally, the following types of decisions are considered at the SMDPs.

- Whether the available information is adequate to conclude that ecological risks (if any) are negligible and, therefore, there is no need for further action on the basis of ecological risk.

- Whether the available information is inadequate to make a decision at this point and the ecological risk assessment process should continue.

- Whether the available information indicates a potential for adverse ecological effects and a more thorough assessment or remediation is warranted.

The remainder of this section presents the methods used in the ERA and is organized as follows:

- Screening Level Ecological Risk Assessment – this section discusses the steps taken in the SLERA and indentifies results that would indicate the need for a more refined BERA; and

- Baseline Ecological Risk Assessment– this section discusses the steps taken in the BERA.

2.4.1 Screening Level Ecological Risk Assessment

A SLERA conservatively estimates potential risks that may affect ecological receptors, including terrestrial and aquatic organisms. The SLERA typically compensates for uncertainty in a precautionary manner, by incorporating numerous conservative assumptions. The outcome of the SLERA is the conclusion that either there is a high probability that ecologically significant risks are not posed to receptors, or further investigation in the form of a BERA is warranted. The SLERA is comprised of the following steps:

- Step 1: Screening-Level Problem Formation and Effects Evaluation;

- Step 2: Screening Level Exposure Estimate and Risk Calculation; and

- Scientific Management Decision Point (SMDP).

Step 1: Screening-Level Problem Formulation and Screening Level Ecological Effects Evaluation

Step 1 of a SLERA consists of both a screening level problem formulation and a screening level ecological effects evaluation. The screening-level problem formulation presents background information on site characterization, receptors, ecosystem characteristics, as well as information on the sources and effects of the stressors

(USEPA, 1998). This information is used to develop a conceptual site model (CSM) that illustrates the potential relationships between stressors, pathways, and receptors such as:

- Environmental Setting;
- Identification of Constituents Detected;
- Description of Constituent Fate and Transport Pathways;
- Description of Constituent Mechanisms of Ecotoxicity;
- Description of Potentially Exposed Receptors;
- Identification of Potentially Complete Exposure Pathways; and
- Selection of Generic Assessment and Measurement Endpoints.

2.4.1.1 Environmental Setting

SWMU 19 consist of an active steam wash pad and drains (SWMU 19) and the associated OWS (SWMU 20) located in the southern Main Post area of the White Sands Missile Range in Dona Ana County, New Mexico. Combined, the two SWMUs encompass an area less than 0.5 acre. They are bounded by Building 1753 to the south beyond which is Martin Luther King Blvd., and by Sioux Street to the east beyond which is SWMU 64. The entire area is surrounded by a chain-link fence.

This section describes the habitat at SWMU 19. An ecological reconnaissance of the Main Post sites occurred on March 19, 2009.

2.4.1.1.1 Terrestrial Habitat

No significant terrestrial habitat occurs within SWMU 19. The SWMUs consist of a washpad and drains and an OWS surrounded by concrete or gravel. Site photographs are presented in Attachment A.

It is important to note here that due to its location within an active military facility and current land cover (i.e., cement, gravel), SWMU 19 do not provide any significant habitat for ecological receptors and there are no complete exposure pathways to potentially affected media (i.e., soil) under current conditions. The potential risks described below are only associated with hypothetical future use conditions where no exposure barriers exist (i.e., where the current land cover has been removed).

2.4.1.2Identification of Constituents Detected

The soil depth horizon of interest defined by NMED (2008) is from the ground surface to a depth 10 ft bgs. While many wildlife species would only be exposed to near surface soils (e.g., 0 to 2 ft bgs), the subsurface soils down to a depth of 10 ft bgs were included in the evaluation to address potential exposure scenarios in the event there are burrowing wildlife or vegetation with deep rooting zones. The range of detected concentrations and other relevant statistics for the soil data (0 to 2 ft bgs, and 0 to 10 ft bgs) were summarized for the site. Subsurface soil (i.e., soil at a depth greater than 10 ft bgs) was not evaluated with regard to ecological risks due to limited potential for wildlife exposures.

Soil data for SWMU 19 were evaluated as discussed in Section 2.2 and data summaries were prepared. The data summary tables present the frequency of detection, the range of sample quantitation limits, the range of detected concentrations, and the exposure point concentrations (EPC) for each detected constituent in each medium.

2.4.1.2.1Frequency of Detection

Constituents that are infrequently detected might not be related to site-specific operations and therefore should not be considered in the risk assessment evaluation. In accordance with the NMED (2008) guidance, constituents with detection frequency of less than five percent that are not suspected to be related to the SWMUs were not carried forward in the BERA evaluation.

2.4.1.3Description of Constituent Fate and Transport Pathways

Knowledge about the potential constituent fate and transport pathways is vital to understanding which constituents and receptors are associated with potentially complete current and future exposure pathways. This is because a constituent may reach an ecological receptor in a variety of ways. In addition, the pathway and route of exposure may have a strong influence on the ecological effect of a constituent. This information is used in the development of a CSM for potential ecological receptors.

2.4.1.4Description of Constituent Mechanisms of Ecotoxicity

The mechanisms of ecotoxicity for constituents vary depending on a wide range of factors, such as constituent concentrations, the receptor species exposed, the exposure route (e.g., ingestion or direct contact), and physical factors (e.g., pH, soil type). Some of the effects that could be observed in wildlife are mortality, reduced reproductive ability, decreased fertility, decreased offspring survival, alteration of immune and behavioral function, decreased hatching success of eggs/larvae, and retarded growth (Sample et al., 1996; USEPA, 2001b). The remainder of this subsection discusses mechanisms of ecotoxicity for the classes of constituents detected at SWMU 19. These descriptions of constituent mechanisms of toxicity are presented without consideration of constituent concentrations, as the descriptions are intended to convey an understanding of possible effects, rather than to describe the concentrations at which these effects might occur.

Volatile Organic Compounds

VOCs tend to attenuate rapidly in surface soil due to their inherent volatility. Although the effects of VOCs on ecological receptors are not well-understood, there have been extensive inhalation studies of the effects of VOCs under laboratory conditions. Inhaled volatile organics are typically metabolized in the body (often the liver), which may cause liver damage (depending on the organism) or the release of more toxic secondary metabolites. The VOCs or their metabolites may also cause neurological damage, and many are mutagenic or carcinogenic. Additionally, some VOCs are fetotoxic and/or teratogenic (USEPA, 2009b; Sample et al., 1996).

Semi-Volatile Organic Compounds

Semi-volatile organic compounds (SVOCs) include a wide variety of compound classes, such as phenols, organochlorine alkenes, phthalates, and PAHs. SVOCs vary greatly in regard to their toxicity, mechanism of action, bioaccumulative potential,

and susceptibility to being metabolized. Phthalates, a class of SVOCs, are known endocrine disruptors affecting sexual development in males. They are common in the environment, but do not dissolve easily in water and generally attach strongly to soil particles. PAHs such as acenaphthene and naphthalene are often released to the environment as a result of human activities, including the incomplete combustion of fossil fuels or other organic materials. Most PAHs are sorbed to solid particles in the environment, which radically reduces the bioavailability and toxicity of the sorbed PAHs. PAHs have been shown to cause changes in liver enzymes and to perturb cell membranes, but in general, are not viewed as acutely toxic.

Explosives

Subchronic or chronic toxicity studies with mammalian wildlife species were not found for nitroaromatic munition compounds. However, some compounds (e.g., trinitrotoluene, dinitrobenzene, hexahydro-trinitro-triazine [RDX], and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine [HMX]) have been studied in common laboratory species (e.g., rats, mice, and dogs). The liver, kidney, and spleen appear to be the primary target organs for the tested nitroaromatic compounds. Adverse effects observed in mammals include reduced food intake, anemia, enlarged organs (liver, spleen), decreased body weight, testicular atrophy, reduced sperm production, lesions of various organs and tissues (e.g., cerebrum, spleen, liver, kidney, bladder, and urogenital tract), and, in one study, leukemia and malignant lymphoma of the spleen.

All but one of the tested nitroaromatic munition compounds is readily absorbed following oral administration (Talmage et al., 1999). The exception is HMX, which is poorly absorbed by the gastrointestinal tract (e.g., < 5 percent of oral dose in mice and rats), mostly being excreted in the feces as unchanged HMX. All of the tested munitions are rapidly metabolized and excreted in mammals and do not accumulate in tissues. Thus, nitroaromatic munitions are not expected to bioaccumulate. Low octanol-water partition coefficient (K_{ow}) values (i.e., log K_{ow} values at or below 2) also indicate a low potential for bioaccumulation.

Inorganics

Many trace inorganics (e.g., cobalt, copper, chromium, iron, manganese, nickel, molybdenum, selenium, and zinc) are important in plant and animal nutrition, but the optimal concentration ranges are usually narrow (Leland and Kuwabara, 1985). Other inorganics are nonessential, such as lead, cadmium, and mercury, and are toxic to receptors at very low concentrations.

Mechanisms of toxicity of inorganics to plants tend to depend on the nature of the reactivity of the inorganic itself (Efroymson et al., 1997a). They may alter or inhibit enzyme activity, interfere with deoxyribonucleic acid (DNA) synthesis or electron transport, or block uptake of essential elements. Little is known about mechanisms of toxicity of constituents in earthworms (Efroymson et al., 1997b).

Trace metals (such as arsenic, barium, beryllium, chromium, copper, lead, and zinc) are better understood than PAHs and polychlorinated biphenyl (PCBs) with respect to their potential adverse impacts on aquatic wildlife (Newman, 1998). Chromium, copper, and zinc are essential for healthy enzyme function, and some organisms cannot survive without these metals. However, these naturally occurring constituents may cause adverse effects when exposure occurs at concentrations that significantly exceed background concentrations. The toxicity and effects of trace metals may be greatly influenced by pH and organic carbon content of the media in which they occur (Leland and Kuwabara, 1985).

Imbalances in the essential trace metals may cause a decrease in photosynthetic ability, poor spawning/hatching success, teratogenesis, susceptibility to predation and disease, reduced growth, mortality, histopathological changes, organ dysfunction of the liver or kidneys, neurological defects, changes in respiration and osmoregulation, and anemia. Some metals may bioaccumulate, but this mechanism is thought to be a less important ecological concern. Because these constituents are naturally occurring, many organisms have a capacity (albeit limited) to biotransform and/or eliminate naturally occurring inorganics (Newman, 1998; Leland and Kuwabara, 1985).

2.4.1.5Description of Potentially Exposed Receptors

The identification of the categories of receptors most likely to be exposed helps to focus the SLERA. Potentially exposed receptors are designated based on the available habitat associated with SWMU 19. As described above, potentially exposed receptors include terrestrial wildlife (including mammals, birds, reptiles, and invertebrates), and terrestrial plants.

This section also provides an evaluation of potential exposures to individual organisms of threatened and endangered species at the sites. The New Mexico Department of Game and Fish (NMDGF) biennial review of threatened and endangered species in New Mexico does list several birds, mammals, fish and reptiles as species of conservation concern in Dona Ana County. However, previous ecological evaluations of the White Sands Missile Range facility have determined that there are no rare,

threatened or endangered species known or expected to occur in the habitat present at WSMR (White Sands Technical Services, 2008). Furthermore, it has been reported that the habitat present at WSMR is not considered rare or sensitive by any of the regulatory agencies that oversee these issues, including the U.S. Fish and Wildlife Service (USFWS), NMDGF, and the White Sands Missile Range Directorate of Environment and Safety. Therefore, additional consideration of species and habitats of concern is not included in this risk assessment.

2.4.1.6Identification of Potentially Complete Exposure Pathways

A complete exposure pathway is "one in which the chemical can be traced or expected to travel from the source to a receptor that can be affected by the chemicals" (USEPA, 2001c). Therefore, a constituent, its release and migration from the source, a receptor, and the mechanisms of toxicity of that constituent must be demonstrated before a complete exposure pathway can be identified. The table below illustrates possible exposure routes for the two general types of terrestrial receptors at SWMU 19 (USEPA, 1999).

Organism	Possible Exposure Routes
Terrestrial animals	Ingestion, inhalation, dermal contact, food chain
Terrestrial plants	Direct contact, leaf absorption of soil vapor, leaf absorption of constituents deposited on leaves, root uptake

Although inhalation is listed as a possible exposure route, under most exposure conditions inhalation pathways do not represent a significant contribution to receptor risk (USEPA, 2005c), and are not evaluated quantitatively in this risk assessment.

2.4.1.7Identification of Generic Assessment and Measurement Endpoints

Assessment endpoints are the explicit expression of the ecological values to be protected (USEPA, 1999). The selection of assessment endpoints depends on knowledge of the receiving environment, knowledge about the constituents released (including their toxicological properties and the relevant concentrations), and understanding of the values that will drive risk management decisions (Suter et al., 1995). Consistent with USEPA (1998) guidance, two elements are required to define

an assessment endpoint: the specific valued ecological entity and the characteristic about the entity that is important to protect.

The USEPA (1997) guidance states, “For the SLERA, assessment endpoints are any adverse effects on ecological receptors, where receptors are plant and animal populations and communities, habitats, and sensitive environments. Many of the screening ecotoxicity values are based on generic assessment endpoints (e.g., protection of communities from changes in structure or function) and are assumed to be widely applicable to sites around the United States”. However, the identification of assessment endpoints is limited by the availability of ecotoxicity screening values for all media.

USEPA guidance provides that remedial actions should be designed not to protect organisms on an individual basis, but to protect local populations and communities of biota (USEPA, 1999). Thus, the first management principle for conducting an ERA is to provide a basis for selecting a response action “that will result in the recovery and/or maintenance of healthy local populations/communities of ecological receptors that are or should be present at or near the site” (USEPA, 1999).

For SWMU 19, hypothetical assessment endpoints include the following:

- Sustainability of small mammal populations;
- Sustainability of avian populations;
- Sustainability of terrestrial plant communities; and
- Sustainability of soil invertebrate communities.

Because direct measurement of assessment endpoints is often difficult or impossible, surrogate endpoints called measurement endpoints are used to provide the information necessary to evaluate whether the values associated with the assessment endpoint are being protected. A measurement endpoint is defined as a measurable ecological characteristic and/or response to a stressor (USEPA, 1998). Hazard quotients typically serve as the measurement endpoints for SLERAs and are further discussed in Section 2.4.3.

2.4.2 Screening-Level Ecological Effects Evaluation

The screening-level ecological effects evaluation involves the identification of ecological screening levels (ESLs) for each constituent found in soil at SWMU 19 (Table ERA-1). ESLs are generally based on effects such as mortality and reproductive impairment, and are assumed to be widely applicable to sites around the United States for screening purposes (USEPA, 1997). For most constituents and receptors, the data available to generate ESLs are limited and related to effects on individual organisms, rather than populations or communities. Given these limitations, conservative assumptions are typically used to ensure that the ESLs are protective. ESLs available in the literature are screening values and do not constitute remediation goals, as they are sometimes based on highly conservative exposure assumptions and/or wildlife receptors that may not be applicable to a particular site. As such, their robustness and biological association with the assessment endpoint may be limited. However, conservative benchmarks provide a starting point for the SLERA in that they may provide an indication of the worst-case measure of the potential for adverse effects. Typically in a SLERA, ESLs are gathered from a few sources leaving constituents without ESLs to be evaluated in the BERA. Ecological soil screening levels have not been developed by NMED or USEPA Region 6. Therefore, the following hierarchy was used to identify soil ESLs for the SLERA:

- USEPA Ecological Soil Screening Levels (EcoSSLs) (USEPA, 2008c; http://www.epa.gov/ecotox/ecossl/);
- USEPA Region 4 Ecological Soil Screening Values (USEPA, 2001d); and
- USEPA Region 5 Ecological Soil Screening Levels (USEPA, 2003).

To date, ecological screening levels for TPH have not been developed by USEPA or other state agencies, including NMED. Therefore, additional sources (e.g., Efroymson, et al., 2004; Wong et al., 1999) were obtained that provide additional information on the toxicity of TPH and suggest possible ecological benchmarks. The American Petroleum Institute (API) notes in a 1997 publication that “disposed wastes containing crude oil are generally protective of water, plants and soil microbes if they contain no more than 10,000 milligrams per kilogram (mg/kg) of oil and grease or TPH in soil” (Efroymson et al., 2004). At this concentration, plant growth and yield should not be impaired (Deuel, 1991; Overcash and Pal, 1981). A benchmark protective of plants and invertebrates of 10,000 mg/kg is used in this report.

Additionally, in this step, constituents that have a tendency to bioaccumulate were also identified if they are included in the USEPA list of bioaccumulative compounds (USEPA, 2000b).

2.4.3 Screening-Level Exposure Estimate and Risk Calculation

The screening-level exposure assessment is comprised of the identification of exposure estimates, risk calculations, and the evaluation of uncertainties (USEPA, 2001a; 1999). These components form the lines of evidence necessary to support the SMDP at the conclusion of the SLERA.

The exposure concentrations that are used in the SLERA are the maximum concentrations (NMED, 2008; USEPA, 2000a; 2001a). The data sets from which the maximum concentrations are drawn are the same site specific data sets used in the human health risk assessment. The surface soil data (0 to 2 ft bgs) is pooled into a single data set to identify the maximum concentration for that depth interval. Surface and subsurface soil data (0 to 10 ft bgs) is similarly pooled into a single data set. Surface water and sediment habitats are not present on or adjacent to SWMU 19.

Non-detected constituents are also evaluated with respect to the ecological screening levels. The SQLs or reporting limits (RLs) of non-detected constituents exceeding their screening level are identified during the screening process and discussed in the uncertainty section (Section 2.4.5.5).

Risks to ecological receptors are calculated by dividing the exposure estimates (i.e., the maximum detected concentrations) by the conservative ESLs. The resulting ratio, the “maximum HQ”, is a highly conservative surrogate for the assessment endpoints. HQs equal to or less than a value of 1 (to nearest whole number) indicate that adverse or significant ecological effects are unlikely (USEPA, 1997). Maximum HQs greater than 1 indicate that further evaluation is warranted to evaluate the potential for adverse ecological effects. Therefore, the constituents with HQs greater than 1 are identified as Constituents of Potential Ecological Concern (COPECs) and carried forward into Step 3a of the BERA. Detected constituents were also identified as COPECs if no ESL was available.

In cases where exceedances are considered extremely marginal or slight, discussion with risk managers for the site may result in a constituent with a HQ greater than 1 not being evaluated in the BERA.

The lack of screening ecotoxicity values for some constituents is one of the main contributors to uncertainty associated with the SLERA evaluation. HQs cannot be calculated for constituents that lack screening ecotoxicity values. Therefore, a constituent that lacks a screening value was carried forward to the BERA. Exception to this may occur when risk managers for the site agree that a BERA is not warranted. For example, the situation may exist that a very limited number of constituents do not have screening values, and those constituents that do have screening values have HQs well below a value of 1. These risk management decisions are agreed to during the SMDP.

2.4.3.1 Surface Soil

Surface soil COPECs were selected by comparing the analytical data with ESLs from sources identified in Section 2.4.2 (Screening Level Ecological Effects Evaluation). Table ERA-2 presents the selection of surface soil COPECs for the ERA.

As summarized in Table ERA-2, the four following constituents were identified as COPECs in surface soil at SWMU 19: cadmium, lead, mercury and silver.

2.4.3.2 Combined Surface and Subsurface Soil

Combined surface and subsurface soil COPECs were selected by comparing the analytical data with ESLs from sources identified in Section 2.4.2. Table ERA-3 presents the selection of surface and subsurface soil COPECs for the ERA.

As summarized in Table ERA-3, the four following constituents were identified as COPECs in combined surface and subsurface soil at SWMU 19: cadmium, lead, mercury and silver.

2.4.4 Scientific Management Decision Point and Reporting

This first SMDP is purposefully flexible (per the USEPA paradigm) to occur after Steps 2 or 3a, depending on the results obtained at Step 2 (Figure 2-2). The purpose of the flexibility of the first SMDP is so that additional evaluation of risks can occur and reporting can be streamlined into a single report. The results of the SLERA were expressed in terms of the following conclusions or recommended actions:

1. There is adequate information to conclude that ecological risks are unlikely and no further action is warranted.

2. The information is not adequate to make a decision at this point. The ecological risk assessment process will continue to Step 3a – the initial step of the BERA.

3. Remedial actions may be considered for the media and constituents that are identified at the end of Step 2, to determine if cost-effective actions can be implemented to reduce or prevent risks to wildlife.

Based on the results of the SLERA, the following conclusions regarding the potential for adverse ecological risks at SWMU 19 can be drawn: the ERA should continue at this time. As such, a BERA is presented in the following sections.

2.4.5 Baseline Ecological Risk Assessment

The BERA is designed to more realistically identify the nature and extent of ecological risks to support informed risk management decision-making (USEPA, 2000a; 1997). This approach contrasts with the SLERA, which is designed to conservatively rule out further evaluation of constituents and media that clearly do not pose a significant ecological risk.

The BERA was conducted in a manner consistent with the following guidance:

- "Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment" (NMED, 2008);
- "Ecological Risk Assessment Guidance for Superfund" (USEPA, 1997; 1999);
- "Amended Guidance on Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders" (USEPA, 2000a);
- "ECO-Update: Role of Screening-level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments," (USEPA, 2001a); and
- "Guidelines for Ecological Risk Assessment" (USEPA, 1998).

Step 3a of the BERA for SWMU 19 is a refinement of the Step 2 exposure estimates and risk characterization, focused only on the constituents and media that progress beyond the SLERA. The assumptions used in Step 3a are refinements of the

conservative estimates of exposure and toxicological impacts, to site-specific (or receptor-specific) estimates of exposure, and more relevant ecotoxicity screening values, if available (USEPA, 2001b). Risks are recalculated using these refined assumptions. The outcome of this refined screening process is a list of COPECs to be retained for further evaluation in the BERA process. This effort was conducted as part of the Step 3a, BERA Problem Formulation. Step 3a involves the refinement of the following:

- Media of Concern;
- Constituents of Potential Ecological Concern (COPECs);
- Risk Calculations for Direct Contact COPECs;
- Assessment and Measurement Endpoints for Bioaccumulative COPECs;
- Bioaccumulative COPECs by Preliminary Food Chain Modeling;
- Risk Characterization by Evaluation of Weight of Evidence and Ecological Significance; and
- Uncertainties.

Step 3a is followed by a SMDP that involves the reporting of results of Steps 1 through 3a.

2.4.5.1Refinement of Risk Calculations for Direct Contact Constituents of Potential Ecological Concern

The refinement of the COPECs identified in the SLERA is necessary to help focus further risk assessment activities on the constituents which pose the greatest potential risk to ecological receptors. USEPA guidance for this approach (USEPA, 1999; 2000a; 2001a; 1997) indicates that the refinement of COPECs streamlines the overall ERA process by using realistic criteria to focus the risk assessment on those constituents that may pose unacceptable ecological risks. It is intended as an “incremental iteration of exposure, effects, and risk characterization” (USEPA, 2001a). The outcome of this screening is that constituents are either excluded as COPECs or retained for further evaluation in the BERA process.

The refinement of COPECs is focused on refining the ecological exposure assumptions. An EPC is calculated for each constituent separately. These EPCs are compared with the relevant SLERA screening toxicity values. To the extent appropriate, the 95 percent upper confidence limit (UCL) on the mean concentration is used as the EPC for the refinement of COPECs. The UCL for each COPEC is calculated using the USEPA's ProUCL 4.0 statistical software (USEPA, 2007a).

The UCL represents an upperbound estimate of average exposure conditions, which is an appropriate estimate for mobile terrestrial wildlife species and for exposures of plant and animal communities (rather than individuals). However, the UCL may not be considered the appropriate comparative statistic if the data sets are small. In this case, the maximum detected concentration is considered the appropriate comparative statistic. In cases where the UCL is greater than the maximum detected concentration, the maximum detected concentration is used as the EPC. Constituents with EPCs greater than the SLERA screening ecotoxicity value, and analytes for which there are no screening ecotoxicity values, are retained for further consideration.

Each of the constituents identified as a COPEC is considered a COPEC for direct contact exposures. A subset of these COPECs is also considered for bioaccumulative exposures. A list of bioaccumulative constituents prepared by the USEPA is used to identify potential bioaccumulative COPECs (i.e., those constituents that will magnify in the food chain). Table ERA-1 identifies bioaccumulative constituents as defined in the USEPA guidance *Bioaccumulative Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs* (USEPA, 2000b). Direct contact COPECs that are listed as bioaccumulative compounds are also considered and evaluated as bioaccumulative COPECs.

The COPECs identified for the SWMU 19 SLERA were re-evaluated for the surface soil and combined surface and subsurface soil data sets by calculating refined HQs. The refined HQs were calculated for the COPECs using refined EPCs (shown in Tables ERA-5 and ERA-6). Since cadmium, lead, and silver are bioaccumulative, they were carried forward into the food chain models. The results of the refined HQ calculations for SWMU 19 are summarized in the subsections below.

2.4.5.1.1 Surface Soil

Four COPECs (cadmium, lead, mercury and silver) in surface soil were carried forward into the BERA. Due to the low number of detections, UCLs were not calculated for the surface soil COPECs. Therefore, the refined EPCs equal the maximum detections and

the refined HQ for cadmium, lead, mercury, and silver are greater than 1. The BERA results for the surface soil COPEC at SWMU 19 are presented in Table ERA-5 and are discussed below:

- Cadmium – One of five surface soil samples reported a detected concentration (38.5 mg/kg) above the ESL (0.36 m/kg). This maximum concentration was reported for sample location SB02. Due to the low number of detections of cadmium (1 of 5), the areal extent of samples containing lead above its ESL is very limited. The calculated HQ of 100 is based on an USEPA Ecological Soil Screening Level (EcoSSL) for a mammalian ground insectivore (shrew) which was calculated assuming a diet of earthworms (USEPA, 2005d). EcoSSLs for herbivorous and carnivorous mammals range from 73 mg/kg to 84 mg/kg. Avian EcoSSLs for cadmium range from 0.77 mg/kg (based on insectivore diet of earthworms) to 630 mg/kg (avian carnivore). For all practical purposes, earthworms do not occur in the desert southwest (Werner and Olson, 1994). Therefore, the EcoSSL of 28 mg/kg (based on avian herbivore) may be more appropriate for the site. Using a screening level of 28 mg/kg and the maximum detected concentration, the HQ for cadmium would be 1 indicating that adverse ecological effects are unlikely if exposure was to occur. In addition, as discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model, the calculated HQ values were all less than 1 with the exception of the desert shrew which had an HQ only slightly above 1 (i.e., 2). Based on these considerations, adverse impacts are not expected for wildlife potentially exposed to cadmium at SWMU 19.

- Lead – Five of five surface soil samples reported a detected concentration above the ESL (11 m/kg). The maximum concentration (46.2 mg/kg) was reported for sample location SB01. The calculated HQ of 4 is based on an EcoSSL (USEPA, 2005e) for a woodcock (avian insectivore) which was calculated assuming a diet of earthworms. EcoSSLs for herbivorous and carnivorous birds range from 46 mg/kg to 510 mg/kg. Mammalian EcoSSLs for lead range from 56 mg/kg (based on insectivore diet of earthworms) to 1,200 mg/kg (herbivorous mammal). As mentioned above, for all practical purposes, earthworms do not occur in the desert southwest (Werner and Olson, 1994). Therefore, the EcoSSL of 46 mg/kg (based on avian herbivore) may be more appropriate for the site. Using a screening level of 46 mg/kg and the maximum detected concentration, the HQ for lead would be 1 indicating that adverse ecological effects are unlikely if exposure was to occur. In addition, as discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model, the calculated HQ values

were all less than 1. Based on these considerations, adverse impacts are not expected for wildlife potentially exposed to lead at SWMU 19.

- Mercury – Two of five surface soil samples reported detected concentrations above the ESL (0.1 m/kg). The areal extent of samples containing mercury above the ESL is extremely limited as they both occur at one sample location (SWMU 19 SB02). The calculated HQ of 6 is based on an ESL derived by Efroymson et al (1997b) for the toxicity of mercury to soil invertebrates (i.e., earthworms), and as indicated, earthworms do not occur in the desert southwest. Efroymson et al. (1997b) used a lowest observed effect concentration (LOEC) (based on survival) of 0.5 mg/kg and applied an uncertainty factor of 5. The resulting benchmark of 0.1 mg/kg has low confidence due to the limited amount of data. Given the conservative assumptions in the ESL, and considering the limited areal extent of samples containing mercury above its ESL, adverse impacts are not expected for wildlife potentially exposed to mercury at SWMU 19.

- Silver – One of five samples reported detected concentrations of silver at SWMU 19. The detected concentration (59.8 mg/kg) reported for sample SB02 exceeded the ESL (4.2 mg/kg). Due to the low number of detections (1 of 5), the areal extent of samples containing silver above its ESL is very limited. The calculated HQ of 10 is based on an EcoSSL (USEPA, 2006) for a woodcock (avian insectivore) which was calculated assuming a diet of earthworms. EcoSSLs for herbivorous and carnivorous birds range from 69 mg/kg to 930 mg/kg. Mammalian EcoSSLs for silver range from 14 mg/kg (based on insectivore diet of earthworms) to 1,500 mg/kg (herbivorous mammal). For all practical purposes, earthworms do not occur in the desert southwest (Werner and Olson, 1994). Therefore, the EcoSSL of 69 mg/kg (based on avian herbivore) may be more appropriate for the site. Using a screening level of 69 mg/kg and the maximum detected concentration, the HQ for silver is 0.9 indicating that adverse ecological effects are unlikely if exposure was to occur. In addition, as discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model, the calculated HQ values were all less than 1 with the exception of the desert shrew which had an HQ only slightly above 1 (i.e., 2). Based on these considerations, adverse impacts are not expected for wildlife potentially exposed to silver at SWMU 19.

Cadmium, lead, and silver were identified as bioaccumulative and evaluated in the terrestrial food chain model presented in Section 2.4.5.3

2.4.5.1.2 Combined Surface and Subsurface Soil (0 to 10 ft bgs)

Four COPECs (cadmium, lead, mercury, and silver) in combined surface and subsurface soil were carried forward into the BERA. When the refined EPCs for lead (27.53 mg/kg) and mercury (0.501 mg/kg) were compared with their ESLs (11 mg/kg and 0.1 mg/kg, respectively), and the maximum concentrations (UCLs were not calculated due to the low number of detections) for cadmium and silver were compared with their ESLs (0.36 mg/kg and 4.2 mg/kg, respectively), all four COPECs had a refined HQ greater than 1. The BERA results for the surface and subsurface soil COPEC at SWMU 19 are presented in Table ERA-6 and are discussed below:

- Cadmium – One of eleven combined surface and subsurface soil samples reported a detected concentration (38.5 mg/kg) above the ESL (0.36 m/kg). This maximum concentration was reported for sample location SB02. Due to the low number of detections of cadmium (1 of 11), the areal extent of samples containing lead above its ESL is very limited. The calculated HQ of 100 is based on an EcoSSL for a mammalian ground insectivore (shrew) which was calculated assuming a diet of earthworms. As discussed in Section 2.4.5.1.1, the EcoSSL of 28 mg/kg (based on avian herbivore) may be more appropriate for the site. Using a screening level of 28 mg/kg and the maximum detected concentration, the HQ for cadmium would be 1 indicating that adverse ecological effects are unlikely if exposure was to occur. In addition, as discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model for the desert kit fox, the calculated HQ values were all well below 1. Based on these considerations, adverse impacts are not expected for desert kit fox or other burrowing wildlife potentially exposed to cadmium at SWMU 19.

- Lead – Eleven of eleven combined surface and subsurface soil samples reported a detected concentration above the ESL (11 m/kg). The maximum concentration (46.2 mg/kg) was reported for sample location SB01. The calculated HQ of 3 is based on an EPC of 27.53 mg/kg and an EcoSSL for a woodcock (avian insectivore) which was calculated assuming a diet of earthworms. As discussed in Section 2.4.5.1.1, the EcoSSL of 46 mg/kg (based on avian herbivore) may be more appropriate for the site. Using a screening level of 46 mg/kg and the maximum detected concentration, the HQ for lead would be 1 indicating that adverse ecological effects are unlikely if exposure was to occur. In addition, as discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model, the calculated HQ values were all less than 1. Based on these considerations, adverse impacts are not expected for desert kit fox or other burrowing wildlife potentially exposed to lead at SWMU 19.

- Mercury – Two of eleven combined surface and subsurface soil samples reported detected concentrations above the ESL (0.1 m/kg). The areal extent of samples containing mercury above the ESL is extremely limited as they both occur at one sample location (SWMU 19 SB02). The calculated HQ of 5 is based on an EPC of 0.501 mg/kg and an ESL derived by Efroymson et al (1997b) for the toxicity of mercury to soil invertebrates (i.e., earthworms). Efroymson et al. (1997b) used a lowest observed effect concentration (LOEC) (based on survival) of 0.5 mg/kg and applied an uncertainty factor of 5. The resulting benchmark of 0.1 mg/kg has low confidence due to the limited amount of data. Given the conservative assumptions in the ESL, and considering the limited areal extent of samples containing mercury above its ESL, adverse impacts are not expected for desert kit fox or other burrowing wildlife potentially exposed to mercury at SWMU 19.

- Silver – One of eleven samples reported detected concentrations of silver at SWMU 19. The detected concentration (59.8 mg/kg) reported for sample SB02 exceeded the ESL (4.2 mg/kg). Due to the low number of detections of silver (1 of 11), the areal extent of samples containing silver above its ESL is very limited. The calculated HQ of 10 is based on an EcoSSL for a woodcock (avian insectivore) which was calculated assuming a diet of earthworms. As discussed in Section 2.4.5.1.1, the EcoSSL of 69 mg/kg (based on avian herbivore) may be more appropriate for the site. Using a screening level of 69 mg/kg and the maximum detected concentration, the HQ for silver is 0.9 indicating that adverse ecological effects are unlikely if exposure was to occur. In addition, as discussed in the sections below, when this COPEC was further evaluated in the site-specific terrestrial food chain model for the desert kit fox, the calculated HQ values were well below 1. Based on these considerations, adverse impacts are not expected for desert kit fox or other burrowing wildlife potentially exposed to silver in subsurface soil at SWMU 19.

Cadmium, lead, and silver were identified as bioaccumulative and evaluated in the terrestrial food chain model for the kit fox[1] presented in Section 2.4.5.4.

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[1] As discussed in Section 2, a desert kit fox can burrow to a depth of 3 meters and may be exposed to surface and subsurface soil (0 to 10 ft bgs).

2.4.5.2Assessment and Measurement Endpoints for Bioaccumulative COPECs

The assessment and measurement endpoints from the SLERA are refined for bioaccumulative COPECs listed in Table ERA-1. Bioaccumulative COPECs are those COPECs that may have toxic effects when they transfer through the food chain. The bioaccumulative COPECs indentified in soil at SWMU 19 are cadmium, lead and silver. The SLERA assessment and measurement endpoints were refined for bioaccumulative COPECs because the SLERA endpoints are general in nature and do not necessarily identify receptors that are susceptible to food chain exposures. BERA assessment endpoints for bioaccumulation are based on receptors appropriate to the habitat present at the site, as well as the media in which bioaccumulative COPECs are identified (i.e., soil). The food chain assessment and measurement endpoints considered appropriate for SWMU 19 are as follows:

Assessment Endpoint	Measurement Endpoint	Effects Measured
Survival and reproductive success of mammals exposed to bioaccumulative compounds in the terrestrial food chain	Changes in survival and reproduction as indicated by food chain modeling for mammalian indicator species	NOAELs and LOAELs related to chronic effects such as reduced survival and reduced litter size
Survival and reproductive success of birds exposed to bioaccumulative compounds in the terrestrial food chain	Changes in survival and reproduction as indicated by food chain modeling for avian indicator species	NOAELs and LOAELs related to chronic effects such as eggshell thinning or reduced fledgling survival

NOAEL no-observed-adverse-effect-level

LOAEL lowest-observed-adverse-effect-level

2.4.5.3Terrestrial Food Chain Modeling

Ingestion-based food chain modeling was used in Step 3a of the BERA to evaluate bioaccumulative COPECs. The purpose of the food chain modeling is to characterize potential exposures to COPECs via the food chain and to identify potential adverse effects for mammals and birds. The remainder of this section provides general information regarding the following components of the model:

- Wildlife receptors and exposure parameters;
- Bioaccumulation and bioconcentration factors;
- Food chain ingestion modeling;

- Ecotoxicity benchmarks and extrapolation approach; and
- Risk characterization for food chain modeling.

2.4.5.3.1 Terrestrial Wildlife Receptors and Exposure Parameters

Indicator species were chosen to represent a cross-section of feeding guilds for selected assessment endpoints and allow estimation of rates of survival, growth and reproduction for populations or receptors they represent.

Indicator species selected are as follows:

- herbivorous bird: mourning dove (Zenaida macroura);
- insectivorous bird: cactus wren (Campylorhynchus brunneicapillus);
- carnivorous bird: red-tailed hawk (Buteo jamaicensis);
- herbivorous mammal: Merriam's kangaroo rat (Dipodomys merriami);
- insectivorous mammal: desert shrew (Notiosorex crawfordi); and
- carnivorous mammal: desert kit fox (Vulpes macrotis).

Indicator species were selected to represent avian and mammalian populations that might reside or forage in habitats present at the site and surrounding area. Indicator species were not selected to represent reptiles that might access the site, because the available toxicity data are insufficient to support establishing distinct risk-based screening criteria (USEPA, 2005c). Because effects data for reptiles are extremely limited (Sparling, et al., 2000), it is often necessary to assume that the risk characterizations for other receptors is protective of these species.

Selection of Herbivorous Avian Receptor – Mourning dove is among the most abundant and widespread terrestrial bird species endemic to North America and has been observed on the WSMR facility. It is an herbivorous bird that forages on the ground. Open habitats are preferred, but the species generally shuns only extensively forested areas and wetlands (Tomlinson, 1993). Mourning doves are habitat generalists that opportunistically take advantage of seasonally available food resources among a wide variety of habitats that vary across its extensive range. Diet consists

mostly (99%) of seeds from cultivated or wild plants with insignificant amounts of animal matter and leafy vegetation incidentally ingested. Mourning doves feed almost entirely on the ground, and avoid rank, tall vegetation. They seldom feed where ground litter makes food difficult to find (Mirachi, 1993).

Mourning dove was selected to represent herbivorous birds for the following reasons:

- It has been observed near SWMU 19;
- It feeds primarily on seeds, which potentially bioaccumulate COPECs;
- COPEC bioaccumulation data are available for plants;
- It gleans food from the ground resulting in a relatively high incidental soil ingestion rate, a potential route of exposure to COPECs; and
- A substantial amount of literature for exposure parameters and toxicity values for birds are available.

Selection of Insectivorous Avian Receptor – The cactus wren is an insectivorous bird that forages on the ground and in low vegetation for insects, spiders, other small invertebrates, cactus fruits, other fruits, nectar, and seeds (Bent, 1948; Anderson and Anderson, 1973; both cited in California Department of Fish and Game [CDFG], 2005). However, cactus wren feed primarily on insects. In Arizona, the cactus wren diet is composed mainly of beetles, ants and wasps, grasshoppers, butterflies and moths, true bugs, and spiders (Beal, 1907; Storer, 1920). Vegetation is used for cover, and nests are also used for roosting. Nesting typically occurs in cactus or other thorny shrubs. The cactus wren territory averages 4.8 acres and is likely similar to the home range (CDFG, 2005).

Cactus wren was selected to represent insectivorous birds associated with the sites for the following reasons:

- It is a common bird in desert riparian habitats and xeric scrub and cactus habitats;
- Suitable habitat is available near SWMU 19;
- It preys on primarily insects, which may accumulate COPECs;

- COPEC bioaccumulation data are available for invertebrates;
- It forages on the ground during which the intake of COPEC could occur through incidental soil ingestion; and
- A substantial amount of literature for exposure parameters and toxicity values for birds are available.

Selection of Carnivorous Avian Receptor – Red-tailed hawks are moderately large soaring birds that inhabit open or semi-open areas. They prey on ground-dwelling vertebrates such as hares, mice, small birds, amphibians, and reptiles. They may be exposed to COPECs through bioaccumulation in prey that forage on the ground and ingest soil incidentally through food. Red-tailed hawks lay one clutch per year with one to three eggs. Most red-tailed hawks attempt to breed at two years of age. They are territorial throughout the year and have a home range size that can vary from less than 1 to over 10 square kilometers (km^2)(CDFG, 2005).

Red-tailed hawk was selected as a representative species for the following reasons:

- Red-tailed hawks have been observed in some areas of the WSMR facility;
- It preys on small mammals, which may bioaccumulate COPECs;
- COPEC bioaccumulation data are available for small mammals; and
- A substantial amount of literature for exposure parameters and toxicity values for birds are available.

Selection of Herbivorous Mammalian Receptor – The kangaroo rat is primarily herbivorous, but may also feed on arthropods seasonally. It is found in desert scrub and alkali desert scrub, sagebrush, Joshua tree, and pinyon-juniper habitats. They are solitary animals and receive cover from burrows they dig in sandy soil. Kangaroo rats may breed several times per year but once is normal. They normally have a litter size of four young. Population density has been reported between 13-19 individuals per hectare in creosote scrub populations (CDFG, 2005).

Kangaroo rat was chosen as a representative species for the following reasons:

- Kangaroo rats are a common herbivorous species present in desert habitats;

- Suitable habitat for kangaroo rat is available near the site;
- It feeds on plants, which may bioaccumulate COPECs;
- COPEC bioaccumulation data are available for plants;
- It forages on the ground where intake of COPECs in the soil may occur;
- It is an important prey species for higher level trophic predators;
- Its burrows provide important cover for other animals; and
- Exposure parameters and toxicity information for small mammals are available.

Selection of Insectivorous Mammalian Receptor – The desert shrew is an insectivorous mammal that forages on the ground. There is little data on food preferences of the desert shrew in the wild, but in the laboratory food consumed included worms, grasshoppers, cockroaches, and other invertebrates (Hoffmeister and Goodpaster, 1962, as cited in CDFG, 2005). Additionally, other species of shrews are known to feed almost exclusively on invertebrates (Hamilton, 1941, Whitaker and Ferraro, 1963, both as cited in USEPA, 1993; Whitaker and Maser, 1976, as cited in CDFG, 2005). The desert shrew will drink water when available, but otherwise obtains water from food. This species occupies a wide variety of habitats, including desert wash, desert scrub, desert riparian, mixed chaparral, and pinyon-juniper habitats. Home range data are limited for shrews and are not available for the desert shrew. However, the home range of the dusky shrew, a similar species, averages 0.1 acre (CDFG, 2005).

The desert shrew was selected as a representative species for the following reasons:

- Desert shrews are a common insectivorous species present in desert habitats;
- Suitable habitat for desert shrew is available near the site;
- It preys primarily on insects, which may accumulate COPECs;
- COPEC bioaccumulation data are available for invertebrates;

- It may be exposed to COPECs via incidental ingestion while foraging on the ground;
- It is an important prey species for higher level trophic predators;
- Exposure parameters are available or can be estimated from the available data from species with similar feeding habits; and
- Toxicity values for small mammals are readily available.

Selection of Carnivorous Mammalian Receptor – The desert kit fox is carnivorous, preying on black-tailed hare, desert cottontails, rodents, birds, and reptiles. They are residents of arid regions, and live in annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub. They dig dens in open, level areas of sandy soil. Kit fox dens/burrows on average range from 1.5 to 3 meters deep (Arjo, et al., 2003). Home range size has been reported as approximately 9.8 km^2 and 12.3 km^2, for females and males, respectively (Zoellick, 1992). Pups are born February through April with an average of four per litter.

The desert kit fox was chosen as a representative species for the following reasons:

- Desert kit fox are a protected fur-bearing species (i.e., hunting is regulated) in New Mexico;
- Desert kit fox are a common carnivorous species present in desert habitats;
- Suitable habitat for desert kit fox is available near the site;
- It preys on small mammals, which may bioaccumulate COPECs;
- COPEC bioaccumulation data are available for small mammals;
- It plays an important role in providing cover for other species by its burrowing activity;
- Desert kit fox dens range from 1.5 to 3 meters deep and therefore are exposed to subsurface soil; and

- Toxicity data are available for larger mammals (e.g., dogs).

Indicator receptor exposure parameters are presented in Table ERA-7.

2.4.5.3.2 Bioaccumulation and Bioconcentration Factors

The processes of bioaccumulation and bioconcentration are important to an ERA because they provide a basis of prediction and discussion regarding the potential for constituent uptake into flora and fauna. Constituents in tissues of organisms in the food chain are likely to be ingested by the species which feed on them (i.e., those occupying higher trophic levels), the result of which may be the expression of toxicological effects by the higher trophic level species.

Bioaccumulation and bioconcentration factors used for the food chain modeling are obtained from literature sources such as USEPA, 2007b; Baes, et al., 1984; Travis and Arms, 1988; and other related literature, and are presented in Table ERA-8.

If a bioaccumulation factor (BAF) or bioconcentration factor (BCF) obtained from the literature was in dry weight, it was converted to wet weight in the estimated ingestion calculation using the following conversion factors: 0.167 for invertebrates; 0.12 for plants and 0.32 for mammals.

$$BAF\ (wet\ weight) = BAF\ (dry\ weight) * Conversion\ Factor$$

2.4.5.3.3 Food Chain Ingestion Modeling

Food chain ingestion-based exposure calculations were performed for the identified representative receptor species to characterize potential exposures to soil constituents via the food chain and to identify potential adverse effects for wildlife at SWMU 19. Ingestion modeling is based on species-specific exposure parameters and ingestion intake requirements. Arithmetic mean and UCL concentrations were used to evaluate the range of potential ingestion-based exposures. The use of mean concentrations is appropriate because birds and mammals are highly mobile and consume prey items containing varying levels of COPECs. The use of UCL concentrations is intended to represent, in effect, a reasonable maximum exposure estimate. The following model is used to calculate the ingestion based exposure for each indicator receptor:

$$\text{Ingestion (mg/kg - day)} = \left(\frac{\{(P_{MEDIUM} \times C_{MEDIUM} \times (IR_M)) + ((P_{FOOD1} \times C_{FOOD1}) + (P_{FOOD2} \times C_{FOOD2}) \times (IR_F))\} \times (SUF) \times (ED)}{BW} \right)$$

Where:

P_{MEDIUM} = Proportion of the diet comprised of the medium (unitless)

C_{MEDIUM} = Concentration of the constituent in the medium (mg/kg)

P_{FOOD1} = Proportion of the diet comprised of the first food item (unitless)

C_{FOOD1} = Concentration of the constituent in the first food item (mg/kg)

P_{FOOD2} = Proportion of the diet comprised of the second food item (unitless)

C_{FOOD2} = Concentration of the constituent in the second food item (mg/kg)

IR_F = Ingestion rate of food (kg/day)

IR_M = Ingestion rate of media (kg/day)

SUF = Site use factor (unitless)

ED = Exposure duration (unitless)

BW = Body weight of the organism (kg)

and:

C_{FOOD1} = C_{MEDIUM} x BAF_{FOOD1}

C_{FOOD2} = C_{MEDIUM} x BAF_{FOOD2}

BAF_{FOOD1} = Bioaccumulation factor for first food item (unitless)

BAF_{FOOD2} = Bioaccumulation factor for second food item (unitless)

2.4.5.3.4 Site Use Factor Approach

A site use factor (SUF) of 1 was employed in this ERA for the maximum scenario under the assumption that the receptors obtain their entire diet from SWMU 19. However, for the refined scenarios, SUFs were adjusted based on literature values for the foraging/home range of a measurement receptor. For several of the receptors (mourning dove, cactus wren, red-tailed hawk, desert kit fox), those home ranges are larger than the area evaluated for SWMU 19. The SUF calculation is represented by a simple ratio where the size of the affected area is divided by the size of the home or foraging range of the receptor. As a conservative measure in this report, the size of the affected area was based on the boundary of the SWMUs. The calculated SUFs for SWMU 19 are based on each receptors' home range and the approximate size of SWMU 19 (i.e., 1 acre). Table ERA-7 provides the home ranges obtained from the literature for each receptor.

2.4.5.3.5 Ecotoxicity Benchmarks and Extrapolation Approach

Modeling studies use constituent-specific toxicity reference values (TRVs) for the purpose of estimating risk. For the most part, TRVs are based on studies using laboratory species because toxicological studies have not been conducted on most wildlife species. TRVs are available from a variety of sources such as USEPA (2009b; 2005c); Sample, et al., (1996 and 1997); Agency for Toxic Substances and Disease (ATSDR), and many constituent-specific scientific sources and publications. Toxicological benchmarks are typically reported as no observed adverse effect levels (NOAELs) and lowest observed adverse effect levels (LOAELs). Both NOAELS and LOAELs for each COPEC are used in the food chain modeling so that a range of predicted food chain impacts can be evaluated. A list of ecotoxicity values for the specific COPECs associated with the site are provided in the site-specific BERA and presented in Tables ERA-9 and ERA-10. These ecotoxicity values will vary depending on the species, as described below.

Toxicity values must be carefully selected, and may require mathematical adjustment in order to represent the species selected for a site. In order to have a toxicity value representative of specific mammalian wildlife species rather than a mammalian laboratory species, an extrapolation (i.e., a mathematical formula based on differences in body weights) is needed (Sample, et al., 1997). The extrapolation is necessary because the laboratory mammalian species and wildlife species are of varying sizes.

A generic approach for modeling a constituent-specific reference toxicity value for the purpose of estimating risk to a generic mammalian "wildlife species," is shown below (Sample, et al., 1996):

$$\text{NOAEL}_{\text{WildlifeSpecies}} = \text{NOAEL}_{\text{Test Species}} \times \left[\frac{\text{BW}_{\text{TestSpecies}}}{\text{BW}_{\text{WildlifeSpecies}}} \right]^{\frac{1}{4}}$$

Where:

$\text{NOAEL}_{\text{Wildlife Species}}$	=	NOAEL for the wildlife species (i.e., the TRV)
$\text{NOAEL}_{\text{Test Species}}$	=	NOAEL for the laboratory test species (i.e., the toxicological benchmark)
$\text{BW}_{\text{Test Species}}$	=	Body weight of the laboratory test species
$\text{BW}_{\text{Wildlife Species}}$	=	Body weight of the wildlife species

No body size scaling extrapolation was applied to toxicity values obtained from USEPA EcoSSL guidance (2005c) since those values are derived using multiple mammal test species.

Toxicity values for birds are not typically extrapolated, regardless of the laboratory test species (Sample, et al., 1996). For example, the NOAEL for a laboratory bird (e.g., a mallard duck) would be used exactly to represent a NOAEL for the cactus wren.

2.4.5.4 Terrestrial Food Chain Modeling Risk Characterization

As summarized in Tables ERA-26 and ERA-27, the refined scenario LOAEL and NOAEL HQs for the mourning dove, red-tailed hawk, Merriam's kangaroo rat, and desert kit fox exposed to cadmium, lead, and silver in surface soil were all less than or equal to 1.

The refined scenario LOAEL and NOAEL HQs for the desert shrew exposed to cadmium and silver in surface soil were 2 and 16, and 2 and 22, respectively. If only the NOAEL HQs were considered, then these results would suggest the potential for adverse impacts to mammal and avian receptors may occur if all exposure assumptions are met. However, the NOAEL, by definition, is a very conservative screening criterion. The LOAEL indicates a concentration above which adverse

impacts to individual receptors may occur. While the HQs calculated using the conservative NOAELs are greater than 1, these HQs likely overestimate the exposures to desert shrew (and other invertivorous mammals), and likely overestimate the toxicity of cadmium and silver to these populations. Considering the LOAEL HQs (a more realistic indicator of toxicity) for the desert shrew are only slightly above 1, and that the spatial extent of affected soil is extremely small (less than 0.5 acre), ecological effects are unlikely if exposure to SWMU 19 surface soil were to occur in the future.

The refined scenario LOAEL and NOAEL HQs for the desert kit fox potentially exposed to combined surface and subsurface soil were less than 1 for SWMU 19. These results indicate that if kit foxes (or other similar burrowing mammals) are exposed to cadmium, lead, or silver in the future, they are not expected to experience adverse effects.

Based on the overall analysis of terrestrial food chain modeling HQs, including the limited spatial extent of the affected soil, if exposure to these bioaccumulative COPECs were to occur in the future, then adverse effects are not expected for wildlife.

2.4.5.5Evaluation of Uncertainties

Uncertainty is “the imperfect knowledge concerning the present or future state of the system under consideration; a component of risk resulting from imperfect knowledge of the degree of hazard or of its spatial and temporal distribution,” (USEPA, 1997). Uncertainties that may lead to either an overestimate or underestimate of risk are associated with each stage of risk assessment. Uncertainty is inherent to ERA, in part, because the sciences of ecology and ecotoxicology are relatively young and not yet fully developed (Kapustka and Landis, 1998; Newman, 1998; Emlen and Springman, 2007; Kapustka, 2008; Suter, 2008). Uncertainty also exists in many aspects of the toxicology relied upon for conducting ERAs (Newman, 1998; Lovett Doust, et al., 1993; Dale, et al., 2008). General uncertainties associated with the SLERA are identified on Table ERA-4.

Eighteen constituents, including seven VOCs (i.e., chloroform; 2-chlorophenol; vinyl chloride; bis(2-ethylhexyl)phthalate; 2,4-dimethylphenol, diphenylamine (0-10 ft depth only]; and hexachlorobenzene), nine PAHs (i.e., anthracene; benzo[a]pyrene; benzo[b]fluoranthene; 1-chloronaphthalene; 2-chloronaphthalene; fluoranthene; naphthalene; phenanthrene; and pyrene), one explosive (i.e., 2,6-dinitrotoluene), and one inorganic (selenium), were not detected, but had some SQLs greater than the screening values. Because these 18 constituents were not detected in any sample

collected from SWMU 19, it is not possible to conduct a quantitative evaluation. The majority of the soil samples collected in 1993, while analyzed using standard laboratory methods and instrumentation appropriate for that time period, have SQLs that are elevated in relation to SQLs that have become increasingly lower over the past approximately 16 year period. The high SQLs associated with the SWMU 19 data set are believed to be the result of outdated laboratory methods and instrumentation rather than a function of constituent content within a sample. Therefore, the SQLs associated with historical data are considered a minor uncertainty in the risk assessment.

2.4.6 Ecological Risk Summary

A SLERA and BERA were completed for SWMU 19. After the SLERA, four constituents (i.e., cadmium, lead, mercury and silver) were selected as COPECs in surface soil and in combined surface and subsurface soil because their HQs were greater than 1. In the BERA, cadmium, lead, and silver in surface soil and in combined surface and subsurface soil were retained for further evaluation in the food chain modeling since they were identified as bioaccumulative.

Tables ERA-26 and ERA-27 summarize the COPECs in surface soil and combined surface and subsurface soil that were carried through the BERA and evaluated in the terrestrial food chain model. Based on the overall analysis of terrestrial food chain modeling HQs, including the limited spatial extent of the affected soil, if exposure to these bioaccumulative COPECs were to occur in the future, then adverse effects are not expected for wildlife.

2.5 SWMU 19 Summary and Conclusions

A HHRA was conducted to evaluate exposure to COPCs in surface soil, combined surface and subsurface soil, and total soil for site workers under current and future land-use conditions, and construction workers and residents (adult and child) under hypothetical future land-use conditions.

In accordance with NMED guidance (NMED, 2009a), constituent concentrations in surface soil and in combined surface and subsurface soil were compared to health-based screening levels and the calculated ratios summed. The total ratios were less than the NMED target ratio of 1. The results of this data screening process indicate that after comparison to health-based soil screening levels for industrial worker exposure, residential exposure, and construction worker exposure, no COPCs were selected for surface soil or for combined surface and subsurface soil at SWMU 19.

This demonstrates that the constituent concentrations in surface soil and in combined surface and subsurface soil at SWMU 19 are unlikely to result in adverse health impacts to the following potential receptors via direct contact exposure (i.e., ingestion, inhalation of vapor/dust, dermal):

- Current and future site workers;
- Future residents (adults and children); and
- Future construction workers.

No VOCs were detected in total soil; therefore no COPCs were identified for the vapor intrusion evaluation at SWMU 19. This demonstrates that the constituent concentrations in soil at SWMU 19 are unlikely to result in adverse health impacts to the following potential receptors via inhalation of indoor air:

- Future site workers; and
- Future residents (adults and children).

A SLERA and BERA were completed for SWMU 19 to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil and subsurface soil, and to conduct food chain modeling for the COPECs identified as bioaccumulative. The results of the SLERA and BERA for direct contact exposure and for food chain modeling indicate there is adequate information to conclude that adverse impacts are unlikely to occur for ecological receptors potentially exposed to constituents in soil. Therefore, no further ecological evaluations at SWMU 19 are warranted.

There are no adverse environmental impacts associated with SWMU 19 as a result of historical site activities and no restrictions need to be applied to current or potential future land use at the site. Accordingly, the site is recommended for no further action and should be closed out of the RCRA process.

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Tables

Table Data-1
Soil Risk Assessment Dataset
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]		Detects		Sample Quantitation Limit		Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]
	number of detects / number of samples	FOD %	Min (mg/kg)	Max (mg/kg)	Min (mg/kg)	Max (mg/kg)			
Volatile Organic Compounds									
Acetone	0 - 3	0	–	–	0.0202	0.0203	–	0.0202	–
Acrolein	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Acrylonitrile	0 - 3	0	–	–	0.0101	0.0101	–	0.0101	–
Benzene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Bis(2-chloroisopropyl)ether	0 - 3	0	–	–	0.333	0.335	–	0.334	–
Bromodichloromethane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Bromomethane	0 - 3	0	–	–	0.0101	0.0101	–	0.0101	–
2-Butanone	0 - 3	0	–	–	0.0202	0.0203	–	0.0202	–
Carbon disulfide	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Carbon tetrachloride	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Chlorobenzene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Chloroethane	0 - 3	0	–	–	0.0101	0.0101	–	0.0101	–
Chloroform	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Chloromethane	0 - 3	0	–	–	0.0101	0.0101	–	0.0101	–
2-Chlorophenol	0 - 3	0	–	–	0.333	0.335	–	0.334	–
Dibenzofuran	0 - 3	0	–	–	0.333	0.335	–	0.334	–
Dibromomethane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,2-Dichlorobenzene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,4-Dichlorobenzene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,4 Dichloro-2-butene	0 - 3	0	–	–	0.0101	0.0101	–	0.0101	–
1,1-Dichloroethane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,2-Dichloroethane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
cis-1,2-Dichloroethene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
trans-1,2-Dichloroethene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,2-Dichloropropane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
cis-1,3-Dichloropropene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
trans-1,3-Dichloropropene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Ethyl methacrylate	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Ethylbenzene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
Iodomethane	0 - 3	0	–	–	0.0101	0.0101	–	0.0101	–
Nitrobenzene	0 - 3	0	–	–	0.333	0.335	–	0.334	–
Tetrachloroethene	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,1,2,2-Tetrachloroethane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,1,1-Trichloroethane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,1,2-Trichloroethane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–
1,2,3-Trichloropropane	0 - 3	0	–	–	0.00504	0.00507	–	0.00506	–

Table Data-1
Soil Risk Assessment Dataset
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]				Detects			Sample Quantitation Limit			Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]
	number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)			
1,2,4-Trichlorobenzene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Vinyl acetate	0	-	3	0	–	-	–	0.0202	-	0.0203	–	0.0202	–
Vinyl chloride	0	-	3	0	–	-	–	0.0101	-	0.0101	–	0.0101	–
Semi Volatile Organic Compounds													
Benzidine	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
Benzoic acid	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
Benzyl alcohol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Bis(2-ethylhexyl)phthalate	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
4-Chloro-3-methylphenol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
3,3'-Dichlorobenzidine	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2,4-Dichlorophenol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2,4-Dimethylphenol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2,4-Dinitrophenol	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
2,4-Dinitrotoluene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
1,2-Diphenylhydrazine	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
4,6-Dinitro-2-methylphenol	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
Diphenylamine	0	-	3	0	–	-	–	1.01	-	1.01	–	1.01	–
Hexachlorobenzene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Hexachlorocyclopentadiene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Hexachloroethane	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2-Methylphenol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2-Nitroaniline	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
3-Nitroaniline	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
2-Nitrophenol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
4-Nitrophenol	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
n-Nitrosodiphenylamine	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Pentachlorophenol	0	-	3	0	–	-	–	1.61	-	1.62	–	1.62	–
Phenol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2,4,5-Trichlorophenol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2,4,6-Trichlorophenol	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Acenaphthylene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Anthracene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Benzo(a)anthracene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Benzo(a)pyrene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Benzo(b)fluoranthene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Benzo(g,h,i)perylene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–

Table Data-1
Soil Risk Assessment Dataset
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]				Detects			Sample Quantitation Limit			Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]
	number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)			
Benzo(k)fluoranthene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
1-Chloronaphthalene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2-Chloronaphthalene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Fluoranthene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Fluorene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Indeno(1,2,3-cd)pyrene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
2-Methylnaphthalene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Naphthalene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Phenanthrene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Pyrene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Total Petroleum Hydrocarbons (TPH)													
Total Petroleum Hydrocarbons (TPH)	5	-	5	100	68.3	-	234	–	-	–	SWMU 19 SB-02(12/4/1993)	124	–
Explosives													
2,6-Dinitrotoluene	0	-	3	0	–	-	–	0.333	-	0.335	–	0.334	–
Inorganics													
Arsenic	0	-	5	0	–	-	–	2.74	-	2.74	–	2.74	–
Barium	1	-	5	20	193	-	193	25.2	-	25.5	SWMU 19 SB-02(12/4/1993)	58.8	–
Cadmium	1	-	5	20	38.5	-	38.5	5.04	-	5.1	SWMU 19 SB-02(12/4/1993)	11.7	–
Chromium	0	-	5	0	–	-	–	23.6	-	23.6	–	23.6	–
Lead	5	-	5	100	22.2	-	46.2	–	-	–	SWMU 20 SB-01(12/4/1993)	32.9	–
Mercury	5	-	5	100	0.0612	-	0.644	–	-	–	SWMU 19 SB-02(12/4/1993)	0.24	–
Selenium	0	-	5	0	–	-	–	2.77	-	2.77	–	2.77	–
Silver	1	-	5	20	59.8	-	59.8	25.2	-	25.5	SWMU 19 SB-02(12/4/1993)	32.2	–

Notes:

– = Not analyzed/ not applicable.

mg/kg = Milligrams per kilogram.

[a] Only constituents analyzed are presented.
For duplicate samples, the highest detected value or the lowest sample quantitation limit were used.
For constituents analyzed in two methods, the result of the more precise method was used.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

[c] The upper confidence limits on the mean (UCLs) were calculated using ProUCL 4.0 if a sufficient number of samples were collected.

Table Data-2
Soil Risk Assessment Dataset
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]		Detects		Sample Quantitation Limit		Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]
	number of detects / number of samples	FOD %	Min (mg/kg)	Max (mg/kg)	Min (mg/kg)	Max (mg/kg)			
Volatile Organic Compounds									
Acetone	0 - 9	0	–	–	0.02	0.0211	–	0.0204	–
Acrolein	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Acrylonitrile	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–
Benzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Bis(2-chloroisopropyl)ether	0 - 9	0	–	–	0.33	0.348	–	0.336	–
Bromodichloromethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Bromomethane	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–
2-Butanone	0 - 9	0	–	–	0.02	0.0211	–	0.0204	–
Carbon disulfide	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Carbon tetrachloride	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Chlorobenzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Chloroethane	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–
Chloroform	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Chloromethane	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–
2-Chlorophenol	0 - 9	0	–	–	0.33	0.348	–	0.336	–
Dibenzofuran	0 - 9	0	–	–	0.33	0.348	–	0.336	–
Dibromomethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,2-Dichlorobenzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,4-Dichlorobenzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,4 Dichloro-2-butene	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–
1,1-Dichloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,2-Dichloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
cis-1,2-Dichloroethene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
trans-1,2-Dichloroethene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,2-Dichloropropane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
cis-1,3-Dichloropropene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
trans-1,3-Dichloropropene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Ethyl methacrylate	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Ethylbenzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
Iodomethane	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–
Nitrobenzene	0 - 9	0	–	–	0.33	0.348	–	0.336	–
Tetrachloroethene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,1,2,2-Tetrachloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,1,1-Trichloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,1,2-Trichloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–
1,2,3-Trichloropropane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–

Table Data-2
Soil Risk Assessment Dataset
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]		Detects		Sample Quantitation Limit		Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]
	number of detects / number of samples	FOD %	Min - Max (mg/kg)		Min - Max (mg/kg)				
1,2,4-Trichlorobenzene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Vinyl acetate	0 - 9	0	– - –		0.02 - 0.0211		–	0.0204	–
Vinyl chloride	0 - 9	0	– - –		0.01 - 0.0105		–	0.0102	–
Semi Volatile Organic Compounds									
Benzidine	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
Benzoic acid	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
Benzyl alcohol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Bis(2-ethylhexyl)phthalate	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
4-Chloro-3-methylphenol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
3,3'-Dichlorobenzidine	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
2,4-Dichlorophenol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
2,4-Dimethylphenol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
2,4-Dinitrophenol	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
2,4-Dinitrotoluene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
1,2-Diphenylhydrazine	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
4,6-Dinitro-2-methylphenol	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
Diphenylamine	0 - 9	0	– - –		1 - 1.05		–	1.02	–
Hexachlorobenzene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Hexachlorocyclopentadiene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Hexachloroethane	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
2-Methylphenol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
2-Nitroaniline	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
3-Nitroaniline	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
2-Nitrophenol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
4-Nitrophenol	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
n-Nitrosodiphenylamine	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Pentachlorophenol	0 - 9	0	– - –		1.6 - 1.69		–	1.63	–
Phenol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
2,4,5-Trichlorophenol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
2,4,6-Trichlorophenol	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Acenaphthylene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Anthracene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Benzo(a)anthracene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Benzo(a)pyrene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Benzo(b)fluoranthene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–
Benzo(g,h,i)perylene	0 - 9	0	– - –		0.33 - 0.348		–	0.336	–

Table Data-2
Soil Risk Assessment Dataset
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]				Detects			Sample Quantitation Limit			Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]
	number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)			
Benzo(k)fluoranthene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
1-Chloronaphthalene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
2-Chloronaphthalene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
Fluoranthene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
Fluorene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
Indeno(1,2,3-cd)pyrene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
2-Methylnaphthalene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
Naphthalene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
Phenanthrene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
Pyrene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
Total Petroleum Hydrocarbons (TPH)													
Total Petroleum Hydrocarbons (TPH)	7	-	11	63.6	39.8	-	234	30.2	-	31.6	SWMU 19 SB-02(12/4/1993)	76.9	115.7
Explosives													
2,6-Dinitrotoluene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–
Inorganics													
Arsenic	0	-	11	0	–	-	–	2.74	-	2.74	–	2.74	–
Barium	3	-	11	27.3	26.5	-	193	25.2	-	26.4	SWMU 19 SB-02(12/4/1993)	41	–
Cadmium	1	-	11	9.09	38.5	-	38.5	5.03	-	5.27	SWMU 19 SB-02(12/4/1993)	8.13	–
Chromium	0	-	11	0	–	-	–	23.6	-	23.6	–	23.6	–
Lead	11	-	11	100	4.46	-	46.2	–	-	–	SWMU 20 SB-01(12/4/1993)	19.2	27.53
Mercury	9	-	11	81.8	0.0211	-	0.644	0.0201	-	0.0206	SWMU 19 SB-02(12/4/1993)	0.13	0.501
Selenium	0	-	11	0	–	-	–	2.77	-	2.77	–	2.77	–
Silver	1	-	11	9.09	59.8	-	59.8	25.2	-	26.4	SWMU 19 SB-02(12/4/1993)	28.6	–

Notes:

– = Not analyzed/ not applicable.

mg/kg = Milligrams per kilogram.

[a] Only constituents analyzed are presented.
For duplicate samples, the highest detected value or the lowest sample quantitation limit were used.
For constituents analyzed in two methods, the result of the more precise method was used.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

[c] The upper confidence limits on the mean (UCLs) were calculated using ProUCL 4.0 if a sufficient number of samples were collected.

Table Data-3
Soil Risk Assessment Dataset
Total Soil Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]		Detects		Sample Quantitation Limit		Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]	Volatile [d] (YES/no)
	number of detects / number of samples	FOD %	Min (mg/kg)	Max (mg/kg)	Min (mg/kg)	Max (mg/kg)				
Volatile Organic Compounds										
Acetone	0 - 9	0	–	–	0.02	0.0211	–	0.0204	–	Y
Acrolein	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Acrylonitrile	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–	Y
Benzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Bis(2-chloroisopropyl)ether	0 - 9	0	–	–	0.33	0.348	–	0.336	–	Y
Bromodichloromethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Bromomethane	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–	Y
2-Butanone	0 - 9	0	–	–	0.02	0.0211	–	0.0204	–	Y
Carbon disulfide	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Carbon tetrachloride	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Chlorobenzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Chloroethane	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–	Y
Chloroform	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Chloromethane	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–	Y
2-Chlorophenol	0 - 9	0	–	–	0.33	0.348	–	0.336	–	Y
Dibenzofuran	0 - 9	0	–	–	0.33	0.348	–	0.336	–	Y
Dibromomethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,2-Dichlorobenzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,4-Dichlorobenzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,4 Dichloro-2-butene	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–	Y
1,1-Dichloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,2-Dichloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
cis-1,2-Dichloroethene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
trans-1,2-Dichloroethene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,2-Dichloropropane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
cis-1,3-Dichloropropene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
trans-1,3-Dichloropropene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Ethyl methacrylate	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Ethylbenzene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
Iodomethane	0 - 9	0	–	–	0.01	0.0105	–	0.0102	–	Y
Nitrobenzene	0 - 9	0	–	–	0.33	0.348	–	0.336	–	Y
Tetrachloroethene	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,1,2,2-Tetrachloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,1,1-Trichloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,1,2-Trichloroethane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y
1,2,3-Trichloropropane	0 - 9	0	–	–	0.005	0.00527	–	0.00509	–	Y

Table Data-3
Soil Risk Assessment Dataset
Total Soil Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]				Detects			Sample Quantitation Limit			Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]	Volatile [d] (YES/no)
	number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)				
1,2,4-Trichlorobenzene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Vinyl acetate	0	-	9	0	–	-	–	0.02	-	0.0211	–	0.0204	–	Y
Vinyl chloride	0	-	9	0	–	-	–	0.01	-	0.0105	–	0.0102	–	Y
Semi Volatile Organic Compounds														
Benzidine	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
Benzoic acid	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
Benzyl alcohol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Bis(2-ethylhexyl)phthalate	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
4-Chloro-3-methylphenol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
3,3'-Dichlorobenzidine	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
2,4-Dichlorophenol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
2,4-Dimethylphenol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
2,4-Dinitrophenol	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
2,4-Dinitrotoluene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
1,2-Diphenylhydrazine	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
4,6-Dinitro-2-methylphenol	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
Diphenylamine	0	-	9	0	–	-	–	1	-	1.05	–	1.02	–	N
Hexachlorobenzene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Hexachlorocyclopentadiene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Hexachloroethane	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
2-Methylphenol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
2-Nitroaniline	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
3-Nitroaniline	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
2-Nitrophenol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
4-Nitrophenol	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
n-Nitrosodiphenylamine	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Pentachlorophenol	0	-	9	0	–	-	–	1.6	-	1.69	–	1.63	–	N
Phenol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
2,4,5-Trichlorophenol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
2,4,6-Trichlorophenol	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Acenaphthylene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Anthracene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Benzo(a)anthracene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Benzo(a)pyrene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Benzo(b)fluoranthene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Benzo(g,h,i)perylene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N

Table Data-3
Soil Risk Assessment Dataset
Total Soil Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent [a]	Frequency of Detection [b]				Detects			Sample Quantitation Limit			Maximum Location	Arithmetic Average	Upper Confidence Limit on the Mean [c]	Volatile [d] (YES/no)
	number of detects / number of samples			FOD %	Min (mg/kg)	-	Max (mg/kg)	Min (mg/kg)	-	Max (mg/kg)				
Benzo(k)fluoranthene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
1-Chloronaphthalene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
2-Chloronaphthalene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Fluoranthene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Fluorene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Indeno(1,2,3-cd)pyrene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
2-Methylnaphthalene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Naphthalene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Phenanthrene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	Y
Pyrene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Total Petroleum Hydrocarbons (TPH)														
Total Petroleum Hydrocarbons (TPH)	7	-	11	63.6	39.8	-	234	30.2	-	31.6	SWMU 19 SB-02(12/4/1993)	76.9	115.7	N
Explosives														
2,6-Dinitrotoluene	0	-	9	0	–	-	–	0.33	-	0.348	–	0.336	–	N
Inorganics														
Arsenic	0	-	11	0	–	-	–	2.74	-	2.74	–	2.74	–	N
Barium	3	-	11	27.3	26.5	-	193	25.2	-	26.4	SWMU 19 SB-02(12/4/1993)	41	–	N
Cadmium	1	-	11	9.09	38.5	-	38.5	5.03	-	5.27	SWMU 19 SB-02(12/4/1993)	8.13	–	N
Chromium	0	-	11	0	–	-	–	23.6	-	23.6	–	23.6	–	N
Lead	11	-	11	100	4.46	-	46.2	–	-	–	SWMU 20 SB-01(12/4/1993)	19.2	27.53	N
Mercury	9	-	11	81.8	0.0211	-	0.644	0.0201	-	0.0206	SWMU 19 SB-02(12/4/1993)	0.13	0.501	N
Selenium	0	-	11	0	–	-	–	2.77	-	2.77	–	2.77	–	N
Silver	1	-	11	9.09	59.8	-	59.8	25.2	-	26.4	SWMU 19 SB-02(12/4/1993)	28.6	–	N

Notes:

– = Not analyzed/ not applicable.

mg/kg = Milligrams per kilogram.

[a] Only constituents analyzed are presented.
For duplicate samples, the highest detected value or the lowest sample quantitation limit were used.
For constituents analyzed in two methods, the result of the more precise method was used.

[b] Frequency of detection (FOD) = number of detects / total number of samples analyzed.

[c] The upper confidence limits on the mean (UCLs) were calculated using ProUCL 4.0 if a sufficient number of samples were collected.

[d] Only constituents identified as volatile will be evaluated for the vapor intrusion pathway.

Table HHRA-1
Screening Levels for the Protection of Human Health - Soil
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	NMED Soil Regional Screening Level [a]						Adjusted Soil Regional Screening Level (Soil RSL) [b]				Site Soil Regional Screening Level [c]					
	Residential Soil		Industrial/ Occupational Soil		Construction Worker Soil		Residential		Industrial		Residential		Industrial		Construction	
	mg/kg		mg/kg		mg/kg		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
Volatile Organic Compounds																
Acetone	6.75E+04	n	8.51E+05	nls	2.63E+05	nls	6.10E+04	n	6.30E+05	nms	6.75E+04	n	8.51E+05	nls	2.63E+05	nls
Acrolein	6.46E-01	n	2.06E+00	n	1.83E+00	n	1.50E-01	n	6.50E-01	n	6.46E-01	n	2.06E+00	n	1.83E+00	n
Acrylonitrile	5.97E+00	c	3.14E+01	c	2.90E+02	n	2.40E+00	c	1.20E+01	c	5.97E+00	c	3.14E+01	c	2.90E+02	n
Benzene	1.55E+01	c	8.54E+01	c	4.71E+02	n	1.10E+01	c	5.40E+01	c	1.55E+01	c	8.54E+01	c	4.71E+02	n
Bis(2-chloroisopropyl)ether	9.15E+01	c	4.54E+02	c	3.10E+03	cs	NA		NA		9.15E+01	c	4.54E+02	c	3.10E+03	cs
Bromodichloromethane	5.25E+00	c	2.92E+01	c	3.50E+03	cs	2.70E+00	c	1.40E+01	c	5.25E+00	c	2.92E+01	c	3.50E+03	cs
Bromomethane	2.23E+01	n	8.36E+01	n	6.71E+01	n	7.30E+00	n	3.20E+01	n	2.23E+01	n	8.36E+01	n	6.71E+01	n
2-Butanone (MEK)	3.96E+04	n	3.69E+05	nl	1.48E+05	nls	2.80E+04	n	2.00E+05	nms	3.96E+04	n	3.69E+05	nl	1.48E+05	nls
Carbon disulfide	1.94E+03	ns	7.54E+03	ns	5.89E+03	ns	8.20E+02	ns	3.70E+03	ns	1.94E+03	ns	7.54E+03	ns	5.89E+03	ns
Carbon tetrachloride	4.38E+00	c	2.43E+01	c	1.99E+02	n	2.50E+00	c	1.20E+01	c	4.38E+00	c	2.43E+01	c	1.99E+02	n
Chlorobenzene	5.08E+02	ns	2.14E+03	n	1.58E+03	ns	2.90E+02	n	1.40E+03	ns	5.08E+02	ns	2.14E+03	n	1.58E+03	ns
Chloroethane	4.36E+04	ns	1.37E+05	nls	1.23E+05	nls	1.50E+04	ns	6.10E+04	ns	4.36E+04	ns	1.37E+05	nls	1.23E+05	nls
Chloroform	5.72E+00	c	3.19E+01	c	6.71E+02	c	2.90E+00	c	1.50E+01	c	5.72E+00	c	3.19E+01	c	6.71E+02	c
Chloromethane	3.56E+01	c	1.98E+02	c	1.13E+03	n	1.20E+02	n	5.00E+02	n	3.56E+01	c	1.98E+02	c	1.13E+03	n
2-Chlorophenol	3.91E+02	n	5.68E+03	n	1.55E+03	n	3.90E+02	n	5.10E+03	n	3.91E+02	n	5.68E+03	n	1.55E+03	n
Dibenzofuran	NA		NA		NA		7.80E+01	n	1.00E+03	ns	7.80E+01	n	1.00E+03	ns	2.25E+02	n_calc
Dibromomethane	7.82E+02	n	1.14E+04	ns	3.10E+03	ns	2.50E+01	n	1.10E+02	n	7.82E+02	n	1.14E+04	ns	3.10E+03	ns
1,2-Dichlorobenzene	3.01E+03	ns	1.43E+04	ns	9.71E+03	ns	1.90E+03	ns	9.80E+03	ns	3.01E+03	ns	1.43E+04	ns	9.71E+03	ns
1,4-Dichlorobenzene	3.22E+01	c	1.80E+02	c	3.78E+03	cs	2.40E+01	c	1.20E+02	c	3.22E+01	c	1.80E+02	c	3.78E+03	cs
1,4-Dichloro-2-butene	4.60E-02	c	2.58E-01	c	5.80E+00	c	6.50E-02	c	3.30E-01	c	4.60E-02	c	2.58E-01	c	5.80E+00	c
1,1-Dichloroethane	6.29E+01	c	3.50E+02	c	6.88E+03	cs	3.30E+01	c	1.70E+02	c	6.29E+01	c	3.50E+02	c	6.88E+03	cs
1,2-Dichloroethane	7.74E+00	c	4.28E+01	c	7.51E+02	c	4.30E+00	c	2.20E+01	c	7.74E+00	c	4.28E+01	c	7.51E+02	c
cis-1,2-Dichloroethene	7.82E+02	n	1.14E+04	ns	3.10E+03	cs	7.80E+02	n	1.00E+04	ns	7.82E+02	n	1.14E+04	ns	3.10E+03	cs
trans-1,2-Dichloroethene	2.73E+02	n	9.95E+02	n	8.14E+02	n	1.50E+02	n	6.90E+02	n	2.73E+02	n	9.95E+02	n	8.14E+02	n
1,2-Dichloropropane	1.47E+01	c	8.17E+01	c	1.17E+02	n	8.90E+00	c	4.50E+01	c	1.47E+01	c	8.17E+01	c	1.17E+02	n
cis-1,3-Dichloropropene	2.35E+01	c	1.26E+02	c	5.10E+02	n	1.70E+01	c	8.10E+01	c	2.35E+01	c	1.26E+02	c	5.10E+02	n
trans-1,3-Dichloropropene	2.35E+01	c	1.26E+02	c	5.10E+02	n	1.70E+01	c	8.10E+01	c	2.35E+01	c	1.26E+02	c	5.10E+02	n
Ethyl methacrylate	7.04E+03	ns	1.02E+05	nls	2.79E+04	ns	7.00E+03	ns	9.20E+04	ns	7.04E+03	ns	1.02E+05	nls	2.79E+04	ns
Ethylbenzene	6.97E+01	c	3.85E+02	c	6.63E+03	cs	5.40E+01	c	2.70E+02	c	6.97E+01	c	3.85E+02	c	6.63E+03	cs
Iodomethane	NA		NA		NA		NA		NA		5.96E+00	n_calc	2.26E+01	n_calc	1.97E+01	n_calc
Nitrobenzene	4.94E+01	c	2.77E+02	c	5.20E+02	n	4.80E+01	c	2.40E+02	c	4.94E+01	c	2.77E+02	c	5.20E+02	n
Tetrachloroethene	6.99E+00	c	3.64E+01	c	3.38E+02	cs	5.50E+00	c	2.60E+01	c	6.99E+00	c	3.64E+01	c	3.38E+02	cs
1,1,2,2-Tetrachloroethane	7.98E+00	c	4.33E+01	c	5.99E+02	c	5.60E+00	c	2.80E+01	c	7.98E+00	c	4.33E+01	c	5.99E+02	c
1,1,1-Trichloroethane	2.18E+04	ns	7.71E+04	ns	6.43E+04	ns	8.70E+03	ns	3.80E+04	ns	2.18E+04	ns	7.71E+04	ns	6.43E+04	ns
1,1,2-Trichloroethane	1.72E+01	c	9.43E+01	c	1.24E+03	ns	1.10E+01	c	5.30E+01	c	1.72E+01	c	9.43E+01	c	1.24E+03	ns
1,2,3-Trichloropropane	9.15E-01	c	4.54E+00	c	3.10E+01	c	5.00E-02	c	9.50E-01	c	9.15E-01	c	4.54E+00	c	3.10E+01	c
1,2,4-Trichlorobenzene	1.43E+02	ns	5.25E+02	ns	4.27E+02	ns	2.20E+02	c	9.90E+02	c	1.43E+02	ns	5.25E+02	ns	4.27E+02	ns
Vinyl acetate	3.65E+03	n	1.19E+04	ns	1.05E+04	ns	9.70E+02	n	4.10E+03	ns	3.65E+03	n	1.19E+04	ns	1.05E+04	ns
Vinyl chloride	8.65E-01	c	2.59E+01	c	2.48E+02	c	6.00E-01	c	1.70E+01	c	8.65E-01	c	2.59E+01	c	2.48E+02	c

Table HHRA-1
Screening Levels for the Protection of Human Health - Soil
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	NMED Soil Regional Screening Level [a]						Adjusted Soil Regional Screening Level (Soil RSL) [b]				Site Soil Regional Screening Level [c]					
	Residential Soil		Industrial/ Occupational Soil		Construction Worker Soil		Residential		Industrial		Residential		Industrial		Construction	
	mg/kg		mg/kg		mg/kg		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
Semi Volatile Organic Compounds																
Benzidine	2.11E-02	c	8.33E-02	c	7.20E-01	c	5.00E-03	c	7.50E-02	c	2.11E-02	c	8.33E-02	c	7.20E-01	c
Benzoic acid	NA		NA		NA		2.40E+05	nm	2.50E+06	nm	2.40E+05	nm	2.50E+06	nm	9.53E+05	n_calc
Benzyl alcohol	NA		NA		NA		6.10E+03	n	6.20E+04	n	6.10E+03	n	6.20E+04	n	1.19E+05	n_calc
Bis(2-ethylhexyl) phthalate	3.47E+02	c	1.37E+03	c	4.76E+03	n	3.50E+02	c	1.20E+03	c	3.47E+02	c	1.37E+03	c	4.76E+03	n
4-Chloro-3-methylphenol	NA		NA		NA		6.10E+03	n	6.20E+04	n	6.10E+03	n	6.20E+04	n	NA	
3,3'-Dichlorobenzidine	NA		NA		NA		1.10E+01	c	3.80E+01	c	1.10E+01	c	3.80E+01	c	3.50E+02	c_calc
2,4-Dichlorophenol	1.83E+02	n	2.05E+03	n	7.15E+02	n	1.80E+02	n	1.80E+03	n	1.83E+02	n	2.05E+03	n	7.15E+02	n
2,4-Dimethylphenol	1.22E+03	n	1.37E+04	n	4.76E+03	n	1.20E+03	n	1.20E+04	n	1.22E+03	n	1.37E+04	n	4.76E+03	n
2,4-Dinitrophenol	1.22E+02	n	1.37E+03	n	4.76E+02	n	1.20E+02	n	1.20E+03	n	1.22E+02	n	1.37E+03	n	4.76E+02	n
2,4-Dinitrotoluene	1.57E+01	c	1.03E+02	c	4.76E+02	n	1.60E+01	c	5.50E+01	c	1.57E+01	c	1.03E+02	c	4.76E+02	n
1,2-Diphenylhydrazine	6.08E+00	c	2.39E+01	c	2.07E+02	c	6.10E+00	c	2.20E+01	c	6.08E+00	c	2.39E+01	c	2.07E+02	c
Diphenylamine	NA		NA		NA		1.50E+03	n	1.50E+04	n	1.50E+03	n	1.50E+04	n	5.96E+03	n_calc
Hexachlorobenzene	3.04E+00	c	1.20E+01	c	1.03E+02	c	3.00E+00	c	1.10E+01	c	3.04E+00	c	1.20E+01	c	1.03E+02	c
Hexachlorocyclopentadiene	3.67E+02	n	4.10E+03	n	8.11E+02	n	3.70E+02	n	3.70E+03	n	3.67E+02	n	4.10E+03	n	8.11E+02	n
Hexachloroethane	6.11E+01	n	6.84E+02	n	2.38E+02	n	3.50E+02	c	1.20E+03	c	6.11E+01	n	6.84E+02	n	2.38E+02	n
2-Methyl-4,6-dinitrophenol	NA		NA		NA		6.10E+00	n	6.20E+01	n	6.10E+00	n	6.20E+01	n	2.38E+01	n_calc
2-Methylphenol	NA		NA		NA		3.10E+03	n	3.10E+04	n	3.10E+03	n	3.10E+04	n	1.19E+04	n_calc
2-Nitroaniline	NA		NA		NA		6.10E+02	n	6.00E+03	n	6.10E+02	n	6.00E+03	n	2.23E+02	n_calc
3-Nitroaniline	NA		NA		NA		NA		NA		NA		NA		NA	
2-Nitrophenol	NA		NA		NA		NA		NA		NA		NA		NA	
4-Nitrophenol	NA		NA		NA		NA		NA		NA		NA		NA	
n-Nitrosodiphenylamine	9.93E+02	c	3.91E+03	c	3.40E+04	c	9.90E+02	c	3.50E+03	c	9.93E+02	c	3.91E+03	c	3.40E+04	c
Pentachlorophenol	2.98E+01	c	1.00E+02	c	1.03E+03	c	3.00E+01	c	9.00E+01	c	2.98E+01	c	1.00E+02	c	1.03E+03	c
Phenol	1.83E+04	n	2.05E+05	nl	6.88E+04	n	1.80E+04	n	1.80E+05	nm	1.83E+04	n	2.05E+05	nl	6.88E+04	n
2,4,5-Trichlorophenol	6.11E+03	n	6.84E+04	n	2.38E+04	n	6.10E+03	n	6.20E+04	n	6.11E+03	n	6.84E+04	n	2.38E+04	n
2,4,6-Trichlorophenol	6.11E+01	n	6.84E+02	n	2.38E+02	n	4.40E+02	c	1.60E+03	c	6.11E+01	n	6.84E+02	n	2.38E+02	n
Polycyclic Aromatic Hydrocarbons																
Acenaphthene	3.44E+03	ns	3.67E+04	ns	1.86E+04	n	3.40E+03	n	3.30E+04	n	3.44E+03	ns	3.67E+04	ns	1.86E+04	n
Acenaphthylene	NA		NA		NA		NA		NA		3.44E+03	n_calc	3.67E+04	n_calc	1.34E+04	n_calc
Anthracene	1.72E+04	ns	1.83E+05	nl	6.68E+04	ns	1.70E+04	n	1.70E+05	nm	1.72E+04	ns	1.83E+05	nl	6.68E+04	ns
Benzo(a)anthracene	6.21E+00	c	2.34E+01	c	2.13E+02	c	1.50E+00	c	2.10E+01	c	6.21E+00	c	2.34E+01	c	2.13E+02	c
Benzo(a)pyrene	6.21E-01	c	2.34E+00	c	2.13E+01	c	1.50E-01	c	2.10E+00	c	6.21E-01	c	2.34E+00	c	2.13E+01	c
Benzo(b)fluoranthene	6.21E+00	c	2.34E+01	c	2.13E+02	c	1.50E+00	c	2.10E+01	c	6.21E+00	c	2.34E+01	c	2.13E+02	c
Benzo(g,h,i)perylene	NA		NA		NA		NA		NA		1.72E+03	n_calc	1.83E+04	n_calc	6.68E+03	n_calc
Benzo(k)fluoranthene	6.21E+01	c	2.34E+02	c	2.06E+03	c	1.50E+01	c	2.10E+02	c	6.21E+01	c	2.34E+02	c	2.06E+03	c
1-Chloronaphthalene	6.26E+03	ns	9.08E+04	ns	2.48E+04	ns	6.30E+03	ns	8.20E+04	ns	6.26E+03	ns	9.08E+04	ns	2.48E+04	ns
2-Chloronaphthalene	6.26E+03	ns	9.08E+04	ns	2.48E+04	ns	6.30E+03	ns	8.20E+04	ns	6.26E+03	ns	9.08E+04	ns	2.48E+04	ns
Fluoranthene	2.29E+03	n	2.44E+04	n	8.91E+03	n	2.30E+03	n	2.20E+04	n	2.29E+03	n	2.44E+04	n	8.91E+03	n
Fluorene	2.29E+03	ns	2.44E+04	ns	8.91E+03	ns	2.30E+03	n	2.20E+04	n	2.29E+03	ns	2.44E+04	ns	8.91E+03	ns
Indeno(1,2,3-c,d)pyrene	6.21E+00	c	2.34E+01	c	2.13E+02	c	1.50E+00	c	2.10E+01	c	6.21E+00	c	2.34E+01	c	2.13E+02	c
2-Methylnaphthalene	NA		NA		NA		3.10E+02	n	4.10E+03	ns	3.10E+02	n	4.10E+03	ns	8.91E+02	n_calc

Table HHRA-1
Screening Levels for the Protection of Human Health - Soil
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	NMED Soil Regional Screening Level [a]						Adjusted Soil Regional Screening Level (Soil RSL) [b]				Site Soil Regional Screening Level [c]					
	Residential Soil		Industrial/ Occupational Soil		Construction Worker Soil		Residential		Industrial		Residential		Industrial		Construction	
	mg/kg		mg/kg		mg/kg		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
Naphthalene	4.50E+01	c	2.52E+02	cs	7.02E+02	ns	3.60E+01	c	1.80E+02	c	4.50E+01	c	2.52E+02	cs	7.02E+02	ns
Phenanthrene	1.83E+03	ns	2.05E+04	ns	7.15E+03	ns	NA		NA		1.83E+03	ns	2.05E+04	ns	7.15E+03	ns
Pyrene	1.72E+03	ns	1.83E+04	ns	6.68E+03	ns	1.70E+03	n	1.70E+04	n	1.72E+03	ns	1.83E+04	ns	6.68E+03	ns
TPH	4.40E+02		8.90E+02		NA		NA		NA		4.40E+02		8.90E+02		NA	
Explosives																
2,6-Dinitrotoluene	6.12E+01	n	6.87E+02	n	2.39E+02	n	6.10E+01	n	6.20E+02	n	6.12E+01	n	6.87E+02	n	2.39E+02	n
Inorganics																
Arsenic	3.90E+00	c	1.77E+01	c	6.54E+01	n	3.90E+00	c	1.60E+01	c	3.90E+00	c	1.77E+01	c	6.54E+01	n
Barium	1.56E+04	n	2.24E+05	nl	4.35E+03	n	1.50E+04	n	1.90E+05	nm	1.56E+04	n	2.24E+05	nl	4.35E+03	n
Cadmium	7.79E+01	n	1.12E+03	n	3.09E+02	n	7.00E+01	n	8.00E+02	n	7.79E+01	n	1.12E+03	n	3.09E+02	n
Chromium	2.19E+02	n	2.92E+03	n	4.49E+02	n	1.29E+01	c	6.60E+01	c	2.19E+02	n	2.92E+03	n	4.49E+02	n
Lead	4.00E+02	IEUBK	8.00E+02	IEUBK	8.00E+02	IEUBK	4.00E+02	nL	8.00E+02	nL	4.00E+02	IEUBK	8.00E+02	IEUBK	8.00E+02	IEUBK
Mercury	7.71E+00	ns	4.99E+01	n	6.36E+01	ns	5.60E+00	ns	3.40E+01	ns	7.71E+00	ns	4.99E+01	n	6.36E+01	ns
Selenium	3.91E+02	n	5.68E+03	n	1.55E+03	n	3.90E+02	n	5.10E+03	n	3.91E+02	n	5.68E+03	n	1.55E+03	n
Silver	3.91E+02	n	5.68E+03	n	1.55E+03	n	3.90E+02	n	5.10E+03	n	3.91E+02	n	5.68E+03	n	1.55E+03	n

Notes:

mg/kg =	Milligrams per kilogram.
c =	carcinogen.
n =	noncarcinogenic.
cs =	carcinogenc, NMED SSL may exceed saturation.
ns =	noncarcinongen, NMED SSL may exceed saturation.
nl =	noncarcinogen, NMED SSL may exceed ceiling limit.
nls =	noncarcinogen, NMED SSL may exceed both saturation and ceiling limit.
c_calc =	Calculated based on cancer effects.
IEUBK =	Integrated Exposure Uptake Biokinetic.
max =	For certain inorganic and semivolatile organic compounds (SVOCs) that exhibit relatively low toxicity, a non risk-based maximum concentration of 1E+05 mg/kg is given. When the risk-based SSL exceeds that level. These are noted as “max” in the table.
n-calc =	Calculated based on noncancer effects.
sat =	SSLs for certain volatile chemicals are determined based on a ceiling limit concentration termed the soil saturation limit (and denoted as Csat) above which these chemicals may occur as nonaqueous phase liquids (NAPLs) in soil. These are noted as “sat” in the table.
NA =	Not available.
[a]	Values are from New Mexico Environment Department (NMED), "Soil Screening Levels" (December 2009) with the exception of TPH, those are from NMED "TPH Screening
[b]	The adjusted screening levels were regional screening levels for the residential and industrial scenarios from USEPA (2009). Screening levels based on cancer effects were adjusted by a factor of 10 to reflect a target risk of 1 $x10^{-5.}$
	c = cancer; n = noncancer; m = Concentration may exceed ceiling limit; s = Concentration may exceed saturation concentration (Csat).
	< The screening level for lead is based on noncancer effects but uses blood lead level estimates rather than a hazard quotient.
[c]	Site screening levels were selected from following critieria: NMED SLs then adjusted USEPA RSLs. For the construction scenario, screening levels were calculated based on NMED soil screening guidance (2006) where not available in guidance.

Table HHRA-2
Selection of Constituents of Potential Concern in Soil - Based on Maximum Detected Concentration
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19 (SWMU 19)
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Frequency of Detection (FOD) number of detects / number of samples			FOD %	Max Detect [a] (mg/kg)	Max SQL (mg/kg)	Site Screening Level (SL) [b] Residential Scenario (mg/kg)		Site Screening Level (SL) [b] Industrial Scenario (mg/kg)		Is Maximum > Screening Level? Residential Scenario	Is Maximum > Screening Level? Industrial Scenario	Residential Scenario Max / SL (cancer)	Residential Scenario Max / SL (noncancer)	Industrial Scenario Max / SL (cancer)	Industrial Scenario Max / SL (noncancer)	Constituent of Potential Concern (COPC)? [c] Residential	Constituent of Potential Concern (COPC)? [c] Industrial
Volatile Organic Compounds																		
Acetone	0	/	3	0	–	0.0203	6.75E+04	n	8.51E+05	n	–	–	–	–	–	–	no	no
Acrolein	0	/	3	0	–	0.0051	6.46E-01	n	2.06E+00	n	–	–	–	–	–	–	no	no
Acrylonitrile	0	/	3	0	–	0.0101	5.97E+00	c	3.14E+01	c	–	–	–	–	–	–	no	no
Benzene	0	/	3	0	–	0.0051	1.55E+01	c	8.54E+01	c	–	–	–	–	–	–	no	no
Bis(2-chloroisopropyl)ether	0	/	3	0	–	0.335	9.15E+01	c	4.54E+02	c	–	–	–	–	–	–	no	no
Bromodichloromethane	0	/	3	0	–	0.0051	5.25E+00	c	2.92E+01	c	–	–	–	–	–	–	no	no
Bromomethane	0	/	3	0	–	0.0101	2.23E+01	n	8.36E+01	n	–	–	–	–	–	–	no	no
2-Butanone	0	/	3	0	–	0.0203	3.96E+04	n	3.69E+05	n	–	–	–	–	–	–	no	no
Carbon disulfide	0	/	3	0	–	0.0051	1.94E+03	n	7.54E+03	n	–	–	–	–	–	–	no	no
Carbon tetrachloride	0	/	3	0	–	0.0051	4.38E+00	c	2.43E+01	c	–	–	–	–	–	–	no	no
Chlorobenzene	0	/	3	0	–	0.0051	5.08E+02	n	2.14E+03	n	–	–	–	–	–	–	no	no
Chloroethane	0	/	3	0	–	0.0101	4.36E+04	n	1.37E+05	n	–	–	–	–	–	–	no	no
Chloroform	0	/	3	0	–	0.0051	5.72E+00	c	3.19E+01	c	–	–	–	–	–	–	no	no
Chloromethane	0	/	3	0	–	0.0101	3.56E+01	c	1.98E+02	c	–	–	–	–	–	–	no	no
2-Chlorophenol	0	/	3	0	–	0.335	3.91E+02	n	5.68E+03	n	–	–	–	–	–	–	no	no
Dibenzofuran	0	/	3	0	–	0.335	7.80E+01	n	1.00E+03	n	–	–	–	–	–	–	no	no
Dibromomethane	0	/	3	0	–	0.0051	7.82E+02	n	1.14E+04	n	–	–	–	–	–	–	no	no
1,2-Dichlorobenzene	0	/	3	0	–	0.0051	3.01E+03	n	1.43E+04	n	–	–	–	–	–	–	no	no
1,4-Dichlorobenzene	0	/	3	0	–	0.0051	3.22E+01	c	1.80E+02	c	–	–	–	–	–	–	no	no
1,4 Dichloro-2-butene	0	/	3	0	–	0.0101	4.60E-02	c	2.58E-01	c	–	–	–	–	–	–	no	no
1,1-Dichloroethane	0	/	3	0	–	0.0051	6.29E+01	c	3.50E+02	c	–	–	–	–	–	–	no	no
1,2-Dichloroethane	0	/	3	0	–	0.0051	7.74E+00	c	4.28E+01	c	–	–	–	–	–	–	no	no
cis-1,2-Dichloroethene	0	/	3	0	–	0.0051	7.82E+02	n	1.14E+04	n	–	–	–	–	–	–	no	no
trans-1,2-Dichloroethene	0	/	3	0	–	0.0051	2.73E+02	n	9.95E+02	n	–	–	–	–	–	–	no	no
1,2-Dichloropropane	0	/	3	0	–	0.0051	1.47E+01	c	8.17E+01	c	–	–	–	–	–	–	no	no
cis-1,3-Dichloropropene	0	/	3	0	–	0.0051	2.35E+01	c	1.26E+02	c	–	–	–	–	–	–	no	no
trans-1,3-Dichloropropene	0	/	3	0	–	0.0051	2.35E+01	c	1.26E+02	c	–	–	–	–	–	–	no	no
Ethyl methacrylate	0	/	3	0	–	0.0051	7.04E+03	n	1.02E+05	n	–	–	–	–	–	–	no	no
Ethylbenzene	0	/	3	0	–	0.0051	6.97E+01	c	3.85E+02	c	–	–	–	–	–	–	no	no
Iodomethane	0	/	3	0	–	0.0101	5.96E+00	n	2.26E+01	n	–	–	–	–	–	–	no	no
Nitrobenzene	0	/	3	0	–	0.335	4.94E+01	c	2.77E+02	c	–	–	–	–	–	–	no	no
Tetrachloroethene	0	/	3	0	–	0.0051	6.99E+00	c	3.64E+01	c	–	–	–	–	–	–	no	no
1,1,2,2-Tetrachloroethane	0	/	3	0	–	0.0051	7.98E+00	c	4.33E+01	c	–	–	–	–	–	–	no	no
1,1,1-Trichloroethane	0	/	3	0	–	0.0051	2.18E+04	n	7.71E+04	n	–	–	–	–	–	–	no	no
1,1,2-Trichloroethane	0	/	3	0	–	0.0051	1.72E+01	c	9.43E+01	c	–	–	–	–	–	–	no	no
1,2,3-Trichloropropane	0	/	3	0	–	0.0051	9.15E-01	c	4.54E+00	c	–	–	–	–	–	–	no	no
1,2,4-Trichlorobenzene	0	/	3	0	–	0.335	1.43E+02	n	5.25E+02	n	–	–	–	–	–	–	no	no
Vinyl acetate	0	/	3	0	–	0.0203	3.65E+03	n	1.19E+04	n	–	–	–	–	–	–	no	no
Vinyl chloride	0	/	3	0	–	0.0101	8.65E-01	c	2.59E+01	c	–	–	–	–	–	–	no	no
Semi Volatile Organic Compounds																		
Benzidine	0	/	3	0	–	1.62 ^	2.11E-02	c	8.33E-02	c	–	–	–	–	–	–	no	no
Benzoic acid	0	/	3	0	–	1.62	2.40E+05	n	2.50E+06	n	–	–	–	–	–	–	no	no
Benzyl alcohol	0	/	3	0	–	0.335	6.10E+03	n	6.20E+04	n	–	–	–	–	–	–	no	no
Bis(2-ethylhexyl)phthalate	0	/	3	0	–	0.335	3.47E+02	c	1.37E+03	c	–	–	–	–	–	–	no	no
4-Chloro-3-methylphenol	0	/	3	0	–	0.335	6.10E+03	n	6.20E+04	n	–	–	–	–	–	–	no	no
3,3'-Dichlorobenzidine	0	/	3	0	–	0.335	1.10E+01	c	3.80E+01	c	–	–	–	–	–	–	no	no
2,4-Dichlorophenol	0	/	3	0	–	0.335	1.83E+02	n	2.05E+03	n	–	–	–	–	–	–	no	no
2,4-Dimethylphenol	0	/	3	0	–	0.335	1.22E+03	n	1.37E+04	n	–	–	–	–	–	–	no	no
2,4-Dinitrophenol	0	/	3	0	–	1.62	1.22E+02	n	1.37E+03	n	–	–	–	–	–	–	no	no
2,4-Dinitrotoluene	0	/	3	0	–	0.335	1.57E+01	c	1.03E+02	c	–	–	–	–	–	–	no	no
1,2-Diphenylhydrazine	0	/	3	0	–	1.62	6.08E+00	c	2.39E+01	c	–	–	–	–	–	–	no	no
Diphenylamine	0	/	3	0	–	1.01	1.50E+03	n	1.50E+04	n	–	–	–	–	–	–	no	no
Hexachlorobenzene	0	/	3	0	–	0.335	3.04E+00	c	1.20E+01	c	–	–	–	–	–	–	no	no
Hexachlorocyclopentadiene	0	/	3	0	–	0.335	3.67E+02	n	4.10E+03	n	–	–	–	–	–	–	no	no
Hexachloroethane	0	/	3	0	–	0.335	6.11E+01	n	6.84E+02	n	–	–	–	–	–	–	no	no
4,6-Dinitro-2-methylphenol	0	/	3	0	–	1.62	6.10E+00	n	6.20E+01	n	–	–	–	–	–	–	no	no

Table HHRA-2
Selection of Constituents of Potential Concern in Soil - Based on Maximum Detected Concentration
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19 (SWMU 19)
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Frequency of Detection (FOD) number of detects /	number of samples	FOD %	Max Detect [a] (mg/kg)	Max SQL (mg/kg)	Site Screening Level (SL) [b] Residential Scenario (mg/kg)		Industrial Scenario (mg/kg)		Is Maximum > Screening Level? Residential Scenario	Industrial Scenario	Residential Scenario Max / SL (cancer)	Max / SL (noncancer)	Industrial Scenario Max / SL (cancer)	Max / SL (noncancer)	Constituent of Potential Concern (COPC)? [c] Residential	Industrial
2-Methylphenol	0	3	0	–	0.335	3.10E+03	n	3.10E+04	n	–	–	–	–	–	–	no	no
2-Nitroaniline	0	3	0	–	1.62	6.10E+02	n	6.00E+03	n	–	–	–	–	–	–	no	no
3-Nitroaniline	0	3	0	–	1.62	NA	n	NA	n	–	–	–	–	–	–	no	no
2-Nitrophenol	0	3	0	–	0.335	NA	n	NA	n	–	–	–	–	–	–	no	no
4-Nitrophenol	0	3	0	–	1.62	NA	n	NA	n	–	–	–	–	–	–	no	no
n-Nitrosodiphenylamine	0	3	0	–	0.335	9.93E+02	c	3.91E+03	c	–	–	–	–	–	–	no	no
Pentachlorophenol	0	3	0	–	1.62	2.98E+01	c	1.00E+02	c	–	–	–	–	–	–	no	no
Phenol	0	3	0	–	0.335	1.83E+04	n	2.05E+05	n	–	–	–	–	–	–	no	no
2,4,5-Trichlorophenol	0	3	0	–	0.335	6.11E+03	n	6.84E+04	n	–	–	–	–	–	–	no	no
2,4,6-Trichlorophenol	0	3	0	–	0.335	6.11E+01	n	6.84E+02	n	–	–	–	–	–	–	no	no
Polycyclic Aromatic Hydrocarbons																	
Acenaphthene	0	3	0	–	0.335	3.44E+03	n	3.67E+04	n	–	–	–	–	–	–	no	no
Acenaphthylene	0	3	0	–	0.335	3.44E+03	n	3.67E+04	n	–	–	–	–	–	–	no	no
Anthracene	0	3	0	–	0.335	1.72E+04	n	1.83E+05	n	–	–	–	–	–	–	no	no
Benzo(a)anthracene	0	3	0	–	0.335	6.21E+00	c	2.34E+01	c	–	–	–	–	–	–	no	no
Benzo(a)pyrene	0	3	0	–	0.335	6.21E-01	c	2.34E+00	c	–	–	–	–	–	–	no	no
Benzo(b)fluoranthene	0	3	0	–	0.335	6.21E+00	c	2.34E+01	c	–	–	–	–	–	–	no	no
Benzo(g,h,i)perylene	0	3	0	–	0.335	1.72E+03	n	1.83E+04	n	–	–	–	–	–	–	no	no
Benzo(k)fluoranthene	0	3	0	–	0.335	6.21E+01	c	2.34E+02	c	–	–	–	–	–	–	no	no
1-Chloronaphthalene	0	3	0	–	0.335	6.26E+03	n	9.08E+04	n	–	–	–	–	–	–	no	no
2-Chloronaphthalene	0	3	0	–	0.335	6.26E+03	n	9.08E+04	n	–	–	–	–	–	–	no	no
Fluoranthene	0	3	0	–	0.335	2.29E+03	n	2.44E+04	n	–	–	–	–	–	–	no	no
Fluorene	0	3	0	–	0.335	2.29E+03	n	2.44E+04	n	–	–	–	–	–	–	no	no
Indeno(1,2,3-cd)pyrene	0	3	0	–	0.335	6.21E+00	c	2.34E+01	c	–	–	–	–	–	–	no	no
2-Methylnaphthalene	0	3	0	–	0.335	3.10E+02	n	4.10E+03	n	–	–	–	–	–	–	no	no
Naphthalene	0	3	0	–	0.335	4.50E+01	c	2.52E+02	c	–	–	–	–	–	–	no	no
Phenanthrene	0	3	0	–	0.335	1.83E+03	n	2.05E+04	n	–	–	–	–	–	–	no	no
Pyrene	0	3	0	–	0.335	1.72E+03	n	1.83E+04	n	–	–	–	–	–	–	no	no
Total Petroleum Hydrocarbons (TPH)																	
Total Petroleum Hydrocarbons (TPH)	5	5	100	234	–	4.40E+02	n	8.90E+02	n	no	no	–	5.32E-01	–	2.63E-01	no	no
Explosives																	
2,6-Dinitrotoluene	0	3	0	–	0.335	6.12E+01	n	6.87E+02	n	–	–	–	–	–	–	no	no
Inorganics																	
Arsenic	0	5	0	–	2.74	3.90E+00	c	1.77E+01	c	–	–	–	–	–	–	no	no
Barium	1	5	20	193	25.5	1.56E+04	n	2.24E+05	n	no	no	–	1.24E-02	–	8.62E-04	no	no
Cadmium	1	5	20	38.5	5.1	7.79E+01	n	1.12E+03	n	no	no	–	4.94E-01	–	3.42E-02	no	no
Chromium	0	5	0	–	23.6	2.19E+02	n	2.92E+03	n	–	–	–	–	–	–	no	no
Lead	5	5	100	46.2	–	4.00E+02	IEUBK	8.00E+02	IEUBK	no	no	–	–	–	–	no	no
Mercury	5	5	100	0.644	–	7.71E+00	n	4.99E+01	n	no	no	–	8.35E-02	–	1.29E-02	no	no
Selenium	0	5	0	–	2.77	3.91E+02	n	5.68E+03	n	–	–	–	–	–	–	no	no
Silver	1	5	20	59.8	25.5	3.91E+02	n	5.68E+03	n	no	no	–	1.53E-01	–	1.05E-02	no	no

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Solid Waste Managment Unit 19 (SWMU 19)
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Frequency of Detection (FOD) number of detects / number of samples	FOD %	Max Detect [a] (mg/kg)	Max SQL (mg/kg)	Site Screening Level (SL) [b] Residential Scenario (mg/kg)	Site Screening Level (SL) [b] Industrial Scenario (mg/kg)	Is Maximum > Screening Level? Residential Scenario	Is Maximum > Screening Level? Industrial Scenario	Residential Scenario Max / SL (cancer)	Residential Scenario Max / SL (noncancer)	Industrial Scenario Max / SL (cancer)	Industrial Scenario Max / SL (noncancer)	Constituent of Potential Concern (COPC)? [c] Residential	Constituent of Potential Concern (COPC)? [c] Industrial
Total Maximum / Screening Level Ratios									NA	1	NA	0.3		
Total Maximum / Screening Level Risk (multiply cancer ratio by 1E-5 and non cancer ratio by 1)									NA	1	NA	0.3		
							Target Organ Max/SL Ratios							
							Kidney and Liver			1		0.3		
							Brain			NA		NA		
							Nasal			NA		NA		
							Eyes			NA		NA		
							Skin			0.2		0.01		
							Lungs			NA		NA		
							Gastrointestinal Tract and Forestomach			NA		NA		
							Whole Body			NA		NA		
							Blood			0.5		0.3		
							Nervous System			0.08		0.01		
							Dental			NA		NA		
							Red Blood Cells			NA		NA		
							Glands			NA		NA		
							Fetus			0.01		0.0009		
							Immune System			NA		NA		
							Development			NA		NA		
							Reproduction			NA		NA		
							Bone			NA		NA		
							Not Available/ Not Reported			NA		NA		

Notes:

– = Not applicable.
! = Constituent was detected and screening level/ toxicity information is not available.
^ = Maximum SQL exceeds minimum criteria for constituent not detected otherwise.
Max = Maximum concentration.
mg/kg = Milligrams per kilogram.
NA = Not available.
SQL = Sample Quantification Limit.

[a] Maximum detected concentration.
[b] See Table HHRA-1 for sources of soil screening levels and explanation of notes.
[c] Constituents were selected as COPCs if the screening risk (Maximum/Screening Level) exceeded 1 x 10^{-5} for cancer effects and/or 1 for non-cancer effects, and any of the sums for target organ ratios also exceeded 1 unless it was an essential nutrient (i.e., calcium, magnesium, potassium, sodium).

Table HHRA-3
Selection of Constituents of Potential Concern in Soil - Based on Maximum Detected Concentrations
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19 (SWMU 19)
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Frequency of Detection (FOD) number of detects / number of samples			FOD %	Max Detect [a] (mg/kg)	Max SQL (mg/kg)	Site Screening Level (SL) [b] Construction Scenario (mg/kg)		Is EPC > Screening Level? Construction Scenario	Construction Scenario Max / SL (cancer)	Construction Scenario Max / SL (noncancer)	Constituent of Potential Concern (COPC)? [c] Construction
Volatile Organic Compounds												
Acetone	0	/	9	0	–	0.0211	2.63E+05	n	–	–	–	no
Acrolein	0	/	9	0	–	0.0053	1.83E+00	n	–	–	–	no
Acrylonitrile	0	/	9	0	–	0.0105	2.90E+02	n	–	–	–	no
Benzene	0	/	9	0	–	0.0053	4.71E+02	n	–	–	–	no
Bis(2-chloroisopropyl)ether	0	/	9	0	–	0.348	3.10E+03	c	–	–	–	no
Bromodichloromethane	0	/	9	0	–	0.0053	3.50E+03	c	–	–	–	no
Bromomethane	0	/	9	0	–	0.0105	6.71E+01	n	–	–	–	no
2-Butanone	0	/	9	0	–	0.0211	1.48E+05	n	–	–	–	no
Carbon disulfide	0	/	9	0	–	0.0053	5.89E+03	n	–	–	–	no
Carbon tetrachloride	0	/	9	0	–	0.0053	1.99E+02	n	–	–	–	no
Chlorobenzene	0	/	9	0	–	0.0053	1.58E+03	n	–	–	–	no
Chloroethane	0	/	9	0	–	0.0105	1.23E+05	n	–	–	–	no
Chloroform	0	/	9	0	–	0.0053	6.71E+02	c	–	–	–	no
Chloromethane	0	/	9	0	–	0.0105	1.13E+03	n	–	–	–	no
2-Chlorophenol	0	/	9	0	–	0.348	1.55E+03	n	–	–	–	no
Dibenzofuran	0	/	9	0	–	0.348	2.25E+02	n	–	–	–	no
Dibromomethane	0	/	9	0	–	0.0053	3.10E+03	n	–	–	–	no
1,2-Dichlorobenzene	0	/	9	0	–	0.0053	9.71E+03	n	–	–	–	no
1,4-Dichlorobenzene	0	/	9	0	–	0.0053	3.78E+03	c	–	–	–	no
1,4 Dichloro-2-butene	0	/	9	0	–	0.0105	5.80E+00	c	–	–	–	no
1,1-Dichloroethane	0	/	9	0	–	0.0053	6.88E+03	c	–	–	–	no
1,2-Dichloroethane	0	/	9	0	–	0.0053	7.51E+02	c	–	–	–	no
cis-1,2-Dichloroethene	0	/	9	0	–	0.0053	3.10E+03	c	–	–	–	no
trans-1,2-Dichloroethene	0	/	9	0	–	0.0053	8.14E+02	n	–	–	–	no
1,2-Dichloropropane	0	/	9	0	–	0.0053	1.17E+02	n	–	–	–	no
cis-1,3-Dichloropropene	0	/	9	0	–	0.0053	5.10E+02	n	–	–	–	no
trans-1,3-Dichloropropene	0	/	9	0	–	0.0053	5.10E+02	n	–	–	–	no
Ethyl methacrylate	0	/	9	0	–	0.0053	2.79E+04	n	–	–	–	no
Ethylbenzene	0	/	9	0	–	0.0053	6.63E+03	c	–	–	–	no
Iodomethane	0	/	9	0	–	0.0105	1.97E+01	n	–	–	–	no
Nitrobenzene	0	/	9	0	–	0.348	5.20E+02	n	–	–	–	no
Tetrachloroethene	0	/	9	0	–	0.0053	3.38E+02	c	–	–	–	no
1,1,2,2-Tetrachloroethane	0	/	9	0	–	0.0053	5.99E+02	c	–	–	–	no
1,1,1-Trichloroethane	0	/	9	0	–	0.0053	6.43E+04	n	–	–	–	no
1,1,2-Trichloroethane	0	/	9	0	–	0.0053	1.24E+03	n	–	–	–	no
1,2,3-Trichloropropane	0	/	9	0	–	0.0053	3.10E+01	c	–	–	–	no
1,2,4-Trichlorobenzene	0	/	9	0	–	0.348	4.27E+02	n	–	–	–	no
Vinyl acetate	0	/	9	0	–	0.0211	1.05E+04	n	–	–	–	no
Vinyl chloride	0	/	9	0	–	0.0105	2.48E+02	c	–	–	–	no
Semi Volatile Organic Compounds												
Benzidine	0	/	9	0	–	1.69 ^	7.20E-01	c	–	–	–	no
Benzoic acid	0	/	9	0	–	1.69	9.53E+05	n	–	–	–	no
Benzyl alcohol	0	/	9	0	–	0.348	1.19E+05	n	–	–	–	no
Bis(2-ethylhexyl)phthalate	0	/	9	0	–	0.348	4.76E+03	n	–	–	–	no
4-Chloro-3-methylphenol	0	/	9	0	–	0.348	NA	n	–	–	–	no
3,3'-Dichlorobenzidine	0	/	9	0	–	0.348	3.50E+02	c	–	–	–	no
2,4-Dichlorophenol	0	/	9	0	–	0.348	7.15E+02	n	–	–	–	no
2,4-Dimethylphenol	0	/	9	0	–	0.348	4.76E+03	n	–	–	–	no
2,4-Dinitrophenol	0	/	9	0	–	1.69	4.76E+02	n	–	–	–	no
2,4-Dinitrotoluene	0	/	9	0	–	0.348	4.76E+02	n	–	–	–	no
1,2-Diphenylhydrazine	0	/	9	0	–	1.69	2.07E+02	c	–	–	–	no
Diphenylamine	0	/	9	0	–	1.05	5.96E+03	n	–	–	–	no
Hexachlorobenzene	0	/	9	0	–	0.348	1.03E+02	c	–	–	–	no

Table HHRA-3
Selection of Constituents of Potential Concern in Soil - Based on Maximum Detected Concentrations
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19 (SWMU 19)
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Frequency of Detection (FOD) number of detects / number of samples			FOD %	Max Detect [a] (mg/kg)		Max SQL (mg/kg)	Site Screening Level (SL) [b] Construction Scenario (mg/kg)		Is EPC > Screening Level? Construction Scenario	Construction Scenario Max / SL (cancer)	Construction Scenario Max / SL (noncancer)	Constituent of Potential Concern (COPC)? [c] Construction
Hexachlorocyclopentadiene	0	/	9	0	–		0.348	8.11E+02	n	–	–	–	no
Hexachloroethane	0	/	9	0	–		0.348	2.38E+02	n	–	–	–	no
4,6-Dinitro-2-methylphenol	0	/	9	0	–		1.69	2.38E+01	n	–	–	–	no
2-Methylphenol	0	/	9	0	–		0.348	1.19E+04	n	–	–	–	no
2-Nitroaniline	0	/	9	0	–		1.69	2.23E+02	n	–	–	–	no
3-Nitroaniline	0	/	9	0	–		1.69	NA	n	–	–	–	no
2-Nitrophenol	0	/	9	0	–		0.348	NA	n	–	–	–	no
4-Nitrophenol	0	/	9	0	–		1.69	NA	n	–	–	–	no
n-Nitrosodiphenylamine	0	/	9	0	–		0.348	3.40E+04	c	–	–	–	no
Pentachlorophenol	0	/	9	0	–		1.69	1.03E+03	c	–	–	–	no
Phenol	0	/	9	0	–		0.348	6.88E+04	n	–	–	–	no
2,4,5-Trichlorophenol	0	/	9	0	–		0.348	2.38E+04	n	–	–	–	no
2,4,6-Trichlorophenol	0	/	9	0	–		0.348	2.38E+02	n	–	–	–	no
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	0	/	9	0	–		0.348	1.86E+04	n	–	–	–	no
Acenaphthylene	0	/	9	0	–		0.348	1.34E+04	n	–	–	–	no
Anthracene	0	/	9	0	–		0.348	6.68E+04	n	–	–	–	no
Benzo(a)anthracene	0	/	9	0	–		0.348	2.13E+02	c	–	–	–	no
Benzo(a)pyrene	0	/	9	0	–		0.348	2.13E+01	c	–	–	–	no
Benzo(b)fluoranthene	0	/	9	0	–		0.348	2.13E+02	c	–	–	–	no
Benzo(g,h,i)perylene	0	/	9	0	–		0.348	6.68E+03	n	–	–	–	no
Benzo(k)fluoranthene	0	/	9	0	–		0.348	2.06E+03	c	–	–	–	no
1-Chloronaphthalene	0	/	9	0	–		0.348	2.48E+04	n	–	–	–	no
2-Chloronaphthalene	0	/	9	0	–		0.348	2.48E+04	n	–	–	–	no
Fluoranthene	0	/	9	0	–		0.348	8.91E+03	n	–	–	–	no
Fluorene	0	/	9	0	–		0.348	8.91E+03	n	–	–	–	no
Indeno(1,2,3-cd)pyrene	0	/	9	0	–		0.348	2.13E+02	c	–	–	–	no
2-Methylnaphthalene	0	/	9	0	–		0.348	8.91E+02	n	–	–	–	no
Naphthalene	0	/	9	0	–		0.348	7.02E+02	n	–	–	–	no
Phenanthrene	0	/	9	0	–		0.348	7.15E+03	n	–	–	–	no
Pyrene	0	/	9	0	–		0.348	6.68E+03	n	–	–	–	no
Total Petroleum Hydrocarbons (TPH)													
Total Petroleum Hydrocarbons (TPH)	7	/	11	63.6	234	!	31.6	NA	n	NA	–	–	no
Explosives													
2,6-Dinitrotoluene	0	/	9	0	–		0.348	2.39E+02	n	–	–	–	no
Inorganics													
Arsenic	0	/	11	0	–		2.74	6.54E+01	n	–	–	–	no
Barium	3	/	11	27.3	193		26.4	4.35E+03	n	no	–	4.43E-02	no
Cadmium	1	/	11	9.09	38.5		5.27	3.09E+02	n	no	–	1.25E-01	no
Chromium	0	/	11	0	–		23.6 ^	4.49E+02	n	–	–	–	no
Lead	11	/	11	100	46.2		–	8.00E+02	IEUBK	no	–	–	no
Mercury	9	/	11	81.8	0.644		0.0206	6.36E+01	n	no	–	1.01E-02	no
Selenium	0	/	11	0	–		2.77	1.55E+03	n	–	–	–	no
Silver	1	/	11	9.09	59.8		26.4	1.55E+03	n	no	–	3.86E-02	no

Table HHRA-3
Selection of Constituents of Potential Concern in Soil - Based on Maximum Detected Concentrations
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19 (SWMU 19)
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Frequency of Detection (FOD) number of detects / number of samples	FOD %	Max Detect [a] (mg/kg)	Max SQL (mg/kg)	Site Screening Level (SL) [b] Construction Scenario (mg/kg)	Is EPC > Screening Level? Construction Scenario	Construction Scenario Max / SL (cancer)	Construction Scenario Max / SL (noncancer)	Constituent of Potential Concern (COPC)? [c] Construction
Total Maximum / Screening Level Ratios							NA	0.2	
Total Maximum / Screening Level Risk (multiply cancer ratio by 1E-5 and non cancer ratio by 1)							NA	0.2	
						Target Organ Max/SL Ratios			
						Kidney and Liver		0.2	
						Brain		NA	
						Nasal		NA	
						Eyes		NA	
						Skin		0.04	
						Lungs		NA	
						Gastrointestinal Tract and Forestomach		NA	
						Whole Body		NA	
						Blood		NA	
						Nervous System		0.01	
						Dental		NA	
						Red Blood Cells		NA	
						Glands		NA	
						Fetus		0.04	
						Immune System		NA	
						Development		NA	
						Reproduction		NA	
						Bone		NA	
						Not Available/ Not Reported		NA	

Notes:

– =	Not applicable.
! =	Constituent was detected and screening level/ toxicity information is not available.
^ =	Maximum SQL exceeds minimum criteria for constituent not detected otherwise.
Max =	Maximum concentration.
mg/kg =	Milligrams per kilogram.
NA =	Not available.
SQL =	Sample Quantification Limit.

[a]	Maximum detected concentration.
[b]	See Table HHRA-1 for sources of soil screening levels and explanation of notes.
[c]	Constituents were selected as COPCs if the screening risk (Maximum/Screening Level) exceeded $1x10^{-5}$ for cancer effects and/or 1 for non-cancer effects, and any of the sums for target organ ratios also exceeded 1 unless it was an essential nutrient (i.e., calcium, magnesium, potassium, sodium).

Table HHRA-4
Selection of Constituents of Potential Concern in Soil for the Vapor Intrusion Pathway
Total Soil Depth Interval
Solid Waste Managment Unit 19 (SWMU 19)
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Volatile Constituent [a]	Frequency of Detection (FOD) number of detects /		number of samples	FOD %	Max Detect (mg/kg)	Constituent of Potential Concern for Vapor Inhalation [a]
Volatile Organic Compounds						
Acetone	0	/	9	0	–	no
Acrolein	0	/	9	0	–	no
Acrylonitrile	0	/	9	0	–	no
Benzene	0	/	9	0	–	no
Bis(2-chloroisopropyl)ether	0	/	9	0	–	no
Bromodichloromethane	0	/	9	0	–	no
Bromomethane	0	/	9	0	–	no
2-Butanone	0	/	9	0	–	no
Carbon disulfide	0	/	9	0	–	no
Carbon tetrachloride	0	/	9	0	–	no
Chlorobenzene	0	/	9	0	–	no
Chloroethane	0	/	9	0	–	no
Chloroform	0	/	9	0	–	no
Chloromethane	0	/	9	0	–	no
2-Chlorophenol	0	/	9	0	–	no
Dibenzofuran	0	/	9	0	–	no
Dibromomethane	0	/	9	0	–	no
1,2-Dichlorobenzene	0	/	9	0	–	no
1,4-Dichlorobenzene	0	/	9	0	–	no
1,4 Dichloro-2-butene	0	/	9	0	–	no
1,1-Dichloroethane	0	/	9	0	–	no
1,2-Dichloroethane	0	/	9	0	–	no
cis-1,2-Dichloroethene	0	/	9	0	–	no
trans-1,2-Dichloroethene	0	/	9	0	–	no
1,2-Dichloropropane	0	/	9	0	–	no
cis-1,3-Dichloropropene	0	/	9	0	–	no
trans-1,3-Dichloropropene	0	/	9	0	–	no
Ethyl methacrylate	0	/	9	0	–	no
Ethylbenzene	0	/	9	0	–	no
Iodomethane	0	/	9	0	–	no
Nitrobenzene	0	/	9	0	–	no
Tetrachloroethene	0	/	9	0	–	no
1,1,2,2-Tetrachloroethane	0	/	9	0	–	no
1,1,1-Trichloroethane	0	/	9	0	–	no
1,1,2-Trichloroethane	0	/	9	0	–	no
1,2,3-Trichloropropane	0	/	9	0	–	no
1,2,4-Trichlorobenzene	0	/	9	0	–	no
Vinyl acetate	0	/	9	0	–	no
Vinyl chloride	0	/	9	0	–	no
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0	/	9	0	–	no
Acenaphthylene	0	/	9	0	–	no
Anthracene	0	/	9	0	–	no
1-Chloronaphthalene	0	/	9	0	–	no
2-Chloronaphthalene	0	/	9	0	–	no
Fluorene	0	/	9	0	–	no
2-Methylnaphthalene	0	/	9	0	–	no
Naphthalene	0	/	9	0	–	no
Phenanthrene	0	/	9	0	–	no

Notes:

– =	Not applicable.
Max =	Maximum concentration.
mg/kg =	Milligrams per kilogram.
NA =	Not available.
SQL =	Sample Quantification Limit.

[a] All detected volatile constituents were selected as COPCs for the vapor inhalation pathway.

Table ERA-1
Ecological Screening Levels
Ecological Risk Assessment
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Potential Surrogate [a]	Soil SLs [b] (mg/kg) Value	Soil SLs [b] (mg/kg) *Source*	Bioaccumulation [c] (Yes/no)	Bioaccumulation [c] *Source*
Volatile Organic Compounds					
Acetone		2.50E+00	R5	no	PJ
Acrolein		5.27E+00	R5	no	PJ
Acrylonitrile		1.00E+03	R4	no	PJ
Benzene		5.00E-02	R4	no	PJ
Bis(2-chloroisopropyl)ether		NA		no	PJ
Bromodichloromethane		5.40E-01	R5	no	PJ
Bromomethane		2.35E-01	R5	no	PJ
2-Butanone		8.96E+01	R5	no	PJ
Carbon disulfide		9.41E-02	R5	no	PJ
Carbon tetrachloride		1.00E+03	R4	no	PJ
Chlorobenzene		5.00E-02	R4	no	PJ
Chloroethane		NA		no	PJ
Chloroform		1.00E-03	R4	no	PJ
Chloromethane		1.04E+01	R5	no	PJ
2-Chlorophenol		2.43E-01	R5	no	PJ
Dibenzofuran	Furan	6.00E+02	R4s	no	PJ
Dibromomethane		6.50E+01	R5	no	PJ
1,2-Dichlorobenzene		2.96E+00	R5	YES	USEPA
1,4-Dichlorobenzene		5.46E-01	R5	YES	USEPA
1,4 Dichloro-2-butene		NA		no	PJ
1,1-Dichloroethane		2.01E+01	R5	no	PJ
1,2-Dichloroethane		4.00E-01	R4	no	PJ
cis-1,2-Dichloroethene	1,2-Dichloroethene mix	NA		no	PJ
trans-1,2-Dichloroethene		7.84E-01	R5	no	PJ
1,2-Dichloropropane		7.00E+02	R4	no	PJ
cis-1,3-Dichloropropene		3.98E-01	R5	no	PJ
trans-1,3-Dichloropropene		3.98E-01	R5	no	PJ
Ethyl methacrylate		3.00E+01	R5	no	PJ
Ethylbenzene		5.00E-02	R4	no	PJ
Iodomethane		1.23E+00	R5	no	PJ
Nitrobenzene		4.00E+01	R4	no	PJ
Tetrachloroethene		9.92E+00	R5	no	PJ
1,1,2,2-Tetrachloroethane		1.27E-01	R5	no	PJ
1,1,1-Trichloroethane		2.98E+01	R5	no	PJ
1,1,2-Trichloroethane		2.86E+01	R5	no	PJ
1,2,4-Trichlorobenzene		1.11E+01	R5	YES	USEPA
1,2,3-Trichloropropane		3.36E+00	R5	no	PJ
Vinyl acetate		1.27E+01	R5	no	PJ
Vinyl chloride		1.00E-02	R4	no	PJ
Semi Volatile Organic Compounds					
Benzidine		NA		no	PJ
Benzoic acid		NA		no	PJ
Benzyl alcohol		6.58E+01	R5	no	PJ
Bis(2-ethylhexyl)phthalate		1.00E-01	R4	no	PJ
4-Chloro-3-methylphenol		7.95E+00	R5	no	PJ
3,3'-Dichlorobenzidine		6.46E-01	R5	no	PJ
2,4-Dichlorophenol		8.75E+01	R5	no	PJ
2,4-Dimethylphenol		1.00E-02	R5	no	PJ
2,4-Dinitrophenol		2.00E+01	R4	no	PJ
2,4-Dinitrotoluene		1.28E+00	R5	no	PJ
1,2-Diphenylhydrazine		NA		no	PJ
Diphenylamine		1.01E+00	R5	no	PJ

Table ERA-1
Ecological Screening Levels
Ecological Risk Assessment
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Potential Surrogate [a]	Soil SLs [b] (mg/kg) Value	Soil SLs [b] (mg/kg) *Source*	Bioaccumulation [c] (Yes/no)	Bioaccumulation [c] *Source*
Hexachlorobenzene		2.50E-03	R4	YES	USEPA
Hexachlorocyclopentadiene		1.00E+01	R4	YES	USEPA
Hexachloroethane		5.96E-01	R5	YES	USEPA
2-Methyl-4,6-dinitrophenol		1.44E-01	R5	no	PJ
2-Methylphenol		4.04E+01	R5	no	PJ
2-Nitroaniline		7.41E+01	R5	no	PJ
3-Nitroaniline		3.16E+00	R5	no	PJ
2-Nitrophenol		1.60E+00	R5	no	PJ
4-Nitrophenol		5.12E+00	R5	no	PJ
n-Nitrosodiphenylamine		2.00E+01	R4	no	PJ
Pentachlorophenol		2.10E+00	EcoSSL	YES	USEPA
Phenol		1.20E+02	R5	no	PJ
2,4,5-Trichlorophenol		4.00E+00	R4	no	PJ
2,4,6-Trichlorophenol		1.00E+01	R4	no	PJ
Polycyclic Aromatic Hydrocarbons					
Acenaphthene		2.00E+01	R4	YES	USEPA
Acenaphthylene		6.82E+02	R5	YES	USEPA
Anthracene		1.00E-01	R4	YES	USEPA
Benzo(a)anthracene		5.21E+00	R5	YES	USEPA
Benzo(a)pyrene		1.00E-01	R4	YES	USEPA
Benzo(b)fluoranthene	Fluoranthene	1.00E-01	R4s	YES	USEPA
Benzo(g,h,i)perylene		1.19E+02	R5	YES	USEPA
Benzo(k)fluoranthene		1.48E+02	R5	YES	USEPA
1-Chloronaphthalene	2-Chloronaphthalene	1.22E-02	R5s	no	PJ
2-Chloronaphthalene		1.22E-02	R5	no	PJ
Fluoranthene		1.00E-01	R4	YES	USEPA
Fluorene		1.22E+02	R5	YES	USEPA
Indeno(1,2,3-cd)pyrene		1.09E+02	R5	YES	USEPA
2-Methylnaphthalene		3.24E+00	R5	no	PJ
Naphthalene		1.00E-01	R4	no	PJ
Phenanthrene		1.00E-01	R4	YES	USEPA
Pyrene		1.00E-01	R4	YES	USEPA
Total Petroleum Hydrocarbons (TPH)					
TPH	TPH (total)	1.00E+04	API	no	PJ
Explosives					
2,6-Dinitrotoluene		3.28E-02	R5	no	PJ
Inorganics					
Arsenic		1.80E+01	EcoSSL	YES	USEPA
Barium		3.30E+02	EcoSSL	no	PJ
Cadmium		3.60E-01	EcoSSL	YES	USEPA
Chromium		2.60E+01	EcoSSL	no	PJ
Lead		1.10E+01	EcoSSL	YES	USEPA
Mercury		1.00E-01	R4	no	PJ
Selenium		5.20E-01	EcoSSL	YES	USEPA
Silver		4.20E+00	EcoSSL	YES	USEPA

Table ERA-1
Ecological Screening Levels
Ecological Risk Assessment
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Potential Surrogate [a]	Soil SLs [b] (mg/kg) Value	Soil SLs [b] (mg/kg) *Source*	Bioaccumulation [c] (Yes/no)	Bioaccumulation [c] *Source*

Notes:

– =	Not available or applicable.
mg/kg =	Milligrams per kilogram.
NA =	Not available or applicable.
PJ =	Professional judgement.
s =	Surrogate was used.
USEPA =	United States Environmental Protection Agency.
[a]	Surrogates were used where screening values were not available.
[b]	Ecological soil screening levels were from the following sources in order of priority: USEPA Ecological Soil Screening Levels (USEPA, 2008c; EcoSSL). Region 4 Ecological Screening Values (USEPA, 2001d; R4). Region 5 Ecological Screening Levels (USEPA, 2003; R5). For EcoSSL SLs, the lowest value for all available endpoints was selected.
[c]	The following source was consulted to identify bioaccumulation potential: (USEPA, 2000b).

Table ERA-4

Uncertainties in the Screening-Level and Baseline-Level Ecological Risk Assessments

Ecological Risk Assessment

SWMU 19, Main Post, U.S. Army White Sands Missile Range

White Sands Missile Range, New Mexico

Assumptions	Description And Discussion Related To Uncertainties in ERA	Uncertainty in SLERA	Uncertainty in BERA
Analytical Sampling and Data Analysis			
Limited number of samples	Frequently, there are only a limited number of samples used in ERAs, and very often they are collected in a biased manner (i.e., targeting "hot spots"). This type of sampling often lacks statistical power and does not likely represent the concentrations in the environment in which wildlife exposure occurs. Similarly, limited data used to estimate uptake into organisms may overestimate exposure via the food web.	Overestimate of exposure and risk	Overestimate of exposure and risk
Use of maximum concentrations	Maximum concentrations are used to represent the upper estimate exposures. This practice compensates for uncertainty contributed by limited numbers of samples, but overestimates exposure and risk.	Overestimate of exposure and risk	Overestimate of exposure and risk
Detection limits	Detection limits may exceed ESVs (e.g., PAHs) or thresholds for adverse impacts are well below the analytical methods used in ERA (e.g., compounds that are known or suspected to cause endocrine effects).	May underestimate risk or effect on risk estimate unknown	May underestimate risk or effect on risk unknown
Degradation of chemicals not considered	ERAs are almost exclusively based on concentrations of target compounds, and little if any attention is given to degradation compounds that could be more toxic than the original chemical. Conversely, chemical concentrations may decrease over time due to natural physical processes.	Effect on risk estimate unknown	Effect on risk estimate unknown
Toxicology and ESVs			
Toxicity and exposure data for a limited number of species	Uncertainties exist in many aspects of the toxicology relied upon for conducting ERAs (Newman, 1998; Lovett Doust et al., 1993). Toxicity and wildlife exposure data are only available for a limited number of species (most of them laboratory test species) under a strictly defined set of test conditions that deviate from natural conditions (Sample et al., 1996; Suter, 1996; Sample et al., 1997).	Effect on risk estimate unknown	Effect on risk estimate unknown
Laboratory testing	In current practice, more than 95 percent of the resources in toxicology are focused toward the study of single chemicals (Cassee et al., 1998), while wildlife exposures rarely occur on a chemical-specific basis. Simplistic extrapolations from laboratory species to wildlife species and testing conditions to field conditions are not likely accurate, and are rarely, if ever, validated against natural conditions (Power, 1996; Tannenbaum, 2003).	Effect on risk estimate unknown	Effect on risk estimate unknown
Adaptation and tolerance	There is little consistency and no quantitative methodology for the consideration of the diminished bioavailability (and, thereby, diminished toxicity) even though this process is well documented (e.g., Alexander and Alexander, 1999; Alexander, 2000). Similarly, tolerance and adaptation are not considered directly (Millward and Klerks, 2002; Grant, 2002). Furthermore, the white rat often used in toxicological testing is bred to minimize differences between lab animals, thereby diminishing the genetic variability that gives wildlife some capability for adaptation and tolerance (Tannenbaum, 2003).	Overestimate of risk	Overestimate of risk

Table ERA-4

Uncertainties in the Screening-Level and Baseline-Level Ecological Risk Assessments

Ecological Risk Assessment

SWMU 19, Main Post, U.S. Army White Sands Missile Range

White Sands Missile Range, New Mexico

Assumptions	Description And Discussion Related To Uncertainties in ERA	Uncertainty in SLERA	Uncertainty in BERA
Predator-prey interactions	There are relatively few studies that actually evaluate the effects of toxicity on predator-prey interactions, or on competition for scarce resources (Atchison et al., 1996), the very conditions within which all wildlife exists (Kapustka and Landis, 1998).	Effect on risk estimate unknown	Effect on risk estimate unknown
HQs			
HQs based on maximum	The SLERA HQ is based on the maximum detected concentrations and the most conservative ESVs available (USEPA, 1997c; 2000b). HQs in the BERA are based on the exposure point concentration (minimum of the 95% upper confidence limit on the mean and the maximum concentration).	Overestimate of risk	Overestimate of risk
Elevated HQs for background concentrations	HQs may exceed a value of 1 for background concentrations of naturally occurring metals (Tannenbaum, 2003). This is due to many of the toxicology and ESV uncertainties already discussed.	Overestimate of risk	Overestimate of risk
Interpretation of HQs	An HQ less than or equal to a value of 1 indicates that adverse impacts to wildlife are considered unlikely (USEPA, 2001c). However, there is no clear guidance for interpreting the HQs that exceed a value of 1, except that this point of departure indicates that adverse effects of some kind may have occurred or may occur in the future.	Effect on risk estimate unknown	Effect on risk estimate unknown
HQs for individual used to evaluate risks to populations	HQs are based on the types of impacts that could occur to individuals (i.e., those individuals exposed to maximum concentrations) and they completely fail to address ecological exposure and risk at spatial scale of populations (Tannenbaum, 2003; Durda and Preziosi, 1999).	Overestimate of risk to wildlife populations	Overestimate of risk to wildlife populations
HQs with unrealistic	HQs are seen at magnitudes that suggest that every animal should die upon acute exposure (i.e., in the hundreds or thousands) (Tannenbaum et al., 2003). Often, physical conditions at a site demonstrate that this is not the case.	Overestimate of risk	Overestimate of risk
No evaluation of dermal or inhalation pathways	The dermal and inhalation exposure pathways are generally considered “insignificant” due to protective fur and feathers. Under certain conditions, these exposure pathways may occur, but adequate information is rarely available by which to evaluate them.	Not Applicable	Potentially an underestimate of risk

BERA = Baseline Ecological Risk Assessment.
COPC = Constituent of potential concern.
ERA = Ecological risk assessment.
ESV = Ecological screening value.
HQ = Hazard quotient.
PAH = Polynuclear aromatic hydrocarbon.
TRV = Toxicity reference value.
SLERA = Screening level ecological risk assessment.

Table ERA-7
Exposure Assumptions for Ecological Receptors
Ecological Risk Assessment
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

			Avian and Terrestrial Receptors											
Exposure Parameter	**Acronym**	**Units**	**Mourning Dove**		**Cactus Wren**		**Red-Tailed Hawk**		**Merriam's Kangaroo Rat**		**Desert Shrew**	**Desert Kit Fox**		
Body Weight (BW)	BW	kg	0.125		0.0389		1.134		0.0343		0.005	1.985		
Proportion of Diet (P)	P	unitless												
Maximum Scenario:														
Soil		%	4.8%		9.3%		1.4%		2.4%		2%	2.8%		
Invertebrates		%	–		100.0%		–		–		100.0%	–		
Plants and Fungi		%	100.0%		–		–		100.0%		–	–		
Small Mammals		%	–		–		100.0%		–		–	100.0%		
Refined Scenario:														
Soil		%	4.8%		9.3%		1.4%		2.4%		2%	2.8%		
Invertebrates		%	1.3%		83.0%		–		1.0%		100.0%	1.3%		
Plants and Fungi		%	98.7%		17.0%		–		99.0%		–	0.7%		
Small Mammals		%	–		–		100.0%		–		–	98.0%		
Food Ingestion Rate - dry weight (IRdf)	IRdf	kg/day	0.0109	[c]	0.00713	[c]	0.0899	[c]	0.00282	[c]	0.00101	0.0702	[c]	
Food Ingestion Rate - wet weight (IRwf)	IRwf	kg/day	0.0908	[c]	0.0427	[c]	0.2809	[c]	0.0235	[c]	0.00605	0.219	[c]	
Water Ingestion Rate (IRw)	IRw	L/day	–		–		–		–		–	–		
Home Range	HR	acres	649		4.8		2,470		0.13		0.1	3,039		
Site Use Factor - Maximum Scenario (SUFm)	SUFm	unitless	1		1		1		1		1	1		
Site Use Factor - Refine Scenario (SUFr)	SUFr	unitless												
Exposure Frequency (EF)	EF	unitless	1		1		1		1		1	1		

Notes:
% = Percent.
kg = Kilogram.
L = Liter.

[a] USEPA, 1993.
[b] Beyer et al., 1994.
[c] Nagy, 2001.

Table ERA-8
Bioconcentration and Bioaccumulation Factors for Soil
Ecological Risk Assessment
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

	Soil Bioconcentration and Bioaccumulation Factors (BCFsl and BAFsl)					
	Invertebrates		Vegetation		Mammalian	
Constituent	**$BCFsl_i$ [a]**		**$BCFsl_v$ [b]**		**$BAFsl_m$ [c]**	
Inorganics						
Arsenic	ln(Ci) = 0.706 * ln(Cs) - 1.42		4.56E-03		ln(Cm) = 0.8188 * ln(Cs) - 4.48471	
Lead	ln(Ci) = 0.807 * ln(Cs) - 0.218		ln(Cp) = 0.561 * ln(Cs) - 1.328		ln(Cm) = 0.4422 * ln(Cs) + 0.0761	
Mercury	3.90E-01	[d]	1.80E-01	[e]	1.25E+01	[f]
Selenium	ln(Ci) = 0.733 * ln(Cs) - 0.075		ln(Cp) = 1.104 * ln(Cs) - 0.677		ln(Cm) = 0.3764 * ln(Cs) - 0.4158	
Silver	3.42E-01		1.68E-03		1.28E-03	

Notes:

BAF = Bioaccumulation Factor (unitless); BAF = (Tissue Concentration)/(Dietary Intake).

BCF = Bioconcentration Factor (unitless); BCF = (Tissue Concentration)/(Media Concentration).

[a] $BCFsl_i$ denotes BCFs for invertebrates. Unless otherwise noted, uptake equations for BCFs for earthworms were obtained from USEPA (2007).

[b] $BCFsl_v$ denotes BCFs for vegetation. Unless otherwise noted, uptake equations for BCFs for vegetation were obtained from USEPA (2007) and are presented in dry weight.

[c] $BAFsl_m$ denotes BAFs for mammals. Unless otherwise noted, uptake equations for BCFs for small mammals were obtained from USEPA (2007) and are presented in dry weight.

[d] $BCFsl_i$ for zinc used as a surrogate (USEPA, 2007).

[e] Uptake equation for BCFsl for vegetation was calculated using the Travis and Arms (1988) Log K_{ow} equation: Log BCFv = 1.588 - 0.578 Log K_{ow}. Values for uptake into leafy material, stem, and straw were used. Value was converted to wet weight by assuming vegetation was 88% moisture (each value was multiplied by 0.12 to dilute BCF representative of hydration).

[f] BAFsl for small mammals were estimated from biotransfer factors (BTFs) presented in Baes et al. (1984). BTFs were converted to BAFs by multiplying by an average food ingestion rate of 50 kg/day. Values are in wet weight.

Table ERA-9
Avian Toxicity Reference Values
Ecological Risk Assessment
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Test Species Chronic Toxicity Value (mg/kg BW-day) LOAEL		NOAEL	Test Species	Effect	Body Weight of Test Species	Reference	Toxicity Reference Values (TRV) [a] Mourning Dove LOAEL	Mourning Dove NOAEL	Cactus Wren LOAEL	Cactus Wren NOAEL	Red-Tailed Hawk LOAEL	Red-Tailed Hawk NOAEL
Inorganics													
Arsenic	22.4	[b]	2.24	Multiple Bird Species	Reproduction, growth, survival	NAP	USEPA, 2005c	22.4	2.24	22.4	2.24	22.4	2.24
Lead	16.3	[b]	1.63	Multiple Bird Species	Reproduction, growth, survival	NAP	USEPA, 2005c	16.3	1.63	16.3	1.63	16.3	1.63
Mercury	1		0.5	Japanese Quail	Reproduction	NAP	Hill and Schaffner, 1976	0.9	0.45	0.9	0.45	0.9	0.45
Selenium	3	[b]	0.3	Multiple Bird Species	Reproduction, growth, survival	NAP	USEPA, 2005c	2.9	0.29	2.9	0.29	2.9	0.29
Silver	2.02	[b]	0.202	Multiple Bird Species	Reproduction, growth, survival	NAP	USEPA, 2005c	2.02	0.202	2.02	0.202	2.02	0.202

LOAEL = Lowest Observed Adverse Effects Level.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
NAP = Not applicable because body weight extrapolations are not appropriate for avain species.
NOAEL = No Observed Adverse Effects Level.
TRV = Toxicity Reference Value.
USEPA = United States Environmental Protection Agency.
[a] Toxicity Reference Values for $_{\text{wildlife species}}$ (TRV) = Chronic Toxiity Value for test species x $(BW_{\text{test species}} / BW_{\text{wildlife species}})^{1/4}$
[b] Acute LOAELs and NOAELs were extrapolated (converted) to chronic LOAELs and NOAELs by applying an acute-chronic ratio of 10 (Calabrese and Baldwin, 1993).

Table ERA-10
Mammalian Toxicity Reference Values
Ecological Risk Assessment
SWMU 19, Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Constituent	Test Species Chronic Toxicity Value (mg/kg BW-day) LOAEL		NOAEL		Test Species	Effect	Body Weight of Test Species	Reference	Toxicity Reference Values (TRV) [a] Merriam's Kangaroo Rat LOAEL	NOAEL	Desert Shrew LOAEL	NOAEL	Desert Kit Fox LOAEL	NOAEL
Inorganics														
Arsenic	10.4	[b]	1.04		Multiple Mammals	Reproduction, growth	NAP	USEPA, 2005c	10	1	10	1	10	1
Lead	47	[b]	4.7		Multiple Mammals	Reproduction, growth, survival	NAP	USEPA, 2005c	47	4.7	47	4.7	47	4.7
Mercury	10.1	[b]	1.01		Mink	Reproduction	1	Bleavines and Aulerich, 1981	23	2.3	38	3.8	8.5	0.85
Selenium	1.43	[b]	0.143		Multiple Mammals	Reproduction, growth, survival	NAP	USEPA, 2005c	1.4	0.14	1.4	0.14	1.4	0.14
Silver	6.02		0.602	[b]	Multiple Mammals	Reproduction, growth, survival	NAP	USEPA, 2005c	6	0.6	6	0.6	6	0.6

LOAEL = Lowest Observed Adverse Effects Level.
mg/kg-BW-day = Milligrams per kilogram of body weight per day.
NAP = Not applicable because multiple mammals were used for LOAEL and NOAEL toxicity value determinations.
NOAEL = No Observed Adverse Effects Level.
TRV = Toxicity Reference Value.
USEPA = United States Environmental Protection Agency.

[a] Toxicity Reference $\text{Values}_{\text{wildife species}}$ (TRV) = Chronic Toxicity Value for test species x $(BW_{\text{test species}} / BW_{\text{wildlife species}})^{1/4}$

[b] Acute LOAELs and NOAELs were extrapolated (converted) to chronic LOAELs and NOAELs by applying an acute-chronic ratio of 10 (Calabrese and Baldwin, 1993).

Table ERA-12
Maximum Scenario Food Chain Modeling for the Merriam's Kangaroo Rat
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Maximum Scenario EPC [a] (mg/kg)		Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Maximum Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Maximum Scenario HQ [f]	
			Vegetation	Vegetation	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics									
Cadmium	38.5	m	4.56E+00	5.48E-01	0.45	7.7	0.77	0.06	0.6
Lead	46.2	m	2.28E+00	2.73E-01	0.28	47	4.7	0.006	0.06
Silver	59.8	m	1.68E-03	1.00E-01	0.19	6	0.6	0.03	0.3

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) for the maximum scenario were set at the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-13
Refined Scenario Food Chain Modeling for the Merriam's Kangaroo Rat
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Refined Scenario EPC [a] (mg/kg)	Soil Bioconcentration Factors [b]		Estimated Dietary Tissue Concentrations [c] (mg/kg)		Refined Estimated Dietary Ingestion [d] mg/kg-BW-day	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
		Invertebrate	Vegetation	Invertebrate	Vegetation		LOAEL	NOAEL	LOAEL	NOAEL
Inorganics										
Cadmium	11.7	5.85E+01	2.38E+00	9.77E+00	2.86E-01	0.28	7.7	0.77	0.04	0.4
Lead	32.9	1.90E+00	1.88E+00	3.16E-01	2.26E-01	0.22	47	4.7	0.005	0.05
Silver	32.2	3.42E-01	1.68E-03	1.10E+01	5.41E-02	0.18	6	0.6	0.03	0.3

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) were set at the lower of the arithmetic average (non detects were set at 1/2 the sample quantification limit) and the maximum detected concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of mammalian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-14
Maximum Scenario Food Chain Modeling for the Desert Shrew
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Maximum Scenario EPC [a] (mg/kg)		Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Maximum Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Maximum Scenario HQ [f]	
			Invertebrate	Invertebrate	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics									
Cadmium	38.5	m	1.51E+02	2.52E+01	31	7.7	0.77	4	40
Lead	46.2	m	2.49E+00	4.16E-01	0.69	47	4.7	0.01	0.1
Silver	59.8	m	3.42E-01	2.04E+01	25	6	0.6	4	42

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) for the maximum scenario were set at the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-15
Refined Scenario Food Chain Modeling for the Desert Shrew
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Refined Scenario EPC [a] (mg/kg)	Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
		Invertebrate	Invertebrate	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics								
Cadmium	11.7	5.85E+01	9.77E+00	12	7.7	0.77	2	16
Lead	32.9	1.90E+00	3.16E-01	0.52	47	4.7	0.01	0.1
Silver	32.2	3.42E-01	1.10E+01	13	6	0.6	2	22

Notes:

HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) were set at the lower of the arithmetic average (non detects were set at 1/2 the sample quantification limit) and the maximum detected concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of mammalian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-16
Maximum Scenario Food Chain Modeling for the Desert Kit Fox
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Maximum Scenario EPC [a] (mg/kg)		Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Maximum Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Maximum Scenario HQ [f]	
			Mammal	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics									
Cadmium	38.5	m	1.60E+00	5.11E-01	0.095	7.7	0.77	0.01	0.1
Lead	46.2	m	5.88E+00	1.88E+00	0.25	47	4.7	0.005	0.05
Silver	59.8	m	1.28E-03	7.65E-02	0.068	6	0.6	0.01	0.1

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) for the maximum scenario were set at the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-17
Refined Scenario Food Chain Modeling for the Desert Kit Fox
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Refined Scenario EPC [a] (mg/kg)	Soil Bioconcentration Factors [b]			Estimated Dietary Tissue Concentrations [c] (mg/kg)			Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
		Invertebrate	Vegetation	Mammal	Invertebrate	Vegetation	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics												
Cadmium	11.7	5.85E+01	2.38E+00	9.09E-01	9.77E+00	2.86E-01	2.91E-01	0.000019	7.7	0.77	0.000002	0.00002
Lead	32.9	1.90E+00	1.88E+00	5.06E+00	3.16E-01	2.26E-01	1.62E+00	0.000069	47	4.7	0.000001	0.00001
Silver	32.2	3.42E-01	1.68E-03	1.28E-03	1.10E+01	5.41E-02	4.12E-02	0.000017	6	0.6	0.000003	0.00003

Notes:

HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) were set at the lower of the arithmetic average (non detects were set at 1/2 the sample quantification limit) and the maximum detected concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of mammalian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-18
Maximum Scenario Food Chain Modeling for the Desert Kit Fox
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Maximum Scenario EPC [a] (mg/kg)		Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Maximum Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Maximum Scenario HQ [f]	
			Mammal	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics									
Cadmium	38.5	m	1.60E+00	5.11E-01	0.095	7.7	0.77	0.01	0.1
Lead	27.53		4.67E+00	1.50E+00	0.19	47	4.7	0.004	0.04
Silver	59.8	m	1.28E-03	7.65E-02	0.068	6	0.6	0.01	0.1

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) for the maximum scenario were set at the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of mammalian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-19
Refined Scenario Food Chain Modeling for the Desert Kit Fox
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Refined Scenario EPC [a] (mg/kg)	Soil Bioconcentration Factors [b]			Estimated Dietary Tissue Concentrations [c] (mg/kg)			Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
		Invertebrate	Vegetation	Mammal	Invertebrate	Vegetation	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics												
Cadmium	8.13	4.38E+01	1.95E+00	7.65E-01	7.32E+00	2.34E-01	2.45E-01	0.000015	7.7	0.77	0.000002	0.00002
Lead	19.2	1.23E+00	1.39E+00	3.99E+00	2.05E-01	1.67E-01	1.28E+00	0.000052	47	4.7	0.000001	0.00001
Silver	28.6	3.42E-01	1.68E-03	1.28E-03	9.77E+00	4.80E-02	3.66E-02	0.000015	6	0.6	0.000003	0.00003

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) were set at the lower of the arithmetic average (non detects were set at 1/2 the sample quantification limit) and the maximum detected concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of mammalian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-20
Maximum Scenario Food Chain Modeling for the Mourning Dove
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Maximum Scenario EPC [a] (mg/kg)		Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Maximum Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Maximum Scenario HQ [f]	
			Vegetation	Vegetation	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics									
Cadmium	38.5	m	4.56E+00	5.48E-01	0.56	14.7	1.47	0.04	0.4
Lead	46.2	m	2.28E+00	2.73E-01	0.39	16.3	1.63	0.02	0.2
Silver	59.8	m	1.68E-03	1.00E-01	0.32	2.02	0.202	0.2	2

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) for the maximum scenario were set at the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-21
Refined Scenario Food Chain Modeling for the Mourning Dove
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Refined Scenario EPC [a] (mg/kg)	Soil Bioconcentration Factors [b]		Estimated Dietary Tissue Concentrations [c] (mg/kg)		Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
		Invertebrate	Vegetation	Invertebrate	Vegetation	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics										
Cadmium	11.7	5.85E+01	2.38E+00	9.77E+00	2.86E-01	0.00053	14.7	1.47	0.00004	0.0004
Lead	32.9	1.90E+00	1.88E+00	3.16E-01	2.26E-01	0.00047	16.3	1.63	0.00003	0.0003
Silver	32.2	3.42E-01	1.68E-03	1.10E+01	5.41E-02	0.00043	2.02	0.202	0.0002	0.002

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) were set at the lower of the arithmetic average (non detects were set at 1/2 the sample quantification limit) and the maximum detected concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of avian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-22
Maximum Scenario Food Chain Modeling for the Cactus Wren
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Maximum Scenario EPC [a] (mg/kg)		Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Maximum Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Maximum Scenario HQ [f]	
			Invertebrate	Invertebrate	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics									
Cadmium	38.5	m	1.51E+02	2.52E+01	28	14.7	1.47	2	19
Lead	46.2	m	2.49E+00	4.16E-01	1.2	16.3	1.63	0.07	0.7
Silver	59.8	m	3.42E-01	2.04E+01	23	2.02	0.202	10	114

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) for the maximum scenario were set at the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-23
Refined Scenario Food Chain Modeling for the Cactus Wren
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Refined Scenario EPC [a] (mg/kg)	Soil Bioconcentration Factors [b]		Estimated Dietary Tissue Concentrations [c] (mg/kg)		Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
		Invertebrate	Vegetation	Invertebrate	Vegetation	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics										
Cadmium	11.7	5.85E+01	2.38E+00	9.77E+00	2.86E-01	1.9	14.7	1.47	0.1	1
Lead	32.9	1.90E+00	1.88E+00	3.16E-01	2.26E-01	0.19	16.3	1.63	0.01	0.1
Silver	32.2	3.42E-01	1.68E-03	1.10E+01	5.41E-02	2.2	2.02	0.202	1	11

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) were set at the lower of the arithmetic average (non detects were set at 1/2 the sample quantification limit) and the maximum detected concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of avian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-24
Maximum Scenario Food Chain Modeling for the Red-Tailed Hawk
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Maximum Scenario EPC [a] (mg/kg)		Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Maximum Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Maximum Scenario HQ [f]	
			Mammal	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics									
Cadmium	38.5	m	1.60E+00	5.11E-01	0.17	14.7	1.47	0.01	0.1
Lead	46.2	m	5.88E+00	1.88E+00	0.52	16.3	1.63	0.03	0.3
Silver	59.8	m	1.28E-03	7.65E-02	0.085	2.02	0.202	0.04	0.4

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) for the maximum scenario were set at the upper confidence level on the mean (UCL) or the maximum concentration where the UCL was incalculable. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of avian toxicity reference values.
[f] Maximum hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-25
Refined Scenario Food Chain Modeling for the Red-Tailed Hawk
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

Constituent	Refined Scenario EPC [a] (mg/kg)	Soil Bioconcentration Factors [b]	Estimated Dietary Tissue Concentrations [c] (mg/kg)	Refined Estimated Dietary Ingestion [d]	Toxicity Reference Values [e] mg/kg-BW-day		Refined Scenario HQ [f]	
		Mammal	Mammal	mg/kg-BW-day	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics								
Cadmium	11.7	9.09E-01	2.91E-01	0.000034	14.7	1.47	0.000002	0.00002
Lead	32.9	5.06E+00	1.62E+00	0.00018	16.3	1.63	0.00001	0.0001
Silver	32.2	1.28E-03	4.12E-02	0.000019	2.02	0.202	0.000009	0.00009

Notes:
HQ = Hazard Quotient.
LOAEL = Lowest observed adverse effect level.
mg/kg = Milligrams per kilogram.
mg/kg-BW-day = Milligrams per kilogram of body weight each day.
NOAEL = No observed adverse effect level.

[a] The exposure point concentrations (EPCs) were set at the lower of the arithmetic average (non detects were set at 1/2 the sample quantification limit) and the maximum detected concentration. EPCs marked with "m" are the maximum concentration.
[b] See Table ERA-5 for sources of soil bioaccumulation factors.
[c] Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor (in wet weight) or Estimated tissue concentration = concentration in exposure medium x bioaccumulation factor x tissue percent dry weight (i.e., 12% for plants, 16.7% for invertebrates, and 32% for mammals).
[d] See Table ERA-8 for equations used to estimate dietary ingestion and Table ERA-3 for receptor exposure assumptions.
[e] See Table ERA-7 for sources of avian toxicity reference values.
[f] Refined hazard quotient (HQ) = (estimated dietary ingestion)/(toxicity reference value). HQs are rounded to the nearest whole number.

Table ERA-26
Summary of Refined Ecological Risk Characterization Results - Terrestrial Habitat
Soil 0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

	Soil				BERA Level Assessment			Results of Refined Food Chain Models - Mammalian Species [c]						Results of Refined Food Chain Models - Avian Species [c]					
	Frequency of Detection			EPC	Hazard Quotient	Ecological Screening Level [b]		Merriam's Kangaroo Rat		Desert Shrew		Desert Kit Fox		Morning Dove		Cactus Wren		Red-Tailed Hawk	
Constituent	# detects / n samples			(mg/kg)	[a]	Source	Basis	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL
Inorganics																			
Cadmium	1	-	5	11.7	107	EcoSSL	mam	0.04	0.4	**2**	**16**	0.000002	0.00002	0.00004	0.0004	0.1	1	0.000002	0.00002
Lead	5	-	5	32.9	4	EcoSSL	avi	0.005	0.05	0.01	0.1	0.000001	0.00001	0.00003	0.0003	0.01	0.1	0.00001	0.0001
Silver	1	-	5	32.2	14	EcoSSL	avi	0.03	0.3	**2**	**22**	0.000003	0.00003	0.0002	0.002	1	**11**	0.000009	0.00009

Notes:

BERA = Baseline Ecological Risk Assessment.

EPC = The exposure point concentrations (EPCs) were set at the arithmetic average (non detects were set at 1/2 the sample quantification limit).
EPCs marked with "m" are the maximum concentration.

LOAEL = Lowest observed adverse effect level.

mg/kg = Milligrams per kilogram.

NOAEL = No observed adverse effect level.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to the nearest whole number.

[b] See Table ERA-1 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
R4: Region 4 Ecological Screening Values (USEPA 2001d; R4).
EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005; EcoSSL).
Where readily available (i.e., EcoSSLs), the basis of the ecological screening level is presented.

[c] Food chain modeling was conducted for bioaccumulative COPECs.

Table ERA-27
Summary of Refined Ecological Risk Characterization Results - Terrestrial Habitat
Soil 0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range

	Soil				BERA Level Assessment			Results of Refined Food Chain Models [c]	
	Frequency of Detection			EPC	Hazard Quotient	Ecological Screening Level [b]		Desert Kit Fox	
Constituent	# detects / n samples			(mg/kg)	[a]	Source	Basis	LOAEL	NOAEL
Inorganics									
Cadmium	1	-	11	8.13	107	EcoSSL	mam	0.000002	0.00002
Lead	11	-	11	19.2	3	EcoSSL	avi	0.000001	0.00001
Silver	1	-	11	28.6	14	EcoSSL	avi	0.000003	0.00003

Notes:

BERA = Baseline Ecological Risk Assessment.

EPC = The exposure point concentrations (EPCs) were set at the arithmetic average (non detects were set at 1/2 the sample quantification limit).
EPCs marked with "m" are the maximum concentration.

LOAEL = Lowest observed adverse effect level.

mg/kg = Milligrams per kilogram.

NOAEL = No observed adverse effect level.

[a] Hazard quotients (HQs) greater than one are presented in bold font. HQs are rounded to the nearest whole number.

[b] See Table ERA-1 for sources of ecological screening levels (ESLs); ESLs marked with 's' are based on a surrogate.
R4: Region 4 Ecological Screening Values (USEPA 2001d; R4).
EcoSSL: USEPA Ecological Soil Screening Levels (USEPA 2005; EcoSSL).
Where readily available (i.e., EcoSSLs), the basis of the ecological screening level is presented.

[c] Food chain modeling was conducted for bioaccumulative COPECs.

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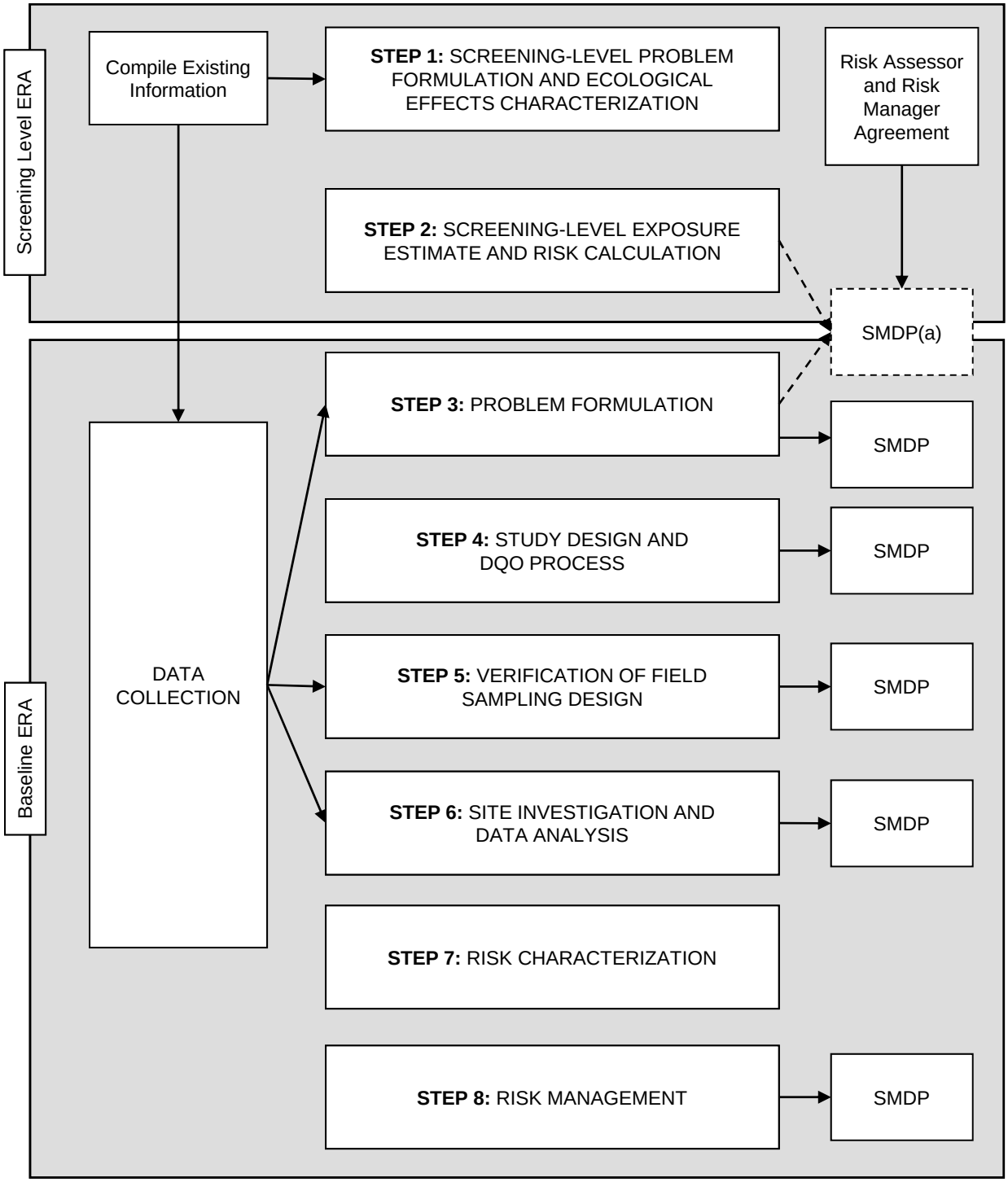
Figures

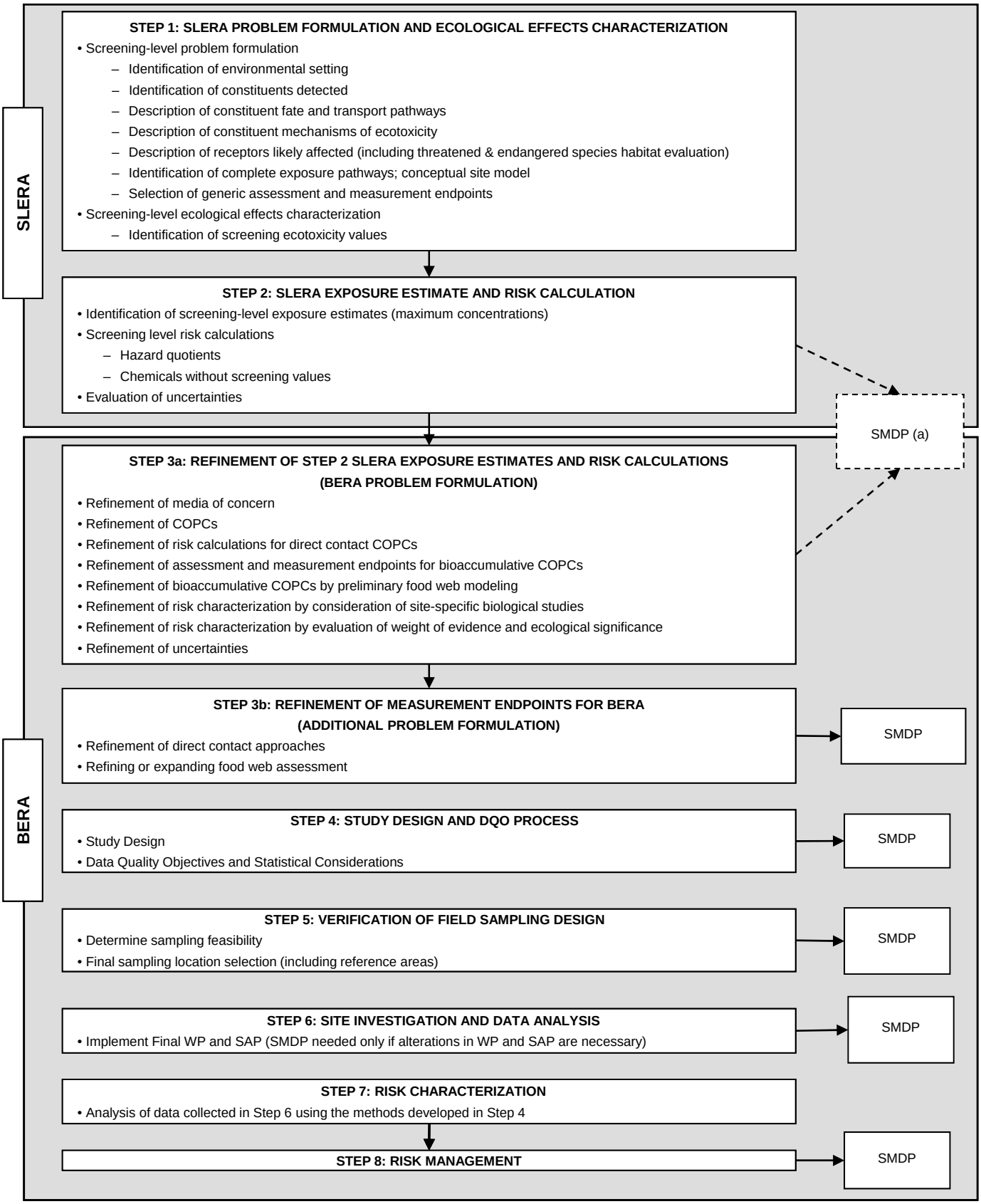
Figure 2-1
Eight-Step Ecological Risk Assessment Process



Notes:

(a) SMDP occurs EITHER after Step 2 or after Step 3a
ERA Ecological Risk Assessment
SMDP Scientific Management Decision Point
Source Adapted from USEPA, 2000a.

Figure 2-2
Expanded Eight-Step Ecological Risk Assessment Process



Notes:

(a)	SMDP occurs EITHER after Step 2 or after Step 3a	(Section)	Section number in parentheses corresponds with text of the Work Plan
COPCs	Constituents of Potential Concern	SMDP	Scientific Management Decision Point
DQO	Data Quality Objectives	SW/SD	Surface water and sediment
GW	Groundwater	WP	Work Plan
SAP	Sampling and Analysis Plan	BERA	Baseline ERA
Source: Adapted from USEPA, 1997 and 2000		SLERA	Screening-level ERA

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Attachments

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Attachment A

Site Photographs

Attachment A
Risk Assessment
SWMU19
White Sands Missile Range
New Mexico

Photograph 1
Oil/Water separator (OWS) with wash pad and drain in background. Main Post, facing northwest.

Photograph 2
Wash pad with OWS in background.
Main Post, facing east.

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Attachment B

Risk Assessment Datasets for SWMU 19-20

Attachment B-1
Soil Risk Assessment Dataset
0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID:		SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01
Sample Depth(ft):		0	0	2	0	2
Date Collected:		12/04/93	12/04/93	12/04/93	12/04/93	12/04/93
Field Notes:	Units	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19
Metals						
Arsenic	mg/kg	<2.74	<2.74	<2.74	<2.74	<2.74
Barium	mg/kg	<25.2	<25.3	193	<25.2	<25.5
Cadmium	mg/kg	<5.04	<5.06	38.5	<5.04	<5.10
Chromium	mg/kg	<23.6	<23.6	<23.6	<23.6	<23.6
Lead	mg/kg	23.7	44.7	22.2	46.2	27.8
Mercury	mg/kg	0.0706	0.644	0.355	0.0706	0.0612
Selenium	mg/kg	<2.77	<2.77	<2.77	<2.77	<2.77
Silver	mg/kg	<25.2	<25.3	59.8	<25.2	<25.5
Parameters						
TPH	mg/kg	79.6	234	136	99.8	68.3
SVOCs						
1,2,4-Trichlorobenzene	mg/kg	<0.333	<0.334	<0.335	NA	NA
1,2-Diphenylhydrazine	mg/kg	<1.61	<1.62	<1.62	NA	NA
1,3-Dichlorobenzene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,4-Dichlorobenzene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1-Chloronaphthalene	mg/kg	<0.333	<0.334	<0.335	NA	NA
2,4,5-Trichlorophenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
2,4,6-Trichlorophenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
2,4-Dichlorophenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
2,4-Dimethylphenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
2,4-Dinitrophenol	mg/kg	<1.61	<1.62	<1.62	NA	NA
2,4-Dinitrotoluene	mg/kg	<0.333	<0.334	<0.335	NA	NA
2,6-Dinitrotoluene	mg/kg	<0.333	<0.334	<0.335	NA	NA
2-Chloronaphthalene	mg/kg	<0.333	<0.334	<0.335	NA	NA
2-Chlorophenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
2-Methylnaphthalene	mg/kg	<0.333	<0.334	<0.335	NA	NA
2-Methylphenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
2-Nitroaniline	mg/kg	<1.61	<1.62	<1.62	NA	NA
2-Nitrophenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
3,3'-Dichlorobenzidine	mg/kg	<0.333	<0.334	<0.335	NA	NA
3-Nitroaniline	mg/kg	<1.61	<1.62	<1.62	NA	NA
4,6-Dinitro-2-methylphenol	mg/kg	<1.61	<1.62	<1.62	NA	NA
4-Bromophenyl-phenylether	mg/kg	<0.333	<0.334	<0.335	NA	NA

Attachment B-1
Soil Risk Assessment Dataset
0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID: Sample Depth(ft): Date Collected: Field Notes:	Units	SWMU 19 SB-01 0 12/04/93 SWMU-19	SWMU 19 SB-02 0 12/04/93 SWMU-19	SWMU 19 SB-02 2 12/04/93 SWMU-19	SWMU 20 SB-01 0 12/04/93 SWMU-19	SWMU 20 SB-01 2 12/04/93 SWMU-19
4-Chloro-3-Methylphenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
4-Chloroaniline	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
4-Chlorophenyl-phenylether	mg/kg	<0.333	<0.334	<0.335	NA	NA
4-Methyl-2-pentanone	mg/kg	<0.0202	<0.0202	<0.0203	NA	NA
4-Methylphenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
4-Nitroaniline	mg/kg	<1.61	<1.62	<1.62	NA	NA
4-Nitrophenol	mg/kg	<1.61	<1.62	<1.62	NA	NA
Acenaphthene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Acenaphthylene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Anthracene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Benzidine	mg/kg	<1.61	<1.62	<1.62	NA	NA
Benzo(a)anthracene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Benzo(a)pyrene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Benzo(b)fluoranthene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Benzo(g,h,i)perylene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Benzo(k)fluoranthene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Benzoic Acid	mg/kg	<1.61	<1.62	<1.62	NA	NA
Benzyl Alcohol	mg/kg	<0.333	<0.334	<0.335	NA	NA
bis(2-Chloroethoxy)methane	mg/kg	<0.333	<0.334	<0.335	NA	NA
bis(2-Chloroethyl)ether	mg/kg	<0.333	<0.334	<0.335	NA	NA
bis(2-Ethylhexyl)phthalate	mg/kg	<0.333	<0.334	<0.335	NA	NA
Butylbenzylphthalate	mg/kg	<0.333	<0.334	<0.335	NA	NA
Chrysene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Dibenzo(a,h)anthracene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Dibenzofuran	mg/kg	<0.333	<0.334	<0.335	NA	NA
Diethylphthalate	mg/kg	<0.333	<0.334	<0.335	NA	NA
Dimethylphthalate	mg/kg	<0.333	<0.334	<0.335	NA	NA
Di-n-Butylphthalate	mg/kg	<0.333	<0.334	<0.335	NA	NA
Di-n-Octylphthalate	mg/kg	<0.333	<0.334	<0.335	NA	NA
Diphenylamine	mg/kg	<1.01	<1.01	<1.01	NA	NA
Fluoranthene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Fluorene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Hexachlorobenzene	mg/kg	<0.333	<0.334	<0.335	NA	NA

Attachment B-1
Soil Risk Assessment Dataset
0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID: Sample Depth(ft): Date Collected: Field Notes:	Units	SWMU 19 SB-01 0 12/04/93 SWMU-19	SWMU 19 SB-02 0 12/04/93 SWMU-19	SWMU 19 SB-02 2 12/04/93 SWMU-19	SWMU 20 SB-01 0 12/04/93 SWMU-19	SWMU 20 SB-01 2 12/04/93 SWMU-19
Hexachlorobutadiene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Hexachlorocyclopentadiene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Hexachloroethane	mg/kg	<0.333	<0.334	<0.335	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Isophorone	mg/kg	<0.333	<0.334	<0.335	NA	NA
Nitrobenzene	mg/kg	<0.333	<0.334	<0.335	NA	NA
N-Nitroso-di-n-propylamine	mg/kg	<0.333	<0.334	<0.335	NA	NA
N-Nitrosodiphenylamine	mg/kg	<0.333	<0.334	<0.335	NA	NA
Pentachlorophenol	mg/kg	<1.61	<1.62	<1.62	NA	NA
Phenanthrene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Phenol	mg/kg	<0.333	<0.334	<0.335	NA	NA
Pyrene	mg/kg	<0.333	<0.334	<0.335	NA	NA
VOCs						
1,1,1-Trichloroethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,1,2,2-Tetrachloroethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,1,2-Trichloroethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,1-Dichloroethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,1-Dichloroethene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,2,3-Trichloropropane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,2-Dichlorobenzene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,2-Dichloroethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,2-Dichloropropane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
1,4 Dichloro-2-butene	mg/kg	<0.0101	<0.0101	<0.0101	NA	NA
2-Butanone	mg/kg	<0.0202	<0.0202	<0.0203	NA	NA
2-Chloroethylvinylether	mg/kg	<0.0101	<0.0101	<0.0101	NA	NA
2-Hexanone	mg/kg	<0.0202	<0.0202	<0.0203	NA	NA
Acetone	mg/kg	<0.0202	<0.0202	<0.0203	NA	NA
Acrolein	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Acrylonitrile	mg/kg	<0.0101	<0.0101	<0.0101	NA	NA
Benzene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
bis(2-Chloroisopropyl)ether	mg/kg	<0.333	<0.334	<0.335	NA	NA
Bromodichloromethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA

Attachment B-1
Soil Risk Assessment Dataset
0-2 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID: Sample Depth(ft): Date Collected: Field Notes:	Units	SWMU 19 SB-01 0 12/04/93 SWMU-19	SWMU 19 SB-02 0 12/04/93 SWMU-19	SWMU 19 SB-02 2 12/04/93 SWMU-19	SWMU 20 SB-01 0 12/04/93 SWMU-19	SWMU 20 SB-01 2 12/04/93 SWMU-19
Bromomethane	mg/kg	<0.0101	<0.0101	<0.0101	NA	NA
Carbon Disulfide	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Carbon Tetrachloride	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Chlorobenzene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Chloroethane	mg/kg	<0.0101	<0.0101	<0.0101	NA	NA
Chloroform	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Chloromethane	mg/kg	<0.0101	<0.0101	<0.0101	NA	NA
cis-1,2-Dichloroethene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
cis-1,3-Dichloropropene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Dibromochloromethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Dibromomethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Ethyl Methacrylate	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Ethylbenzene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Iodomethane	mg/kg	<0.0101	<0.0101	<0.0101	NA	NA
Methylene Chloride	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Naphthalene	mg/kg	<0.333	<0.334	<0.335	NA	NA
Styrene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Tetrachloroethene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Toluene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
trans-1,2-Dichloroethene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
trans-1,3-Dichloropropene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Trichloroethene	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Trichlorofluoromethane	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA
Vinyl Acetate	mg/kg	<0.0202	<0.0202	<0.0203	NA	NA
Vinyl Chloride	mg/kg	<0.0101	<0.0101	<0.0101	NA	NA
Xylenes (total)	mg/kg	<0.00504	<0.00506	<0.00507	NA	NA

Attachment B-2
Soil Risk Assessment Dataset
0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID:		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
Sample Depth(ft):		0	4	8.5	0	2	4	8	0	2	4	8.5
Date Collected:		12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93
Field Notes:	Units	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19
Metals												
Arsenic	mg/kg	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74
Barium	mg/kg	<25.2	27.2	<26.4	<25.3	193	26.5	<25.2	<25.2	<25.5	<25.4	<25.7
Cadmium	mg/kg	<5.04	<5.04	<5.27	<5.06	38.5	<5.10	<5.03	<5.04	<5.10	<5.08	<5.15
Chromium	mg/kg	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6
Lead	mg/kg	23.7	6.19	8.49	44.7	22.2	10.8	4.79	46.2	27.8	12.1	4.46
Mercury	mg/kg	0.0706	0.0403	0.0211	0.644	0.355	0.0826	<0.0201	0.0706	0.0612	0.0406	<0.0206
Selenium	mg/kg	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77
Silver	mg/kg	<25.2	<25.2	<26.4	<25.3	59.8	<25.5	<25.2	<25.2	<25.5	<25.4	<25.7
Parameters												
TPH	mg/kg	79.6	<30.2	<31.6	234	136	39.8	<30.2	99.8	68.3	65	<30.9
SVOCs												
1,2,4-Trichlorobenzene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
1,2-Diphenylhydrazine	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
1,3-Dichlorobenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,4-Dichlorobenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1-Chloronaphthalene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4,5-Trichlorophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4,6-Trichlorophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4-Dichlorophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4-Dimethylphenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4-Dinitrophenol	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
2,4-Dinitrotoluene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,6-Dinitrotoluene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Chloronaphthalene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Chlorophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Methylnaphthalene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Methylphenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Nitroaniline	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
2-Nitrophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
3,3'-Dichlorobenzidine	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
3-Nitroaniline	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
4,6-Dinitro-2-methylphenol	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
4-Bromophenyl-phenylether	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
4-Chloro-3-Methylphenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
4-Chloroaniline	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
4-Chlorophenyl-phenylether	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
4-Methyl-2-pentanone	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
4-Methylphenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
4-Nitroaniline	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
4-Nitrophenol	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
Acenaphthene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Acenaphthylene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Anthracene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzidine	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
Benzo(a)anthracene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzo(a)pyrene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzo(b)fluoranthene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340

Attachment B-2
Soil Risk Assessment Dataset
0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID:		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
Sample Depth(ft):		0	4	8.5	0	2	4	8	0	2	4	8.5
Date Collected:		12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93
Field Notes:	Units	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19
Benzo(g,h,i)perylene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzo(k)fluoranthene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzoic Acid	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
Benzyl Alcohol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
bis(2-Chloroethoxy)methane	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
bis(2-Chloroethyl)ether	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
bis(2-Ethylhexyl)phthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Butylbenzylphthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Chrysene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Dibenzo(a,h)anthracene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Dibenzofuran	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Diethylphthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Dimethylphthalate	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Di-n-Butylphthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Di-n-Octylphthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Diphenylamine	mg/kg	<1.01	<1.01 [<1.00]	<1.05	<1.01	<1.01	<1.02	<1.01	NA	NA	<1.02	<1.03
Fluoranthene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Fluorene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Hexachlorobenzene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Hexachlorobutadiene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Hexachlorocyclopentadiene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Hexachloroethane	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Indeno(1,2,3-cd)pyrene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Isophorone	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Nitrobenzene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
N-Nitroso-di-n-propylamine	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
N-Nitrosodiphenylamine	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Pentachlorophenol	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
Phenanthrene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Phenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Pyrene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
VOCs												
1,1,1-Trichloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,1,2,2-Tetrachloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,1,2-Trichloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,1-Dichloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,1-Dichloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,2,3-Trichloropropane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,2-Dichlorobenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,2-Dichloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,2-Dichloropropane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,4 Dichloro-2-butene	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
2-Butanone	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
2-Chloroethylvinylether	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
2-Hexanone	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
Acetone	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
Acrolein	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515

Attachment B-2
Soil Risk Assessment Dataset
0-10 foot Depth Interval
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID:		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
Sample Depth(ft):		0	4	8.5	0	2	4	8	0	2	4	8.5
Date Collected:		12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93
Field Notes:	Units	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19
Acrylonitrile	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Benzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
bis(2-Chloroisopropyl)ether	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Bromodichloromethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Bromomethane	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Carbon Disulfide	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Carbon Tetrachloride	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Chlorobenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Chloroethane	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Chloroform	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Chloromethane	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
cis-1,2-Dichloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
cis-1,3-Dichloropropene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Dibromochloromethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Dibromomethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Ethyl Methacrylate	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Ethylbenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Iodomethane	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Methylene Chloride	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Naphthalene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Styrene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Tetrachloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Toluene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
trans-1,2-Dichloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
trans-1,3-Dichloropropene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Trichloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Trichlorofluoromethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Vinyl Acetate	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
Vinyl Chloride	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Xylenes (total)	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515

Attachment B-3
Total Soil Risk Assessment Dataset
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID:		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
Sample Depth(ft):		0	4	8.5	0	2	4	8	0	2	4	8.5
Date Collected:		12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93
Field Notes:	Units	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19
Metals												
Arsenic	mg/kg	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74	<2.74
Barium	mg/kg	<25.2	27.2	<26.4	<25.3	193	26.5	<25.2	<25.2	<25.5	<25.4	<25.7
Cadmium	mg/kg	<5.04	<5.04	<5.27	<5.06	38.5	<5.10	<5.03	<5.04	<5.10	<5.08	<5.15
Chromium	mg/kg	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6	<23.6
Lead	mg/kg	23.7	6.19	8.49	44.7	22.2	10.8	4.79	46.2	27.8	12.1	4.46
Mercury	mg/kg	0.0706	0.0403	0.0211	0.644	0.355	0.0826	<0.0201	0.0706	0.0612	0.0406	<0.0206
Selenium	mg/kg	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77	<2.77
Silver	mg/kg	<25.2	<25.2	<26.4	<25.3	59.8	<25.5	<25.2	<25.2	<25.5	<25.4	<25.7
Parameters												
TPH	mg/kg	79.6	<30.2	<31.6	234	136	39.8	<30.2	99.8	68.3	65	<30.9
SVOCs												
1,2,4-Trichlorobenzene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
1,2-Diphenylhydrazine	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
1,3-Dichlorobenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,4-Dichlorobenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1-Chloronaphthalene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4,5-Trichlorophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4,6-Trichlorophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4-Dichlorophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4-Dimethylphenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,4-Dinitrophenol	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
2,4-Dinitrotoluene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2,6-Dinitrotoluene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Chloronaphthalene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Chlorophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Methylnaphthalene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Methylphenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
2-Nitroaniline	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
2-Nitrophenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
3,3'-Dichlorobenzidine	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
3-Nitroaniline	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
4,6-Dinitro-2-methylphenol	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
4-Bromophenyl-phenylether	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
4-Chloro-3-Methylphenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
4-Chloroaniline	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
4-Chlorophenyl-phenylether	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
4-Methyl-2-pentanone	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
4-Methylphenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
4-Nitroaniline	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
4-Nitrophenol	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
Acenaphthene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Acenaphthylene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Anthracene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzidine	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
Benzo(a)anthracene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzo(a)pyrene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzo(b)fluoranthene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340

Attachment B-3
Total Soil Risk Assessment Dataset
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID:		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
Sample Depth(ft):		0	4	8.5	0	2	4	8	0	2	4	8.5
Date Collected:		12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93
Field Notes:	Units	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19
Benzo(g,h,i)perylene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzo(k)fluoranthene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Benzoic Acid	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
Benzyl Alcohol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
bis(2-Chloroethoxy)methane	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
bis(2-Chloroethyl)ether	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
bis(2-Ethylhexyl)phthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Butylbenzylphthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Chrysene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Dibenzo(a,h)anthracene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Dibenzofuran	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Diethylphthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Dimethylphthalate	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Di-n-Butylphthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Di-n-Octylphthalate	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Diphenylamine	mg/kg	<1.01	<1.01 [<1.00]	<1.05	<1.01	<1.01	<1.02	<1.01	NA	NA	<1.02	<1.03
Fluoranthene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Fluorene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Hexachlorobenzene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Hexachlorobutadiene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Hexachlorocyclopentadiene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Hexachloroethane	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Indeno(1,2,3-cd)pyrene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Isophorone	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Nitrobenzene	mg/kg	<0.333	<1.61 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
N-Nitroso-di-n-propylamine	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
N-Nitrosodiphenylamine	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Pentachlorophenol	mg/kg	<1.61	<1.61 [<1.60]	<1.69	<1.62	<1.62	<1.63	<1.61	NA	NA	<1.63	<1.65
Phenanthrene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Phenol	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Pyrene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
VOCs												
1,1,1-Trichloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,1,2,2-Tetrachloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,1,2-Trichloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,1-Dichloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,1-Dichloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,2,3-Trichloropropane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,2-Dichlorobenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,2-Dichloroethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,2-Dichloropropane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
1,4 Dichloro-2-butene	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
2-Butanone	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
2-Chloroethylvinylether	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
2-Hexanone	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
Acetone	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
Acrolein	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515

Attachment B-3
Total Soil Risk Assessment Dataset
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Location ID:		SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-01	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 19 SB-02	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01	SWMU 20 SB-01
Sample Depth(ft):		0	4	8.5	0	2	4	8	0	2	4	8.5
Date Collected:		12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93
Field Notes:	Units	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19	SWMU-19
Acrylonitrile	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Benzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
bis(2-Chloroisopropyl)ether	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Bromodichloromethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Bromomethane	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Carbon Disulfide	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Carbon Tetrachloride	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Chlorobenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Chloroethane	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Chloroform	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Chloromethane	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
cis-1,2-Dichloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
cis-1,3-Dichloropropene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Dibromochloromethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Dibromomethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Ethyl Methacrylate	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Ethylbenzene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Iodomethane	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Methylene Chloride	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Naphthalene	mg/kg	<0.333	<0.332 [<0.330]	<0.348	<0.334	<0.335	<0.336	<0.332	NA	NA	<0.335	<0.340
Styrene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Tetrachloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Toluene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
trans-1,2-Dichloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
trans-1,3-Dichloropropene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Trichloroethene	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Trichlorofluoromethane	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515
Vinyl Acetate	mg/kg	<0.0202	<0.0201 [<0.0200]	<0.0211	<0.0202	<0.0203	<0.0204	<0.0201	NA	NA	<0.0203	<0.0206
Vinyl Chloride	mg/kg	<0.0101	<0.0101 [<0.0100]	<0.0105	<0.0101	<0.0101	<0.0102	<0.0101	NA	NA	<0.0102	<0.0103
Xylenes (total)	mg/kg	<0.00504	<0.00504 [<0.00500]	<0.00527	<0.00506	<0.00507	<0.00510	<0.00503	NA	NA	<0.00508	<0.00515

Notes for Attachments B.1-3
Risk Assessment Datasets
Solid Waste Managment Unit 19
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

Notes:

<	=	Result is non-detect
[ ]	=	Indicates field duplicate result
J	=	Laboratory qualifier, indicates estimated result
ft	=	Foot
mg/kg	=	Milligrams per kilogram
NA	=	Not available
SVOC	=	Semi-volatile Organic Compound
TPH	=	Total petroleum hydrocarbon.
VOC	=	Volatile Organic Compound

ARCADIS

Attachment C

ProUCL Output for SWMU 19-20

Attachment C - ProUCL Output for SWMU 19
Soil Risk Assessment Dataset
0-10 foot Depth Interval
Main Post, U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Result (lead)

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	11

Raw Statistics

Minimum	4.46
Maximum	46.2
Mean	19.22
Median	12.1
SD	15.21
Coefficient of Variation	0.791
Skewness	0.914

Log-transformed Statistics

Minimum of Log Data	1.495
Maximum of Log Data	3.833
Mean of log Data	2.647
SD of log Data	0.848

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.855
Shapiro Wilk Critical Value	0.85

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	27.53

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	28.11
95% Modified-t UCL	27.74

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.929
Shapiro Wilk Critical Value	0.85

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	41.92
95% Chebyshev (MVUE) UCL	42.11
97.5% Chebyshev (MVUE) UCL	51.93
99% Chebyshev (MVUE) UCL	71.22

Gamma Distribution Test

k star (bias corrected)	1.346
Theta Star	14.28
nu star	29.62
Approximate Chi Square Value (.05)	18.19
Adjusted Level of Significance	0.0278
Adjusted Chi Square Value	16.75
Anderson-Darling Test Statistic	0.369
Anderson-Darling 5% Critical Value	0.74
Kolmogorov-Smirnov Test Statistic	0.167
Kolmogorov-Smirnov 5% Critical Value	0.259

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	31.29
95% Adjusted Gamma UCL	33.99

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	26.76
95% Jackknife UCL	27.53
95% Standard Bootstrap UCL	26.49
95% Bootstrap-t UCL	30.42
95% Hall's Bootstrap UCL	30.16
95% Percentile Bootstrap UCL	27.02
95% BCA Bootstrap UCL	27.52
95% Chebyshev(Mean, Sd) UCL	39.21
97.5% Chebyshev(Mean, Sd) UCL	47.85
99% Chebyshev(Mean, Sd) UCL	64.84

Potential UCL to Use

Use 95% Student's-t UCL 27.53

Result (mercury)

General Statistics

Number of Valid Data	11	Number of Detected Data	9
Number of Distinct Detected Data	8	Number of Non-Detect Data	2
		Percent Non-Detects	18.18%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0211	Minimum Detected	-3.858
Maximum Detected	0.644	Maximum Detected	-0.44
Mean of Detected	0.154	Mean of Detected	-2.482
SD of Detected	0.21	SD of Detected	1.082
Minimum Non-Detect	0.0201	Minimum Non-Detect	-3.907
Maximum Non-Detect	0.0206	Maximum Non-Detect	-3.882

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	2
Number treated as Detected	9
Single DL Non-Detect Percentage	18.18%

Warning: There are only 9 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.65
5% Shapiro Wilk Critical Value	0.829

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.881
5% Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.128
SD	0.196
95% DL/2 (t) UCL	0.235
Maximum Likelihood Estimate(MLE) Method	
Mean	0.104
SD	0.214
95% MLE (t) UCL	0.221
95% MLE (Tiku) UCL	0.218

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.865
SD	1.289
95% H-Stat (DL/2) UCL	0.246
Log ROS Method	
Mean in Log Scale	-2.938
SD in Log Scale	1.403
Mean in Original Scale	0.127
SD in Original Scale	0.197
95% Percentile Bootstrap UCL	0.219
95% BCA Bootstrap UCL	0.264

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.707
Theta Star	0.218
nu star	12.73
A-D Test Statistic	0.948
5% A-D Critical Value	0.745
K-S Test Statistic	0.745
5% K-S Critical Value	0.287

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.644
Mean	0.126
Median	0.0612
SD	0.198
k star	0.204
Theta star	0.616
Nu star	4.498
AppChi2	0.928
95% Gamma Approximate UCL	0.611
95% Adjusted Gamma UCL	0.814

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.13
SD	0.186
SE of Mean	0.0595
95% KM (t) UCL	0.238
95% KM (z) UCL	0.228
95% KM (jackknife) UCL	0.234
95% KM (bootstrap t) UCL	0.901
95% KM (BCA) UCL	0.254
95% KM (Percentile Bootstrap) UCL	0.236
95% KM (Chebyshev) UCL	0.389
97.5% KM (Chebyshev) UCL	0.501
99% KM (Chebyshev) UCL	0.722

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.501

Result (tph)

General Statistics

Number of Valid Data	11	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	4
		Percent Non-Detects	36.36%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	39.8	Minimum Detected	3.684
Maximum Detected	234	Maximum Detected	5.455
Mean of Detected	103.2	Mean of Detected	4.49
SD of Detected	65.13	SD of Detected	0.571
Minimum Non-Detect	30.2	Minimum Non-Detect	3.408
Maximum Non-Detect	31.6	Maximum Non-Detect	3.453

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	4
Number treated as Detected	7
Single DL Non-Detect Percentage	36.36%

Warning: There are only 7 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.849	Shapiro Wilk Test Statistic	0.975
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	71.27	Mean	3.851
SD	67.15	SD	0.991
95% DL/2 (t) UCL	108	95% H-Stat (DL/2) UCL	118.4
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	55.77	Mean in Log Scale	3.942
SD	83.86	SD in Log Scale	0.887
95% MLE (t) UCL	101.6	Mean in Original Scale	72.96
95% MLE (Tiku) UCL	106.1	SD in Original Scale	65.66
		95% Percentile Bootstrap UCL	105.7
		95% BCA Bootstrap UCL	116.2

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	2.132	Data appear Normal at 5% Significance Level
Theta Star	48.4	
nu star	29.85	
A-D Test Statistic	0.29	
5% A-D Critical Value	0.711	
K-S Test Statistic	0.711	
5% K-S Critical Value	0.313	
Data appear Gamma Distributed at 5% Significance Level		

Assuming Gamma Distribution		Nonparametric Statistics	
Gamma ROS Statistics using Extrapolated Data		Kaplan-Meier (KM) Method	
Minimum	35.3	Mean	80.15
Maximum	234	SD	56.96
Mean	87.43	SE of Mean	18.55
Median	68.3	95% KM (t) UCL	113.8
SD	56	95% KM (z) UCL	110.7
k star	2.74	95% KM (jackknife) UCL	110.8
Theta star	31.91	95% KM (bootstrap t) UCL	144.2
Nu star	60.29	95% KM (BCA) UCL	128.8
AppChi2	43.43	95% KM (Percentile Bootstrap) UCL	115.7
95% Gamma Approximate UCL	121.4	95% KM (Chebyshev) UCL	161
95% Adjusted Gamma UCL	128.2	97.5% KM (Chebyshev) UCL	196
		99% KM (Chebyshev) UCL	264.7
		Potential UCLs to Use	
		95% KM (t) UCL	113.8
		95% KM (Percentile Bootstrap) UCL	115.7

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Result (lead)

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	11

Raw Statistics

Minimum	4.46
Maximum	46.2
Mean	19.22
Median	12.1
SD	15.21
Coefficient of Variation	0.791
Skewness	0.914

Log-transformed Statistics

Minimum of Log Data	1.495
Maximum of Log Data	3.833
Mean of log Data	2.647
SD of log Data	0.848

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.855
Shapiro Wilk Critical Value	0.85

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	27.53

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	28.11
95% Modified-t UCL	27.74

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.929
Shapiro Wilk Critical Value	0.85

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	41.92
95% Chebyshev (MVUE) UCL	42.11
97.5% Chebyshev (MVUE) UCL	51.93
99% Chebyshev (MVUE) UCL	71.22

Gamma Distribution Test

k star (bias corrected)	1.346
Theta Star	14.28
nu star	29.62
Approximate Chi Square Value (.05)	18.19
Adjusted Level of Significance	0.0278
Adjusted Chi Square Value	16.75
Anderson-Darling Test Statistic	0.369
Anderson-Darling 5% Critical Value	0.74
Kolmogorov-Smirnov Test Statistic	0.167
Kolmogorov-Smirnov 5% Critical Value	0.259

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	31.29
95% Adjusted Gamma UCL	33.99

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	26.76
95% Jackknife UCL	27.53
95% Standard Bootstrap UCL	26.49
95% Bootstrap-t UCL	30.42
95% Hall's Bootstrap UCL	30.16
95% Percentile Bootstrap UCL	27.02
95% BCA Bootstrap UCL	27.52
95% Chebyshev(Mean, Sd) UCL	39.21
97.5% Chebyshev(Mean, Sd) UCL	47.85
99% Chebyshev(Mean, Sd) UCL	64.84

Potential UCL to Use

Use 95% Student's-t UCL 27.53

Result (mercury)

General Statistics

Number of Valid Data	11	Number of Detected Data	9
Number of Distinct Detected Data	8	Number of Non-Detect Data	2
		Percent Non-Detects	18.18%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0211	Minimum Detected	-3.858
Maximum Detected	0.644	Maximum Detected	-0.44
Mean of Detected	0.154	Mean of Detected	-2.482
SD of Detected	0.21	SD of Detected	1.082
Minimum Non-Detect	0.0201	Minimum Non-Detect	-3.907
Maximum Non-Detect	0.0206	Maximum Non-Detect	-3.882

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	2
Number treated as Detected	9
Single DL Non-Detect Percentage	18.18%

Warning: There are only 9 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.65
5% Shapiro Wilk Critical Value	0.829

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.881
5% Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.128
SD	0.196
95% DL/2 (t) UCL	0.235
Maximum Likelihood Estimate(MLE) Method	
Mean	0.104
SD	0.214
95% MLE (t) UCL	0.221
95% MLE (Tiku) UCL	0.218

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.865
SD	1.289
95% H-Stat (DL/2) UCL	0.246
Log ROS Method	
Mean in Log Scale	-2.938
SD in Log Scale	1.403
Mean in Original Scale	0.127
SD in Original Scale	0.197
95% Percentile Bootstrap UCL	0.219
95% BCA Bootstrap UCL	0.264

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.707
Theta Star	0.218
nu star	12.73
A-D Test Statistic	0.948
5% A-D Critical Value	0.745
K-S Test Statistic	0.745
5% K-S Critical Value	0.287

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.644
Mean	0.126
Median	0.0612
SD	0.198
k star	0.204
Theta star	0.616
Nu star	4.498
AppChi2	0.928
95% Gamma Approximate UCL	0.611
95% Adjusted Gamma UCL	0.814

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.13
SD	0.186
SE of Mean	0.0595
95% KM (t) UCL	0.238
95% KM (z) UCL	0.228
95% KM (jackknife) UCL	0.234
95% KM (bootstrap t) UCL	0.901
95% KM (BCA) UCL	0.254
95% KM (Percentile Bootstrap) UCL	0.236
95% KM (Chebyshev) UCL	0.389
97.5% KM (Chebyshev) UCL	0.501
99% KM (Chebyshev) UCL	0.722

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.501

Result (tph)

General Statistics

Number of Valid Data	11	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	4
		Percent Non-Detects	36.36%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	39.8	Minimum Detected	3.684
Maximum Detected	234	Maximum Detected	5.455
Mean of Detected	103.2	Mean of Detected	4.49
SD of Detected	65.13	SD of Detected	0.571
Minimum Non-Detect	30.2	Minimum Non-Detect	3.408
Maximum Non-Detect	31.6	Maximum Non-Detect	3.453

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	4
Number treated as Detected	7
Single DL Non-Detect Percentage	36.36%

Warning: There are only 7 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.849	Shapiro Wilk Test Statistic	0.975
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	71.27	Mean	3.851
SD	67.15	SD	0.991
95% DL/2 (t) UCL	108	95% H-Stat (DL/2) UCL	118.4
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	55.77	Mean in Log Scale	3.942
SD	83.86	SD in Log Scale	0.887
95% MLE (t) UCL	101.6	Mean in Original Scale	72.96
95% MLE (Tiku) UCL	106.1	SD in Original Scale	65.66
		95% Percentile Bootstrap UCL	105.7
		95% BCA Bootstrap UCL	116.2

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.132	Data appear Normal at 5% Significance Level	
Theta Star	48.4		
nu star	29.85		
A-D Test Statistic	0.29	**Nonparametric Statistics**	
5% A-D Critical Value	0.711	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.711	Mean	80.15
5% K-S Critical Value	0.313	SD	56.96
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	18.55
		95% KM (t) UCL	113.8
Assuming Gamma Distribution		95% KM (z) UCL	110.7
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	110.8
Minimum	35.3	95% KM (bootstrap t) UCL	144.2
Maximum	234	95% KM (BCA) UCL	128.8
Mean	87.43	95% KM (Percentile Bootstrap) UCL	115.7
Median	68.3	95% KM (Chebyshev) UCL	161
SD	56	97.5% KM (Chebyshev) UCL	196
k star	2.74	99% KM (Chebyshev) UCL	264.7
Theta star	31.91		
Nu star	60.29	**Potential UCLs to Use**	
AppChi2	43.43	95% KM (t) UCL	113.8
95% Gamma Approximate UCL	121.4	95% KM (Percentile Bootstrap) UCL	115.7
95% Adjusted Gamma UCL	128.2		

Note: DL/2 is not a recommended method.

3. SWMUs 47 and 48: North Oscura Peak Landfills

3.1 Summary

During the WSMR RFA (Kearney, 1988), three trenches comprising a single landfill operation were identified in a remote northern portion of the Oscura Mountains (Figure 3-1, Appendix 3A, pg. 3A-1) at an elevation of 7,750 ft amsl. The landfill formerly served the North Oscura Range Camp and received mostly ordinary municipal waste and construction debris from the 1950s to 1989, although exact dates of operation are not known. The first buildings, consisting of a radar building and instrument pad, were built in North Oscura Peak in 1952. It was reported that the landfill also may have received ordinary municipal/commercial waste from the Atom Site, located 3,500 ft west of the landfill, and in operation from 1960 to 1972 (BAE, 2004). The North Oscura Peak site was used as a telemetry data recovery and analysis station (BAE, 2004). The HSWA module to the White Sands 1989 hazardous waste management permit issued under the RCRA individually lists three trenches at the landfill site as SWMUs 47, 48 and 49 (collectively WSMR-71). However, the December 2009 WSMR permit now lists only SWMUs 47 and 48 and states that SWMUs 48 and 49 were combined as SWMU 48.

A *RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report* (Kearney, 1988) was completed for WSMR in 1988. The RFA report identified the three trenches that corresponded to SWMUs 47, 48 and 49 (now SWMUs 47 and 48). At the time of the site visit, the three SWMUs comprised a single, active landfill operation (Figure 3-2, Appendix 3A, pg. 3A-2) that consisted of two open trenches (SWMUs 47 and 48) and a covered, backfilled trench (SWMU 49). Visible debris in both of the open trenches included glass and plastic bottles, rubber tubing, aluminum cans, wood, and waste paper. The RFA report concluded that the release potential to environmental media (soil/groundwater, surface water, air and subsurface gas) was unknown since "the exact inventory of the waste disposed is unknown."

A *Decision Document for the North Oscura Peak Landfill* (MEVATEC, 1999a) was completed to describe and formalize the decision by the US Army to proceed with an environmental corrective response action selected for the North Oscura Peak Landfill at WSMR, New Mexico. This document reported that septage was segregated into SWMU 47, SWMU 49 was filled with solid waste, and SWMU 48 had received several loads of solid waste prior the facility's closure. It was estimated that the small landfill contained from 200 to 400 cubic meters of waste (MEVATEC, 1999a). In June 1997,

six samples of soil and waste were collected from the three trenches of the landfill. The sampling results indicated that the soil and waste were non-hazardous. Based on the analytical results and an evaluation of potential receptor pathways, the selected response action alternative was waste removal. This response action would greatly reduce or eliminate potential exposure routes and the contaminant migration sources. The selected remedy was considered protective of human health and the environment, attained Federal and State requirements that were applicable or relevant and appropriate to the removal, and was cost effective. This remedy satisfied statutory preference for remedies that employ waste management to reduce toxicity, mobility or volume as a principal element. The selected remedy presented a permanent solution and resource recovery to the maximum extent practicable.

A *Voluntary Corrective Measures Implementation Report for the North Oscura Peak Landfill, SWMU 47, 48, and 49* (BAE, 2004) was completed and submitted to the NMED for review in February 2004. A corrective measures implementation work plan was prepared in December 1999 and subsequently submitted to the NMED for review. The work plan was approved and WSMR initiated corrective measures to excavate and dispose of the materials buried in the SWMUs. Excavation of the landfills began on December 7, 2001 and concluded on June 7, 2002. A total of 2,682 cubic yards (cu yds) of solid waste were disposed of at the Rio Rancho Landfill north of Albuquerque, New Mexico. Fill material was recovered from the landfills during excavation. Confirmation samples were taken from the bottom of the excavation and from the fill material. The samples confirmed the presence of residual contaminants, which included a variety of metals, semi volatiles and pesticides. A human health and ecological risk assessment was performed to determine whether further corrective measures would be necessary to address the residual contaminants. The potential exposure routes considered were direct contact, ingestion of the soil, and inhalation of airborne contaminants. Leaching to groundwater was not considered a complete exposure pathway since the only sustainable aquifer is more than 1,700 ft below the site. Both assessments concluded that the remaining contamination did not pose an unacceptable risk.

On January 18, 2006, the NMED provided correspondence indicating that it requires no further investigations pertaining to North Oscura Peak Landfill and the SWMUs are eligible for a NFA determination. It further stated that WSMR must submit a petition to NMED for a NFA determination and a Class 3 permit modification request to remove SWMUs 47, 48, and 49 from its permit (Appendix 3C, pg. 3C-1).

3.2 Site Description and Operational History

3.2.1 Site Description

The former North Oscura Peak Landfill site was located in the Oscura Mountains, 2 miles southeast of North Oscura Peak Range Center, 500 ft west of WSMR secondary road 331, and 2 miles west of Range Road 9 in the north central area of WSMR (Figures 3-2, Appendix 3A, pg. 3A-2). The site was an irregularly shaped landfill near the North Oscura Peak gate, located at the end of a dirt road off of Range Road 331. The size of the disturbed area was approximately 150 ft by 150 ft.

Three trenches in the landfill were identified as SWMUs 47, 48 and 49. Designs for the landfill do not exist since the construction method only involved trench cutting and backfill. Record searches did not locate a history of waste acceptance. However, interviews with range employees suggested that the facility received ordinary municipal/commercial wastes from the Atom Site (in operation from 1960-1972) and the North Oscura Range Camp complex. Waste disposal operations at the site ceased in 1989.

- SWMU 47 measured 40 ft by 50 ft square and approximately 5 ft deep. A barbed-wire fence surrounded the enclosed depression, which received primarily septic tank sludge. A vegetated soil pile on the southwest side of the SWMU likely resulted from the excavation of the septage pit. Plastic, glass and metal containers, wire insulation, wood, cable spools and metal were visible on the surface of the southern half of the trench.

- SWMU 48, an open trench, measured 120 ft long by 5 ft wide and 6 ft deep. The trench had remained uncovered since waste disposal operations ceased in 1989. Wooden cable spools, glass, construction materials, electronic parts and equipment, reels of computer magnetic tape, metal, ceramic and glass food service items, beverage bottles and cans were visible on the bottom of the trench. A mound of topsoil 10 ft high was situated near the northern end of the open trench.

- SWMU 49, a covered trench, was estimated to be an irregular shape measuring 5,700 square ft and 14 ft deep. Five ft of clean overburden covered the trench.

3.2.2 Operational History

The site consisted of three SWMUs (47, 48 and 49) comprising a single landfill operation that received solid wastes, as described above, from the North Oscura Peak Range Center and Atom Peak from the early 1950s to 1989. The exact time that the units first received waste is unknown, but it is known that they were closed in 1989. SWMUs 48 and 49 were recently combined as SWMU 48.

3.3 Land Use

3.3.1 Current

Waste disposal operations at the North Oscura Peak Landfill site ceased in 1989. The landfill trenches have been closed.

3.3.2 Future/Proposed

There are no future land uses proposed for the former North Oscura Peak Landfill site. However, the North Oscura Peak is an integral part of the WSMR due to its superior vantage point for the observation of missile testing areas and bomb ranges in and around the Oscura Mountains.

3.4 Investigative Activities

3.4.1 Summary

SWMUs 47, 48, and 49 were identified during the WSMR RFA conducted in 1988. The RFA considered release potential to various media from the landfill. Although White Sands followed the RFA with a RFI, neither Phase I nor Phase II of the RFI addressed the North Oscura Peak Landfill site. Delineation of the nature of the waste and its volume was conducted through a drilling and sampling program in 1997. In 1999 a Decision Document (MEVATEC, 1999a) was prepared to formalize and describe the corrective action option selected by the Army (waste removal) for the landfill. The decision document demonstrated that the response action chosen was consistent with, and met the requirements of RCRA and the National Environmental Policy Act (NEPA) of 1969. Following submittal of a Corrective Measures Work Plan to the NMED work plan approval, excavation of landfill contents and soil was initiated in December and completed in June 2002. A Voluntary Corrective Measures

Implementation Report summarizing the closure activities was submitted in February 2004 (BAE, 2004b). The NMED approved the conclusion that NFA was required for these SWMUs in a letter dated January 18, 2006 (Appendix 3C, pg. 3C-1). It should be noted that all of the investigation and corrective action activities summarized herein refer to the SWMUs as SWMUs 47, 48 and 49 because SWMUs 48 and 49 were not combined until after these activities had been completed.

3.4.2 Investigation #1: RCRA Facility Assessment (Kearney, 1988)

3.4.2.1 *Non-sampling Data Collection*

The RFA included a VSI and considered release potential to various media from the landfill. The RFA report states that two of the SWMUs (47 and 48) were uncovered and active at the time of the site inspection, and that the start date for the landfills was unknown. A third trench (SWMU 49) was covered. At the time of the VSI, the unit received wastes generated by the North Oscura Range Camp, which had little activity, resulting in minimal waste generation. Most of the exposed waste was refuse. Miscellaneous debris, including rusted out 55-gallon drums, was also noted on the ground north of the landfill area. There was no release history for the landfill. Contaminant release potential to major exposure routes could not be assessed due to uncertainty about the waste composition.

3.4.2.2 *Sampling Data Collection*

No sampling was conducted for the RFA.

3.4.2.3 *Results and Conclusions*

The RFA concluded that the release potential to four environmental media, soil/groundwater, surface water, air and subsurface gas, were all unknown due to uncertainty about the waste composition. The results of the assessment were provided in the *RCRA Facility Assessment PR/VSI Report, White Sands Missile Range, White Sands, New Mexico* (Kearney, 1988).

3.4.3 Investigation #2: On-Site Waste Characterization

3.4.3.1 *Non-sampling Data Collection*

Investigation of the SWMUs 47, 48 and 49 waste progressed under the Defense Environmental Restoration Program (DERP). Management decisions under DERP required site-specific waste characterization and volume estimates. During the site characterization in 1997, 12 shallow soil borings were completed in the vicinity of SWMU 49 (Appendix 3A, Figure 3-3, pg. 3A-3). The borings also provided characterization of the waste brought up in the drill cuttings through visual inspection and chemical analysis.

3.4.3.2 *Sampling Data Collection*

On June 30, 1997, twelve shallow soil borings were drilled by hollow-stem auger in the vicinity of SWMU 49 (Figures 3-3 and 3-4, Appendix 3A, pgs. 3A-3 and 3A-4) to determine the lateral and vertical extent of the waste. Six waste samples were collected from the subsurface and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, TCLP VOCs, and TCLP SVOCs, including pesticides and herbicides, to determine the available disposal options for the waste.

Six borings drilled in the SWMU 49 area encountered intervals of refuse. Borings BH-2, BH-5, BH-6, BH-7, BH-8, and BH-9 drilled through a single layer of waste a maximum of 8 ft thick. The axis of the SWMU 49 trench was found to trend at an oblique angle to that of the open SWMU 48 trench. This conclusion was drawn from borehole data and the intersection point of the two trenches, where buried waste was exposed in the east sidewall of the SWMU 48 trench. A two-foot interval of waste extended approximately 9 ft horizontally along the sidewall was exposed three ft below grade in the SWMU 48 trench. This location on the eastern side of SWMU 48 was suspected to be the western terminus of the SWMU 49 trench. It was not necessary to drill borings to delineate the boundaries of the two open trenches. No refuse was encountered in borings BH-1, BH-3, BH-4, BH-10, BH-11, and BH-12.

To establish waste removal and disposal options, TCLP samples were taken from three of the borings; BH-2, BH-7 and BH-9 (labeled NOP-BH2-S1, NOP-BH7-S1 and NOP-BH9-S1, respectively). These borings were selected for TCLP analysis since they encountered the thickest intervals of waste (8.5, 2.5, and 5.0 ft, respectively).

Waste samples were taken from depths of between 5.5 and 7.5 ft bgs and analyzed for TCLP metals, TCLP VOCs, and TCLP SVOCs, including pesticides and herbicides.

Waste was sampled from SWMU 47 where septage from the North Oscura Range Camp was discharged into the unlined trench. Borings were not drilled at this uncovered trench since the lateral dimensions are marked at the surface by a fence. Some solid waste was visible at the surface near the south end of SWMU 47. Samples of that solid waste and septage (labeled "NOP-W TRENCH S-S1"), and of the septage from the north end of the SWMU 47 trench (labeled "NOP-W TRENCH N-S1") were obtained by hand augering. During collection of waste samples, the thickness of the waste was determined to be less than one ft. Septage samples were collected from approximately 8-10 inches bgs.

A sixth waste sample (NOP-N TRENCH-S1) was collected from the open SWMU 48 trench for TCLP analysis. The sample included refuse and surface soil/sediment from the bottom of the north end of the trench. The south and central sections of the trench contained no refuse and were not sampled. Sample information generated during the investigation is provided in Table 3-1 (Appendix 3B, pg. 3B-1).

3.4.3.3 *Results and Conclusions*

Based on the TCLP results for the six solid waste samples, the waste was determined to be non-hazardous. The results of the investigation are provided in Table 3-1 (Appendix 3B, pg. 3B-1). A work plan was subsequently developed, submitted to the NMED and approved for the excavation and disposal at a licensed solid waste landfill.

3.4.4 Investigation #3: Voluntary Corrective Measures Implementation (BAE, 2004b)

3.4.4.1 *Non-sampling Data Collection*

Based on the *Decision Document for the North Oscura Peak Landfill* (MEVATEC, 1999a) evaluation of corrective action options, waste removal was determined to be the remedy that was protective of human health and the environment and attained Federal and State requirements that are applicable or relevant and appropriate to this site. This remedy presented a permanent solution and resource recovery to the maximum extent practicable and would achieve the goal of eliminating potential soil and water contamination source(s) and eventual deletion of the SWMUs from the HSWA corrective action permit.

A Corrective Measures Implementation Work Plan was prepared in December 1999 and submitted to the NMED for review. The work plan was approved and WSMR initiated corrective measures to excavate and dispose of the materials buried in the SWMUs. The objective of the corrective measures was to achieve clean closure of the three trenches.

Excavation of the landfills began on December 7, 2001 but was halted on December 11, 2001 when ordnance-related material (ORM) was discovered. Work resumed on May 7, 2002 and concluded on June 7, 2002. Once work resumed, an ordnance specialist and an archeologist were on site to inspect and log items found during excavation. Excavated materials were screened and the soil was staged for reuse pending analytical results confirming that it could be used to backfill the excavations. Ordnance-related items were segregated and taken to a designated unexploded ordnance (UXO) storage area for eventual disposal and decommissioning; no UXO was discovered during the excavation. None of the items found during the excavation provided reliable dating information to pinpoint when the landfill operations may have begun at the site (BAE, 2004b).

On May 20, 2002, approximately 13.5 cubic ft of presumed asbestos-containing floor tiles were discovered in the excavation. Work was halted to notify the NMED and to allow licensed asbestos abatement personnel to remove the floor tiles from the excavation. The asbestos-containing materials (ACM) were taken to the WSMR Main Post Asbestos Landfill for proper disposal.

A total of 2,682 cubic yards (cu yds) of solid waste, comprised of approximately 28 cu yds from SWMU 47, 314 cu yds from SWMU 48, and 2,340 cu yds from SWMU 49, were disposed of at the Rio Rancho Sanitary Landfill north of Albuquerque, New Mexico. The site was backfilled with the soil recovered during the excavation, and the site surface was graded and contoured to prevent soil erosion. The site was inspected twice between June and October 2002 to evaluate soil and revegetation. No further inspections were warranted since the site exhibited no signs of discernable soil loss and new vegetation was bountiful. A site survey was completed before and after excavation, and after surface grading and contouring (BAE, 2004b).

3.4.4.2 *Sampling Data Collection*

During landfill excavation activities, soil was separated from the solid waste using a mechanical screen. The soil was sampled and stockpiled until analytical results were

received. The soil was used as clean fill after results indicated that there were no contaminants exceeding the NMED residential Soil Screening Level (SSL) and/or background levels.

A total of 25 confirmation samples were obtained from the three SWMUs, the vegetated swale adjacent to the landfill and a background location (Figure 3-5, Appendix 3A, pg.3A-5). Samples were collected from the bottom of the excavation for each of the three SWMUs and from the fill material. The confirmation samples were representative of what contamination may have remained following excavation and fill material samples demonstrated the concentration of contaminants present in the soils to be used as backfill. Background samples were also obtained to demonstrate the range of metal concentrations that were found in nearby soils unaffected by the landfill. Samples were collected as follows:

- Nine samples were collected and analyzed from SWMU 49.
- Two samples were taken from SWMU 48.
- Three samples were taken from SWMU 47.
- One sample was obtained from the vegetated swale to characterize the impact from stormwater runoff from the landfill.
- Five background samples were taken to define the level of metal concentrations in the native soil.
- Five samples were taken from the stockpiles of fill for confirmation that the concentration of contaminants was below acceptable risk levels.

All samples were analyzed for metals, VOCs, polynuclear aromatic hydrocarbons (PAHs), pesticides, chlorinated herbicides, polychlorinated biphenyls (PCBs) and explosive residues in accordance with USEPA Test Methods.

3.4.4.3 *Results and Conclusions*

Concentrations of analytes for confirmation samples are presented in Table 3-2 (Appendix 3B, pg. 3B-2) and analyte concentrations from samples collected from fill

material and background are provided in Table 3-3 (Appendix 3B, pg. 3B-4). Confirmation sampling demonstrated that low concentrations of various metals, pesticides, and PAHs associated with the waste remained. These contaminants were evaluated by a screening level human health risk assessment. As shown on Table 3-4 (Appendix 3B, pg. 3B-6), the assessment involved development of a conceptual site model, establishing background concentrations, and screening detected contaminants against the NMED SSLs. The assessment indicated that all of the contaminants were below the default screening criteria protective of human health for the residential land use category.

3.5 Site Conceptual Model

3.5.1 Nature and Extent of Contamination

The extent of waste disposal was defined by soil borings during the 1997 waste characterization evaluation and during the excavation of wastes in 2001-2002. All visible wastes were removed from the trenches. As detailed in the discussions on previous investigations, a total of 2,682 cu yds of solid waste were removed from the three landfill trenches. Confirmation sampling demonstrated that low concentrations of various metals, PAHs, and pesticides associated with the waste remained in soils in the former trenches. It should be noted that access to the facility is restricted to the public. The residual contaminants would not be an exposure risk by volatilization. In addition, groundwater, which is more than 1,700 ft bgs would not be impacted by the residual contamination. The screening level human health risk assessment that was performed considered potential exposure pathways to be direct contact with or ingestion of soil, or inhalation of airborne contaminants. This human health risk assessment determined that all of the contaminants were below the default screening criteria protective of human health for the residential land use category.

3.5.2 Environmental Fate

There were no impacts to the vegetated swale that receives storm water runoff in the vicinity of the former landfill operation. The data collected from confirmation sampling after the wastes were removed revealed only low levels of various metals, pesticides and PAHs. Groundwater is not considered a pathway since it is well documented that groundwater resources in the Oscura Mountains are not sufficient to supply drinking water to even a minimal population and the depth to usable groundwater is more than

1,700 ft bgs. An ecological risk assessment was conducted to assess potential impacts associated with the residual contaminants. No ecological risks were identified.

3.6 Site Assessments

3.6.1 Human Health Screening and Risk Assessments (BAE, 2004b)

A screening level human health risk assessment was conducted in 2004 to determine whether the site warranted further evaluation from a human health standpoint. The assessment involved the development of a conceptual site model, establishing background concentrations and screening detected contaminants against default screening criteria.

The NMED SSLs for the residential land-use category were used to determine if any of the chemicals detected were considered COPC at this site. The screening levels addressed potential exposure pathways identified in the site-specific conceptual site model. The pathways were direct contact, ingestion and inhalation of airborne contaminants.

The contaminant concentration representative of the site was estimated using the 95 percent upper confidence limit (UCL) of the arithmetic mean. Summary statistics (such as the minimum, maximum, and 95% UCL) were calculated for constituents detected in the confirmation and stockpile samples during development of the Human Health Risk Assessment (Table 3-4, Appendix 3B, pg. 3B-6).

Comparison of the 95th UCL for each of the detected contaminants against the NMED Residential SSLs demonstrates that the concentrations are below the acceptable risk criteria. In fact, with the exception of arsenic, which was determined to be naturally-occurring, all detected constituent concentrations were below the SSLs. Therefore, there are no COPCs at this site and no further evaluation is necessary.

3.6.2 Ecological Screening and Risk Assessments (BAE, 2004b)

A site visit was conducted in August 2002 at the North Oscura Peak landfill site to determine ecological habitat, biological receptors associated with the site, and potential exposure pathways.

Following the site visit, a SLERA was prepared. Seven metals and seven organic compounds were detected and considered as preliminary ecological contaminants of potential concern (PECOPCs). A Tier 1 screening was then conducted, which compared maximum detected values to ecological screening values. The only compounds that failed the Tier 1 screening were 1,1-bis(chlorophenyl)-2,2,2-trichloroethane (DDT), (1,1-bis(chlorophenyl)-2,2-dichloroethene) (DDE), and 1,1-bis(chlorophenyl)-2,2-dichloroethane) (DDD). These compounds were identified as the ecological compounds of potential concern (ECOPCs) for the assessment.

A food web and ecological receptors of concern (ROC) were identified for the site. A Tier 2 analysis was conducted, which involved converting soil concentrations to doses in soil and food to which ROC (bird and mammals) could be exposed. These doses were compared to toxicity reference values (TRVs) to determine potential for toxic effects.

All doses were below the lowest observed adverse effects levels (LOAELs) reported in the literature for similar species. Therefore, no further action is recommended with regard to ecological impacts of residual soil contamination at the site.

3.6.3 Other Applicable Assessments (BAE, 2004b)

During the CMI field work, on-site monitoring of excavation and removal activities was performed by Human Systems Research, Inc. in order to locate, identify, and document artifacts as they were removed from the landfill SWMUs. This monitoring activity began in December 2001 and determined that the area was used as a military dump associated with activities in the North Oscura Peak area. Recovered artifacts ranged from computer printouts, office paper waste and computer reels to newspapers, dining ware, and other recreational items (beverage cans and paint bottles), which reflected activities typical of a military technical support facility congruent with the mission at North Oscura Peak. Artifacts that demonstrate domestic and leisure activities of the personnel stationed at the site were also found, including dishes, eating utensils, hobby paint bottles, and beer, wine, and liquor containers. The monitoring report, *Monitoring Activities for Corrective Measure Implementation at Solid Waste Management Units, North Oscura Peak, White Sands Missile Range, Socorro County, New Mexico,* was included in the Voluntary CMI report (BAE, 2004b).

3.7 No further Action Proposal

3.7.1 Rationale

The majority of pollutants associated with the landfill operations at SWMUs 47 and 48 (formerly SWMUs 47, 48 and 49; SWMUs 48 and 49 were recently combined as SWMU 48) were removed as evidenced by the excavation and disposal of 2,682 cu yds of solid waste. Confirmation sampling demonstrated that low concentrations of contaminants associated with the waste remained. These contaminants were evaluated by a screening level human health risk assessment. The assessment indicated that all of the contaminants were below the default screening criteria protective of human health for the residential land use category.

Groundwater was not considered a pathway since it is well documented that the groundwater resources in the Oscura Mountains are not sufficient to supply drinking water to even a minimal population, as it exists today. The depth to groundwater with sufficient capacity is more than 1,700 ft below the site. The minute quantities of residual contaminants that could potentially leach from the site and travel 1,700 ft through the limestone bedrock would be diluted many thousands of times before it reaches a potential receptor. Therefore, the remaining contaminants on the property were not considered to be an unacceptable risk to future potential land users or receptors of groundwater beneath the Oscura Mountains.

An ecological risk assessment was also conducted to evaluate the effect on the environment from the residual contaminants. The assessment determined that the existing levels were protective of the existing food web and ecological receptors. No further ecological evaluation was recommended for this site.

In a letter dated June 18, 2006 (Appendix 3C, p.3C-1), the NMED concurred with the findings of the *Voluntary Corrective Measures Implementation Report for the North Oscura* Landfill, dated February 2004, and stated:

> "*Based on the information in this report, it appears that WSMR has completed corrective actions activities at the three former landfill trenches. All waste and contaminated soil were removed and confirmation soil samples from the excavation pits and fill material were collected and analyzed for hazardous constituents. The data supports the conclusion that any residual contamination remaining at the site does not pose a risk to humans of the environment.*

> *Therefore, NMED requires no further investigations pertaining to North Oscura Peak Landfill at this time and the SWMUs are eligible for a No Further Action (NFA) determination."*

Based on these results, application is hereby made to perform a Class III modification to remove SWMUs 47 and 48 from the White Sands HSWA permit in accordance with 40 CFR 264.514 and 270.42, and 20 NMAC 4.1.

3.7.2 Criterion

The criterion applied to this site is NFA Criterion 5 as described by the NMED: The SWMU has been characterized [and] remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

Appendices

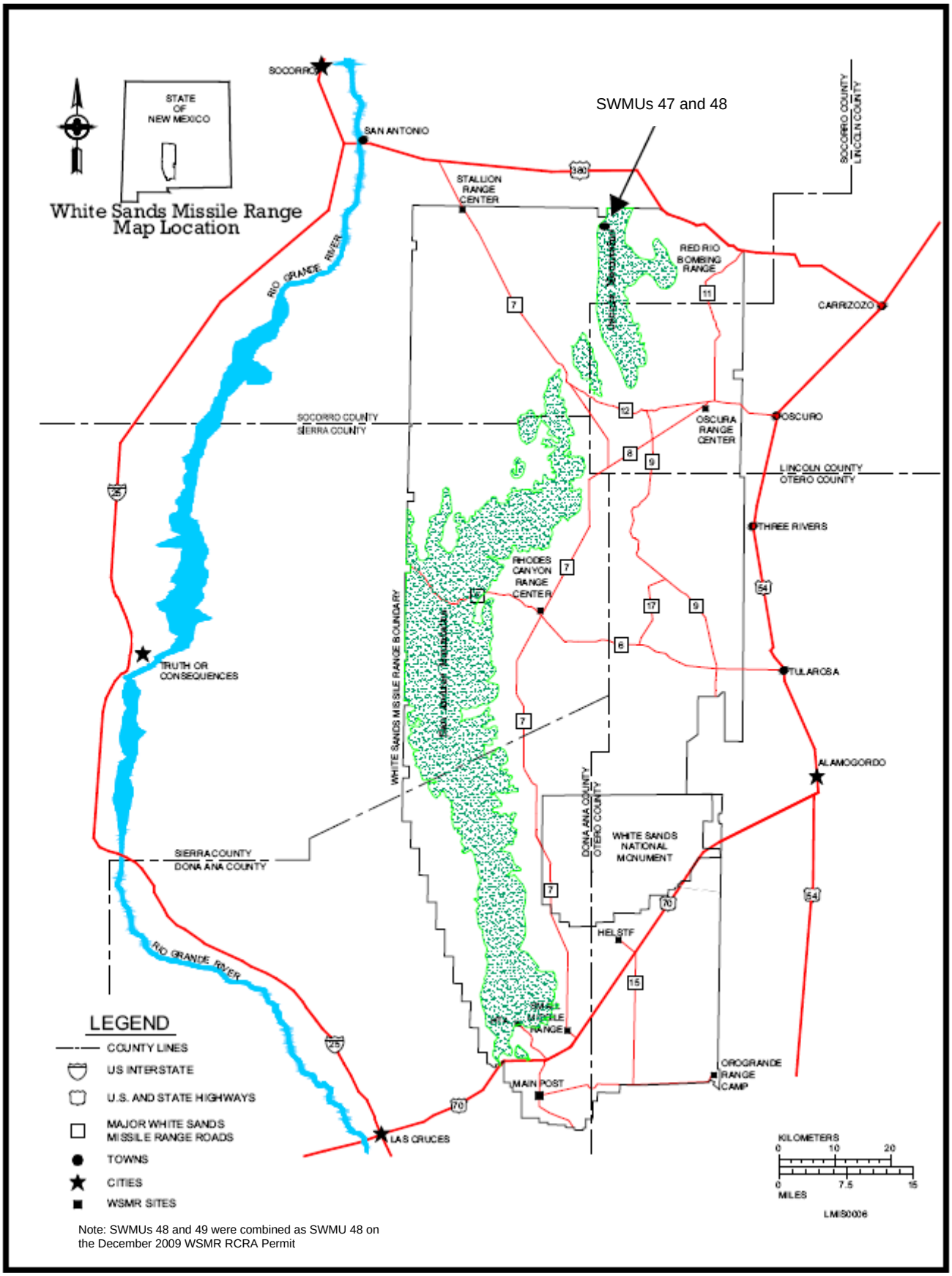
Appendix 3A – Figures

Appendix 3B – Analytical Results Tables

Appendix 3C - Correspondence

Appendix 3A

SWMUs 47 and 48
Figures



Note: SWMUs 48 and 49 were combined as SWMU 48 on the December 2009 WSMR RCRA Permit

Figure 3-1 Site Location Map – SWMUs 47 and 48

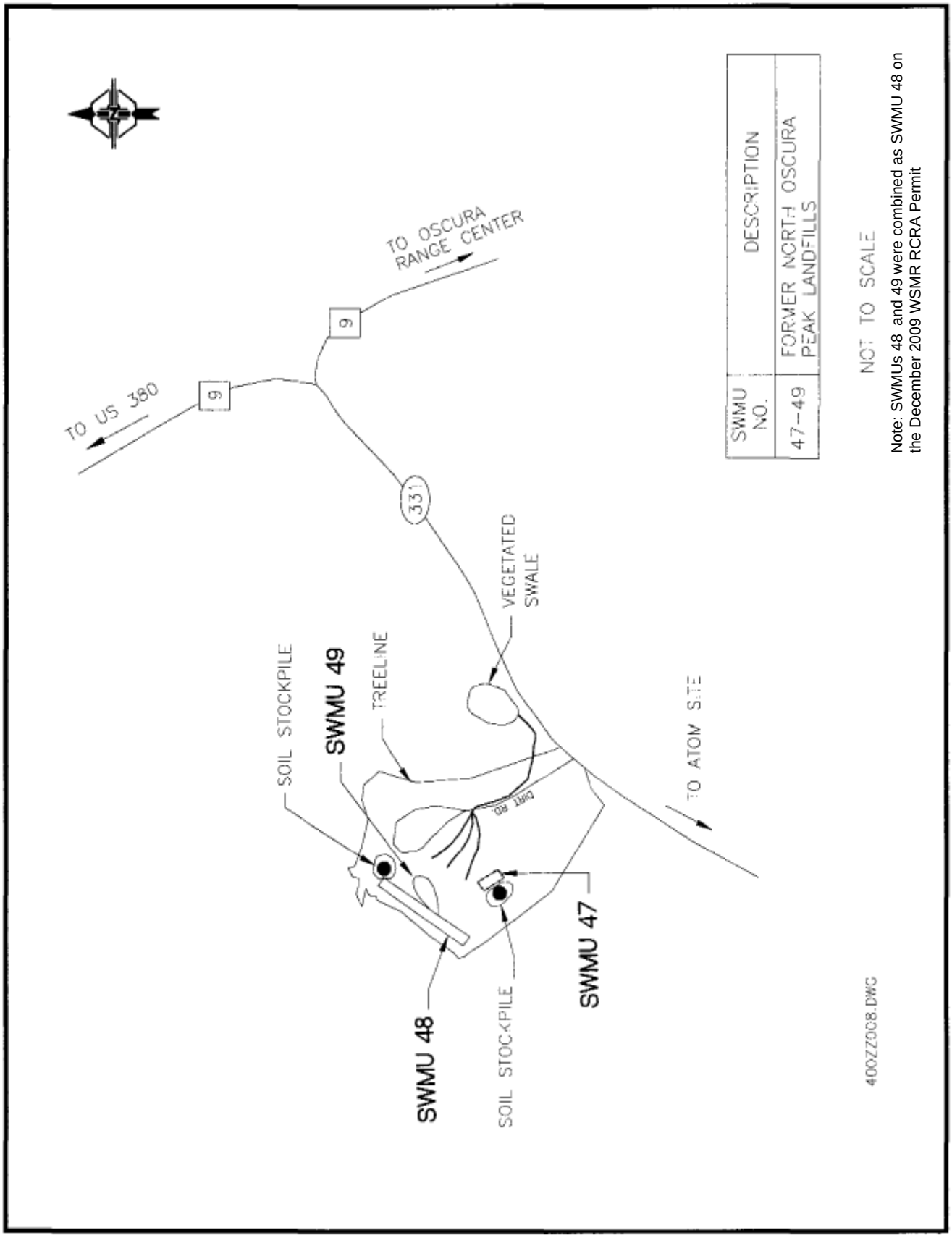
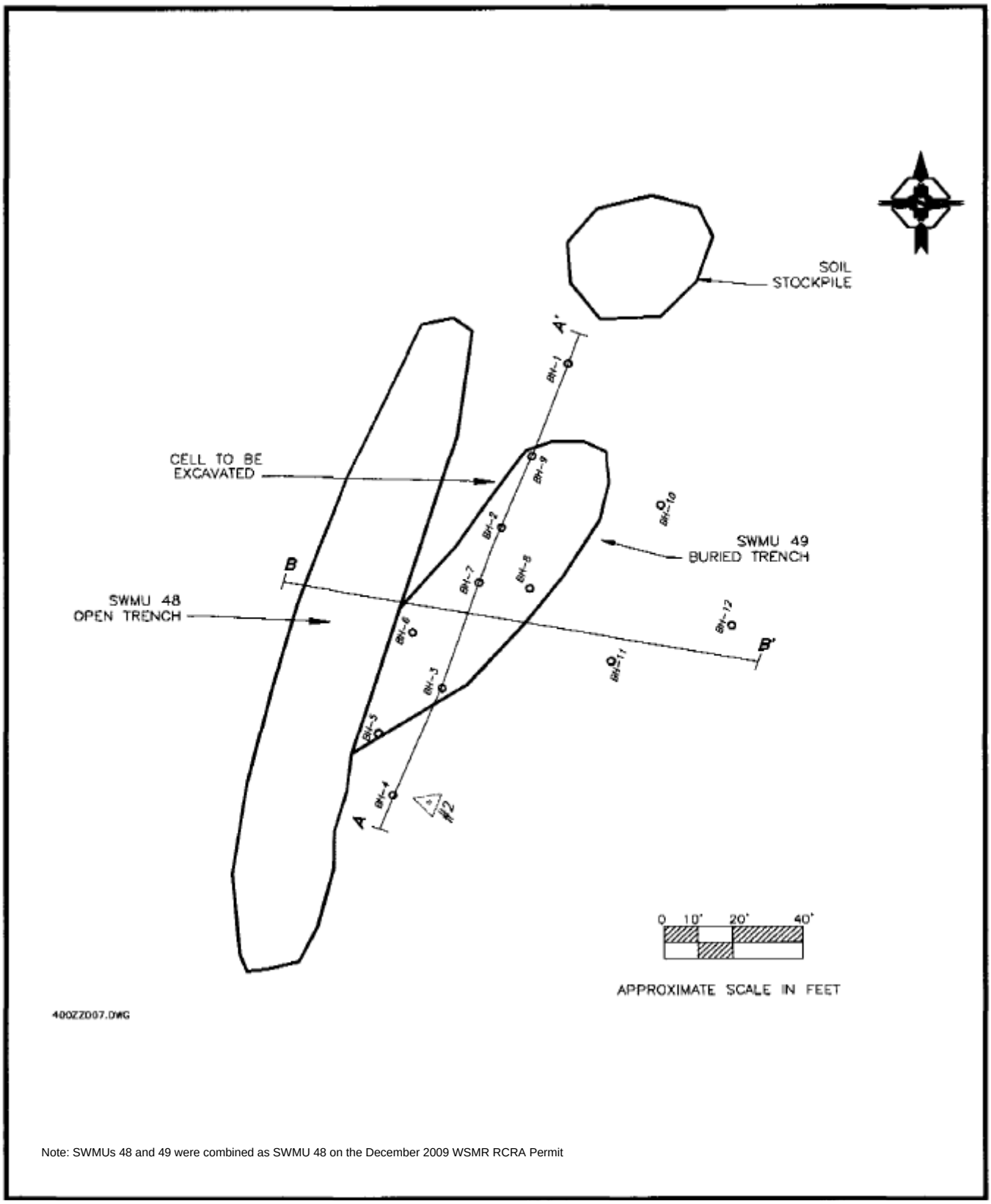


Figure 3-2 Site Plan for the North Oscura Peak Landfills (SWMUs 47 and 48)

Source MEVATEC, 1999b



Note: SWMUs 48 and 49 were combined as SWMU 48 on the December 2009 WSMR RCRA Permit

Figure 3-3 SWMU 48 – Waste Characterization Boring Location

Source: MEVATEC, 1999b

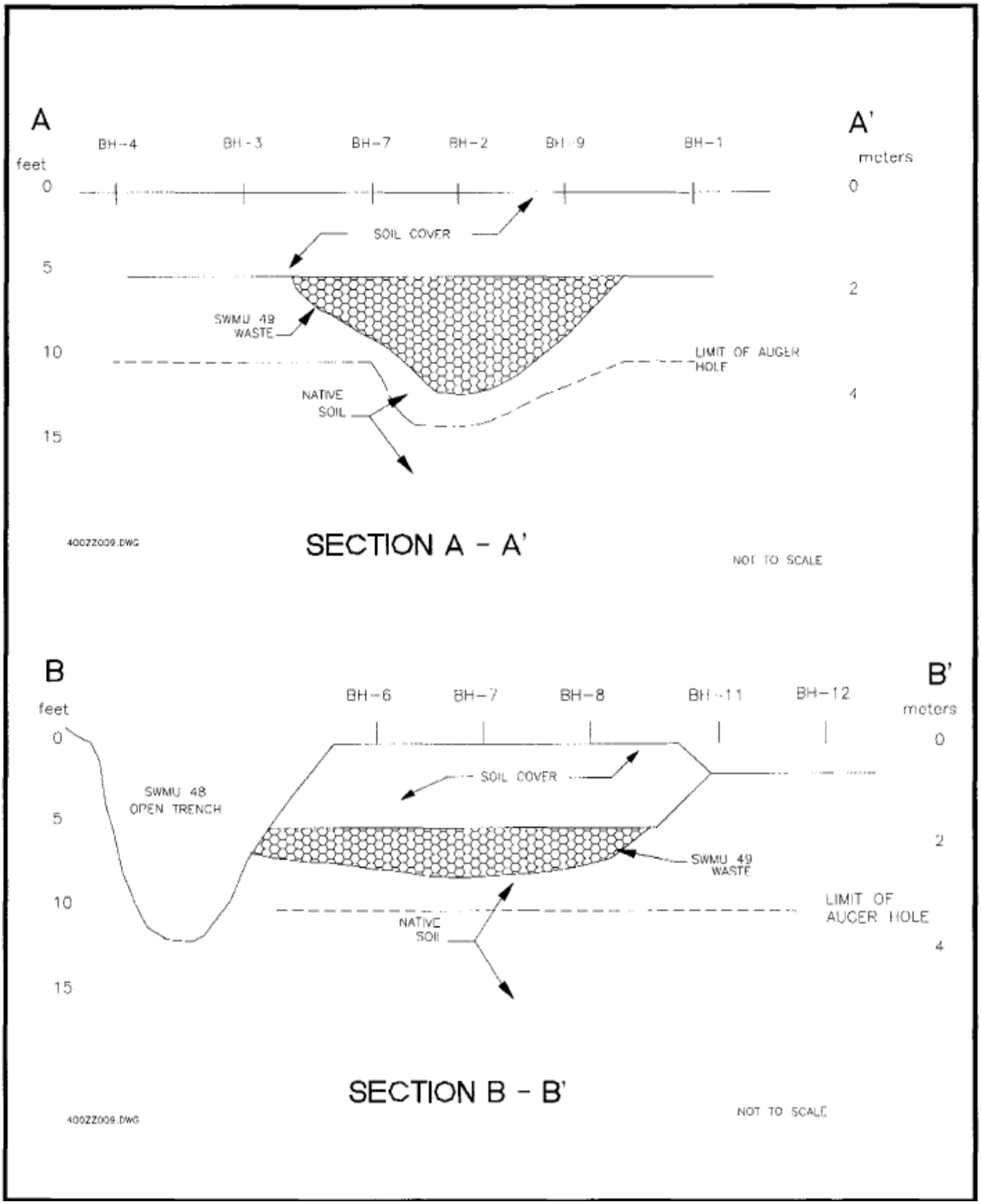


Figure 3-4 Profile of the Buried Waste Trench SWMU 49 (now SWMU 48)

Source: MEVATEC, 1999b

NOTES

1. XYZ COORDINATES ACQUIRED USING GLOBAL POSITIONING SYSTEM WITH POST DIFFERENTIAL CORRECTION
2. CONTOUR LINES CREATED WITH SURFER ® v8.0, A GRID BASED GRAPHICS PROGRAM, USING THE KRIGING GRIDDING METHOD

Legend

- Background Samples
- Confirmation Samples
- Elevation (ft.)
- Predicted Excavation Limits
- Actual Excavation Limits

30 0 30 60 90 120 Feet

SCALE: 1 " equals 30 '

PROJECT TITLE:

NORTH OSCURA PEAK LANDFILLS SWMUs 47 and 48

SHEET TITLE:

ATTACHMENT 1B

CONTOUR MAP OF EXCAVATED AREA

MEVATEC CORPORATION
Bldg. 126, 3rd Floor
P.O. Box 399
White Sands Missile Range
New Mexico, 88002
(505) 678-0263

CHECKED BY:	APRV'D BY:	
LHabel	LHabel	
WAO No: 900xx	MAP BY: RAsbury	DATE: 10/22/02
SIZE: C	SCALE: SEE BAR SCALE	SHEET 1 of 1

Appendix 3B

SWMUs 47 and 48
Analytical Result Tables

Table 3-1. North Oscura Peak Analytes Detected by TCLP

Source: BAE, 2004b

PARAMETER	METHOD	UNITS	NOP-BH2-S1	NOP-BH7-S1	NOP-BH9-S1	NOP-N TRENCH-S1	NOP-W TRENCH S-S1	NOP-W TRENCH N-S1	TC Regulatory Level*
TCLP Metals									
Barium	SW846-6010A	mg/L	0.67	0.96	0.82	1.00	1.00	0.82	100
Cadmium	SW846-6010A	mg/L	<0.05	<0.05	0.10	<0.05	<0.05	<0.05	1.0
Arsenic	SW846-6010A	**No Arsenic detected by this method.**							
Chromium	SW846-6010A	**No Chromium detected by this method.**							
Lead	SW846-6010A	**No Lead detected by this method.**							
Mercury	SW846-7470A	**No Mercury detected by this method.**							
Selenium	SW846-6010A	**No Selenium detected by this method.**							
Silver	SW846-6010A	**No Silver detected by this method.**							
TCLP Volatile Organic Compounds									
Methyl ethyl ketone (MEK)	SW846-8240B	mg/L	<0.050	<0.050	<0.050	<0.050	0.052	<0.050	200.0
Tetrachloroethene (PCE)	SW846-8240B	mg/L	0.018 J	<0.025	<0.025	<0.025	<0.025	<0.025	0.7
TCLP Semi-Volatile Organic Compounds									
	SW846-8270B	**No compounds detected by this method.**							
TCLP Organochlorine Pesticides									
	SW846-8080A	**No compounds detected by this method.**							
TCLP Herbicides									
	SW846-8150B	**No compounds detected by this method.**							

Table 3-2. Results of North Oscura Peak Landfill Confirmation Sample Analysis.

Source: BAE, 2004b

METHOD	ANALYTE	DL	UNIT	CS-1	CS-2	CS-3	CS-4	CS-5	CS-6	CS-7	CS-8	CS-9	CS-10	CS-11	CS-12	CS-13	CS-14	CS-15
RCRA 8 Metals																		
EPA 6010C	Arsenic	0.20	mg/kg	**4.2**	**3.9**	**7.1**	**6.5**	**7.4**	**5.5**	ND	ND	ND	ND	ND	ND	ND	ND	ND
EPA 6010C	Barium	0.10	mg/kg	476	160	159	183	107	148	140	120	41	40	51	140	140	120	120
EPA 6010C	Cadmium	0.10	mg/kg	0.7	0.3	0.6	0.7	1.0	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND
EPA 6010C	Chromium	0.30	mg/kg	23.8	17.8	23.4	24.4	21.9	23.9	23	25	16	25	27	26	28	28	20
EPA 6010C	Lead	**0.25**	mg/kg	**6.0**	**4.8**	**11.1**	**12.4**	**5.1**	**6.9**	ND	ND	ND	ND	ND	ND	ND	**24**	ND
EPA 7471	Mercury	0.10	mg/kg	0.231	0.057	<0.033	0.041	0.059	<0.033	ND	ND	ND	ND	ND	ND	ND	ND	ND
EPA 6010C	Selenium	0.50	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
EPA 6010C	Silver	0.25	mg/kg	1.4	1.3	1.4	2.3	**14.6**	1.5	ND	1.2	ND	ND	ND	ND	ND	ND	ND
Organics																		
EPA 418.1	Total Petroleum Hydrocarbons	20	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	38	ND	ND	ND
Volatile Organic Compounds																		
SW846-8260B	Benzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Toluene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Ethylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Methyl tert-butyl ether (MTBE)	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2,4-Trimethylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,3,5-Trimethylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2-Dichloroethane (EDC)	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2-Dibromoethane (EDB)	**0.050**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Naphthalene	0.10	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1-Methylnaphthalene	0.20	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	2-Methylnaphthalene	0.20	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Bromobenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Bromodichloromethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Bromoform	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Bromomethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Carbon tetrachloride	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Chlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Chloroethane	0.10	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Chloroform	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Chloromethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	2-Chlorotoluene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	4-Chlorotoluene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	cis-1,2-DCE	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	cis-1,3-Dichloropropene	**0.050**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2-Dibromo-3-chloropropane	0.10	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Dibromochloromethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Dibromomethane	0.10	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2-Dichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,3-Dichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,4-Dichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Dichlorodifluoromethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,1-Dichloroethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,1-Dichloroethene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2-Dichloropropane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,3-Dichloropropane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	2,2-Dichloropropane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,1-Dichloropropene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Hexachlorobutadiene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Isopropylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	4-Isopropyltoluene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Methylene chloride	0.15	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	n-Butylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	n-Propylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Sec-Butylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Styrene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Tert-Butylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,1,1,2-Tetrachloroethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,1,2,2-Tetrachloroethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Tetrachloroethene (PCE)	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	trans-1,2-DCE	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	trans-1,3-Dichloropropene	**0.050**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2,3-Trichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2,4-Trichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,1,1-Trichloroethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,1,2-Trichloroethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Trichloroethene (TCE)	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Trichlorofluoromethane	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	1,2,3-Trichloropropane	0.10	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Vinyl chloride	**0.10**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8260B	Xylene, Total	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Polynuclear Aromatic Hydrocarbons																		
SW846-8310	Naphthalene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	1-Methylnaphthalene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	2-Methylnaphthalene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Acenaphthylene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Acenaphthene	0.050	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Fluorene	0.030	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Phenanthrene	0.0060	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Anthracene	0.0060	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Fluoranthene	0.0060	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Pyrene	0.0060	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Benz(a)anthracene	0.00080	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Chrysene	0.0040	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Benzo(b)fluoranthene	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Benzo(k)fluoranthene	0.00050	mg/kg	ND	ND	0.00050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Benzo(a)pyrene	0.00080	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Dibenz(a,h)anthracene	0.0011	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8310	Benzo(g,h,i)perylene	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0073	ND
SW846-8310	Indeno(1,2,3-cd)pyrene	0.0010	mg/kg	ND	ND	0.0029	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0049	ND
Pesticides																		
SW846-8081	4,4'-DDD	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	0.0048	ND
SW846-8081	4.4'-DDE	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	0.0049	ND
SW846-8081	4,4'-DDT	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	Aldrin	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	alpha-BHC	**0.0020**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.020**	ND	ND	ND
SW846-8081	beta-BHC	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	Chlordane	0.10	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<1.0	ND	ND	ND
SW846-8081	delta-BHC	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	Dieldrin	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.020**	ND	ND	ND
SW846-8081	Endosulfan I	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	Endosulfan II	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	Endosulfan sulfate	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	Endrin	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.020**	ND	ND	ND
SW846-8081	Endrin aldehyde	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	gamma-BHC	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.020**	ND	ND	ND
SW846-8081	Heptachlor	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND

Table 3-2. Results of North Oscura Peak Landfill Confirmation Sample Analysis.

Source: BAE, 2004b

METHOD	ANALYTE	DL	UNIT	CS-1	CS-2	CS-3	CS-4	CS-5	CS-6	CS-7	CS-8	CS-9	CS-10	CS-11	CS-12	CS-13	CS-14	CS-15
SW846-8081	Heptachlor epoxide	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	Methoxychlor	0.0020	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.020	ND	ND	ND
SW846-8081	Toxaphene	**0.10**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<1.0**	ND	ND	ND
Chlorinated Herbicides																		
SW846-8151	2,4,5-T	0.0023	mg/kg	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.012	ND	ND	ND	ND	<0.035	<0.035	<0.035	<0.035
SW846-8151	2.4.5-TP (Silvex)	0.0023	mg/kg	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.012	ND	ND	ND	ND	<0.035	<0.035	<0.035	<0.035
SW846-8151	2,4-D	0.0023	mg/kg	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.012	ND	ND	ND	ND	<0.035	<0.035	<0.035	<0.035
SW846-8151	2,4-DB	0.0023	mg/kg	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.012	ND	ND	ND	ND	<0.035	<0.035	<0.035	<0.035
SW846-8151	Dalapon	0.0023	mg/kg	<7.0	<7.0	<7.0	<7.0	<7.0	<7.0	<0.012	ND	ND	ND	ND	<0.035	<0.035	<0.035	<0.035
SW846-8151	Dicamba	0.0023	mg/kg	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.012	ND	ND	ND	ND	<0.035	<0.035	<0.035	<0.035
SW846-8151	Dichlorprop	0.0023	mg/kg	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.012	ND	ND	ND	ND	<0.035	<0.035	<0.035	<0.035
SW846-8151	Dinoseb	0.0023	mg/kg	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.012	ND	ND	ND	ND	<0.035	<0.035	<0.035	<0.035
Polychlorinated Biphenyls																		
SW846-8082	Aroclor 1016	**0.010**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.10**	ND	ND	ND
SW846-8082	Aroclor 1221	**0.050**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.50**	ND	ND	ND
SW846-8082	Aroclor 1232	**0.010**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.10**	ND	ND	ND
SW846-8082	Aroclor 1242	**0.010**	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.10**	ND	ND	ND
SW846-8082	Aroclor 1248	0.010	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.10	ND	ND	ND
SW846-8082	Aroclor 1254	0.010	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.10	ND	ND	ND
SW846-8082	Aroclor 1260	0.010	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.10	ND	ND	ND
Explosive Residues																		
SW846-8330	2-Amino-4,6-dinitrotoluene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	4-Amino-2,6-dinitrotoluene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	1,3-Dinitrobenzene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	2,4-Dinitrotoluene	**0.25**	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	2,6-Dinitrotoluene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	HMX	**0.25**	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	Nitrobenzene	**0.25**	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	Nitroglycerin	**5.0**	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	2-Nitrotoluene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	3-Nitrotoluene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	4-Nitrotoluene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	PETN	4.0	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	RDX	**0.25**	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	Tetryl	0.50	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	1,3,5-Trinitrobenzene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND
SW846-8330	2,4,6-Trinitrotoluene	0.25	mg/kg							ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

Chromium III NMED SSL provided.

Total lead NMED SSL provided.

Mercury and compounds NMED SSL provided.1,3-Dichloropropene SSL value used for cis- and trans- forms of the compound.

Endosulfan SSL value used for alpha and beta forms of the compound. Alpha and beta concentrations should be added for screening assessment.

Table 3-3. Results of North Oscura Peak Landfill Stockpile and Background Sample Analysis

Source: BAE, 2004b

METHOD	ANALYTE	DL	UNIT	SP-1	SP-2	SP-3	SP-4	SP-5	BK-1	BK-2	BK-3	BK-4	BK-5
RCRA 8 Metals													
EPA 6010C	Arsenic	0.20	mg/kg	ND	ND	ND	ND	ND	**7.3**	ND	ND	ND	ND
EPA 6010C	Barium	0.10	mg/kg	120	130	130	120	130	169	140	84	74	190
EPA 6010C	Cadmium	0.10	mg/kg	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND
EPA 6010C	Chromium	0.30	mg/kg	28	23	25	24	24	15.2	27	24	27	29
EPA 6010C	Lead	**0.25**	mg/kg	**5.1**	**8.8**	**2.9**	**1.0**	**19**	**9.6**	ND	ND	ND	ND
EPA 7471	Mercury	0.10	mg/kg	ND	ND	ND	ND	ND	0.336	ND	ND	ND	ND
EPA 6010C	Selenium	0.50	mg/kg	ND	ND	ND	ND	ND	<1.0	ND	ND	ND	ND
EPA 6010C	Silver	0.25	mg/kg	0.86	5.9	1.6	**28**	2.5	1.2	ND	ND	ND	ND
Organics													
EPA 418.1	Total Petroleum Hydrocarbons	20	mg/kg	110	89	46	ND	ND					
Volatile Organic Compounds													
SW846-8260B	Benzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Toluene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Ethylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Methyl tert-butyl ether (MTBE)	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2,4-Trimethylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,3,5-Trimethylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2-Dichloroethane (EDC)	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2-Dibromoethane (EDB)	**0.050**	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Naphthalene	0.10	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1-Methylnaphthalene	0.20	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	2-Methylnaphthalene	0.20	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Bromobenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Bromodichloromethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Bromoform	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Bromomethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Carbon tetrachloride	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Chlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Chloroethane	0.10	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Chloroform	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Chloromethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	2-Chlorotoluene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	4-Chlorotoluene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	cis-1,2-DCE	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	cis-1,3-Dichloropropene	**0.050**	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2-Dibromo-3-chloropropane	0.10	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Dibromochloromethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Dibromomethane	0.10	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2-Dichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,3-Dichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,4-Dichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Dichlorodifluoromethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,1-Dichloroethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,1-Dichloroethene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2-Dichloropropane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,3-Dichloropropane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	2,2-Dichloropropane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,1-Dichloropropene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Hexachlorobutadiene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Isopropylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	4-Isopropyltoluene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Methylene chloride	0.15	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	n-Butylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	n-Propylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Sec-Butylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Styrene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Tert-Butylbenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,1,1,2-Tetrachloroethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,1,2,2-Tetrachloroethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Tetrachloroethene (PCE)	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	trans-1, 2-DCE	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	trans-1,3-Dichloropropene	**0.050**	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2,3-Trichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2,4-Trichlorobenzene	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,1,1-Trichloroethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,1,2-Trichloroethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Trichloroethene (TCE)	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Trichlorofluoromethane	0.050	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	1,2,3-Trichloropropane	0.10	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Vinyl chloride	**0.10**	mg/kg	ND	ND	ND	ND	ND					
SW846-8260B	Xylene, Total	0.050	mg/kg	ND	ND	ND	ND	ND					
Polynuclear Aromatic Hydrocarbons													
SW846-8310	Naphthalene	0.050	mg/kg	**<0.25**	**<0.25**	ND	ND	ND					
SW846-8310	1-Methylnaphthalene	0.050	mg/kg	<0.25	<0.25	ND	ND	ND					
SW846-8310	2-Methylnaphthalene	0.050	mg/kg	<0.25	<0.25	ND	ND	ND					
SW846-8310	Acenaphthylene	0.050	mg/kg	<0.25	<0.25	ND	ND	ND					
SW846-8310	Acenaphthene	0.050	mg/kg	<0.25	<0.25	ND	ND	ND					
SW846-8310	Fluorene	0.030	mg/kg	<0.15	<0.15	ND	ND	ND					
SW846-8310	Phenanthrene	0.0060	mg/kg	<0.030	<0.030	ND	ND	0.013					
SW846-8310	Anthracene	0.0060	mg/kg	<0.030	<0.030	ND	ND	ND					
SW846-8310	Fluoranthene	0.0060	mg/kg	<0.030	<0.030	ND	ND	0.012					
SW846-8310	Pyrene	0.0060	mg/kg	<0.025	<0.025	ND	ND	ND					
SW846-8310	Benz(a)anthracene	0.00080	mg/kg	0.0050	0.0050	0.0013	ND	0.0028					
SW846-8310	Chrysene	0.0040	mg/kg	<0.020	<0.020	ND	ND	ND					
SW846-8310	Benzo (b) fluoranthene	0.0020	mg/kg	<0.010	<0.010	ND	ND	0.0040					
SW846-8310	Benzo (k) fluoranthene	0.00050	mg/kg	0.0038	0.0025	0.0010	ND	0.0010					
SW846-8310	Benzo (a) pyrene	0.00080	mg/kg	0.016	0.0063	0.0030	ND	0.0020					

Table 3-3. Results of North Oscura Peak Landfill Stockpile and Background Sample Analysis

Source: BAE, 2004b

METHOD	ANALYTE	DL	UNIT	SP-1	SP-2	SP-3	SP-4	SP-5	BK-1	BK-2	BK-3	BK-4	BK-5
SW846-8310	Dibenz (a, h) anthracene	0.0011	mg/kg	<0.0055	<0.0055	0.0015	ND	ND					
SW846-8310	Benzo (g, h, i) perylene	0.0020	mg/kg	0.059	0.012	0.0055	ND	0.0040					
SW846-8310	Indeno (1,2,3-cd) pyrene	0.0010	mg/kg	<0.0050	<0.0050	0.0053	ND	ND					
Pesticides													
SW846-8081	4,4'-DDD	0.0020	mg/kg	<0.020	<0.010	0.0029	ND	ND					
SW846-8081	4.4'-DDE	0.0020	mg/kg	<0.020	<0.010	0.0071	0.0059	0.0075					
SW846-8081	4,4'-DDT	0.0020	mg/kg	<0.020	0.013	0.013	0.012	0.012					
SW846-8081	Aldrin	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	alpha-BHC	**0.0020**	mg/kg	**<0.020**	**<0.010**	ND	ND	ND					
SW846-8081	beta-BHC	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	Chlordane	0.10	mg/kg	<1.0	<0.50	ND	ND	ND					
SW846-8081	delta-BHC	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	Dieldrin	0.0020	mg/kg	**<0.020**	**<0.010**	ND	ND	ND					
SW846-8081	Endosulfan I	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	Endosulfan II	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	Endosulfan sulfate	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	Endrin	0.0020	mg/kg	**<0.020**	**<0.010**	ND	ND	ND					
SW846-8081	Endrin aldehyde	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	gamma-BHC	0.0020	mg/kg	**<0.020**	**<0.010**	ND	ND	ND					
SW846-8081	Heptachlor	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	Heptachlor epoxide	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	Methoxychlor	0.0020	mg/kg	<0.020	<0.010	ND	ND	ND					
SW846-8081	Toxaphene	**0.10**	mg/kg	**<1.0**	**<0.50**	ND	ND	ND					
Chlorinated Herbicides													
SW846-8151	2,4,5-T	0.0023	mg/kg	<0.023	ND	ND	ND	ND					
SW846-8151	2.4.5-TP (Silvex)	0.0023	mg/kg	<0.023	ND	ND	ND	ND					
SW846-8151	2,4-D	0.0023	mg/kg	<0.023	ND	ND	ND	ND					
SW846-8151	2,4-DB	0.0023	mg/kg	<0.023	ND	ND	ND	ND					
SW846-8151	Dalapon	0.0023	mg/kg	<0.023	ND	ND	ND	ND					
SW846-8151	Dicamba	0.0023	mg/kg	<0.023	ND	ND	ND	ND					
SW846-8151	Dichlorprop	0.0023	mg/kg	<0.023	ND	ND	ND	ND					
SW846-8151	Dinoseb	0.0023	mg/kg	<0.023	ND	ND	ND	ND					
Polychlorinated Biphenyls													
SW846-8082	Aroclor 1016	**0.010**	mg/kg	**<0.10**	ND	ND	ND	ND					
SW846-8082	Aroclor 1221	**0.050**	mg/kg	**<0.50**	ND	ND	ND	ND					
SW846-8082	Aroclor 1232	**0.010**	mg/kg	**<0.10**	ND	ND	ND	ND					
SW846-8082	Aroclor 1242	**0.010**	mg/kg	**<0.10**	ND	ND	ND	ND					
SW846-8082	Aroclor 1248	0.010	mg/kg	<0.10	ND	ND	ND	ND					
SW846-8082	Aroclor 1254	0.010	mg/kg	<0.10	ND	ND	ND	ND					
SW846-8082	Aroclor 1260	0.010	mg/kg	<0.10	ND	ND	ND	ND					
Explosive Residues													
SW846-8330	2-Amino-4,6-dinitrotoluene	0.25	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	4-Amino-2,6-dinitrotoluene	0.25	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	1,3-Dinitrobenzene	0.25	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	2,4-Dinitrotoluene	**0.25**	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	2,6-Dinitrotoluene	0.25	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	HMX	**0.25**	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	Nitrobenzene	**0.25**	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	Nitroglycerin	**5.0**	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	2-Nitrotoluene	0.25	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	3-Nitrotoluene	0.25	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	4-Nitrotoluene	0.25	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	PETN	4.0	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	RDX	**0.25**	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	Tetryl	0.50	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	1,3,5-Trinitrobenzene	0.25	mg/kg	ND	ND	ND	ND	ND					
SW846-8330	2,4,6-Trinitrotoluene	0.25	mg/kg	ND	ND	ND	ND	ND					

1. Chromium III NMED SSL provided.
2. Total lead NMED SSL provided.
3. Mercury and compounds NMED SSL provided.
4. 1,3-Dichloropropene SSl value used for cis- and trans- forms of the compound.
5. Endosulfan SSL value used for alpha and beta forms of the compound. Alpha and beta concentrations should be added for screening assessment.

NOTES:

< – less than
mg/kg – milligrams per kilograms
DAF – Dilution attenuation factor
DL – Detection Limit
NA – Not Available
ND – Not Detected Above Detection Limit
SSL – Soil Screening Level

Table 3-4. North Oscura Peak Landfill Human Health Risk Assessment Screening Summary

Source: BAE, 2004b

Chemical Name	Confirmation & Stockpile Samples			Background Samples			NMED SSL
	Max	95% UCL	Mean	Max	Min	Mean	Residential
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Number of Samples	20	**20**	20	5	5	**5**	--
Metals							
Arsenic [1]	7.4	**3.9**	1.8	7.3	ND	**1.5**	**3.9**
Barium	476	**140**	139	190	74	**131**	**5200**
Cadmium	1.0	**0.3**	0.245	0.5	ND	**0.14**	**70**
Chromium	28	**25.1**	23.9	29	15.2	**24.4**	**10,000** [2]
Lead	24.0	**6.9**	5.41	9.6	ND	**1.9**	**400** [3]
Mercury	0.231	**0.057**	0.0561	0.336	ND	**0.1**	**23** [4]
Silver	28	**1.6**	3.18	1.2	ND	**0.25**	**380**
Pesticides							
4,4'-DDD	0.0048	**0.0029**	0.00239	**Not Sampled**			**24**
4,4'-DDE	0.013	**0.012**	0.0042				**17**
4,4'-DDT	0.0075	**0.0059**	0.00317				**17**
Polynuclear Aromatic Hydrocarbons							
Benz(a)anthracene	0.005	**0.0013**	0.00111	**Not Sampled**			**6.2**
Benzo(a)pyrene	0.016	**0.002**	0.00177				**0.62**
Benzo(b)fluoranthen	0.004	**0.004**	0.00175				**6.2**
Benzo(g,h,i)perylene	0.059	**0.004**	0.00534				**1,800** [5]
Benzo(k)fluoranthen	0.0038	**0.005**	0.000678				**62**
Dibenz(a,h)anthrace	0.0015	**0.0015**	0.000928				**0.62**
Fluoranthene	0.012	**0.012**	0.00525				**2300**
Indeno(1,2,3-	0.0053	**0.0029**	0.00138				**6.20**
Phenanthrene	0.013	**0.013**	0.0053				**1800**

1. Arsenic is established as naturally occurring at the site and was not screened against the SSLs.
2. Chromium III NMED SSL provided.
3. Total lead NMED SSL provided.
4. Mercury and compounds NMED SSL provided.
5. Pyrene SSL values used for Benzo(g,h,i)perylene.

DAF – Dilution attenuation factor
mg/kg – milligrams per kilograms
ND = Not Detected Above Detection Limit
SSL – Soil Screening Level
UCL – upper confidence limit

Appendix 3C

SWMUs 47 and 48
Correspondence

WSMR Environment & Safety Tech Lib
2 8800 00027815 1

200-1R
W71-CAP
2006

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

January 18, 2006

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New
Mexico 88002-5000

SUBJECT: VOLUNTARY CORRECTIVE MEASURES IMPLEMENTATION REPORT for the NORTH OSCURA PEAK LANDFILL (SWMUS 47, 48, and 49) WHITE SANDS MISSILE RANGE HWB-WSMR-04-007

Dear Mr. Ladd:

In accordance with 20.4.2.200.A(7) NMAC and 20.1.4 NMAC, NMED has completed a technical review of White Sands Missile Range's (WSMR) *Voluntary Corrective Measures Implementation Report for the North Oscura Peak Landfill*, dated February 2004. Based on the information in this report, it appears that WSMR has completed corrective actions activities at the three former landfill trenches. All waste and contaminated soil were removed and confirmation soil samples from the excavation pits and fill material were collected and analyzed for hazardous constituents. The data supports the conclusion that any residual contamination remaining at the site does not pose a risk to humans or the environment. Therefore, NMED requires no further investigations pertaining to North Oscura Peak Landfill at this time and the SWMUs are eligible for a No Further Action (NFA) determination. WSMR must submit a petition to NMED for a NFA determination and a Class 3 permit modification request to remove SWMUs 47, 48, and 49 from its permit.

In addition, NMED noted that one of the constituents had a detection limit higher than that of the current applicable standard. NMED understands that this constituent was not associated with the waste placed in the trenches and that this constituent and similar constituents were not detected in the soils; however, WSMR must always use detection limits that are lower than applicable standards or clean up levels.

If you have any questions regarding this letter, please contact Cheryl Frischkorn of my staff at (505) 428-2550.

Sincerely,

John E. Kieling
Manager
Hazardous Waste Bureau

cc: *D. Cobrain, NMED HWB
C. Frischkorn, NMED HWB
L. King, EPA Region 6 (6PD-N)
Jose Gallegos, WSMR

File: Reading File and WSMR 2006 File
HWB-WSMR-04-007

4. SWMU 63: Main Post Landfill 1A

4.1 Summary

Three former sanitary landfills were operated at various times in the Main Post area of WSMR. Main Post Landfill 1 was formerly identified as SWMU 63 under the WSMR RCRA Part B Permit Corrective Action Module. Main Post Landfill 1A is now identified as SWMU 63 in the current facility permit. The Main Post (headquarters) area of WSMR is located at the southeastern corner of the installation, approximately 27 miles east-northeast of Las Cruces, New Mexico (Figure 1-1, Appendix 1A, pg 1A-1). SWMU 63 (Landfill 1) was purportedly located in the southeastern section of the Main Post, was closed in 1948 and was presumed to be beneath the site of WSMR Building 1678 (Figure 4-1, Appendix A, pg. 4A-1). The unit was described as a sanitary landfill where only "inert materials" were disposed. Historical data was not available on the size, shape, and exact location of the landfill, the types of waste managed, where the waste was generated, or the volumes of waste disposed. In addition, no historical information was available on the design, construction and operating procedures used at this unit.

The *RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report* (Kearney, 1988) indicated the exact start-up date of the original landfill could not be determined, but possibly coincides with the beginning of activities on WSMR in the early 1940s. The RFA indicates that the original landfill closed in 1948. This unit was in operation prior to the implementation of RCRA and operation of the local hazardous waste landfill (SWMU 91). The generation and management of waste containing hazardous constituents prior to 1972 at WSMR were not documented.

During the *Final RCRA Facility Investigation (RFI) Report, Appendix I Sites* (IT Corp., 1992) for SWMU 63, an initial assessment of the suspected contaminant source was conducted via a SVS and the installation and sampling of two monitor wells (MW-3 and MW-6). The SVS did not provide evidence of a release. In addition, although low concentrations of several constituents were detected in the soil/mud cuttings and groundwater, none of the constituent concentrations could be attributed to a release from this unit. No accumulation of waste was discovered during the Phase I investigation at SWMU 63. However, the RFI determined that the presence of low level contaminants in groundwater samples warranted further investigation.

Two additional monitor wells (MW-11 and MW-12) were installed during the *Phase II RCRA Facility Investigation, Appendix I, II, III and IV Sites* (SEI, 1994) to increase groundwater monitoring coverage in the suspected location of the landfill. Groundwater samples were collected from these wells and the existing Phase I wells and were analyzed for VOCs, SVOCs, TPH, metals (total and filtered), and TDS. No VOCs, SVOCs, or TPH were detected. Barium, chromium, and lead were detected in groundwater. With the exception of one total lead result at MW-12, all metals were below their action levels. Dissolved lead was not detected in groundwater from MW-12.

During the Phase II investigation, site personnel indicated that SWMU 63 might not be located under Building 1678 as initially determined in the RFA. Through the review of historical aerial photographs and an aerial search, a potential location of SWMU 63 was identified to the south and southwest of the present location (south of Martin Luther King Avenue and east of the WSMR golf course). This new area was designated as Landfill 1A (Figure 4-1, Appendix 4A, pg. 4A-1). The Phase II RFI recommended that further investigation of SWMU 63 at the initial location be discontinued since no significant release of contaminants had been identified and a request for a Class 3 permit modification should be submitted by WSMR to terminate the RFI/CMS for this SWMU. However, it was recommended that further studies be performed to identify the true location of the former sanitary landfill #1. The USEPA and the NMED concurred that additional investigation was warranted (Honker, 1996 and Kelley, 1996). The current (December 2009) WSMR permit refers only to Landfill 1A as SWMU 63.

A *RCRA Facility Investigation, Former Main Post Landfill 1A* (MEVATEC, 2000c) was conducted in 1998/1999 to further explore the possibility of a landfill south of Martin Luther King Avenue and east of the WSMR golf course and characterize the composition of any buried waste, if found. In addition, field activities were conducted to determine the horizontal and vertical extent of any soil contamination and characterize the landfill materials. Field activities consisted of geophysical surveys, soil borings, and collection and analysis of depth-specific soil samples. Although the geophysical survey revealed negative results in identifying a landfill, 10 soil borings were completed to verify the absence of buried waste. All laboratory analytical results were well below the EPA Region 9 Preliminary Remediation Goals (PRGs) (Table 4-4, Appendix 4B, pg. 4B-4). Based on the results of the investigation, the RFI concluded no further action would be required for the remedial investigation/feasibility study at the Former Main Post Sanitary Landfill 1A.

In a letter dated August 2, 2004, the NMED stated that no further investigation pertaining to former Main Post Landfill 1A (or Landfill 1) was required and that a good faith effort had been made to locate the landfill (Appendix 4C, pg. 4C-1). The NMED response indicated that SWMU 63 was eligible for NFA determination and that WSMR must submit a separate petition for a Class 3 permit modification to remove the SWMU from its permit. It should be noted that SWMU 63 is described as Landfill 1A on the current (December 2009) WSMR RCRA permit.

4.2 Site Description and Operational History

4.2.1 Site Description

SWMU 63 was believed to have been in use from the early 1940s through 1948. It reportedly ceased receiving waste in 1948. Originally, SWMU 63, Landfill 1, was thought to be located under Building 1678 on the Main Post. However, based on interviews with site personnel, evaluation of aerial photographs, and observations during a helicopter aerial search, it was determined that SWMU 63 may actually have been located east of the golf course and south of Martin Luther King Avenue (Figure 4-1, Appendix 4A, pg. 4A-1). This alternative site was designated Landfill 1A and covered approximately 18 acres.

4.2.2 Operational History

The unit is described as a sanitary landfill where only "inert materials" were disposed. Details are not available on the size, shape, exact location, types of waste that were managed, where the wastes were generated, or the volume of waste disposed. No historical information is available on the design, construction and operating procedures used at the landfills and no documentation of a release from the units was identified. Potential contaminants were believed to be associated with initial post construction in the 1940s. No wastes or waste constituents were discovered at the initial Landfill 1 location near Building 1678, or at the Landfill 1A location (MEVATEC, 1999c).

4.3 Land Use

4.3.1 Current

Building 1678, the original suspected location of SWMU 63 (Landfill 1), is in the Technical Area of the Main Post at WSMR. The alternative location of SWMU 63 (Landfill 1A) was a vacant area, east of the Main Post golf course and south of Martin Luther King Boulevard. White Sands' Headquarters and most installation support activities are currently located at the Main Post area.

4.3.2 Future/Proposed

WSMR functions as an outdoor laboratory consisting of a large complex of test ranges, launch sites, impact areas and instrumentation sites required to develop and test weapons systems. WSMR is an integral part of the defense system of the United States; therefore, the Range will remain active for the foreseeable future. Building 1678 still exists, and there are no known specific future uses planned for the land underlying the building or for the vacant Landfill 1A site.

4.4 Investigative Activities

4.4.1 Summary

Low concentrations of metals were detected in groundwater samples collected during the Phase I and II RFIs at the SWMU 63 Landfill 1 site near Building 1678. All concentrations were below regulatory action levels. In addition, TPH and bis(2-ethylhexyl)phthalate (DEHP) were detected in groundwater during the Phase I investigation, but these occurrences were attributed to fresh paint at the wellhead during sampling. No DEHP or TPH were detected in groundwater during the Phase II RFI. There was no evidence of a contaminant source or a subsurface release at the SWMU 63 Landfill 1 site based on the Phase I and II RFI results.

A subsequent RFI was conducted in 1998-1999 at an alternative location of SWMU 63, designated as Landfill 1A (east of the Main Post Golf Course and south of Martin Luther King Boulevard). The purpose of the RFI for Landfill 1A was to explore the location of the landfill and attempt to characterize the composition of any buried waste, if found. The RFI included geophysical surveys, which failed to detect evidence of Landfill 1A, and the installation of ten soil borings with depth-specific samples collected

and analyzed for pesticides, herbicides, PCBs, VOCs, SVOCs, explosives, TPH and total metals. Only metals were detected at concentrations well below the EPA Region 9 PRGs. Based on the findings of the RFIs at SWMU 63 (Landfill 1 and Landfill 1A sites), no further action was recommended.

4.4.2 Investigation #1: RCRA Facility Assessment (Kearney, 1988)

4.4.2.1 *Non-sampling Data Collection*

The RFA included a visual site inspection, photo documentation, and consideration of release potential to various media from the sanitary landfill, SWMU 63. The RFA report states that the original landfill (SWMU 63) closed in 1948 and was the location of Building 1678 on the Main Post; the start date for the landfill was unknown. Details were not available on the types of wastes managed, where the wastes were generated, or the volumes of wastes disposed; however, one reference indicated that inert materials were disposed. There was no historical information on the design, construction, and operating procedures for the unit and no documented releases. Contaminant release potential to major exposure routes could not be assessed due to the age of the unit and uncertainty about location and waste composition. The Landfill 1A location was not evaluated during the 1988 RFA, as the only information available was related to the Landfill 1 location.

4.4.2.2 *Sampling Data Collection*

No sampling data were collected during the RFA.

4.4.2.3 *Results and Conclusions*

The RFA concluded that the release potential to environmental media were all unknown due to age of the unit and uncertainty about the waste composition. There were no documented releases from the unit.

4.4.3 Investigation #2: Phase I RCRA Facility Investigation - Appendix I Sites (IT Corp., 1992)

4.4.3.1 *Non-sampling Data Collection*

The boreholes for the monitor wells (MW-3 and MW-6), installed during the 1992 Phase I RFI, were logged geophysically, in addition to the field logging performed by

the geologist on site. These logs provided additional information on the stratigraphy in the SWMU 63 Landfill 1 area.

4.4.3.2 *Sampling Data Collection*

The RFI included collection of soil vapor samples, one composite soil sample (monitor well cuttings) and groundwater samples (MW-3 and MW-6). The soil and groundwater samples were analyzed for VOCs, SVOCs, metals and cyanide. The groundwater samples were also analyzed for TPH. Soil vapor samples were analyzed in the field.

4.4.3.3 *Data Gaps*

Phase I RFI activities did not identify evidence of a landfill and, therefore, a geophysical survey was recommended. The Phase I RFI stated that an additional well may be needed if hydraulic gradient cannot be determined by using the two wells installed during the Phase I RFI and a nearby well.

4.4.3.4 *Results and Conclusions*

The SVS detected xylene in the southwest corner of the Building 1678 parking lot and elevated CO_2 at the northeast corner. The groundwater analysis detected DEHP in MW-6, and low levels of TPH in MW-3 and MW-6 (Table 4-1, Appendix 4B, pg. 4B-1). These organic detections were attributed to the new paint on the wellhead. Barium and lead were the only constituents detected in the soil sample, and these concentrations were below regulatory action levels (Table 4-2, Appendix 4B, p. 4B-2).

The Phase I report concluded that there was no evidence of waste accumulation at SWMU 63 (Landfill 1). However, the Phase I RFI report stated that the presence of low concentrations of organics warranted further investigation, including a geophysical survey and periodic monitoring of the two monitor wells.

4.4.4 Investigation #3: Phase II RCRA Facility Investigation - Appendix I, II, III and IV Sites (SEI, 1994)

4.4.4.1 *Non-sampling Data Collection*

Interviews with site personnel, a review of aerial photographs, and aerial reconnaissance revealed that SWMU 63 may have been located at a site other than that previously investigated.

4.4.4.2 *Sampling Data Collection*

To increase the monitoring coverage of the groundwater surrounding SWMU 63, two additional monitor wells (MW-11 and MW-12) were installed during the RFI Phase II. Groundwater samples were collected from MW-11 and MW-12 and the existing Phase I wells, MW-3 and MW-6 (Figure 4-2, Appendix 4A, pg. 4A-2). Samples were analyzed for VOCs, SVOCs, TPH, metals (total and filtered), and TDS.

4.4.4.3 *Data Gaps*

No evidence of a landfill was discovered during the Phase II RFI.

4.4.4.4 *Results and Conclusions*

VOCs, SVOCs and TPH were not detected in groundwater samples collected from MW-11, MW-12, MW-3 and MW-6. Only barium, chromium, and lead were detected in groundwater during the Phase II RFI. Chromium was detected in groundwater from only one well (MW-11), barium was detected in all four wells, and lead was detected in three of the four wells (MW-3, MW-11, and MW-12). All of the detected metals concentrations were below their respective regulatory action levels. TDS at MW-6 was detected at 27,210 mg/l, which exceeded the NMED groundwater protection limit of 10,000 mg/l. The other wells had TDS values below 700 mg/l (Table 4-3, Appendix 4B, pg. 4B-3). No evidence of a landfill was discovered during the Phase I and II RFIs. In addition, the analytical results do not indicate that there has been a release to groundwater at the SWMU 63 (Landfill 1) site near Building 1678. The Phase II RFI recommended that the RFI for SWMU 63 (Landfill 1) be discontinued. The December 2009 WSMR RCRA permit reflects that SWMU 63 now pertains only to Landfill 1A.

Based on interviews with site personnel, a review of historical aerial photographs, and aerial reconnaissance, it was determined that the landfill may have been located to the south and southwest of the location investigated. The Phase II RFI report suggested that further studies be performed to confirm the actual location of the landfill (SEI, 1994).

4.4.5 Investigation #4: RCRA Facility Investigation, Former Main Post landfill 1A (MEVATEC, 2000c)

4.4.5.1 *Non-sampling Data Collection*

The Landfill 1A (SWMU 63) RFI was conducted to fully delineate the area south of Martin Luther King Avenue and east of the WSMR golf course, define trenches and buried waste, and to determine if soil contamination had occurred. A cultural resources inventory of the site area was conducted to address NEPA requirements and National Historic Preservation Act (NHPA) compliance responsibilities. No archeological sites were identified at the Landfill 1A site.

A non-intrusive geophysical survey was performed in June and July 1998 to identify and delineate buried waste, with particular attention to municipal and/or industrial type waste from past activities. The survey included ground conductivity screening and metal detection and magnetometer surveys. Possible landfill cells and trench locations were identified through review of historical aerial photographs and the aerial reconnaissance, and the conductivity patterns from the geophysical survey were coincident with the identified trenches. However, the geophysical survey did not find absolute concentration of buried waste. The RFI report indicated that the identified trenches were likely due to past borrow activities.

4.4.5.2 *Sampling Data Collection*

RFI field activities consisted of geophysical surveys, soil borings, and the collection and analysis of depth-specific soil samples. These activities were completed to provide data that would determine if SWMU 63 was located south of Martin Luther King Drive as well as identifying landfill material and the horizontal and vertical extent of any soil contamination. This area was subsequently named Landfill 1A.

Ten soil borings were placed directly in areas where the geophysical survey indicated possible buried waste. Samples were collected from 8-10 ft, 18-20 ft, and 28-30 ft bgs

in 6 of the 10 soil borings to evaluate the presence of VOCs, SVOCs, PCBs, TPH, pesticides, herbicides, explosives, total metals and total cyanide (Figure 4-3, Appendix 4A, pg. 4A-3).

4.4.5.3 *Data Gaps*

No gaps in the analytical data were reported.

4.4.5.4 *Results and Conclusions*

Soil borings were situated with the intent to identify any buried waste and/or depths at which contamination may have occurred in the area. This methodology was based on the geophysical survey interpretations, which anticipated areas and positions of buried wastes. Six of the ten borings were randomly sampled for constituents within the perimeter of the areas of investigation. The results of the soil analysis only indicated detections of metals, which were all below the EPA PRGs (EPA, 1998) and were considered representative of actual site conditions at the time of sampling. Soil sample results for the RFI are presented in Table 4-4, Appendix 4B, pg. 4B-4.

Based on the geophysical survey and soil boring investigation, no landfill or any sign of buried waste was detected. The RFI determined that no further action was required for the remedial investigation/feasibility study at the alleged Former Main Post Sanitary Landfill 1A (SWMU 63).

4.5 Site Conceptual Model

4.5.1 Nature and Extent of Contamination

Phase I and Phase II RFIs for SWMU 63 (Landfill 1) were conducted in the vicinity of the present site of Building 1678. No buried wastes were discovered during the installation of 6 monitor wells to depths ranging from 343 ft to 376 ft bgs. In addition, no constituents were detected above regulatory action levels in groundwater from these 6 wells.

Based on the results of these investigations, it was recommended that further investigation take place at an area located east of the golf course and south of Martin Luther King Avenue (Landfill 1A). Assessment activities at Landfill 1A consisted of geophysical surveys, soil borings, and collection and analysis of depth-specific soil

samples. The geophysical survey identified some trenches but showed no concentrations of buried waste. Through visual classification of the soil samples, no buried waste was detected, and laboratory analysis did not detect any constituents exceeding regulatory levels. Based on the findings, it was determined that the landfill does not exist and the area east of the golf course and south of Martin Luther King Avenue had not been used for the disposal of any significant quantity of municipal or industrial waste. No wastes and no soil or groundwater contamination associated with SWMU 63 were found during the RFI activities.

4.5.2 Environmental Fate

Based on the results of previous investigations, the areas in question were not used for the disposal of any detectable quantity of municipal or industrial waste. Geophysical surveys, visual observations, soil borings, and soil and groundwater sampling efforts did not identify any buried waste, contaminated soil or groundwater impacts.

4.6 Site Assessments

4.6.1 Human Health Screening and Risk Assessments

A human health screening assessment and risk assessment were not warranted based on the data collected during the RFI activities. The Phase I and II RFIs previously investigated the alleged Landfill 1 in the vicinity of Building 1678. During the Phase I and II RFIs, no buried wastes were encountered, no impacts to soil were noted, and there were no constituents detected in groundwater above the regulatory action levels. The Phase II investigation determined that the former sanitary Landfill 1 was not located under Building 1678. Assessment activities then proceeded east of the golf course (Landfill 1A) with geophysical surveys, soil borings, and analysis of depth-specific soil samples. Findings indicated that there were no buried wastes in the Landfill 1A area and it had not been used for the disposal of any significant quantity of municipal or industrial waste. In addition, no constituents were detected in soil above the regulatory action levels.

4.6.2 Ecological Screening and Risk Assessment

No ecological screening assessment or risk assessment was warranted based on the findings of the RFI activities.

4.6.3 Other Applicable Assessments

Following the Phase I and II RFIs, assessment of the area using aerial photographs and aerial reconnaissance was used to identify potential areas of disturbed soil and possible trenches associated with landfill activities. Assessment activities also included a cultural resources inventory of the site area to meet NEPA requirements and Section 106 compliance responsibility under the NHPA of 1966 as amended. This investigation was directed at identifying any historic properties that could be impacted by the proposed RFI work plan. The survey identified potential adverse effects to historic properties and provided suggestions for mitigating those effects.

4.7 No Further Action Proposal

4.7.1 Rationale

The SWMU 63 RFIs were conducted in an effort to identify the location of a potential landfill reported during the RFA and to assess any impacts to the environment that may have resulted from landfill operations. The WSMR Phase I and Phase II RFIs were conducted in the vicinity of Building 1678 (Landfill 1), the location of SWMU 63 in the RFA. No buried wastes and no impacts to soil or groundwater were discovered during the Phase I and II RFIs. During the Phase II RFI, it was determined that the landfill was apparently in a different location than described in the RFA. A potential location of SWMU 63 was identified east of the Main Post golf course and south of Martin Luther King Boulevard (Landfill 1A). Non-intrusive geophysical studies, soil borings, and soil sampling were conducted in the Landfill 1A area to pinpoint possible trench locations and to identify signs of buried waste. Areas of possible landfill activity were identified; however, the geophysical survey showed no absolute concentration of buried waste. The identified trenches were most likely due to past borrow activities.

To further support the absence of any municipal or industrial waste, ten boreholes were completed in locations identified by the geophysical survey as potential areas of concern. Through visual classification of the soil samples, no buried waste was identified. The first two ft of soil were consistent with the geophysical survey and appeared to be consistent with past borrow activities. In addition, soil samples were collected from six of the ten soil boring locations and analyzed for constituents typically associated with municipal or industrial type waste. Laboratory analysis only detected metals and none exceeded EPA Region 9 Regulatory Levels. No additional constituent specific confirmatory sampling was needed.

Based on previous investigations in the Landfill 1 area and the Landfill 1A RFI findings, no landfill or any sign of buried waste was identified. In addition, there were no impacts to soil or groundwater in these areas. The April 2000 RFI report concluded that no further action was required for the remedial investigation/feasibility study at the alleged Former Main Post Sanitary Landfill 1A (SWMU 63). The RFI recommended that WSMR use this determination in conjunction with the Phase I and II RFIs at the Landfill 1 site at Building 1678 to support a petition for no further action.

In a letter dated August 2, 2004, the NMED stated that, based on information presented in the April 2000 report, the Main Post Landfill 1A (SWMU 63) does not exist in either of the two areas investigated and that WSMR had made a good faith effort to try and locate the landfill. The NMED continued to state that it no further investigations are required for Main Post Landfill 1A and that the SWMU was eligible for NFA status (Appendix 4C, pg. 4C-1).

Based on these results, application is hereby made to perform a Class III modification to remove SWMU 63 from the White Sands HSWA permit in accordance with 40 CFR 264.514 and 270.42, and 20 NMAC 4.1.

4.7.2 Criterion

The criterion applied to this site is NFA Criterion 1 as described by the NMED: The Solid Waste Management Unit cannot be located, does not exist or is a duplicate SWMU.

Appendices

Appendix 4A – Figures

Appendix 4B – Analytical Results Tables

Appendix 4C - Correspondence

Appendix 4A

SWMU 63
Figures

LEGEND

- Wells Screened in the Regional Aquifer
- InvestigationAreas
- Buildings
- Streets
- Fence

Note:
SWMU 63 is identified as Landfill 1A on the December 2009 WSMR RCRA Permit

N

0 350 700 Feet

GRAPHIC SCALE

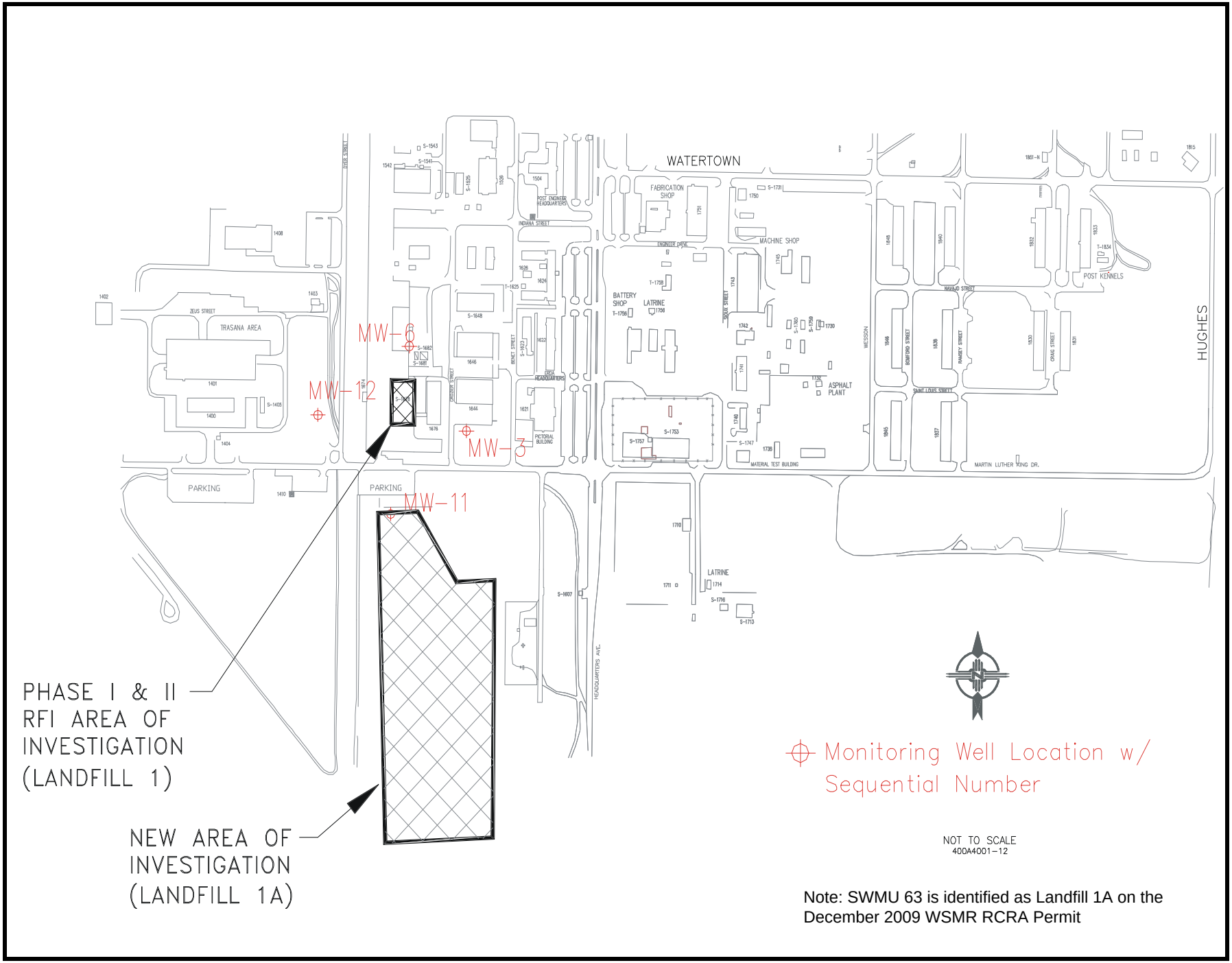
WHITE SANDS MISSLE RANGE
NEW MEXICO

MAIN POST
SWMU 63

ARCADIS

FIGURE
4-1

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: TR:
Project (Project #)
I:\WhiteSands\GIS\ArcMap_MXD\MainPost\SWMU63.mxd - 12/17/2009 @ 1:25:40 PM



Note: SWMU 63 is identified as Landfill 1A on the December 2009 WSMR RCRA Permit

Figure 4-2 SWMU 63 (Landfills 1 and 1A) Areas of Investigation

Source: MEVATEC, 2000c

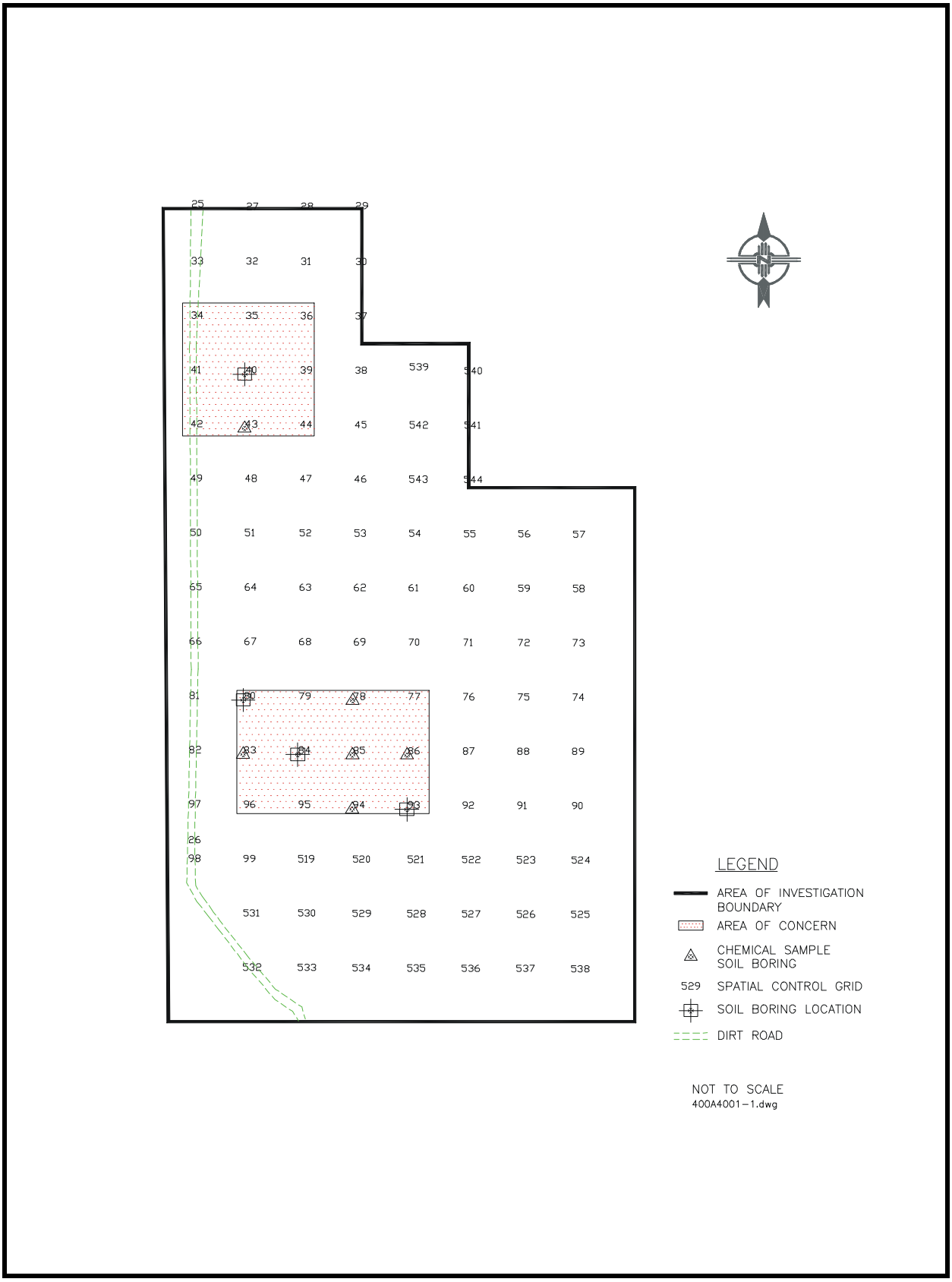


Figure 4-3 SWMU 63 (Landfill 1A) 1999 RFI – Boring Locations

Source: MEVATEC, 2000c

Appendix 4B

SWMU 63
Analytical Results Tables

Table 4-1. Groundwater Analytical Results from SWMU 63 (Landfill 1) – Phase I RFI

Source: IT Corp., 1992

CONSTITUENT[1]	UNITS OF MEASURE	SAMPLE ID.:			MW-3GW	MW-3GWD	MW-6GW
		UPGRADIENT/DOWNGRADIENT[2]:			DG	DG	DG
		SAMPLE TYPE:			Groundwater	Groundwater	Groundwater
		SAMPLE DATE:			05/29/91	05/29/91	05/29/91
EXTRACTABLES		**MCL[3]**	**NM[4]**	**URTH[5]**			
Bis(2-Ethylhexyl)phthalate	mg/L (0.004)	[6] NA		NA	ND	ND	0.012
INORGANICS							
Barium	mg/L	1 *(2 on 1/1/93)*[6] 1		NA	0.046	0.098	0.093
Lead mg/L		0.05 (0.015 on *12/7/92)*[6]	0.05 NA		**0.0070 0.0090**		ND
MISCELLANEOUS							
Total Petroleum Hydrocarbons	mg/L NA		NA	NA	6.1	8.6	4.6

NOTES:

[1] Only samples with constituent concentrations above the detection limit are noted.

[2] Hydraulic gradient direction is assumed from historical data.

[3] MCL = Maximum contaminant level in mg/L (from USEPA Safe Drinking Water Hotline, March 30, 1992, referencing 40 CFR dated July 1. 1991).

[4] NM = New Mexico regulatory levels in mg/L (from "New Mexico Water Quality Control Commission Regulations." 1988).

[5] URTH = Unreasonable Risk to Health (level in mg/L) as recommended by EPA (from October, 1990 "Guidance in Developing Health Criteria for Determining Unreasonable Risks to Health").

[6] Proposed.

ND = Non-detect.

NA = Not applicable.

SWMU 63 is identified as Landfill 1A on the December 2009 WSMR RCRA Permit.

Table 4-2. Drilling Mud/Cuttings Analytical Results from SWMU 63 (Landfill 1) – Phase I RFI

CONSTITUENT[1]	UNITS OF MEASURE	SAMPLE ID*: SAMPLE TYPE: SAMPLE DATE:	63 MUD Soil[2] 06/01/91
INORGANICS		TC LEVEL[3]	
Barium mg/kg		2000	14
Lead mg/kg		100	3.5

NOTES:
[1] Only samples with the constituent concentrations above the detection limit are noted.
[2] Sample is a composite of mud and cuttings from two wells.
[3] From Toxicity Characteristic--Final Rule; values are 20 times the TC level in mg/L
SWMU 63 is identified as Landfill 1A on the December 2009 WSMR RCRA Permit.

Table 4-3. Groundwater Analytical Results for Metals from SWMU 63 (Landfill 1) - Phase II RFI

Source: SEI, 1994

CONSTITUENT	SITE	0063MW03	0063MW06	0063MW11	0063MW12
	SAMPLE ID	0063MW03(WTR)	0063MW06(WTR)	0063MW11(WTR)	0063MW12(WTR)
	DATE	01/23/94	01/21/94	01/22/94	01/22/94
Arsenic	(µg/L)	<5 <5	<5	<5	
Arsenic (Dissolved)	(µg/L)	<5 <5	<5	<5	
Barium	(µg/L)	90	800 130	100	
Barium (Dissolved)	(µg/L)	70	60	120	90
Cadmium	(µg/L)	<5 <5	<5	<5	
Cadmium (Dissolved)	(µg/L)	<5 <5	<5	<5	
Chromium	(µg/L)	<25 <25	<25	<25	
Chromiulll (Dissolved)	(µg/L)	<25	<25 35 <25		
Lead	(µg/L)	6.7 <3	6.6		11.4
Lead (Dissolved)	(µg/L)	<3 <3	<3	<3	
Mercury	(µg/L)	<0.2 UJ	<0.2 UJ	<0.2 UJ	<0.2
Mercury (Dissolved)	(µg/L)	<0.2 UJ	<0.2 UJ	<0.2 UJ	<0.2
Selenium	(µg/L)	<5 <5	<5	<5	
Selenium (Dissolved)	(µg/L)	<5 <5	<5	<5	
Silver	(µg/L)	<25 <25	<25	<25	
Silver (Dissolved)	(µg/L)	<25 <25	<25	<25	
TOTAL DISSOLVED SOLIDS	(mg/l)	204	27210	456	458
pH		6.89	6.84 6.7 6.97		
Specific conductance	(µS/cm)	456 512	696	611	
Temperature	(°C)	25.9 23.4	22.6	23.4	

NOTES:

Values represent total concentrations unless noted

< = Not detected at indicated reporting limit

n/a = Not analyzed

SWMU 63 is identified as Landfill 1A on the December 2009 WSMR RCRA Permit

Table 4-4. Soil Sample Analytical Results from SWMU 63 (Landfill 1A) - 1999 RFI
Source: MEVATEC, 2000c

	Arsenic mg/kg	Barium mg/kg	Chromium mg/kg	Lead mg/kg	Mercury mg/kg	Selenium mg/kg
Detection Limit	**0.252**	**0.5**	**0.5**	**0.151**	**0.1**	**0.25**
EPA Screening Levels	**21**	**5200**	**210**	**130**	**22**	**370**
Sample ID						
0063-43						
8-10 ft	1.97	38	3.4	5.07 0.16	0.79	
18-20 ft	1.61	22	1	4.54 0.16	0.42	
28-30 ft	3.18	44	3.3	10.7 0.19	0.76	
0063-78						
8-10 ft	0.698	13	6.7	2.12	ND	0.33
18-20 ft	2.1	68	6	7.2	ND	0.58
28-30 ft	1.93	36	20	6.54	ND	0.87
28'-30' QC	1.63	39	5.1	5.92	ND	0.58
0063-83						
8-10 ft	2.12	42	2.3	5.32	0.18	ND
18-20 ft	1.87	42	2.1	6.03 0.21	0.84	
28-30 ft	1.51	16	1.2	4.04 0.17	0.39	
0063-85						
8-10 ft	3.67	32	4.1	22	ND	1.9
18-20 ft	1.78	25	1.6	5.21	ND	0.43
28-30 ft	1.8	38	1.9	4.64	0.34	ND
28'-30' QC	1.25	20	1.2	3.36 0.14	0.49	
0063-86						
8-10 ft	1.847	47	2	5.03	ND	0.67
18-20 ft	1.94	31	1.6	5.54 0.14	0.49	
28-30 ft	1.94	47	1.8	4.66	ND	0.66
0063-94						
8-10 ft	1.38	35	1.6	4.26	ND	0.36
18-20 ft	2.12	49	2.6	5.94	ND	0.42
28-30 ft	1.42	22	1.1	4.67	ND	0.46

Appendix 4C

SWMU 63
Correspondence

August 2, 2004

NMED
RFI Report Response Letter

WSMR Environment & Safety Tech Lib
2 8800 00027814 4

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

August 2, 2004

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New
Mexico 88002-5000

SUBJECT: RCRA FACILITY INVESTIGATION
FORMER MAIN POST LANDFILL NO. 1A
(SWMU 63)
HWB-WSMR-04-003

Dear Mr. Ladd:

On February 24, 2004, the New Mexico Environment Department (NMED) determined that the White Sands Missile Range (WSMR), *RCRA Facility Investigation (RFI) Former Main Post Landfill 1A* submitted in April 2000 was administratively complete. NMED confirmed receipt of the fees paid by WSMR on July 13, 2004.

In accordance with 20.4.2.200.A(7) NMAC and 20.1.4 NMAC, NMED has completed a technical review of WSMR's RFI Report. Based on information in this report, it appears that the former Main Post Landfill 1A, Solid Waste Management Unit (SWMU) 63 does not exist in either of the two areas investigated by WSMR and that WSMR has made a good faith effort in trying to locate the landfill. Therefore, NMED requires no further investigations pertaining to former Main Post Landfill 1A at this time and the SWMU is eligible for No Further Action (NFA) status. WSMR must submit a petition to NMED for a NFA determination and a Class 3 permit modification request to remove SWMU 63 for its permit.

If you have any questions regarding this letter, please contact Cheryl Frischkorn of my staff at (505) 428-2550.

Sincerely,

John E. Kieling
Manager
Hazardous Waste Bureau

cc: J. Bearzi, NMED HWB
G. von Gonten, NMED HWB
C. Frischkorn, NMED HWB
L. King, EPA Region 6 (6PD-N)
Gene Forsythe, WSMR
Jose Gallegos, WSMR

File: Reading File and WSMR 2004 File
HWB-WSMR-04-003

5. SWMU 64: Main Post Landfill 2A

5.1 Summary

Three former sanitary landfills were operated at various times in the Main Post area of WSMR. Main Post Landfill 2 was one of three sanitary landfills in the Main Post area of WSMR and was identified as SWMU 64 under the WSMR RCRA Part B Permit Corrective Action Module. Landfill 2A is now identified as SWMU 64 on the current RCRA permit. The Main Post (headquarters) area of WSMR is located at the southeastern corner of the installation, approximately 27 miles east-northeast of Las Cruces, New Mexico. SWMU 64 (Landfill 2) was purportedly located in the southeastern section of the Main Post and was presumed to be beneath the site of WSMR Building 1747 (Figure 5-1, Appendix 5A, pg. 5A-1). The unit was described as a sanitary landfill where only “inert materials” were disposed. Historical data was not available on the size, shape, and exact location of the landfill, the types of waste managed, where the waste was generated, or the volumes of waste disposed. In addition, no historical information was available on the design, construction and operating procedures used at this unit.

The *RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report* (Kearney, 1988) indicated that this landfill unit was operated from 1948, when SWMU 63, Landfill 1 ceased to be used, until 1965. The unit was in operation prior to the implementation of RCRA and the local hazardous waste landfill (SWMU 91). The generation and management of waste containing hazardous constituents prior to 1972 at WSMR were not documented.

During the *Final RCRA Facility Investigation (RFI) Report, Appendix I Sites* (IT Corp., 1992) for SWMU 64 (Landfill 2), an initial assessment of the suspected contaminant source was conducted via a SVS and the installation and sampling of two monitor wells (MW-1 and MW-2) (Figure 5-2, Appendix 5A, pg. 5A-2). The SVS indicated one isolated elevated methane detection, low levels of xylene at four points in a parking lot, and several elevated CO_2 levels. However, none of these detections could be attributed to a significant release from SWMU 64. Barium, chromium, lead, and DEHP were detected in groundwater at concentrations below their respective maximum contaminant levels (MCLs), and cadmium was detected just above its MCL in both wells. Low concentrations of TPH were also detected in groundwater (Table 5-1, Appendix 5B, pg. 5B-1). The organics detections were attributed to fresh paint on the wellhead. Low concentrations (below background) of several metals were detected in

soil/mud cuttings generated during the well installations (Table 5-2, Appendix B, pg. 5B-2). No evidence of a contaminant source or a subsurface release from this unit could be concluded from the Phase I investigation. No accumulation of waste was found during the Phase I investigation at SWMU 64 (Landfill 2) in the vicinity of Building 1747. However, the RFI determined that the presence of contaminants in soil vapor and low level contaminants in groundwater samples warranted further investigation.

During the *Phase II RCRA Facility Investigation, Appendix I, II, III and IV Sites* (SEI, 1994), a 15-point soil gas survey was performed to further evaluate the elevated methane concentration detected during the Phase I SVS. Samples were analyzed for methane, benzene, toluene, xylenes, 1,1,1-trichloroethane, tetrachloroethene, and total VOCs. None of these constituents were detected in soil gas. In addition, one soil boring was advanced at the Phase I SVS point with elevated methane. Six soil samples were collected from the surface to 32.5 ft and analyzed for VOCs, SVOCs, TPH, pesticides/PCBs, and metals. Only low concentrations of lead and mercury were detected below their respective action levels (Table 5-3, Appendix B, pg. 5B-3). In addition, two monitoring wells (MW-9 and MW-10) were installed during the Phase II to increase groundwater monitoring coverage. Groundwater samples were collected from these wells, the existing Phase I wells, and United States Geological Survey (USGS) Well T21, located southeast of the SWMU. Samples from the five wells were analyzed for VOCs, SVOCs, TPH, metals (total and filtered), and TDS. No VOCs, SVOCs, or TPH were detected in any of the samples. Low concentrations of barium, chromium, lead, and selenium were detected in groundwater, and, with the exception of total chromium and total lead that exceeded action levels in groundwater from Well T21, all were below their respective MCLs. Dissolved chromium and lead in groundwater from Well T21 were below the MCLs (Table 5-4, Appendix B, pg. 5B-4). The Phase II RFI report stated that Well T21 had not been developed nor sampled since it was installed in September 1982.

During the Phase II investigation, site personnel indicated that SWMU 64 might not be located under Building 1747 as initially determined in the RFA. Through the review of historical aerial photographs and an aerial reconnaissance, a potential location of SWMU 64 was identified southeast of the present location (south of Martin Luther King Avenue and near the motor pool storage area). This new area was designated as Landfill 2A (Figure 5-2, Appendix 5A, pg. 5A-2). The Phase II RFI recommended that further investigation of SWMU 64 at the initial location near Building 1747 be discontinued since no significant release of contaminants had been identified and a

request for a Class 3 permit modification should be submitted by WSMR to terminate the RFI/CMS for this SWMU. However, it was recommended that further studies be performed to identify the true location of the former sanitary landfill #2. The USEPA and the NMED concurred that additional investigation was warranted (Honker, 1995 and Kelley, 1996). The current (December 2009) WSMR RCRA permit refers only to Landfill 2A for SWMU 64.

A *RCRA Facility Investigation, Former Main Post Landfill 2A* (MEVATEC, 2000d) was conducted to further explore the possibility that SWMU 64 was actually located south of Martin Luther King Avenue and east of Headquarters Avenue, near the motor pool storage area southeast of the Main Post contractor lots. In addition, field activities were conducted to determine the horizontal and vertical extent of any soil contamination and characterize the landfill materials. Field activities consisted of geophysical surveys, soil borings, and collection and analysis of depth-specific soil samples. The geophysical survey identified areas of potential waste and trenching. As a result, 63 soil borings were completed to verify the presence of buried waste. No buried waste was detected in the soil borings (Figure 5-3, Appendix A, pg. 5A-3). Soil samples were collected for laboratory analysis of VOCs, SVOCs, PCBs, TPH, pesticides, herbicides, explosives, total metals, and total cyanide from twenty-five of the borings positioned in the areas of concern identified by the geophysical surveys. All constituents detected were well below the EPA Region 9 PRGs (Table 5-4, Appendix B, pg. 5B-4). Although the review of historical aerial photographs, visual observations during the aerial reconnaissance, and geophysical surveys confirmed evidence of possible trenches, no buried waste was found during the soil boring program. These observations were likely attributable to past borrow activities. Based on the results of the investigation, the RFI concluded no further action would be required for the remedial investigation/feasibility study at the Former Main Post Sanitary Landfill 2A.

In a letter dated July 10, 2003, the NMED stated that no further investigation pertaining to former Main Post Landfill 2A was required and that a good faith effort had been made to locate the landfill in two locations. However, NMED required additional investigation regarding detections of lead and chromium in Well T-21 (Appendix 5C, pg. 5C-1). Final approval regarding the Landfill 2A investigations was subsequently issued in December 1, 2004, after WSMR provided information indicating that Well T-21 did not yield representative groundwater data and that further investigation of the well was not warranted. In addition, lead and chromium were below Water Quality Control Commission (WQCC) standards in groundwater from Well T-21 in 2005.

Based on these results, the NMED stated that required investigations were completed for SWMU 64 and it was eligible for an NFA determination (Appendix 5C, pg. 5C-3). In a letter dated June 20, 2006, the NMED approved the final well abandonment report for Well T-21 and indicated that WSMR had completed the required activities related to this well in the June 10, 2003 letter (Appendix 5C, pg. 5C-5).

5.2 Site Description and Operational History

5.2.1 Site Description

SWMU 64 was believed to have been in use from 1948 through 1965, when it reportedly ceased receiving waste. The landfill was originally thought to exist below Building 1747 (Landfill 2). However, based on interviews with site personnel, review of historical aerial photographs, and observations during aerial reconnaissance, it was determined that SWMU 64 may have been an approximately 68 acre area located southeast of the intersection of Headquarters Avenue and Martin Luther King Avenue (Landfill 2A).

5.2.2 Operational History

The unit is described as a sanitary landfill where only "inert materials" were disposed. Potential contaminants were believed to be associated with initial post construction in the 1940s. Details are not available on the size, shape, exact location, types of waste which were managed, where the wastes were generated, or the volume of waste that was disposed. No historical information is available on the design, construction and operating procedures used at the landfills. No wastes or waste constituents were discovered at the initial Landfill 2 location near Building 1747 or at the Landfill 2A location (MEVATEC, 1999d). No evidence of a release from the units was identified during the RFA or RFIs.

5.3 Land Use

5.3.1 Current

Building 1747, situated on the ground surface above the original possible location of SWMU 64 (Landfill 2), is in the Technical Area of the Main Post. The alternative location of SWMU 64 (Landfill 2A) is located in a vacant area of the Main Post, southeast of the intersection of Headquarters Avenue and Martin Luther King Avenue,

near the motor pool storage area. White Sands' Headquarters and most installation support activities are currently located at the Main Post area.

5.3.2 Future/Proposed

WSMR functions as an outdoor laboratory consisting of a large complex of test ranges, launch sites, impact areas and instrumentation sites required to develop and test weapons systems. WSMR is an integral part of the defense system of the United States; therefore, the Range will remain active for the foreseeable future. Building 1747 still exists in its original location, and there are no know specific future uses for the land underlying that building or for the vacant Landfill 2A site.

5.4 Investigative Activities

5.4.1 Summary

The Phase I and II RFIs conducted in the vicinity of Building 1747 (Landfill 2) included the collection of soil vapor, soil, and groundwater samples. One elevated methane concentration detected during the Phase I RFI, northwest of SWMU 64, warranted further investigation during the Phase II RFI. During the Phase II RFI, no target constituents were detected in soil gas or soil in the area of the elevated methane concentration. This concentration was considered an anomaly that did not warrant further investigation.

Low concentrations of metals were detected in soils during the Phase I and Phase II RFI, well below respective regulatory action levels. A total of four monitor wells were installed and sampled, as well as Well T21, for analysis of VOCs, SVOCs, metals, TPH, cyanide, the TDS. DEHP and TPH were detected in groundwater during the Phase I RFI, but the occurrences were attributed to fresh paint on the wellhead during sampling. No DEHP or TPH were detected in groundwater during the Phase II RFI. With the exception of total chromium and total lead concentrations in groundwater from Well T21, no constituents were detected above regulatory action levels. Dissolved chromium and lead were not detected in groundwater from T21. It was later determined that Well T21 was not a viable well, and it was abandoned, with the approval of the NMED (Appendix 5C, pg. 5C-3). There was no evidence of buried waste or of a release in the vicinity of Building 1747 at the SWMU 64 Landfill 2 site.

Based on the lack of evidence identifying a landfill, interviews with site personnel, review of historical aerial photographs, and an aerial reconnaissance, the investigation of Landfill 2 was moved southeast of the intersection of Martin Luther King Boulevard and Headquarters Avenue (Landfill 2A). The RFI for Landfill 2A conducted in 1998-1999 explored the location of the landfill and attempted to characterize the composition of any buried waste, if found. Geophysical surveys were conducted over the site but failed to detect evidence of a landfill. Sixty-three soil borings were installed with twenty five depth-specific samples collected and analyzed for pesticides, herbicides, PCBs, VOCs, SVOCs, explosives, TPH and total metals. Only metals, methylene chloride, and di-n-butyl-phthalate were detected and all laboratory results were well below the EPA Region 9 PRGs. Based on the findings of the RFIs at SWMU 64 (Landfill 2 and Landfill 2A sites), no further action was recommended.

5.4.2 Investigation #1: RCRA Facility Assessment (Kearney, 1988)

5.4.2.1 *Non-sampling Data Collection*

The RFA included a visual site inspection, photo documentation, and consideration of release potential to various media from the sanitary landfill, SWMU 64. The RFA report stated that the landfill (SWMU 64) operated from 1948 to 1965 and was the site of Building 1747 on the Main Post. Details were not available on the types of wastes managed, where the wastes were generated, or the volumes of wastes disposed; however, one reference reviewed indicated that inert materials were disposed. There was also no historical information on the design, construction, and operating procedures for the unit. The Landfill 2A site was not evaluated during the RFA because the only available information pertained to the Landfill 2 site for SWMU 64.

5.4.2.2 *Sampling Data Collection*

No sampling data were collected during the RFA.

5.4.2.3 *Data Gaps*

Contaminant release potential to major exposure routes could not be assessed due to the age of the unit and uncertainty about the waste composition.

5.4.2.4 *Results and Conclusions*

There were no documented releases from the unit. However, as stated previously, contaminant release potential to major exposure routes could not be assessed due to the age of the unit and uncertainty about the waste composition.

5.4.3 Investigation #2: Phase I RCRA Facility Investigation - Appendix I Sites (IT Corp., 1992)

5.4.3.1 *Non-sampling Data Collection*

The boreholes for the monitor wells (MW-1 and MW-2) installed during the 1992 Phase I RFI were logged geophysically, in addition to the field logging performed by the geologist on site. These logs provided additional information on the stratigraphy in the SWMU 64 Landfill 2 area.

5.4.3.2 *Sampling Data Collection*

Samples collected during the Phase I RFI included soil vapor samples, one composite soil sample from cuttings generated during the installation of monitor wells, and groundwater samples from MW-1 and MW-2. The SVSs were analyzed in the field, and the soil and groundwater samples were submitted to the laboratory for analysis. The soil sample and groundwater samples were analyzed for VOCs, SVOCs, metals and cyanide, and the groundwater samples were also analyzed for TPH.

5.4.3.3 *Data Gaps*

Phase I RFI activities did not identify evidence of a landfill and, therefore, a geophysical survey was recommended. The Phase I RFI stated that an additional well may be needed if hydraulic gradient could not be determined from the two wells installed during the Phase I RFI and a nearby well.

5.4.3.4 *Results and Conclusions*

Table 5-1, Appendix 5B, pg. 5B-1 summarizes the groundwater results for the Phase I RFI. The DEHP and TPH detected in groundwater were attributed to new paint on the wellhead. Cadmium was detected slightly above its MCL in groundwater from both wells. None of the other metals detected were above their respective MCLs. The Phase I concluded there was no evidence of a significant contaminant source or

release at the site. However, the SVS sample with the elevated occurrence of methane (29,000 ppm) and the detection of organics and metals in groundwater indicated that further investigation, including a geophysical survey and periodic monitoring of the two monitor wells, was warranted.

5.4.4 Investigation #3: Phase II RCRA Facility Investigation - Appendix I, II, III and IV Sites (SEI, 1994)

5.4.4.1 *Non-sampling Data Collection*

Interviews with site personnel, a review of aerial photographs, and aerial reconnaissance revealed that SWMU 64 may have been located at a site other than the site previously investigated. An alternative location, designated Landfill 2A, was identified southeast of the intersection of Martin Luther King Avenue and Headquarters Avenue.

5.4.4.2 *Sampling Data Collection*

A 15-point soil gas survey (SGS) was performed to further evaluate the elevated methane concentration detected during the Phase I SVS. Soil gas samples were collected from 5 to 10 ft bgs and analyzed for methane, benzene, toluene, total xylenes, 1,1,1-trichloroethane, tetrachloroethene, and total VOCs.

One soil boring was drilled to a depth of 32.5 ft bgs at the Phase I RFI SVS sampling location. Six soil samples were collected from the boring and analyzed for VOCs, SVOCs, TPH, pesticides/PCBs, and metals.

Two additional monitor wells (MW-9 and MW-10) were installed during the Phase II RFI in the vicinity of Building 1747. Groundwater samples were collected from the newly installed wells and the existing Phase I wells (MW-1 and MW-2). A fifth groundwater sample was collected from USGS Well T21 not associated with Landfill 2A, and located approximately 1,600 ft southeast of the site. The five groundwater samples were analyzed for VOCs, SVOCs, TPH, metals (total and dissolved), and TDS.

5.4.4.3 *Data Gaps*

No evidence of a landfill was discovered during the Phase II RFI.

5.4.4.4 *Results and Conclusions*

The SGS did not detect methane or any other target constituents above their respective detection limits in the vicinity of the elevated methane detected during the Phase I. In addition, only low concentrations of two metals were detected in a soil boring drilled at this location (Table 5-3, Appendix B, pg. 5B-3). Therefore, the elevated methane detected during the Phase I RFI SVS was considered an anomaly and did not warrant further investigation.

The five groundwater samples were analyzed for VOCs, SVOCs, TPH, metals (total and dissolved), and TDS. VOCs, SVOCs and TPH were not detected in the samples. Barium, chromium, lead, and selenium were detected in groundwater at concentrations below regulatory action levels, with two exceptions. T-21 contained the two most substantial concentrations of total chromium and total lead at 90 and 122 micrograms per liter (μg/L), respectively. The dissolved chromium and lead in this well were less than 25 and 10 μg/L respectively. Well T-21 was determined not to be a viable well and was later abandoned with NMED's approval (Appendix 5C, pg 5C-5). With the exception of the total chromium and total lead in Well T21, no other constituents were detected above their respective MCLs (Tables 5-2 and 5-4, Appendix 5B, pg. 5B-2 and 5B-4).

No evidence of a landfill was discovered during the Phase I and II RFIs. In addition, the analytical results do not indicate that there has been a release to groundwater at the SWMU 64 (Landfill 2) site near Building 1747. The Phase II RFI recommended that the RFI for SWMU 64 (Landfill 2) be discontinued. The current RCRA permit now refers to SWMU 64 as Landfill 2A.

Based on interviews with site personnel, a review of historical aerial photographs and a aerial reconnaissance, it was determined that the landfill may have been located to the south and southwest of the location investigated. The Phase II RFI report suggested that further studies be performed to confirm the actual location of the landfill.

5.4.5 Investigation #4: RCRA Facility Investigation, Former Main Post Landfill 2A (MEVATEC, 2000d)

5.4.5.1 *Non-sampling Data Collection*

The Landfill 2A (SWMU 64) RFI was conducted to fully delineate the area south of Martin Luther King Avenue near the motor pool area and to further explore the possibility of a landfill and characterize buried waste, if found. Field activities were designed to determine the horizontal and vertical extent of any soil contamination and define the landfill materials. Investigations consisted of geophysical surveys, soil borings, and collection and analysis of depth-specific soil samples. Each activity was intended to more fully characterize the area, provide information to determine areas in which further data may be required and to provide data to conduct studies for corrective measures, if warranted. A cultural resources inventory of the site area was also conducted to address NEPA requirements and NHPA compliance responsibilities. No archeological sites were identified at the Landfill 2A site.

A non-intrusive geophysical survey was performed in June and July 1998 to identify and delineate buried waste, with particular attention to municipal and/or industrial type waste from past activities. The survey included ground conductivity screening and metal detection and magnetometer surveys. Possible landfill cells and trench locations were identified through review of historical aerial photographs and the aerial reconnaissance, and the conductivity patterns from the geophysical survey were coincident with the identified trenches. However, the geophysical survey did not find absolute concentration of buried waste. The RFI report indicated that the identified trenches were likely due to past borrow activities.

To further investigate the areas of interest identified by the geophysical surveys, 63 30-ft deep soil borings were completed. Analytical samples were collected from 25 of the soil borings; the remaining 38 soil borings were logged to determine if landfill materials were present. No buried wastes were discovered in any of the soil borings.

5.4.5.2 *Sampling Data Collection*

RFI field activities consisted of geophysical surveys, soil borings, and the collection and analysis of depth-specific soil samples. These activities were completed to provide data that would determine if the landfill was located south of Martin Luther King

Drive as well as identifying landfill material and the horizontal and vertical extent of any soil contamination.

A non-intrusive geophysical survey was performed during June and July 1998 to identify and delineate any buried waste with particular attention to municipal and/or industrial type waste from past activities. Due to insufficient data regarding the exact location of waste buried in the suspected landfill area, the investigations included a ground conductivity screening survey with follow-on metal detection and magnetometer surveys. Based on survey results, sixty three (63) soil borings were placed directly in areas where the geophysical survey indicated possible buried waste. Twenty-five (25) of the sixty three boreholes were chosen randomly and sampled for constituents at depths of 2-3 meters (m) (8-10 ft), 5-6 m (18-20 ft), and 8-9 m (28-30 ft). Samples taken were collected to evaluate the presence of VOCs, SVOCs, PCB, TPH, pesticides, herbicides, explosives, total metals and total cyanide.

5.4.5.3 *Data Gaps*

No gaps in the analytical data were reported.

5.4.5.4 *Results and Conclusions*

Soil borings were situated with the intent to identify any buried waste and/or depths at which contamination may have occurred in the Landfill 2A area. This methodology was based on the geophysical survey interpretations, which anticipated areas and positions of buried wastes. The results of the soil analysis only indicated detections of metals, cyanide, methylene chloride, and di-n-butyl-phthalate, which were all below the PRGs (EPA, 1998) and were considered representative of actual site conditions at the time of sampling. Soil sample results are presented in Table 5-4, Appendix 5B, pg. 5B-5. No evidence of buried waste was discovered during the soil boring program. In addition, none of the detections were indicative of a release.

Based on the data assessment of the investigation survey, several apparent borrow pits were identified. However, no landfill or any sign of buried waste was detected. The RFI determined that no further action was required for the remedial investigation/feasibility study at the alleged Former Main Post Sanitary Landfill 2A (SWMU 64).

5.5 Site Conceptual Model

5.5.1 Nature and Extent of Contamination

Phase I and Phase II RFIs were conducted in the vicinity of the present site of Building 1747 (Landfill 2). There was no evidence of a release to soils or groundwater in this area. No buried wastes were discovered during the installation of the 4 monitor wells to depths ranging from 321 to 324 ft bgs. The cadmium concentrations that were detected above the MCLs during the Phase I RFI were not present during the Phase II RFI. The total chromium and total lead exceedances of regulatory standards in USGS Well T21 was not representative of true groundwater conditions because the well had not been properly developed nor properly installed. It was recommended that no further investigation be conducted in the vicinity of Building 1747.

Based on the results of these investigations and information obtained through interviews, historical records review, and aerial reconnaissance, it was recommended that further investigation take place at an area located near the motor pool storage area south of Martin Luther King Avenue (Landfill 2A). Assessment activities at Landfill 2A consisted of geophysical surveys, soil borings, and collection and analysis of depth-specific soil samples. The geophysical survey identified some trenches and locations of apparent buried waste. However, through visual classification of the soil samples, no buried waste was detected and laboratory analysis did not detect any constituents exceeding regulatory levels. Based on the findings, it was determined that the landfill does not exist and the area near the motor pool storage area and south of Martin Luther King Avenue had not been used for the disposal of any significant quantity of municipal or industrial waste. No wastes and no soil or groundwater contamination associated with SWMU 64 were found during the RFI activities.

5.5.2 Environmental Fate

Following the completion of the Phase I and Phase II RFIs, the NMED concurred that there was no evidence of a landfill in this area, but required investigation of the metals occurrences in groundwater at the USGS Well T21. It was later demonstrated that the USGS well was not a viable well, the metals detected were not confirmed in 2005, and the well was abandoned with the NMED's approval.

Based on the results of the RFIs, it was recommended that further investigation take place at an area located near the motor pool storage area and south of Martin Luther

King Avenue to identify an actual location for SWMU 64 (Landfill 2A). Assessment activities at Landfill 2A consisted of geophysical surveys, soil borings, and collection and analysis of depth-specific soil samples. The geophysical survey identified some trenches and locations of apparent buried waste. However, through visual classification of the soil samples, no buried waste was detected and laboratory analysis did not detect any constituents exceeding regulatory levels. Based on the findings, it was determined that the landfill does not exist and the area near the motor pool storage area and south of Martin Luther King Avenue had not been used for the disposal of any significant quantity of municipal or industrial waste. No wastes and no soil or groundwater contamination associated with SWMU 64 were found during the RFI activities.

5.6 Site Assessments

5.6.1 Human Health Screening and Risk Assessments

A human health screening assessment and risk assessment were not warranted based on the data collected during the RFI activities. The Phase I and II RFIs previously investigated the alleged Landfill 2 area under and near Building 1747. During the Phase I and II RFIs, no buried wastes were encountered, no impacts to soil were noted, and there were no constituents consistently detected in groundwater above regulatory action levels. The Phase II investigation determined that the former sanitary Landfill 2 was not located under Building 1747. Assessment activities then proceeded in an alternative area designated as Landfill 2A, southeast of the intersection of Headquarters Avenue and Martin Luther King Avenue, near the motor pool storage area, with geophysical surveys, soil borings, and analysis of depth-specific soil samples. Findings indicated that there were no buried wastes in the Landfill 2A area and it had not been used for the disposal of any significant quantity of municipal or industrial waste. In addition, no constituents were detected in soil above the regulatory action levels.

5.6.2 Ecological Screening and Risk Assessments

No ecological screening assessment or risk assessment was warranted based on the findings of the RFI activities.

5.6.3 Other Applicable Assessments

When no evidence of a landfill was discovered during the Phase I and II RFIs, SEI conducted interviews with site personnel and learned that the landfill may actually have been in another location (i.e., the Landfill 2A area). SEI reviewed aerial photographs and conducted aerial reconnaissance of the Landfill 2A area to assist in finding areas of disturbed soil and possible trenches that would have been associated with landfill activities.

Prior to conducting the 1998-1999 RFI in the Landfill 2A area, a cultural resources inventory of the site was conducted to meet NEPA requirements and Section 106 compliance responsibility under the NHPA of 1966 as amended. The survey identified potential adverse effects to historic properties and provided suggestions for mitigating those effects. Landfill 2A was identified primarily with the Cold War historic context and contains a Cold War bottle/domestic refuse dump. It was also reported that a fragment of the plutonium recovery chamber of the Trinity Test experiment known as Jumbo may be buried at this site. A Formative period lithic and ceramic artifact scatter had also been discovered at this site. Due to the findings of the cultural resources inventory, the cuttings retrieved from the soil borings during this RFI were analyzed by an archeologist prior to being placed back into the borehole (MEVATEC, 1999c).

As discussed in Section 5.3.4.1, non-intrusive geophysical surveys were conducted in the Landfill 2A area following the historical research and completion of the cultural resources inventory. Possible trench locations were identified through review of historical aerial photographs and the aerial reconnaissance, and the conductivity patterns from the geophysical survey were coincident with those identified trenches. However, the geophysical survey did not find absolute concentration of buried waste. The 2000 RFI report indicated that the identified trenches were likely due to past borrow activities.

5.7 No Further Action Proposal

5.7.1 Rationale

The SWMU 64 RFIs were conducted in an effort to identify the location of a potential landfill reported during the RFA and to assess any impacts to the environment that may have resulted from landfill operations. The Phase I and Phase II RFIs were conducted in the vicinity of Building 1747 (Landfill 2 site), the location of SWMU 64 in

the RFA. No buried wastes and no impacts to soil or groundwater were discovered during the Phase I and II RFIs. During the Phase II RFI, it was determined that the landfill was apparently in a different location than described in the RFA. A second possible location of SWMU 64 was identified southeast of the intersection of Martin Luther King Boulevard and Headquarters Avenue and designated Landfill 2A. Non-intrusive geophysical studies, soil borings, and soil sampling were conducted in the Landfill 2A area to pinpoint possible trench locations and to identify signs of buried waste. Areas of possible landfill activity were identified; however, the geophysical survey showed no absolute concentration of buried waste. The identified trenches were most likely due to past borrow activities.

To further support the absence of any municipal or industrial waste, 63 boreholes were completed in locations identified by the geophysical survey as potential areas of concern. Through visual classification of the soil samples, no buried waste was identified. The first two ft of soil were consistent with the geophysical survey and appeared to be consistent with past borrow activities. In addition, soil samples were collected from 25 of the 63 soil boring locations and analyzed for constituents typically associated with municipal or industrial type waste. Laboratory analysis only detected low concentrations of metals, cyanide, methylene chloride, and di-n-butyl-phthalate metals. None of these constituent concentrations exceeded EPA Region 9 Regulatory Levels. No additional constituent specific confirmatory sampling was needed.

Based on previous investigations in the Landfill 2 area and the Landfill 2A RFI findings, no landfill or any sign of buried waste was identified. In addition, there were no impacts to soil or groundwater in these areas. The June 2000 RFI report concluded that no further action was required for the remedial investigation/feasibility study at the alleged Former Main Post Sanitary Landfill 2A (SWMU 64).

In a letter dated July 10, 2003, the NMED indicated that no further investigation pertaining to former Main Post Landfill 2A was required and that a good faith effort had been made to locate the landfill in two locations. However, additional investigation regarding detections of lead and chromium in Well T-21 sampled during the RFI was required by NMED (Appendix 5C, pg. 5C-1). Final approval regarding the Landfill 2A investigations was subsequently issued in December 1, 2004. In addition, lead and chromium concentrations were below WQCC standards in groundwater from Well T-21 in 2005. Based on these results, the NMED stated that required investigations were completed for SWMU 64 and that it was eligible for an NFA determination (Appendix 5C, pg. 5C-3). In a letter dated June 20, 2006, the NMED approved the final well

abandonment report for Well T-21 and indicated that WSMR had completed the required activities related to this well in the July 10, 2003 letter (Appendix 5C, pg. 5C-5).

Based on these results, application is hereby made to perform a Class III modification to remove SWMU 64 from the White Sands HSWA permit in accordance with 40 CFR 264.514 and 270.42, and 20 NMAC 4.1. SWMU 64 is identified as Landfill 2A in the December 2009 WSMR RCRA permit.

5.7.2 Criterion

The criterion applied to this site is NFA Criterion 1 as described by the NMED: The Solid Waste Management Unit cannot be located, does not exist or is a duplicate SWMU.

Appendices

Appendix 5A – Figures

Appendix 5B – Analytical Results Tables

Appendix 5C – Correspondence

Appendix 5A

SWMU 64
Figures

LEGEND

- Wells Screened in the Regional Aquifer
- InvestigationAreas
- Buildings
- Streets
- Fence

Note:
SWMU 64 is identified as Landfill 2A on the December 2009 WSMR RCRA Permit

N

0 400 800 Feet
GRAPHIC SCALE

WHITE SANDS MISSLE RANGE
NEW MEXICO

MAIN POST
SWMU 64

ARCADIS

FIGURE
5-1

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: TR:
Project (Project #)
I:\WhiteSands\GIS\ArcMap_MXD\MainPost\SWMU64.mxd - 12/17/2009 @ 1:39:22 PM

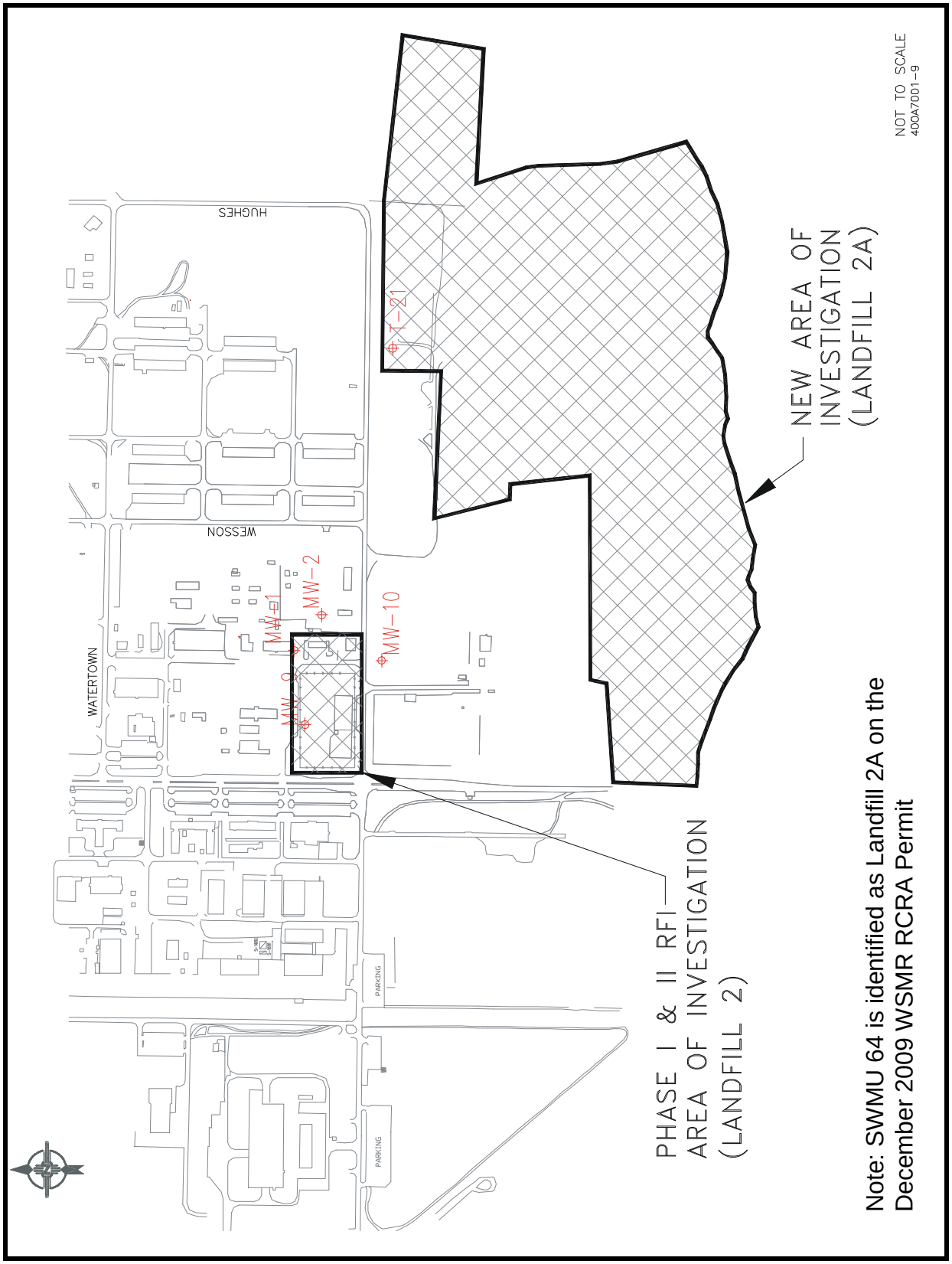


Figure 5-2 SWMU 64 (Landfills 2 and 2A) Areas of Investigation

Source: MEVATEC, 2000d

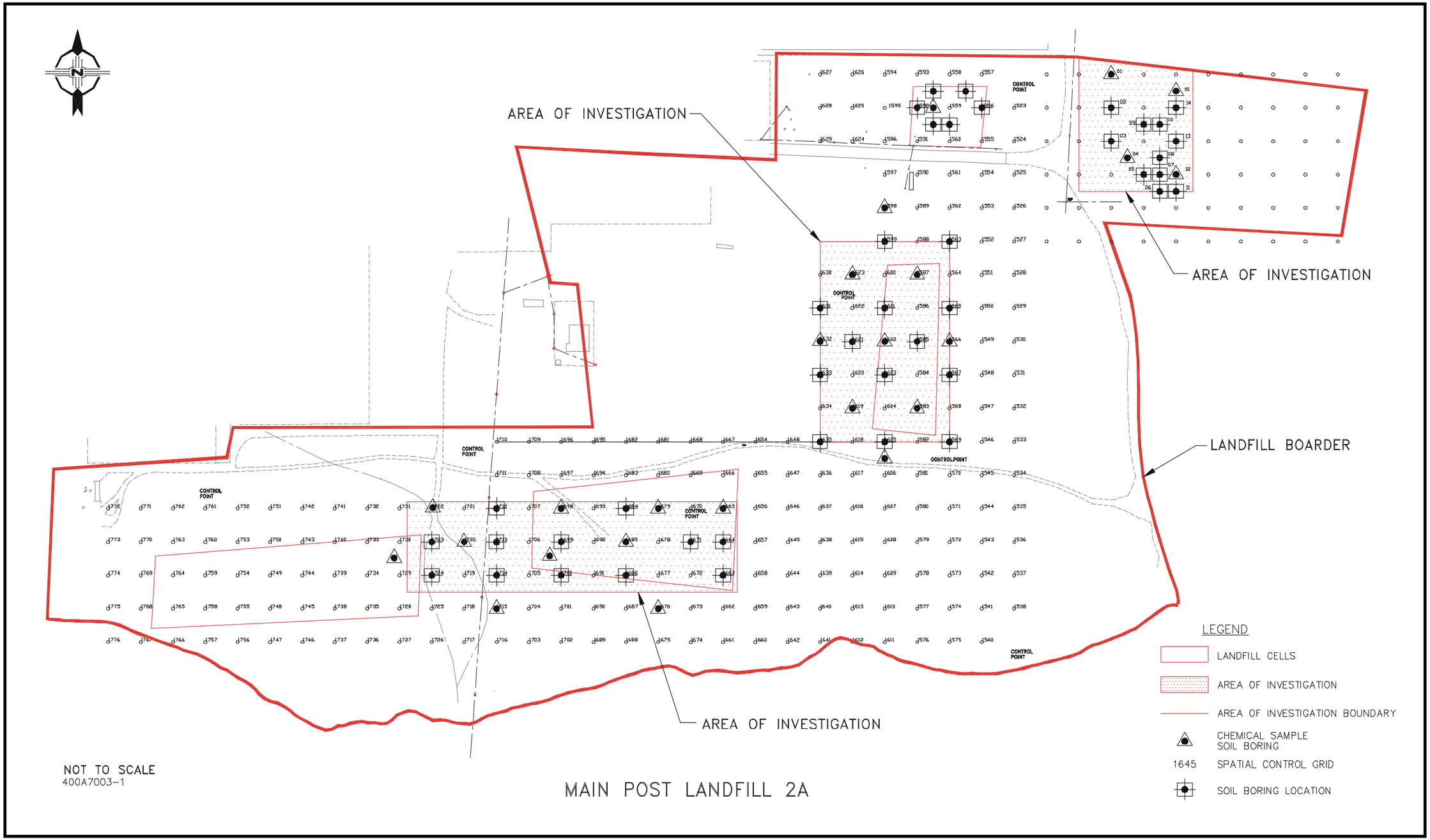


Figure 5-3 SWMU 64 (Landfill 2A) RFI – Boring Locations

Source: MEVATEC, 2000d

Appendix 5B

SWMU 64
Analytical Result Tables

Table 5-1. Groundwater Analytical Results from SWMU 64 – WSMR Phase I RFI Appendix 1 Sites
Source: IT Corp., 1992

CONSTITUENT[1]	UNITS OF MEASURE	SAMPLE ID:			MW-1GWD	MW-1GW	MW-2GW
		UPGRADIENT/DOWNGRADIENT[2]:			DG	DG	DG
		SAMPLE TYPE:			Groundwater	Groundwater	Groundwater
		SAMPLE DATE:			05/31/91	05/31/91	05/31/91
EXTRACTABLES		**MCL[3]**	**NM[4]**	**URTH[5]**			
Bis(2-Ethylhexyl)phthalate	mg/L	(0.004)[6]	NA	NA	ND	ND	0.014
INORGANICS	mg/L						
Barium		1 (2 on 1/1/93)[6]	1	NA	0.087	0.76	0.086
Cadmium	mg/L	0.005 (0.010 on 7/30/92)[6]	0.01	0.005	ND	**0.0072**	**0.0054**
Chromium	mg/L	0.005 (0.010 on 7/30/92)[6]	0.05	NA	ND	ND	0.013
Lead	mg/L	0.05 (0.015 on 12/7/92)[6]	0.05	NA	**0.0090**	**0.0090**	**0.011**
MISCELLANEOUS							
Total Petroleum Hydrocarbons	mg/L	NA	NA	NA	1.5	ND	1.7

NOTES:
[1] Only samples with constituent concentrations above the detection limit are noted.
[2] Hydraulic gradient direction is assumed from historical data.
[3] MCL = Maximum contaminant level in mg/L (from USEPA Safe Drinking Water Hotline, March 30, 1992, referencing 40 CFR dated July 1. 1991).
[4] NM = New Mexico regulatory levels in mg/L (from "New Mexico Water Quality Control Commission Regulations." 1988).
[5] URTH = Unreasonable Risk to Health (level in mg/L) as recommended by EPA (from October, 1990 "Guidance in Developing Health Criteria for Determining Unreasonable Risks to Health").
[6] Proposed.
ND = Non-detect.
NA = Not applicable.

Table 5-2. WSMR Phase II RFI SWMU 64 Soil Analysis Detected Metals
Source: SEI, 1994

CONSTITUENT	UNITS OF MEASURE	SAMPLE ID:	0064SB01	0064SB01	0064SB01	0064SB01	0064SB01	0064SB01
		SAMPLE DEPTH:	0.0	2.0	8.5	19	23.5	32.5
		SAMPLE DATE:	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93	12/04/93
METALS								
Lead	mg/kg		6.28	6.08	10.2	7.93	6.13	14.2
Mercury	mg/kg		0.0305	0.0613	<0.0208	<0.0205	<0.0201	<0.0206

Notes:

Values represent total concentrations unless noted

< = not detected at indicated reporting limit

Table 5-3. WSMR Phase II RFI SWMU 64 Groundwater Analysis – Detected Metals
Source: SEI, 1994

CONSTITUENT	SITE	0064MW01	0064MW02	0064MW09	0064MW10	0064MW21
	SAMPLE ID	0064MW01(WTR)	0064MW02(WTR)	0064MW09(WTR)	0064MW10(WTR)	0064MW21(WTR)
	DATE	01/21/94	01/20/94	01/24/94	01/25/94	01/22/945
Arsenic	(µg/L)	<5	<5	<5	<5	<5
Arsenic (Dissolved)	(µg/L)	<5	<5	<5	<10	<10
Barium	(µg/L)	50	70	90	80	300
Barium (Dissolved)	(µg/L)	<50	<50	80	<50	<50
Cadmium	(µg/L)	<5	<5 UJ	<5	<5	<5
Cadmium (Dissolved)	(µg/L)	<5	<5	<5	<5	<5
Chromium	(µg/L)	<25	<25 UJ	40	<25	90
Chromium (Dissolved)	(µg/L)	<25	<25	32	<25	<25
Lead	(µg/L)	<3	6	4.2	6.6	122
Lead (Dissolved)	(µg/L)	<3	<3	<3	<3	<3
Mercury	(µg/L)	<0.2 UJ	<0.2 UJ	<0.2 UJ	<0.2 UJ	<0.2 UJ
Mercury (Dissolved)	(µg/L)	<0.2 UJ	<0.2 UJ	<0.2 UJ	<0.2 UJ	<0.2 UJ
Selenium	(µg/L)	<5	<5	<5	<5	<5
Selenium (Dissolved)	(µg/L)	<5	7	<5	<10 UJ	<10 UJ
Silver	(µg/L)	<25	<25 UJ	<25	<25	<25
Silver (Dissolved)	(µg/L)	<25	<25	<25	<25	<25
TOTAL DISSOLVED SOLIDS	(mg/l)	178	336	296	138	228
pH		7.15	7.28	6.95	7.24	7.48
Specific conductance	(µS/cm)	306	309	537	314	355
Temperature	(°C)	23.7	24.7	23.9	23.8	24.3

NOTES:
Values represent total concentrations unless noted
< = Not detected at indicated reporting limit
n/a = Not analyzed

Table 5-4. RCRA Facility Investigation Landfill 2A (SWMU 64) Soil Sample Analytical Results

Source: MEVATEC, 2000d

	Cyanide	**Methylene Chloride** VOC	**Di-n-butyl-phthalate** SVOC	**Arsenic** Metal	**Barium** Metal	**Chromium** Metal	**Lead** Metal	**Mercury** Metal	**Selenium** Metal
	mg/kg	ug/kg	ug/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Detection Limit	**0.51**	**5**	**340**	**0.25**	**0.5**	**0.5**	**0.15**	**0.1**	**0.25**
EPA Screening Levels	**1100**	**8.5**	**5500**	**21**	**5200**	**210**	**130**	**22**	**370**
Sample ID									
0063-01									
14-16 ft	ND	ND	ND	0.998	38	5.1	3.22	ND	ND
28-30 ft	ND	ND	ND	1.29	21	1.4	4.27	ND	ND
0063-04									
14-16 ft	ND	ND	ND	1.62	28	2.6	4.5	ND	ND
28-30 ft	ND	ND	ND	2.27	27	2.4	6.37	ND	ND
0063-12									
14-16 ft	ND	ND	ND	1.49	34	1.6	4.43	0.04	ND
28-30 ft	ND	ND	ND	1.69	30	2.3	3.97	0.03	ND
28'-30' QC	ND	ND	ND	1.61	29	1.8	4.28	0.05	ND
0063-15									
14-16 ft	ND	ND	ND	1.58	22	2	4.08	0.1	ND
28-30 ft	ND	ND	ND	1.54	26	2	4.52	0.04	ND
0063-1559									
14-16 ft	ND	ND	ND	1.08	49	0.97	3.49	0.04	ND
28-30 ft	ND	ND	ND	2.11	46	1.8	5.22	0.04	ND
0063-1566									
8-10 ft	ND	ND	ND	1.69	33	2.2	4.04	ND	ND
18-20 ft	ND	ND	ND	2.16	44	2.1	6.22	ND	ND
28-30 ft	1.801	2.8	ND	1.45	30	1.3	4.39	ND	ND
0063-1583									
8-10 ft	ND	2.6	ND	1.71	45	2	5.69	ND	ND

Table 5-4. RCRA Facility Investigation Landfill 2A (SWMU 64) Soil Sample Analytical Results (cont)

	Cyanide	**Methylene Chloride** VOC	**Di-n-butyl-phthalate** SVOC	**Arsenic** Metal	**Barium** Metal	**Chromium** Metal	**Lead** Metal	**Mercury** Metal	**Selenium** Metal
	mg/kg	ug/kg	ug/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Detection Limit	**0.51**	**5**	**340**	**0.25**	**0.5**	**0.5**	**0.15**	**0.1**	**0.25**
EPA Screening Levels	**1100**	**8.5**	**5500**	**21**	**5200**	**210**	**130**	**22**	**370**
18-20 ft	ND	2.9	ND	1.88	46	2.1	6.61	ND	ND
28-30 ft	ND	2.7	ND	1.51	49	1.9	4.92	ND	ND
0063-1587									
8-10 ft	2.7	ND	ND	2.19	51	3.5	6.83	ND	ND
18-20 ft	ND	ND	ND	1.27	22	1	3.55	ND	ND
28-30 ft	2.7	ND	ND	1.48	30	1.6	4.97	ND	ND
0063-1598									
14-16 ft	ND	3.7	ND	1.52	26	9.2	4.56	ND	ND
28-30 ft	0.9895	3.6	ND	2.1	42	2.8	6.52	ND	ND
0063-1602									
8-10 ft	ND	ND	ND	1.76	47	1.9	5.26	ND	ND
18-20 ft	ND	ND	ND	2.12	53	2.3	7.24	ND	ND
28-30 ft	ND	2.6	ND	1.66	44	5.5	5.39	ND	ND
0063-1605A									
8-10 ft	ND	ND	ND	1.39	24	1.4	3.33	0.17	ND
18-20 ft	0.7188	ND	ND	2.2	60	2.2	6.89	0.17	0.46
28-30 ft	0.8355	ND	ND	1.59	21	1.6	5.04	0.16	0.43
28'-30' QC	ND	ND	ND	1.73	32	1.6	5.39	0.12	0.7
0063-1619									
8-10 ft	ND	3.7	ND	2.58	72	3.6	9.57	ND	ND
18-20 ft	ND	2.6	230	2.14	76	2.8	6.56	ND	ND
28-30 ft	ND	3.4	ND	1.88	49	2.2	5.36	ND	ND
0063-1623									
8-10 ft	ND	ND	ND	1.24	27	1	3.19	ND	ND
18-20 ft	ND	3.7	ND	1.26	26	1.5	4.05	ND	ND

Table 5-4. RCRA Facility Investigation Landfill 2A (SWMU 64) Soil Sample Analytical Results (cont)

	Cyanide	**Methylene Chloride** VOC	**Di-n-butyl-phthalate** SVOC	**Arsenic** Metal	**Barium** Metal	**Chromium** Metal	**Lead** Metal	**Mercury** Metal	**Selenium** Metal
	mg/kg	ug/kg	ug/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Detection Limit	**0.51**	**5**	**340**	**0.25**	**0.5**	**0.5**	**0.15**	**0.1**	**0.25**
EPA Screening Levels	**1100**	**8.5**	**5500**	**21**	**5200**	**210**	**130**	**22**	**370**
28-30 ft	ND	3.9	ND	0.991	31	30	4.33	ND	ND
0063-1632									
18-20 ft	ND	ND	ND	1.07	19	1.3	2.9	ND	ND
28-30 ft	ND	ND	ND	1.49	34	4.9	4.88	0.04	ND
0063-1665									
8-10 ft	ND	ND	ND	2.36	43	4.6	6.87	ND	0.81
18-20 ft	0.729	ND	ND	2.32	70	7.5	7.36	ND	0.59
28-30 ft	ND	ND	ND	1.41	29	2.7	4.11	ND	0.35
0063-1676									
8-10 ft	ND	ND	ND	2.81	56	3	8.3	0.16	0.69
18-20 ft	0.6401	ND	ND	1.67	27	1.6	4.82	0.38	0.71
28-30 ft	ND	ND	ND	1.9	39	3.9	6.33	0.17	0.4
0063-1679									
8-10 ft	ND	ND	ND	1.74	30	1.6	4.44	ND	0.5
18-20 ft	ND	ND	ND	1.32	28	2.6	3.45	ND	0.27
28-30 ft	ND	ND	ND	1.78	39	3.8	4.9	ND	ND
0063-1685									
8-10 ft	ND	ND	ND	1.42	35	1.6	4.11	ND	0.56
18-20 ft	ND	ND	ND	2.21	60	4.6	8.12	0.13	0.63
28-30 ft	ND	ND	ND	2.4	50	6	7.19	ND	0.36
28'-30' QC	ND	ND	ND	1.61	30	1.7	4.35	ND	0.5
0063-1698									
8-10 ft	ND	ND	ND	1.27	23	6.6	3.82	ND	0.32
18-20 ft	ND	ND	ND	1.02	30	1.6	3.03	0.12	ND
28-30 ft	ND	ND	ND	2.1	43	2.9	6.9	0.15	0.54

Table 5-4. RCRA Facility Investigation Landfill 2A (SWMU 64) Soil Sample Analytical Results (cont)

	Cyanide	**Methylene Chloride** VOC	**Di-n-butyl-phthalate** SVOC	**Arsenic** Metal	**Barium** Metal	**Chromium** Metal	**Lead** Metal	**Mercury** Metal	**Selenium** Metal
	mg/kg	ug/kg	ug/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Detection Limit	**0.51**	**5**	**340**	**0.25**	**0.5**	**0.5**	**0.15**	**0.1**	**0.25**
EPA Screening Levels	**1100**	**8.5**	**5500**	**21**	**5200**	**210**	**130**	**22**	**370**
0063-1699									
8-10 ft	ND	ND	ND	1.65	34	3.2	4.83	ND	ND
18-20 ft	ND	ND	ND	1.92	24	2.3	5.14	ND	0.48
28-30 ft	ND	ND	ND	1.42	23	1.6	4.44	ND	ND
0063-1706									
8-10 ft	ND	ND	ND	1.28	39	21	4.49	ND	0.66
18-20 ft	ND	ND	ND	1.54	23	8.2	5.19	ND	0.44
28-30 ft	ND	ND	ND	1.04	12	3.7	3.05	ND	0.35
0063-1715									
8-10 ft	ND	ND	ND	1.27	34	1.7	3.5	ND	ND
18-20 ft	ND	ND	ND	2.6	65	3.3	5.84	ND	1
28-30 ft	ND	ND	ND	2.5	59	3.8	7.79	ND	0.34
28'-30' QC	ND	ND	ND	2.77	68	3.8	7.86	ND	0.45
0063-1720									
8-10 ft	ND	ND	ND	1.86	38	14	5.91	ND	0.49
18-20 ft	ND	ND	ND	1.14	22	11	3.39	ND	0.52
28-30 ft	ND	ND	ND	1.31	17	5.5	4.32	ND	0.6
28'-30' QC				1.31	19	1.6	4.33	ND	0.34
0063-1722									
8-10 ft	ND	ND	ND	1.28	23	1.6	3.82	ND	ND
18-20 ft	ND	ND	ND	1.32	15	1.4	3.49	ND	0.26
28-30 ft	ND	ND	ND	1.52	20	1.9	5.27	0.12	ND
0063-1730									
8-10 ft	ND	ND	ND	2.25	39	3.4	5.51	ND	0.7
18-20 ft	ND	ND	ND	1.22	21	1.5	2.95	ND	ND
28-30 ft	ND	ND	ND	1.1	16	2	4.25	ND	0.42

Appendix 5C

SWMU 64
Correspondence

July 10, 2003

NMED
RFI Report Approval Letter

WSMR Environment & Safety Tech Lib
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State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

July 10, 2003

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New
Mexico 88002-5000

SUBJECT: RCRA FACILITY INVESTIGATION
FORMER MAIN POST LANDFILL NO. 2A
(SWMU 64)
HWB-WSMR-00-011

Dear Mr. Ladd:

On February 17, 2003 the New Mexico Environment Department (NMED) determined that the White Sands Missile Range (WSMR), *RCRA Facility Investigation (RFI) Former Main Post Landfill 2A* submitted in June of 2000 was administratively complete. NMED confirmed receipt of the fees paid by WSMR on June 3, 2003.

In accordance with 20.4.2.200.A(7) NMAC and 20.1.4 NMAC, NMED has completed a technical review of WSMR's RFI. Based on information in this document, it appears that the former Main Post Landfill 2A does not exist in either of the two areas investigated by WSMR and that WSMR has made a good faith effort in trying to locate the landfill. NMED requires no further investigations pertaining to former Main Post Landfill 2A at this time. However, the detection of lead and chromium above New Mexico Water Quality Control Commission (WQCC) standards in well T-21 warrants further investigation. WSMR must propose an investigative approach in a

work plan that will enable WSMR to determine the possible source of the metals detected in the ground water in well T-21. Within 180 days of receipt of this letter, WSMR must submit a work plan to investigate the detected metals in well T-21

If you have any questions regarding this letter, please call me at (505) 428-2550.

Sincerely,

Cheryl A. Frischkorn
White Sands Missile Range Project Leader
Permits Management Program

cc: S. Martin, NMED HWB
J. Kieling, NMED HWB
G. von Gonten, NMED HWB
L. King, EPA Region 6 (6PD-N)
Gene Forsythe, WSMR

File: Reading File and WSMR 2003 File
HWB-WSMR-00-011

December 1, 2004

NMED
Completion of Investigation Well T-21 Letter

WSMR Environment & Safety Tech Lib
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State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

December 1, 2004

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New
Mexico 88002-5000

SUBJECT: COMPLETION OF INVESTIGATION
WELL T-21 GROUNDWATER SAMPLING REPORT SUBMITTAL;
~~FORMER MAIN~~ POST LANDFILL No. 2A
IRP SITE WSMR-40; SWMU 64
WHITE SANDS ~~MISSILE RANGE~~
EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has completed a technical review of WSMR's Letter Report titled *Well T-21 Groundwater Sampling Report Submittal; Former Main Post Landfill No. 2A*. This letter report contains supporting data that Well T-21 does not yield representative ground water samples and that further investigation regarding this well is unwarranted. Neither lead nor chromium was detected in ground water samples collected August 4-5, 2005 at concentrations that exceed the New Mexico Water Quality Control Commission (WQCC) standards. Therefore, WSMR has completed the required investigations pertaining to Former Main Post Landfill No. 2A.

If you have any questions regarding this letter, please call Cheryl Frischkorn of my staff at (505) 428-2550.

Sincerely,

John E. Kieling
Manager
Permits Management Program

cc: J. Bearzi, NMED HWB
G. von Gonten, NMED HWB
C. Frischkorn, NMED HWB
L. King, EPA Region 6 (6PD-N)
Gene Forsythe, WSMR
Jose Gallegos, WSMR

File: Reading File and WSMR 2004 File

WSMR Environment & Safety Tech Lib
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State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

June 20, 2006

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range,
New Mexico 88002-5000

SUBJECT: WELL T-21 FINAL REPORT
WELL ABANDONMENT
WHITE SANDS MISSILE RANGE
EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) received WSMR's *Well T-21 Final Report Well Abandonment*, dated May 30, 2006. The report contains information regarding well abandonment activities for test well T-21 which was sampled in support of corrective action activities for Solid Waste Management Unit (SWMU) 64 – Former Main Post Landfill No. 2A. NMED has determined that the activities described in NMED's letter dated July 10, 2003 have been fulfilled and the report is hereby approved.

If you have any questions regarding this letter, please call me at (505) 428-2550.

Sincerely,

Cheryl Frischkorn
WSMR Project Leader
Permits Management Program

CAF

cc: *D. Cobrain, NMED HWB
Jose Gallegos, WSMR
L. King, EPA Region 6 (6PD-N)

File: Reading File & WSMR 2006 File

6. SWMU 108: (WSMR -41) – Vapor Extraction Well at TTF

6.1 Summary

The Temperature Test Facility (TTF), located approximately 2 miles east of the Main Post area (Figure 6-1, Appendix 6A, pg. 6A-1), was designed to test materials and components in simulated extreme weather conditions by inducing a wide range of temperature and climatic variations, including freezing rain. Various refrigerants, including Freon 22, Freon 503, Freon 113, and methylene chloride brine containing methylene chloride and small amounts of trichloroethane (TCA), trichloroethene (TCE), and tetrachloroethene (PCE), were used during the early facility operations in the mid to late 1980s.

The facility was constructed between 1981 and 1984 and was turned over to WSMR in January 1984. It was estimated that 10,000 to 12,000 gallons (gal) of methylene chloride (containing TCA, TCE, and PCE) was lost by spillage and leakage between 1983 (during construction) and 1984 (during operations). The spills and leaks of refrigerant occurred inside the TTF building and were subsequently flushed to the adjacent evaporation surface impoundment (SWMU 104) via floor drains. It was then discovered that the impoundment's high-density polyethylene liner had eroded and leaked its contents to the underlying soil. It was likely that the pond liner failed as early as January 1984. The pond (SWMU 104) was drained by March 1985 and was not used after that date. Faulty valves associated with an underground interceptor tank also released methylene chloride to the subsurface in the area east of the TTF building (Geoscience, 1987).

In 1990, WSMR, with approval from the NMED HRMB, installed an impermeable cap over the area of soil contamination beneath the former surface impoundment (SWMU 104) and surrounding area (Figure 6-1, Appendix 6A, pg. 6A-1). The cap was constructed similarly to a RCRA landfill cap (WCFS, 1996). The site was issued a post-closure care permit on September 30, 1993 by the NMED HRMB and operated under that permit until clean closure activities were completed; the permit was entitled *Post-Closure Care Permit for the Temperature Test Facility Disposal Surface Impoundment*.

A number of soil, soil gas, and/or groundwater investigations were performed to characterize and delineate the impacts of the releases associated with SWMU 104, prior to the installation and operation of the Soil Vapor Extraction (SVE) system

(SWMU 108). Remediation of the subsurface methylene chloride plume was initiated in 1995 with the installation of a SVE system (SWMU 108) to remove methylene chloride and other VOCs within the vadose zone beneath the constructed cap on SWMU 104 (Photograph 6-1, Appendix 6A, pg. 6A-4 and Figure 6-2, Appendix 6A, pg. 6A-2). The SVE system and extraction wells were monitored daily using an organic vapor analyzer. The cleanup goal and SVE shutdown criteria was 50 parts per million (ppm) at the SVE system inlet (AWD, 994), which was met on June 30, 1997. The last non-zero measurement was observed in February 2001, but that detection was attributed to instrument noise. No other detections were recorded between February 2001 and December 2002. When the SVE system failed to re-start after routine maintenance in 2002, its operation ceased, as coordinated with the NMED.

The SVE system (SWMU 108) was dismantled between January 2003 and August 2004 (Photograph 6-2, Appendix 6A, pg. 6A-4). System components were cleaned and wipe samples were collected, prior to disposal. Hazardous waste determinations were performed for all components of the SVE operating system. With the exception of the carbon canisters, all of the components were disposed of off-site as non-hazardous wastes; the carbon canisters were disposed of offsite as listed hazardous waste (BAE, 2004e) (Appendix 6D, pg. 6D-1).

Sampling conducted for the Clean Closure Demonstration Project for SWMU 104 (URS & WTS, 2005 and 2006) indicated that no methylene chloride was detected in 86 of the 87 soil samples collected from 11 soil borings installed across the site. One soil boring indicated a detection of methylene chloride, but the concentration was two orders of magnitude below NMED SSLs. Twenty soil vapor samples were also collected for VOC analysis. A total of 31 different VOCs (including methylene chloride) were detected in soil vapor samples, but their maximum concentrations were below their respective Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs). The report concluded that soil vapor concentrations were protective of human health and the environment. However, in a letter dated January 24, 2006, the NMED requested that WSMR conduct an evaluation of vapor intrusion and future risk to a residential occupant at the site (Appendix 6C, pg. 6C-1). This evaluation was completed and approved by the NMED in a letter dated February 7, 2007 (Appendix 6C, pg. 6C-4). This letter indicated requirements for closure of SWMU 104 had been met and that WSMR was required to provide a final closure certification and survey plat within 90 days.

The Closure Certification and Survey Plat for SWMUs 104/108 were submitted to the NMED on May 22, 2007 (Appendix 6C, pg. 6C-7). After receiving the Closure Certification and Survey Plat and after completing a site visit to observe the unit, the NMED verified that the closure of the unit was complete in a letter dated July 6, 2007 (Appendix 6C, pg. 6C-13). It should be noted that this letter referred to SWMU 108 rather than SWMU 104. In a letter dated July 11, 2007, the NMED sent a letter to correct the unit designation to SWMU 104. This letter also stated that the Closure Certification also included SWMU 108, which is not a regulated unit subject to the same closure requirements as SWMU 104 (Appendix 6C, pg. 6C-16).

After the clean closure had been approved for SWMU 104, the final closure activities for SWMU 108 were completed. With the exception of two of the monitor wells that were retained for regional groundwater monitoring by WSMR, all of the extraction wells, monitor wells, and associated appurtenances were removed between November 26 and December 12, 2007 (Appendix 6D, pg. 6D-13). The well abandonment activities represent the final closure activities for SWMU 108.

6.2 Site Description and Operational History

6.2.1 Site Description

SWMU 108, the Vapor Extraction Well at TTF, was a SVE system installed in 1995 to remediate methylene chloride and other constituents in soils associated with a release at the TTF, located approximately 2 miles east of the Main Post area (Figure 6-1, Appendix 6A, pg. 6A-1). The constituents in the soil were the result of releases of approximately 8,000 gal of coolant from a lined wastewater pond (SWMU 104), approximately 5,000 gal, from faulty valves associated with an underground tank located between SWMU 104 and the TTF building, and approximately 4,500 gal spilled on the ground during building construction. Additional releases from other sources likely occurred but were not well documented (Geoscience, 1986).

6.2.2 Operational History

The TTF building began operation in 1983, as a facility to simulate extreme weather conditions by inducing a wide range of temperature and climatic variations. SWMU 104 was constructed concurrently with the TTF building and received methylene chloride from January 1984 to January 1985. The other releases to soils occurred between 1983 and 1991, when methylene chloride usage at the TTF ceased. SWMU

108, consisting of 19 soil vapor extraction wells, was installed in 1995. Six additional extraction wells were installed in 1998. Operation of the SVE system continued until October 2002, when the system shut down due to maintenance issues. At this time permanent system shutdown was recommended, as no constituents had been detected in soil vapor extracted from the system since October of 2000. Dismantling of the SVE system was initiated in January 2003 and completed in August 2004. Sampling and disposition of SVE system components is documented on Tables 6-1 and 6-2 (Appendix 6B, pg. 6B-1 and 6B-2) and in a letter report from BAE Systems included in Appendix 6D, pg 6D-1. Vapor and groundwater wells associated with the system were plugged and abandoned in November and December of 2007.

The SVE unit consisted of a 14.2 cubic meter per minute (500 cubic ft per minute) positive displacement vacuum blower with a piping and manifold system connected to an array of 25 soil gas extraction wells. A granular activated carbon (GAC) absorption treatment system was also constructed to treat extracted VOCs prior to discharge to the atmosphere. A site plan showing the SVE system layout is provided as Figure 6-2, Appendix 6A, pg. 6A-2.

6.3 Land Use

6.3.1 Current

The TTF is an active facility. However, the area in the TTF where SWMUs 104 and 108 were located is currently vacant.

6.3.2 Future/Proposed

Clean closure of SWMU 104 indicates unrestricted future use of the former release area (including the area beneath SWMU 108). WSMR functions as an outdoor laboratory consisting of a large complex of test ranges, launch sites, impact areas and instrumentation sites required to develop and test weapons systems. WSMR is an integral part of the defense system of the United States; therefore, the Range will remain active for the foreseeable future.

6.4 Investigative Activities

6.4.1 Summary

Following discovery of the release from SWMU 104 (former surface impoundment at the TTF), a number of investigations were performed to characterize and delineate the impacts to soil beneath and surrounding the surface impoundment, and to determine if the release had impacted underlying groundwater. These investigations preceded the introduction of SWMU 108, the SVE system that was used to remediate soils beneath and in the vicinity of SWMU 104. The results of the investigations were submitted to the NMED in reports that supported the characterization and delineation efforts conducted from 1985 through 1992, the 1990 closure of the surface impoundment (i.e., construction of the engineered RCRA cap), development of the September 30, 1993 Post-Closure Care Permit, the 1995 RFI and BRA, and the Clean Closure Demonstration.

SWMU 108 was designed and constructed based on the findings of the investigations conducted for SWMU 104 between 1985 and 1995. No unit-specific environmental investigations were conducted for SWMU 108, and all of the investigation and closure work conducted for SWMU 104 has already been reviewed and approved by the NMED. Therefore, the descriptions provided in this section are limited to those activities that support regulatory closure of SWMU 108.

6.4.2 Investigation #1: Temperature Test Facility Soil Vapor Extraction System Component Disposition (BAE, 2004)

The SVE system (SWMU 108) was operated from April 1995 until October 2002, when the system failed to restart following routine maintenance and a formal shutdown was coordinated with the NMED Hazardous Waste Bureau (HWB). No VOCs had been detected at the sampling ports of any active extraction well for the final two years of system operation. The SVE system was dismantled in 2004, as described in the letter report in Appendix 6D, pg. 6-D-1, and summarized in this section.

6.4.2.1 *Non-sampling Data Collection*

Hazardous waste determinations were performed for all components of the SVE operating system. The spilled methylene chloride was deemed a listed hazardous waste bearing the RCRA waste code U080. The letter report stated that, since there

had been no detections of VOCs anywhere in the extraction or treatment systems during the final two years of SVE system operation, and given the volatile nature of all of the COCs, the uncontaminated vapor passing through the system constituted a decontamination step for all of the system components except for the activated carbon canisters. These canisters were disposed of as listed hazardous wastes, and BAE Systems coordinated disposal of the remaining system components as nonhazardous wastes after wipe sampling results for those other components were evaluated and supported the non-hazardous waste classification.

6.4.2.2 *Sampling Data Collection*

To confirm the success of the decontamination process, a total of 13 wipe samples were collected for the system components (with the exception of the carbon canisters). Components were wiped with a methanol solvent and analyzed for the 8 COCs identified in the Post-Closure Care permit for the TTF Methylene Chloride Spill Area (methylene chloride, TCE, TCA, PCE, and Benzene, Toluene, Ethylbenzene, Xylene [BTEX]).

6.4.2.3 *Data Gaps*

No data gaps were reported.

6.4.2.4 *Results and Conclusions*

The VOCs that were detected above their respective detection limits in wipe samples collected from the SVE system components are shown on Table 6-1, Appendix 6B, pg. 6B-1. No methylene chloride, TCE, TCA, PCE or benzene were detected in any of the wipe samples. Toluene, ethylbenzene, and xylenes were detected in all samples; however, the highest concentrations were detected in the modified trip blank. The report indicated that these results indicated that the contamination most likely occurred during sample transport and was not residual in the SVE system. Five other VOCs (not recognized as COCs associated with the SVE system operations) were detected in one or more samples. BAE Systems determined that the concentrations of detected VOCs would not warrant consideration of any of the SVE system components as hazardous waste. All detected constituents were well below the Universal Treatment Standards (UTS), as shown on Table 6-1, Appendix 6B, pg. 6B-1. The absence of methylene chloride and the other 7 COCs specified in the post-closure care permit on the surfaces of the SVE system components confirmed that the components could be

disposed of as non-hazardous wastes. The final disposition of the SVE system components is summarized in Table 6-2, Appendix 6B, pg. 6B-2. BAE Systems coordinated the disposal of remaining SVE system components with the WSMR Property Book Office. The concrete pad, metal sled, and electrical control box, which never contacted the waste being treated, were not considered part of the active treatment system and, therefore, no confirmation samples were collected. These components were transferred to the TTF Management for unrestricted future use.

Throughout the operation of the SVE system, it was identified as SWMU 108. The demolition and proper disposal of its components were required to obtain closure of SWMU 108. However, SWMU 108 has been designated as "Vapor Extraction Well at TTF" on the facility's permit. Therefore, closure was considered complete after the wells were abandoned in 2007, as described in Section 6.4.5.

6.4.3 Investigation #2: Final Clean Demonstration Project, Methylene Chloride Spill Area – Vapor Extraction at the TTF, WSMR-41 (SWMU 108) (URS & WTS, 2006a)

Field activities for the TTF Clean Closure Demonstration Project were conducted during two 10-day shifts between May 17 and June 9, 2005. The results of these activities were summarized in the report entitled *Final Clean Closure Demonstration Report, Revision 2, Methylene Chloride Spill Area – Vapor Extraction at the Temperature Test Facility WSMR-41 (SWMU 108)* (URS & WTS, 2005). It should be noted that these activities were conducted to accomplish clean closure for SWMU 104, the former surface impoundment. Successful closure of SWMU 104 would then lead to successful closure of SWMU 108, the SVE system used to remediate soils at SWMU 104.

6.4.3.1 *Non-sampling Data Collection*

No non-sampling data were collected during the Clean Closure Demonstration Project. The geologic logs produced for the 11 soil borings drilled during the project were compared against the conceptual geologic model provided in the 1996 RFI (WCFS, 1996); no major discrepancies were identified.

6.4.3.2 *Sampling Data Collection*

Eleven soil borings were completed during the project (Figure 6-3, Appendix 6A, pg. 6A-3). From the borings and associated soil cuttings, 95 soil samples, 20 vapor

samples, 2 waste samples, and various quality control samples were collected for laboratory analysis. Soil and vapor samples were analyzed for VOCs. A summary of the soil and vapor samples collected from each boring for VOC analysis is provided in Table 6-3, Appendix 6B, pg. 6B-3. In addition, detailed lithologic logs were prepared for each boring, particularly to confirm the geologic conceptual model presented in the 1996 RFI, which indicated the existence of several lo-permeability layers, some of which were interpreted to be continuous across the site (identified as units 5, 7, 9, and 11). Unit 9, a lean clay, was considered a significant and continuous stratum.

6.4.3.3 *Data Gaps*

No data gaps were reported. However, in a letter dated January 24, 2006 (Appendix 6C, Page 6C-1), the NMED requested that WSMR conduct an evaluation of vapor intrusion and future risk to a residential occupant at the site. This evaluation was completed and is discussed in Section 6.4.4.

6.4.3.4 *Results and Conclusions*

In total, 87 primary soil samples and 8 duplicate samples were collected from the borings at depths ranging from 5 ft bgs to 140.5 ft bgs for laboratory analysis of VOCs. With one exception, all soil samples had non-detectable levels of VOCs. One soil sample had a methylene chloride concentration of 2.1 mg/kg, which was well below the NMED residential SSL of 165 mg/kg.

Twenty vapor samples were collected for VOC analysis. Evacuated SUMMA canisters provided by the laboratory were used for vapor sample collection. A total of 31 different VOCs were detected in the vapor samples, as shown on Table 6-4 (Appendix 6B, pg 6B-4). Methylene chloride was detected at the highest concentration of any VOC, at 8,500 parts per billion by volume (ppbv) from approximately 100 ft bgs in boring SB-08. methyl ethyl ketone (2-butanone) (MEK), followed by acetone and ethanol, were the most commonly detected analytes in the vapor samples.

As a basis for evaluation, maximum soil-vapor concentrations for the 12 primary VOCs from the current study were compared to their respective OSHA Permissible Exposure Limits (PELs). As shown on Table 6B-5 (Appendix 6B, pg 6B-5), the maximum soil vapor concentrations at the site ranged from 1 to 5 orders of magnitude below the OSHA PELs.

In general, vapor phase VOCs were found dispersed horizontally and vertically throughout the site. Based on a comparison to samples drawn from soil-gas monitoring wells in support of the 1996 RFI, maximum vapor concentrations have diminished significantly at the site. Maximum concentrations have declined by at least 98.8 percent for the eight analytes detected in both the RFI and clean closure project samples. Maximum and average concentrations of methylene chloride have declined by 99.98 percent since 1995. Comparisons of the 1995 and 2005 vapor data are provided in Table 6-6, Appendix 6B, pg 6B-5.

Based on the soil and vapor samples analyzed during the clean closure demonstration project, it was concluded that SVE at the site successfully had remediated adsorbed and vapor-phase contaminants to well below health and environmental standards. The report stated that based on comparison of the soil results to the NMED SSLs and comparison of the vapor results to the OSHA PELs, residual levels remaining in the subsurface at the site are sufficiently low to warrant clean closure. As stated previously, an additional measure, including vapor intrusion modeling and evaluation of risk to a future residential occupant, was completed at the request of the NMED. The results of the modeling and risk analysis are discussed in the following section.

6.4.4 Investigation #3: Revised Addendum for the Clean Closure Demonstration Report, Methylene Chloride Spill Area, Vapor Extraction at the Temperature Test Facility, WSMR-41 (SWMU 108) (URS and WTS, 2006b)

The work described herein was conducted to supplement the Clean Closure Demonstration for SWMU 104, which was summarized in the previous section of this document. As stated previously, successful closure of SWMU 104 (the former surface impoundment) would lead to the successful closure of SWMU 108, the SVE system used to remediate the soils at SWMU 104.

6.4.4.1 *Non-sampling Data Collection*

In response to a comment in the NMED's letter dated January 24, 2006 (Appendix 6C, pg. 6C-1), vapor intrusion modeling and investigation of risk was conducted for the site. The screening process, as applied for this project, intended to evaluate if the indoor air vapor pathway could be "ruled out" as a source of unacceptable risk to human health.

A three-tiered screening approach was conducted in accordance with EPA *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (EPA, 2002). Data used for this risk screening were limited to analyses of vapor samples collected during field activities for the TTF Clean closure Demonstration Project, which was conducted during two 10-day shifts between May 17 and June 9, 2005. A conservative scenario considering a residence built directly on the SWMU and disregarding any effects of the current cap, demonstrated that there were no identified unacceptable risks associated with subsurface vapor-phase contamination at the TTF.

6.4.4.2 *Sampling Data Collection*

No additional sampling data were collected for the risk screening and modeling conducted for this report.

6.4.4.3 *Data Gaps*

No data gaps were reported.

6.4.4.4 *Results and Conclusions*

Based on the risk screening and Johnson and Ettinger modeling conducted for this study, there were no identified unacceptable risk associated with subsurface vapor-phase contamination at the TTF. The model results for a future residential occupant are summarized in Table 6-7 (Appendix 6B, pg. 6B-6).

The NMED approved the Revised Addendum Clean Closure Report in a letter dated February 7, 2007 (Appendix 6C, pg. 6C-4). The letter stated that this revised addendum and the Final Clean Report for this SWMU, dated October 2005, constituted fulfillment of the requirement of a closure report for this Site. The letter indicated that WSMR was required to provide a closure certification and a survey plat within 90 days in order to fully comply with the regulatory closure requirements. The Closure Certification and Survey Plat were submitted to the NMED on May 22, 2007 (Appendix 6C, pg. 6C-7), and the NMED verified completion of unit closure in a letter dated July 6, 2007, which was corrected in a July 11, 2007 letter indicating that the closure was completed for SWMU 104 rather than SWMU 108 (Appendix 6C, pg. 6C-13).

6.4.5 Investigation #4: Abandonment of Monitor and Vapor Wells Associated with SWMU 104 (WTS, 2008)

A letter report was prepared in January 2008 to summarize the well abandonment activities at the TTF following the NMED's approval of the Clean Closure Demonstration for SWMU 104. A copy of this report is provided in Appendix 6D. These activities also represent the final closure activities for SWMU 108, designated as Vapor Extraction Well at TTF on the facility's RCRA permit.

6.4.5.1 *Non-sampling Data Collection*

Following receipt of the NMED's letter of July 11, 2007 (Appendix 6C, pg. 6C-16) verifying that WSMR had completed the closure of the former surface impoundment (SWMU 104) at the TTF, WSMR submitted a letter on August 8, 2007 to notify the NMED that, based on NMED's approval of the SWMU 104 closure, WSMR would cease the routine monthly monitoring and maintenance activities at the site and prepare to abandon the existing on-site monitoring and vapor extraction wells (Appendix 6C, pg 6C-18). The final groundwater monitoring event occurred in November 2006. WSMR and the NMED verbally agreed that the planned May 2007 groundwater event was not necessary. WSMR continued inspection activities at the TTF through June 2007. These inspection reports were included as an appendix to the 2008 White Sands Technical Services, LLC (WTS) letter report prepared to summarize the well abandonment activities (Appendix 6D, pg. 6D-13).

Well abandonment activities were conducted over 8 days between November 26 and December 12, 2007. During the course of the well abandonment work, 34 well appurtenances were removed and 4,330 ft of well length was backfilled with bentonite/cement grout. Two wells, designated "NW" (254.8 ft deep below top of casing [TOC]) and "E-3" (233.2 ft deep below TOC), were not abandoned so that they could be used for monitoring the regional water table. A table summarizing the wells that were abandoned is provided in the 2008 letter report in Appendix 6D, pg. 6D-13.

This information was provided in support of the closure certification and verification for SWMU 104, but also supports the closure of SWMU 108 (TTF Vapor Extraction Well). As stated previously, SWMU 104 (former TTF surface impoundment), was successfully clean closed. The elements of SWMU 108 (SVE system and wells) have also been successfully decontaminated and removed.

6.4.5.2 *Sampling Data Collection*

No sampling data were collected during the well abandonment activities.

6.4.5.3 *Data Gaps*

No data gaps were reported.

6.4.5.4 *Results and Conclusions*

During the course of well abandonment work, 34 well appurtenances were removed and 4,300 ft of well length was backfilled with bentonite/cement grout. Based on visual inspection and records research, no other wells remain except for the two (NW and E-3) that were purposely left in place for regional water table monitoring. The well abandonment represents the final closure activities for SWMUs 104 and 108.

6.5 Site Conceptual Model

6.5.1 Nature and Extent of Contamination

The nature and extent of contamination related to the release of methylene chloride and other VOCs from the TTF building was defined during the investigations conducted for SWMU 104. The nature and extent of contamination that was defined by those investigations were the basis for the design of the SVE system and wells that comprised SWMU 108. The impacts were limited to soils beneath the former surface impoundment and surrounding areas, including near the area of leaking valves on the exterior eastern side of the TTF building. Groundwater in the TTF area is located approximately 200 ft bgs. No groundwater impacts were discovered during the investigation and remediation activities that were conducted between 1985 and 2002.

There was no release from SWMU 108; it was a remediation system installed to treat contamination in soils in order to achieve clean closure of SWMU 104. The SVE system (SWMU 108) was dismantled in 2003-2004.

During the 2007 clean closure demonstration project, soil sampling results indicated that site soil concentrations were below the NMED SSLs, soil vapor results were below OSHA PELs, and vapor intrusion modeling indicated that there was no unacceptable risk to a residence constructed on the contaminated soils (URS & WTS, 2006). The

NMED approved clean closure of SMWU 104 in a letter dated July11, 2007 (Appendix C, pg. 6C-16).

6.5.2 Environmental Fate

Clean closure of SWMU 104 was attained successfully. The components of SWMU 108 (SVE system and wells) have either been abandoned (extraction wells) or decontaminated and removed for off-site disposal. Therefore, there are no contaminants of concern that would impact the environment.

6.6 Site Assessments

6.6.1 Human Health Screening and Risk Assessments

Risk assessment work was conducted as part of the SWMU 104 investigation and clean closure demonstration, as reported to the NMED for SWMU 104. No additional risk assessment work was warranted for SWMU 108.

6.6.2 Ecological Screening and Risk Assessments

Risk assessment work was conducted as part of the SWMU 104 investigation and clean closure demonstration, as reported to the NMED for SWMU 104. No additional risk assessment work was warranted for SWMU 108.

6.6.3 Other Applicable Assessments

No other applicable assessments were conducted for the SWMU 108.

6.7 No Further Action Proposal

6.7.1 Rationale

SWMU 108, a soil vapor extraction system, was installed in 1995 to address releases associated with the TTF. The SVE system continued operation until October 2002, when the system shut down due to maintenance issues. At this time permanent system shutdown was recommended by WSMR, as no constituents had been detected in soil vapor extracted from the system since October of 2000. Dismantling of the SVE system was initiated in January 2003 and completed in August 2004. System

components were cleaned and wipe samples were collected prior to disposal. Sampling and disposition of SVE system components is documented in a letter report from BAE Systems included in Appendix 6D, pg 6D-1.

NMED approved the clean closure certification for SWMU 104 in a letter dated July 11, 2007 (Appendix C, pg. 6C-16). SWMU 108 was the SVE system used to remediate SWMU 104 soil impacts and to achieve the clean closure. The SVE system (SWMU 108) was decontaminated and dismantled for off-site disposal in 2003-2004 (Appendix D, pg. 6D-1). After the clean closure was approved for SWMU 104, all of the wells, except for two retained for regional groundwater monitoring, were properly abandoned. These wells included the extraction wells that were also an integral element of SWMU 108 (designated as Vapor Extraction Well at TTF). The well abandonment constitutes the final closure activities for SWMU 108.

Based on these results, application is hereby made to perform a Class III modification to remove SWMU 108 from the White Sands RCRA permit in accordance with 40 CFR 264.514 and 270.42, and 20 NMAC 4.1.

6.7.2 Criterion

The criterion applied to this site is NFA Criterion 5 as described by the NMED: The Solid Waste Management Unit has been remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current projected future land use.

Appendices

Appendix 6A – Figures and Photographs

Appendix 6B – Analytical Results Tables

Appendix 6C – Correspondence

Appendix 6D – Reports

Appendix 6A

SWMU 108
Figures and Photographs

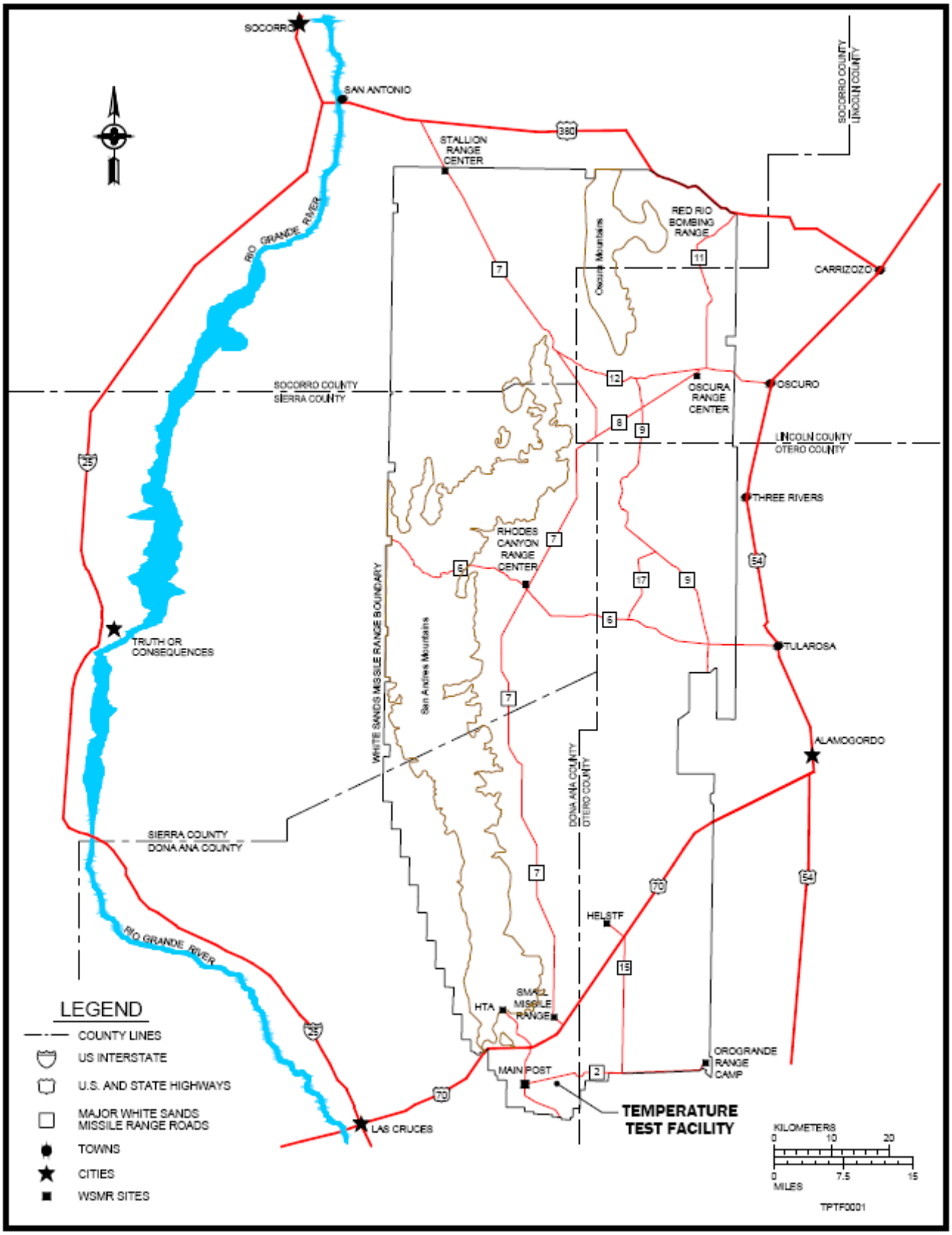


Figure 6-1 Location of the Temperature Test Facility

Source: BAE, 2003

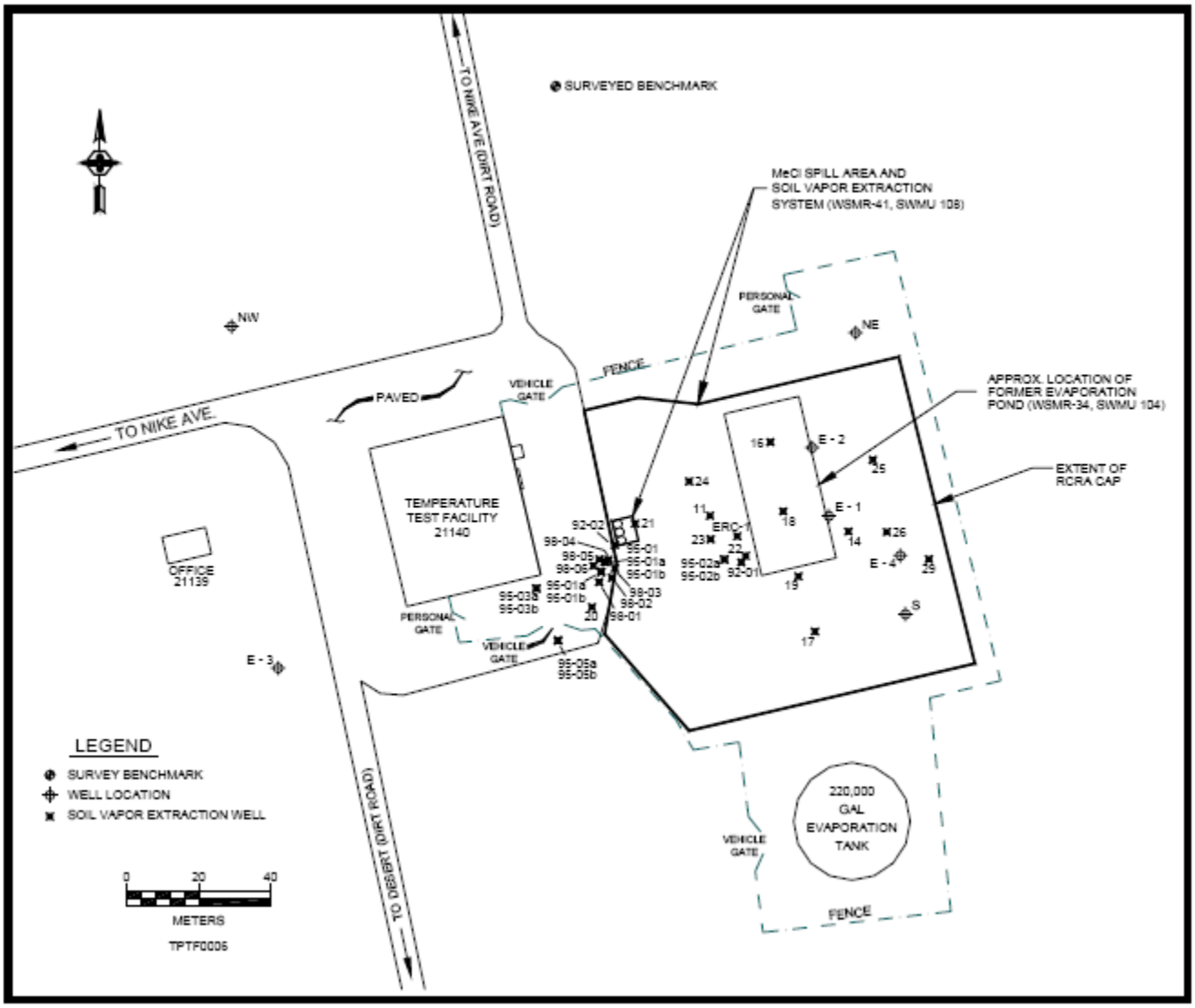


Figure 6-2 Temperature Test Facility Site Map

Source: BAE, 2003

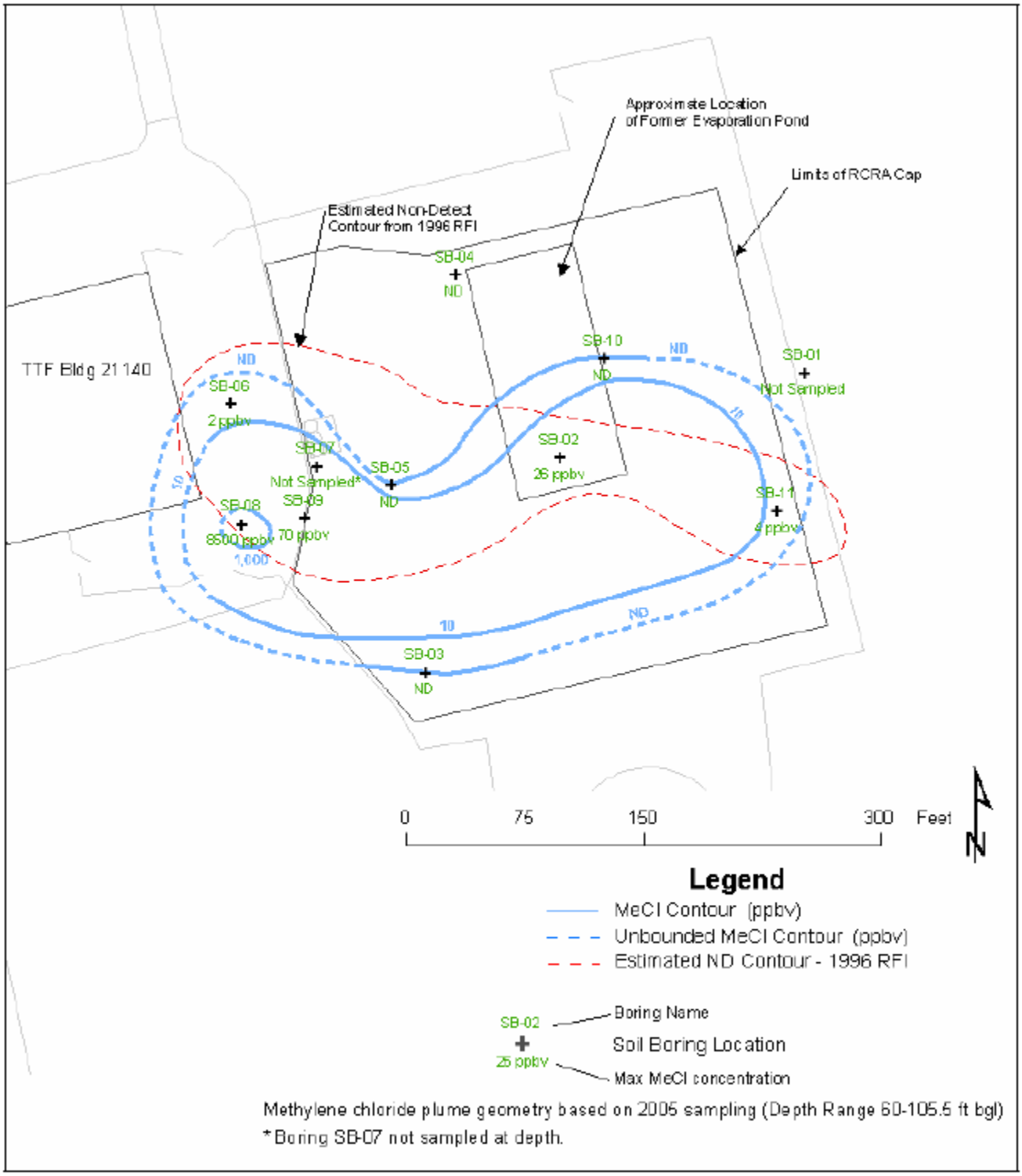
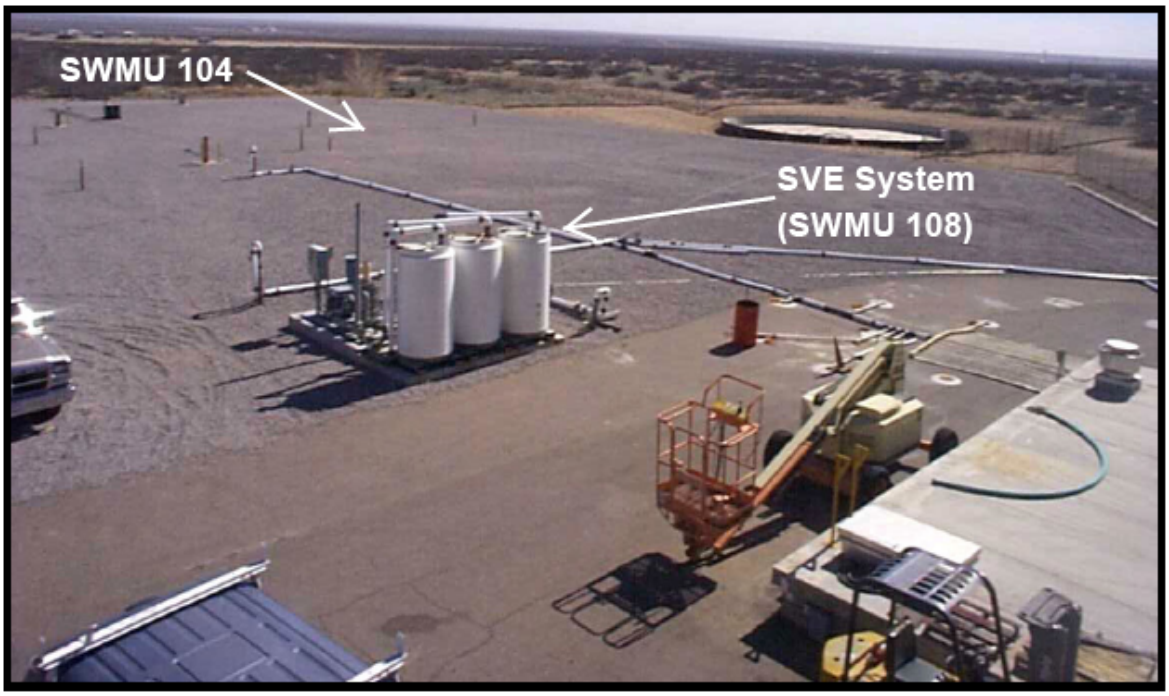
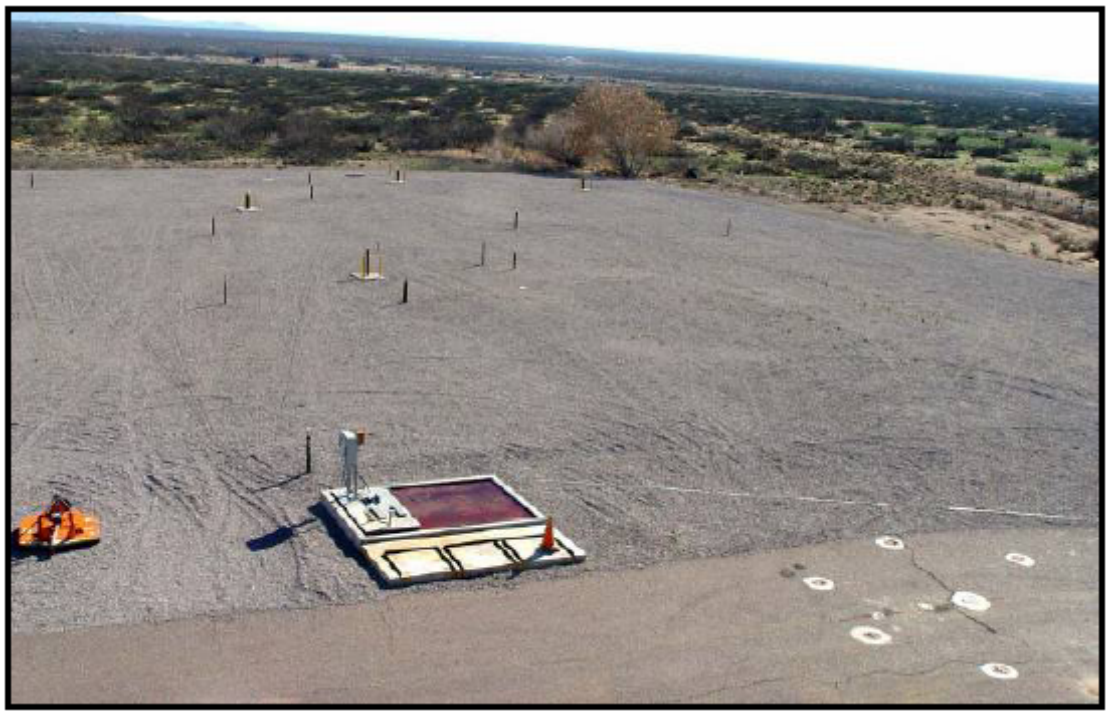


Figure 6-3 Estimated Vapor-Phase Methylene Chloride Plume Based on 2005 Sampling

Source: BAE, 2003



Photograph 6-1 Soil Vapor Extraction System (SWMU 108)



Photograph 6-2 Engineered Cover, Former SVE System, and Monitoring Wells at the TTF SVE SITE

Appendix 6B

SWMU 108
Analytical Result Tables

Table 6-1 Detected VOCs in Wipe Samples from SVE System (SWMU 108) Components

Source: BAE Systems, 2004e

Sample Number	Sample Location	Positive Detections (ng/in^2)
TPTF-0108-WS-001-0704	Blower outlet	chloromethane: 1.56 bromomethane: 0.95 carbon disulfide: 5.31
TPTF-0108-WS-002-0704	Exhaust stack	chloromethane: 0.64 bromomethane: 0.32 carbon disulfide: 8.75
TPTF-0108-WS-003-0704	Inlet to moisture separator	chloromethane: 0.90 bromomethane: 0.60 carbon disulfide: 8.75
TPTF-0108-WS-004-0704	Blower inlet	chloromethane: 1.51 bromomethane: 0.74
TPTF-0108-WS-005-0704	Moisture separator	chloromethane: 1.31 bromomethane: 0.61
TPTF-0108-WS-105-0704	Moisture separator—duplicate	chloromethane: 1.36 bromomethane: 0.81
TPTF-0108-WS-006-0704	Air filter inlet	chloromethane: 2.41 bromomethane: 1.13
TPTF-0108-WS-007-0704	Moisture separator outlet	chloromethane: 9.23 bromomethane: 4.30
TPTF-0108-WS-008-0704	Sump pump	chloromethane: 12.10 bromomethane: 7.32 trichlorofluoromethane: 5.25
TPTF-0108-WS-009-0704	Composite of pre-treatment piping	chloromethane: 0.38 bromomethane: 0.09 carbon disulfide: 0.68
TPTF-0108-WS-010-0704	Composite of intra- and post-treatment piping	chloromethane: 0.42 bromomethane: 0.06 chloroform: 0.08
TPTF-0108-WS-011-0704	Composite of pre-treatment piping	chloromethane: 0.22 bromomethane: 0.13 carbon disulfide: 2.67
TPTF-0108-WS-012-0704	Composite of intra- and post-treatment piping	chloromethane: 0.12 bromomethane: 0.04
TPTF-0108-WS-013-0704	Extra inlet structure for moisture separator, staged onsite	chloromethane: 0.83 bromomethane: 0.57
Universal Treatment Standards Under the Land Disposal Restrictions (40 CFR 268.48)		**chloromethane: 30 mg/kg** **bromomethane: 15 mg/kg** **carbon disulfide 4.8 mg/L (TCLP)** **chloroform: 6 mg/kg** **trichlorofluoromethane: 30 mg/kg**

Table 6-2 = Final Disposition of SVE System (SWMU 108) Components

Source: BAE Systems, 2004e

Component	Component Function	Component Disposition
Concrete Pad	Staging for SVE equipment	Onsite, turned over to TTF management in August 2004
Metal Sled	Staging for SVE blower, pumps, and associated equipment	Onsite, turned over to TTF management in August 2004
Electrical Control Box	Power supply and control for SVE components	Onsite, turned over to TTF management in August 2004
Blower	Inducing negative gage pressure to extract potentially contaminated vadose zone vapor	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Inlet Air Filter	Air filter at the inlet to the system blower	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Moisture Separator/ Knock-out Pot	Separating extracted vapor into liquid and gas phases	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Exhaust Muffler	Noise suppression at blower outlet	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Exhaust Stack	Discharge conduit for treated gas-phase to atmosphere	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Carbon Canisters—Vapor Treatment (3)	Treatment of extracted contaminated vapor (gas and liquid phase)	Shipped to carbon reactivation facility as a hazardous waste (U080) in January 2003
Carbon Canisters Liquid-Phase Treatment (2)	Treatment of liquid following moisture separation	Disposed through the WSMR Hazardous Waste Minimization Center as a hazardous waste (U080) in April 2004
Pre-Treatment Piping (Well Connections)	Conduits to deliver extracted vapor to treatment	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004
Intra- and Post-Treatment Piping (System Connections)	Conduits between unit processes	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004
Condensate Recovery Tank	Collection of separated moisture following carbon-filtration	Transferred to TTF Management in April 2004 based on non-detection of COCs in condensate sampling performed by Radian International
Pump between Moisture Separator and Liquid-Phase Carbon Canisters	Providing energy for fluid movement	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004
Pump between Liquid-Phase Carbon Canisters and Condensate Recovery Tank	Providing energy for fluid movement	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004
Sump Pump	Providing energy to move moisture accumulated in individual extraction wells to treatment	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004

Table 6-3 Soil and Vapor Samples, Clean Closure Demonstration for SWMU 104

Source: URS & WTS, 2006

Soil Boring ID	Total Depth (ft bgs)	Surface Elev. (ft)	Vapor Sample Depth Intervals (ft bgs) / (Geologic Unit*)	Soil Sample Depths** (ft bgs)
TPTF-SB-01	126.5	4024.91	NS	20, 41, 60, 80, 90, 103, 105, 115, 125
TPTF-SB-02	119.0	4032.35	1.5-2, 58-61.5 / **(5)**, 100-104 / **(9)**	25, 49.5, 60.5, 75.5, 103.5, 113, 117.5, 118
TPTF-SB-03	103.5	4031.51	1.5-2, 98-103.5 / **(10)**	25.5, 48.5, 65, 76, 85.5, 98, 102
TPTF-SB-04	116.5	4031.38	1.5-2, 99.5-101.5 / **(9)**	23†, 39, 64.5, 80, 90, 95.5, 100.5, 110, 115.5
TPTF-SB-05	101.5	4035.01	1.5-2, 88-91.5 / **(9)**	25, 45, 65†, 76.5, 90.5, 100.5†
TPTF-SB-06	103.5	4034.44	88-90.5 / **(9)**	5, 25, 45, 65, 80, 89.4, 102.5
TPTF-SB-07	141.5	4034.55	1.5-2†	25, 45†, 65, 78, 89, 104, 106.5, 115, 125.5, 136, 140.5
TPTF-SB-08	105.5	4034.06	77-81.5, 101-105.5† / **(10)**	25, 25.7, 45.5, 65, 80.5, 90, 104†
TPTF-SB-09	105.5	4034.16	103-105.5 / **(10/11)**	25.5†, 45, 66, 75, 87.5, 89, 101, 104, 105
TPTF-SB-10	98.5	4030.91	2-2.5, 84-89 / **(7)**	23, 45, 60, 79†, 87.5, 95, 97.5
TPTF-SB-11	111.5	4028.75	1.5-2, 82-91.5 / **(7)**	20, 27, 40, 60, 73.5, 89, 110.5†

Total number of soil samples, 95, including 8 duplicate samples. Total number of vapor samples, 20, including 2 duplicate samples.
* Estimated geological unit listed in parentheses, based on interpretation by the Field Geologist at the time of sampling.
** Listed depths represent top of sampled core interval. Core samples collected from 0.5 to 1-foot intervals.
† Indicates depth where primary and duplicate samples collected.
NS Not sampled.

Table 6-4 VOCs Detected in Soil Vapor Samples, Clean Closure Demonstration for SWMU 104

Source: URS & WTS, 2006

VOCs Detected in Vapor Samples	Number of Samples with Detected Levels (18 total vapor samples)	Maximum Value (ppbv)	Average Value (ppbv)
2-Butanone (Methyl Ethyl Ketone)	18	810	91.5
Acetone	17	2,800	735.6
Ethanol	16	99	31.3
Hexane	11	61	9.3
Toluene	11	2,000	382.9
4-Methyl-2-pentanone	11	75	20.9
Carbon Disulfide	10	29	10.2
1,2,4-Trimethylbenzene	9	12	5.9
2-Propanol	8	93	24
Freon 11	8	190	53.5
2-Hexanone	8	38	13.5
m,p-Xylene	8	12	5
Heptane	8	16	3.8
Benzene	7	12	4.6
2,2,4-Trimethylpentane	7	410	142.7
Methylene Chloride	6	8,500	1,443
Tetrachloroethene	5	6	4
1,1-Dichloroethene	5	86	25.8
4-Ethyltoluene	4	7	4.8
1,1,1-Trichloroethane	4	13	6.5
Chloroform	4	17	6
Trichloroethene	4	15	9.3
o-Xylene	4	6	7
Ethyl Benzene	3	5	2.7
1,4-Dichlorobenzene	3	2	1.3
1,3,5-Trimethylbenzene	3	3	2.7
Freon 12	2	1	1
trans-1,2-Dichloroethene	2	2	1.5
Cyclohexane	2	3	2.5
Propylbenzene	1	2	2
Styrene	1	2	2

Table 6-5. Maximum Site Soil Vapor Concentrations Compared to OSHA PELs, Clean Closure Demonstration for SWMU 104

Source: URS & WTS, 2006

Analyte	Maximum Concentration (ppbv)	Maximum Concentration ($\mu g/m^3$)	OSHA PEL* (ppbv)	Ratio of Maximum Concentration to PEL
Methylene Chloride ****	8,500	30,000	25,000	3.4×10^{-1}
Freon 11 (Chlorofluoromethane) ****	190***	1,100***	1,000,000	1.9×10^{-4}
1,1-Dichloroethene ****	86***	350***	1,000	8.6×10^{-2}
2-Butanone (Methyl Ethyl Ketone)	810	2,400	200,000	4.1×10^{-3}
Acetone	2,800	6,600	1,000,000	2.8×10^{-3}
Trichloroethylene ****	15***	121***	100,000	1.5×10^{-4}
Ethanol (Ethyl Alcohol)	99	190	1,000,000	9.9×10^{-5}
Tetrachloroethene ****	6***	101***	100,000	6.0×10^{-5}
1,1,1-Trichloroethane ****	13***	78***	350,000	3.7×10^{-5}
Trans-1,2-Dichloroethene ****	2***	7***	Not Listed	NA
Chloroform ****	17	83	50,000	3.4×10^{-4}
1,1-Dichloroethane ****	ND**	ND**	100,000	1.1×10^{-5}

* OSHA PELs are 8-hour time-weighted-averages (TWA) values.
** 1,1-Dichloroethane was not detected above quantification limits in any sample, the average quantification limit of 1.1 ppbv used for comparison.
*** Maximum concentration values represent average values including duplicates.
**** Analyte also detected in vapor samples collected during the 1996 RFI.

Table 6-6 Comparison of VOC Concentrations in Soil Vapor from 1995 and 2005, Clean Closure Demonstration for SWMU 104

Source: URS & WTS, 2006a

Analyte*	1995 TO-14 Analysis Data			2005 TO-15 Analysis Data		
	Detection Frequency	Maximum Conc. (ppbv)	Average Conc. (ppbv)	Detection Frequency	Maximum Conc. (ppbv)	Average Conc. (ppbv)
Methylene Chloride	8/17	42,000,000	6,757,020	6/18	8,500	1,433
Freon 11	14/17	26,000	9,458	8/18	190	53.5
1,1-Dichloroethene	13/17	25,000	9,198	5/18	86	25.8
Trichloroethylene	13/17	17,000	5,533	4/18	15	9.25
Tetrachloroethene	12/17	16,000	4,579	5/18	6	4
1,1,1-Trichloroethane	12/17	7,400	2,557	4/18	13	6.5
Trans-1,2-Dichloroethene	11/17	1,900	504	2/18	2	1.5
Chloroform	11/17	1,400	359	4/18	17	6
1,1-Dichloroethane	4/17	230	103	0/18	ND	ND

* Analytes detected in the RFI reflect samples collected from the soil-gas monitoring wells and analyzed at an approved laboratory using EPA Method TO-14.

Table 6-7 J&E Model Results for Risk to Future Residential Occupant at SWMU 104

Source: URS & WTS, 2006a

J&E Model Run No.	Contaminant	Conc. ($\mu g/m^3$)	Depth (ft. bgs)	Incremental Cancer Risk	Non-cancer Hazard Quotient (child receptor)
1	Trichloroethylene	160	101	1.36×10^{-6}	1.92×10^{-3}
2	Methylene Chloride	30,000	101	1.37×10^{-6}	5.27×10^{-3}
3	Tetrachloroethene	41	1.5*	2.55×10^{-7}	6.0×10^{-4}
4	Trichloroethylene	82	82	9.69×10^{-7}	1.37×10^{-3}
5	Trichloroethylene	54	58	1.07×10^{-6}	1.51×10^{-3}
6	Chloroform	83	82	2.62×10^{-7}	1.31×10^{-3}
7	Benzene	4	1.5*	3.36×10^{-8}	7.74×10^{-4}
8	Tetrachloroethene	160	101	6.59×10^{-8}	1.55×10^{-4}
9	Chloroform	14	58	7.23×10^{-8}	3.62×10^{-4}
10	Benzene	38	82	3.51×10^{-8}	8.07×10^{-4}
11	Benzene	37	58	5.67×10^{-8}	1.30×10^{-3}

* 1.5-ft depth interval represents vapor samples collected directly underneath existing RCRA cap. For J&E modeling, these concentrations will be assumed to occur at 10 cm below building foundation.

Appendix 6C

SWMU 108
Correspondence

January 24, 2006

NMED
Final Clean Closure Demonstration Report for the Methylene Chloride Spill at the TTF

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

January 24, 2006

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: FINAL CLEAN CLOSURE DEMONSTRATION REPORT FOR THE METHYLENE CHLORIDE SPILL AT THE TEMPERATURE TEST FACILITY WHITE SANDS MISSILE RANGE EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has completed its review of the *Final Clean Closure Report, Methylene Chloride Spill Area, Vapor Extraction at the Temperature Test Facility*, dated October 2005.

Before approval of clean closure can be granted allowing unrestricted land use, White Sands Missile Range (WSMR) must address NMED's concern regarding the potential for subsurface vapors to adversely impact indoor air quality if a building were to be constructed at the site. WSMR must address this concern within 60 days of receipt of this letter. If this issue is addressed to NMED's satisfaction, the TTF will be eligible for clean closure status

In the future, WSMR must present, in their summary tables, soil vapor data in ug/m^3 rather than parts per million vapor (ppmv). NMED compares detected vapor concentrations to the Environmental Protection Agency's (EPA's) Region 6 Human Health Medium-Specific

Screening Levels.
If you have any questions concerning this letter, please contact Cheryl Frischkorn of my staff at 505-428-2550.

Sincerely,

John E. Kieling
Manager
Permits Management Program

JEK:caf

cc: *D. Cobrain, NMED HWB
C. Frischkorn, NMED HWB
L. King, EPA Region 6 (6PD-N)
Jose Gallegos, White Sands Missile Range

File: Reading File & WSMR 2006 File

February 7, 2007

NMED

Approval of Revised Addendum Clean Closure Report
Methylene Chloride Spill Area Vapor Extraction at the TTF

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 476-6000
Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

CINDY PADILLA
DEPUTY SECRETARY

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

February 7, 2007

Thomas A. Ladd
U.S. Army Garrison White Sands
100 Headquarters Avenue (B. 1510
ATTN: IMSW-WSM-PW
White Sands Missile Range, NM 88002

RE: APPROVAL OF REVISED ADDENDUM CLEAN CLOSURE REPORT METHYLENE CHLORIDE SPILL AREA VAPOR EXTRACTION AT THE TEMPERATURE TEST 0FACILITY WHITE SANDS MISSILE RANGE, EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has received the Department of the Army's (Permittee) *Revised Addendum Clean Closure Demonstration Report, Methylene Chloride Spill Area, Vapor Extraction at the Temperature Test Facility,* dated December 2006. NMED hereby approves the *Revised Addendum Clean Closure Demonstration Report.* This revised addendum and the *Final Clean Closure Report, Methylene Chloride Spill Area, Vapor Extraction at the Temperature Test Facility*, dated October 2005 will constitute fulfillment of the requirement for a Closure Report for this site.

In order to fully comply with closure requirements, the Permittee must submit, within 90 days of receipt of this letter, a closure certification in accordance with 20.4.1.500 NMAC, incorporating 40 CFR 264.115 and a survey plat in accordance with 20.4.1.500 NMAC, incorporating 40 CFR 264.116.

Please contact Cheryl Frischkorn at 505.476.6058 if you have question regarding this letter.

Sincerely,

John E. Kieling
Manager
Permits Management Program

JEK:caf

cc: D, Cobrain, NMED HWB
C. Frischkorn, NMED HWB
J. Gallegos, WSMR
File: Reading, WSMR 2007

May 22, 2007

WSMR
Closure Certification Statement and Survey Plat Submittal for SWMU 104/108

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

REPLY TO
ATTENTION OF

Directorate of Public Works

May 22, 2007

Mr. James Bearzi
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Closure Certification Statement and Survey Plat Submittal for Solid Waste Management Unit 104/108 (IRP Site WSMR-34/WSMR-41)

Dear Mr. Bearzi:

In accordance with 20.4.1.500 NMAC, incorporating 40 CFR 264.115 and 40 CFR 264.116, WSMR submits the enclosed closure certification, and survey plat for Solid Waste Management Unit (SWMU) 104, Former Evaporation Pond at the Temperature Test Facility (TTF). SWMU 104 is listed on the NMED 2006 Annual Fee Table A as post closure care unit PCCU-1, "Surface Impoundment TTF". We include SWMU 108, MeCl Spill Area and Soil Vapor Extraction System (IRP Site WSMR-41), on the plat since the SWMU is essentially the same unit at SWMU 104, and, furthermore, SWMU 108 has remained active (and, thus, eligible for funding) in the Army's database while SWMU 104 is listed by the Army's database as IRP Site WSMR-34 and inactive (and, thus, ineligible for funding).

In addition to SWMU 104, SWMU 109, Drum Storage Area and Splash Pad at TTF, is the only other TTF-related unit listed on the NMED 2006 Annual Fee listing. SWMU 109 is listed on Table B. We did not include this unit on the plat as this site requires further discussion between our office, and yours to determine what exactly is required to reach No Further Action status.

Finally, the subject closure certification, and plat will be filed in the WSMR Administrative Record as well as the WSMR Master Planning office for recordkeeping, and any future land transactions.

The following certification is provided as required by our permit and according to NMAC 20.4.1.900, incorporating 40 CFR 270.11:

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

Copies furnished, with enclosure (1 hard copy), to Ms. Cheryl Frischkorn, NMED-HWB; Mr. Chuck Hendrickson, Region VI EPA; Mr. Bill Davis, U.S. Army Environmental Center; and, without enclosure, to Mr. John Kieling, NMED-HWB; and White Sands Technical Services, LLC.

Should you have any questions regarding this matter, please contact Mr. Jose Gallegos of our Environmental Compliance office at (505) 678-1007.

Sincerely,

Thomas A. Ladd

THOMAS A. LADD
Director, Public Works

Enclosures

IMWE-WSM-PW-E-EC 23 May 07

MEMORANDUM FOR PW-M (SAM SANCHEZ)

SUBJECT: Closure Certification and Plat Submittal for SWMU 104/108 (IRP Sites WSMR-34 and 41, respectively), TTF MeCl Spill Site

1. Attached you will find one copy each of three documents:
   a. WSMR Submittal Cover Letter to the New Mexico Environment Department (NMED), dated 22 May 2007.
   b. A signed Closure Certification as required by 40 CFR 264.115.
   c. A signed Closure Plat as required by 40 CFR 264.116.

2. As a condition for closure, WSMR is required to retain a copy of b) and c) in official real estate records for notification of future landowners. One set of copies will be filed in the IRP Administrative Record and with the NMED, including an original Closure Certification. Another set should be kept in the WSMR Master Planning real estate records. Please ensure that these documents are filed in the appropriate records. Thank You.

3. If you have any questions or concerns, please call me at 678-1618.

Encls

JOSE A. GALLEGOS
Acting Chief, Environmental Compliance Branch

CF (w/Enclosures):
WTS (Karen Cazares)

CF (w/o Enclosures):
PW (T.A. Ladd)
SJA (Jim Pigg)
PW-E-EC (Joel Giblin)
WTS (Fred Bourger)

CLOSURE CERTIFICATION FOR THE TEMPERATURE TEST FACILITY FORMER EVAPORATION POND / MeCl SPILL-SVE SYSTEM SOLID WASTE MANAGEMENT UNIT 104 & 108 WHITE SANDS MISSILE RANGE EPA ID NUMBER: NM2750211235

This is to certify that Solid Waste Management Unit (SWMU) 104 (Former Evaporation Pond) and SWMU 108 (Methylene Chloride Spill Area and Soil Vapor Extraction System) located on White Sands Missile Range, Dona Ana County, New Mexico have been clean closed as described in the *Final Clean Closure Demonstration Report, Methylene Chloride Spill Area-Vapor Extraction at the Temperature Test Facility, WSMR-41, SWMU 108* (White Sands Technical Services, LLC & URS Corp.; October 2005), and the *Revised Addendum to the Clean Closure Demonstration Report* (White Sands Technical Services, LLC & URS Corp.; December 2006). Active remediation using Soil Vapor Extraction removed vadose zone contamination at this site to a level that is protective of human health and the environment. This was further demonstrated by confirmation soil and soil vapor sampling as well as vapor intrusion modeling. The remediated contaminant plume is referred to as SWMU 104, a Post-closure Care Unit, in Table A of NMED's 2006 Annual Fee Letter. The site is also referred to as SWMU 108 by the US Army for funding purposes. SWMU boundaries are noted in the attached plat which is signed by a registered Professional Surveyor. In accordance with 40 CFR 264.111, SWMUs 104 and 108 have been clean closed and no land use restrictions should apply to this site. The site plat has been filed with the WSMR Real Property and Environmental Compliance offices.

"I certify under penalty of law that the documents referenced above were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

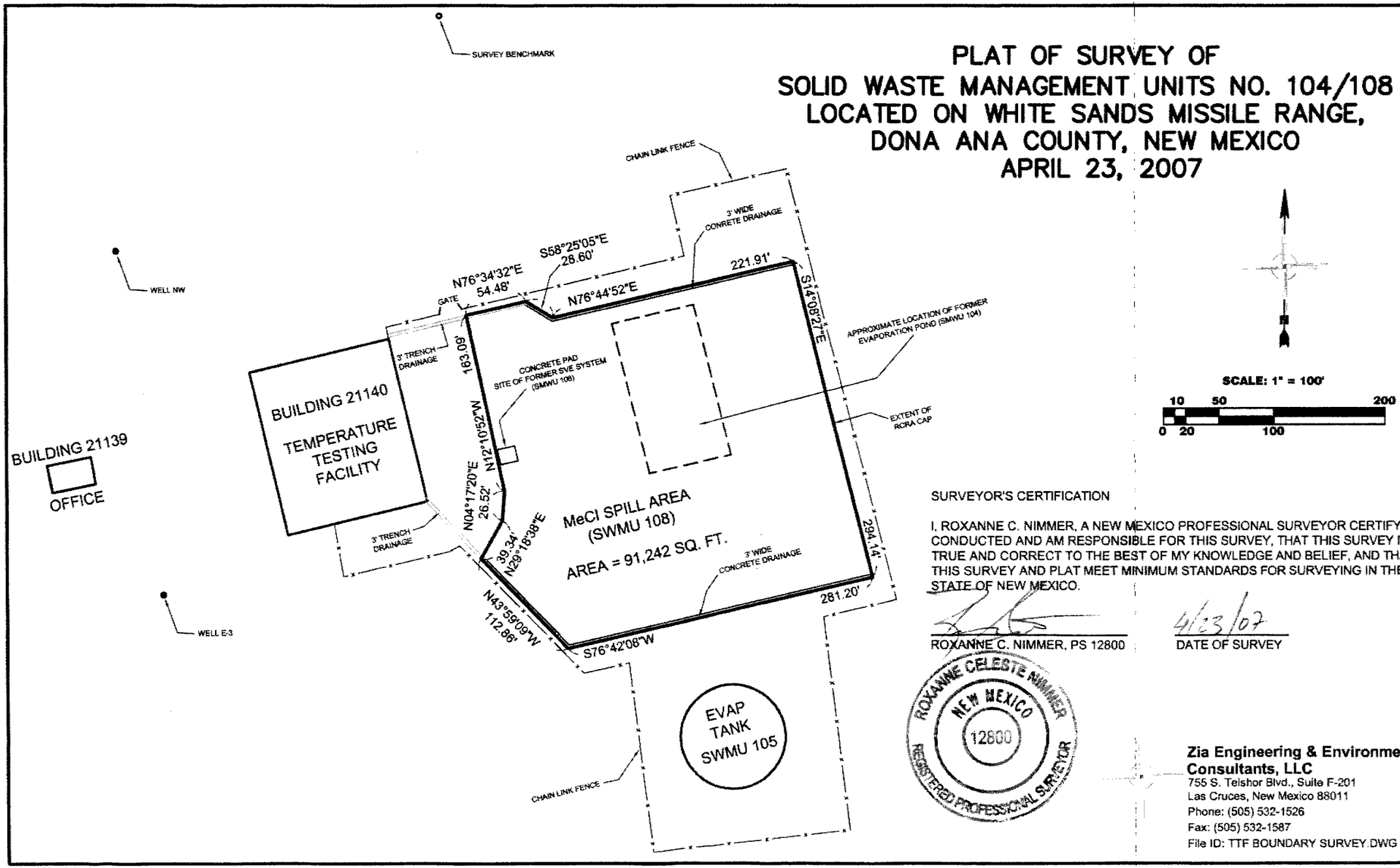
Thomas A. Ladd

Thomas A. Ladd
Director, Public Works
White Sands Missile Range

"I certify that I have reviewed the above noted documents, actively participated in site closure work efforts, and to the best of my knowledge, closure activities were performed in accordance with the closure documents and the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." Provided in accordance with 40 CFR 264.115

James J. Thompson, P. E.
Civil Engineer, NM 17408
White Sands Technical Services, LLC

PLAT OF SURVEY OF SOLID WASTE MANAGEMENT UNITS NO. 104/108 LOCATED ON WHITE SANDS MISSILE RANGE, DONA ANA COUNTY, NEW MEXICO APRIL 23, 2007



SURVEYOR'S CERTIFICATION

I, ROXANNE C. NIMMER, A NEW MEXICO PROFESSIONAL SURVEYOR CERTIFY THAT I CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET MINIMUM STANDARDS FOR SURVEYING IN THE STATE OF NEW MEXICO.

ROXANNE C. NIMMER, PS 12800

4/23/07
DATE OF SURVEY

ROXANNE CELESTE NIMMER
NEW MEXICO
12800
REGISTERED PROFESSIONAL SURVEYOR

Zia Engineering & Environmental Consultants, LLC
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
Phone: (505) 532-1526
Fax: (505) 532-1587
File ID: TTF BOUNDARY SURVEY.DWG

July 2007

NMED
Closure Certification/Verification TTF
(SWMU 104/108)

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 476-6001
Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

CINDY PADILLA
DEPUTY SECRETARY

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

July 6, 2007

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: CLOSURE CERTIFICATION/VERIFICATION
TEMPERATURE TEST FACILITY (TTF)
SOLID WASTE MANAGEMENT UNIT 108
WHITE SANDS MISSILE RANGE
EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has received and reviewed all required closure certification documentation submitted by the Department of the Army (the Permittee) concerning solid waste management unit (SWMU) 108 at the Temperature Test Facility (TTF). NMED has concluded that the Closure Certification Statement and the survey plat for SWMU 108 satisfies the closure requirements specified in 40 CFR 265.115 and 40 CFR 265.116, respectively.

NMED staff visited the TTF to verify closure of the permitted unit in April 26, 2006. NMED has determined that the inspection of the former surface impoundment and the photographs provided by the Permittee sufficiently demonstrate the current condition of the unit. Based on this information, NMED has confirmed the Permittee's completion of closure of the former surface impoundment (SWMU 108) at the TTF.

The Permittee's Closure Certification Statement, dated May 22, 2007 also included SWMU 104. This SWMU is not a regulated unit and, as a result, is not subject to the same closure requirements as SWMU 108.

If you have any questions concerning this letter, please contact Cheryl Frischkorn at 505-476-6058.

Sincerely,

John E. Kieling
Manager
Permits Management Program

cc: D. Cobrain, NMED
C. Frischkorn, NMED
J. Gallegos, WSMR
File: WSMR 2007 File

File Copies:
WSMR-41 Project File
IRP NMED Correspondence File
Admin Record
EC File

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 476-6001
Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

CINDY PADILLA
DEPUTY SECRETARY

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

July 11, 2007

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: CORRECTION
CLOSURE CERTIFICATION/VERIFICATION
TEMPERATURE TEST FACILITY (TTF)
SOLID WASTE MANAGEMENT UNIT 104
WHITE SANDS MISSILE RANGE
EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) sent at letter, dated July 6, 2007, that incorrectly identified the regulated unit that was recently closed at the Temperature Test Facility (TTF) as solid waste management unit (SWMU) 108 instead of SWMU 104. This letter corrects the inaccurate information in the July 6, 2007 letter.

The NMED has received and reviewed all required closure certification documentation submitted by the Department of the Army (the Permittee) concerning SWMU 104 at the Temperature Test Facility (TTF). NMED has concluded that the Closure Certification Statement and the survey plat for SWMU 104 satisfies the closure requirements specified in 40 CFR 265.115 and 40 CFR 265.116, respectively.

NMED staff visited the TTF to verify closure of the permitted unit in April 26, 2006. NMED has determined that the inspection of the former surface impoundment and the photographs provided

by the Permittee sufficiently demonstrate the current condition of the unit. Based on this information, NMED has confirmed the Permittee's completion of closure of the former surface impoundment (SWMU 104) at the TTF.

The Permittee's Closure Certification Statement, dated May 22, 2007 also erroneously included SWMU 108. SWMU 108 is not a regulated unit and, as a result, is not subject to the same closure requirements as SWMU 104.

If you have any questions concerning this letter, please contact Cheryl Frischkorn at 505-476-6058.

Sincerely,

John E. Kieling
Manager
Permits Management Program

cc: D. Cobrain, NMED
C. Frischkorn, NMED
J. Gallegos, WSMR
File: WSMR 2007 File

August 8, 2007

WSMR
Closure Certification/Verification Temperature Test Facility (TTF) Solid Waste Management Unit 104

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

August 8, 2007

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. James Bearzi
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Closure Certification/Verification Temperature Test Facility (TTF) Solid Waste Management Unit 104 White Sands Missile Range EPA ID No. NM2750211235 [IRP Site WSMR-41]

Dear Mr. Bearzi:

White Sands Missile Range (WSMR) has received the NMED letter July 11, 2007 with subject as above which provides closure approval for the TTF site (WSMR-41; SWMU 104). Based on the statements therein, WSMR will:

- Immediately cease the routine monthly monitoring and maintenance activities at the site;
- Prepare to abandon the existing on-site monitoring and vapor extraction wells as soon as practicable. This action will complete all planned and required actions at the site.

As discussed previously with Ms. Cheryl Frischkorn of your office, two of the wells are being transferred to the custody of the Range Hydro geologist to serve as long-term groundwater level monitoring points. These wells are outside the former zone of contamination.

The following certification is provided as required by our permit and according to NMAC 20.4.1.900, incorporating 40 CFR 270.11:

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

Copies furnished to Ms. Cheryl Frischkorn, NMED-HWB; Mr. Chuck Hendrickson, Region VI EPA; Mr. Bill Davis, U.S. Army Environmental Center; Mr. John Kieling, NMED-HWB; and White Sands Technical Services, LLC.

Should you have any questions regarding this matter, please contact Mr. Jose Gallegos of our Environmental Compliance office at (505) 678-1007.

Sincerely,

Thomas A. Ladd

THOMAS A. LADD
Director, Public Works

Appendix 6D

SWMU 108
Reports

August 2004

Temperature Test Facility Soil Vapor Extraction System Component Disposition

BAE SYSTEMS

25 August 2004
MCW-04-0374

U.S. Army White Sands Missile Range
100 Headquarters Avenue
ATTN: SFIM-SW-WS-ES (Ms. Y. Romero)
White Sands Missile Range, NM 88002-5000

Subject: WAO 10-DD, Temperature Test Facility Methylene Chloride Spill

Reference: Contract DAAD07-95-C-0125

Dear Ms. Romero:

This is to submit the following deliverable:

Temperature Test Facility Soil Vapor Extraction System Component Disposition.

This is the final version of this report, serving to document the ultimate disposition of the soil vapor extraction system formerly located at the Temperature Test Facility. Should you have any questions or require additional information, please contact me at 678-7907 or Fred Bourger at 678-3426.

Very truly yours,
BAE SYSTEMS

Donald K. Emig, Ph.D., P.E.
General Manager

Encl/as

cc: Jose Gallegos, Technical Inspector, WS-ES-EC (w/ enclosure)
Rick Reynaud, TTF Facility Manager, MTD-AA (w/ enclosure)
Cathy Giblin, Civil Engineer, WS-IS-C (w/ enclosure)
WS-ES Library (w/ enclosure)

Analytical Solutions P. O. Box 0399 WSMR, NM 88002
Telephone (505) 678-0263 Fax (505) 678-6096

bcc: Donald K. Emig, Ph.D, P.E., General Manager, BAE Systems (w/o enclosure)
Fred Bourger, Deputy General Manager, BAE Systems (w/o enclosure)
Lynne Reynolds, Contracts Administrator, BAE Systems (w/o enclosure)
Kathy Davis, Regulatory Specialist, BAE Systems (w/o enclosure)
Jason Capron, Task Coordinator, BAE Systems (w/ enclosure)
WAO Document Room (w/ enclosure)
Letter file (letter only)

LETTER REPORT

The following letter report was prepared under Contract DAAD07-95-C-0125, WAO No. 20-DD,

1. Title

Temperature Test Facility Soil Vapor Extraction System Component Disposition

2. Date

23 August, 2004

3. Introduction

Prior to completion of construction at the Temperature Test Facility (TTF), unused methylene chloride (MeCl) leaked within the facility and was flushed to an adjacent lined surface impoundment. It was subsequently discovered that significant failure of the impoundment liner had occurred, resulting in the release of wastewater laden with MeCl and other volatile organic compounds (VOCs) to the subsurface. A soil vapor extraction (SVE) system was installed in 1995 to remove VOC contamination from the vadose zone beneath the former surface impoundment. The MeCl Spill Area and associated SVE system are designated as Solid Waste Management Unit (SWMU) 108 and listed in the Installation Restoration Program (IRP) as WSMR-41.

The SVE system was operated from April 1995 until October 2002, when the system failed to restart following routine maintenance and a subsequent formal shutdown was coordinated with the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB). No VOCs were detected at the sampling ports of any active extraction well for the final two years of system operation.

Hazardous waste determinations have been performed for all dispositions of components of the operating system. The MeCl was the sole active ingredient of an unused commercial chemical product. The spilled MeCl was deemed a listed hazardous waste bearing the RCRA waste code U080.

4. Characterization of System Components

Eight contaminants of concern (COCs) are identified on the Post-Closure Care Permit for the TTF MeCl Spill Area:

- Methylene Chloride (MeCl)
- Trichloroethene (TCE)
- Trichloroethane (TCA)
- Tetrachloroethene (PCE)
- Benzene
- Toluene
- Ethylbenzene
- Xylenes

The MeCl is a listed hazardous waste. The other COCs on this list can be used to confirm the presence/absence of additional contamination. The SVE system components are interpreted as a treatment system for remediation of the spill, thus requiring appropriate disposal under the Resource Conservation and Recovery Act (RCRA). Additionally, the RCRA-listed status of the components can be transferred to an appropriate decontamination fluid. Given that no detections of VOCs occurred anywhere in the extraction or treatment systems during the final two years of SVE system operation and the volatile nature of all eight COCs, it is the position of BAE Systems that the uncontaminated vapor passing through the system constituted a decontamination step for all system components except activated carbon canisters. These canisters were disposed as listed wastes, and BAE Systems coordinated the disposal of remaining system components as non-hazardous wastes.

To confirm the success of the decontamination process, BAE Systems sampled system components using wipe-sampling with a methanol solvent and subsequent analysis of the samples for MeCl and the seven other COCs. Analysis of the 13 wipe samples collected did not result in a detection of MeCl above the reporting limit of 15 nanograms for any wipe sample. Similarly, neither TCE, TCA, PCE, nor benzene was detected above reporting limits in any sample. Toluene, ethylbenzene, and xylenes were detected in all samples, but the greatest mass for each of these compounds was reported for the modified trip blank, leading to the conclusion that this contamination occurred during transport and was not residual in the SVE system. The modified trip blank consisted of a methanol-saturated wipe sample, identical to those used for component-sampling, left sealed in a glass vial and shipped from and to the analytical laboratory with the wipes and containers used for field sampling.

Five other VOCs were detected in one or more samples, as listed in Table 1. The lab-reported concentration unit of nanograms per wipe is converted to nanograms per square inch (ng/in^2), based on the area wipe-sampled, for the purpose of normalizing the data. It is the position of BAE Systems that none of the VOCs listed in Table 1 are present in concentrations that would warrant consideration of any of the components as hazardous waste. It is further possible to extrapolate the concentration units to the more traditional milligrams per kilogram (mg/kg) by considering the ratio of COC-exposed surface area to the total volume of a component and the density of that component. Following this approach using the most liberal estimates of the surface area to volume ratios and the most conservative estimates of density results in maximum concentrations on the order of micrograms per kilogram (μg/kg), at least three orders of magnitude less than the universal treatment standards (UTS) for each constituent under the land disposal restrictions (LDRs) listed in Table 1. Because a TCLP sample cannot be prepared for the components in this scenario, a direct comparison to the UTS under the LDR for carbon disulfide cannot be made, but, as the total concentration is so far below the UTS for the LDR, a TCLP concentration would only be more so.

Table 1. Volatile Organic Compounds Detected Above Reporting Limits on Soil Vapor Extraction System Components.

Sample Number	Sample Location	Positive Detections (ng/in^2)
TPTF-0108-WS-001-0704	Blower outlet	chloromethane: 1.56 bromomethane: 0.95 carbon disulfide: 5.31
TPTF-0108-WS-002-0704	Exhaust stack	chloromethane: 0.64 bromomethane: 0.32 carbon disulfide: 8.75
TPTF-0108-WS-003-0704	Inlet to moisture separator	chloromethane: 0.90 bromomethane: 0.60 carbon disulfide: 8.75
TPTF-0108-WS-004-0704	Blower inlet	chloromethane: 1.51 bromomethane: 0.74
TPTF-0108-WS-005-0704	Moisture separator	chloromethane: 1.31 bromomethane: 0.61
TPTF-0108-WS-105-0704	Moisture separator—duplicate	chloromethane: 1.36 bromomethane: 0.81
TPTF-0108-WS-006-0704	Air filter inlet	chloromethane: 2.41 bromomethane: 1.13
TPTF-0108-WS-007-0704	Moisture separator outlet	chloromethane: 9.23 bromomethane: 4.30
TPTF-0108-WS-008-0704	Sump pump	chloromethane: 12.10 bromomethane: 7.32 trichlorofluoromethane: 5.25
TPTF-0108-WS-009-0704	Composite of pre-treatment piping	chloromethane: 0.38 bromomethane: 0.09 carbon disulfide: 0.68
TPTF-0108-WS-010-0704	Composite of intra- and post-treatment piping	chloromethane: 0.42 bromomethane: 0.06 chloroform: 0.08
TPTF-0108-WS-011-0704	Composite of pre-treatment piping	chloromethane: 0.22 bromomethane: 0.13 carbon disulfide: 2.67
TPTF-0108-WS-012-0704	Composite of intra- and post-treatment piping	chloromethane: 0.12 bromomethane: 0.04
TPTF-0108-WS-013-0704	Extra inlet structure for moisture separator, staged onsite	chloromethane: 0.83 bromomethane: 0.57
Universal Treatment Standards Under the Land Disposal Restrictions (40 CFR 268.48)		**chloromethane: 30 mg/kg** **bromomethane: 15 mg/kg** **carbon disulfide 4.8 mg/L (TCLP)** **chloroform: 6 mg/kg** **trichlorofluoromethane: 30 mg/kg**

5. Disposition of System Components

The absence of MeCl and the seven other permit-listed COCs on system components confirms that the decontamination step was successful and that disposal of remaining components of the SVE system as non-hazardous wastes is acceptable. Further, all constituents detected meet the UTS under the LDRs (which would be imposed only if waste materials were determined to require management as a hazardous waste).

The schematic for the SVE system, as shown in the *Operation & Maintenance Manual*, is attached to this report. The components of the system and current disposition are identified in Table 2.

Table 1. Soil Vapor Extraction System Component Identification.

Component	Component Function	Component Disposition
Concrete Pad	Staging for SVE equipment	Onsite, turned over to TTF management in August 2004
Metal Sled	Staging for SVE blower, pumps, and associated equipment	Onsite, turned over to TTF management in August 2004
Electrical Control Box	Power supply and control for SVE components	Onsite, turned over to TTF management in August 2004
Blower	Inducing negative gage pressure to extract potentially contaminated vadose zone vapor	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Inlet Air Filter	Air filter at the inlet to the system blower	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Moisture Separator/ Knock-out Pot	Separating extracted vapor into liquid and gas phases	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Exhaust Muffler	Noise suppression at blower outlet	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Exhaust Stack	Discharge conduit for treated gas-phase to atmosphere	Disposed at the Main Post Scrap Yard under direction from the WSMR Property Book Office in August 2004
Carbon Canisters—Vapor Treatment (3)	Treatment of extracted contaminated vapor (gas and liquid phase)	Shipped to carbon reactivation facility as a hazardous waste (U080) in January 2003
Carbon Canisters Liquid-Phase Treatment (2)	Treatment of liquid following moisture separation	Disposed through the WSMR Hazardous Waste Minimization Center as a hazardous waste (U080) in April 2004

Table 1 (cont). Soil Vapor Extraction System Component Identification

Component	Component Function	Component Disposition
Pre-Treatment Piping (Well Connections)	Conduits to deliver extracted vapor to treatment	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004
Intra- and Post-Treatment Piping (System Connections)	Conduits between unit processes	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004
Condensate Recovery Tank	Collection of separated moisture following carbon-filtration	Transferred to TTF Management in April 2004 based on non-detection of COCs in condensate sampling performed by Radian International
Pump between Moisture Separator and Liquid-Phase Carbon Canisters	Providing energy for fluid movement	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004
Pump between Liquid-Phase Carbon Canisters and Condensate Recovery Tank	Providing energy for fluid movement	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004
Sump Pump	Providing energy to move moisture accumulated in individual extraction wells to treatment	Disposed at the Main Post C&D Landfill under direction from the WSMR Property Book Office in August 2004

BAE Systems has coordinated with the White Sands Missile Range (WSMR) Property Book Office to dispose remaining SVE system components. The concrete pad, metal sled, and electrical control box never contacted the waste being treated, and were not considered part of the active treatment system and therefore did not require confirmation sampling. These components have been transferred to TTF Management for unrestricted future use.

6. BAE SYSTEMS Contact Information:

Task Manager: Fred Bourger, BAE Systems 678-3426
Task Coordinator: Jason Capron, BAE Systems 678-3434
Regulatory Specialist: Kathy Davis, North Wind, Inc. 678-7656

ATTACHMENT 1

Soil Vapor Extraction System Schematics as presented in the
Soil Vapor Extraction Treatment System Operation & Maintenance Manual for the Temperature Test Facility, White Sands Missile Range, New Mexico
(Radian International, December 1999)

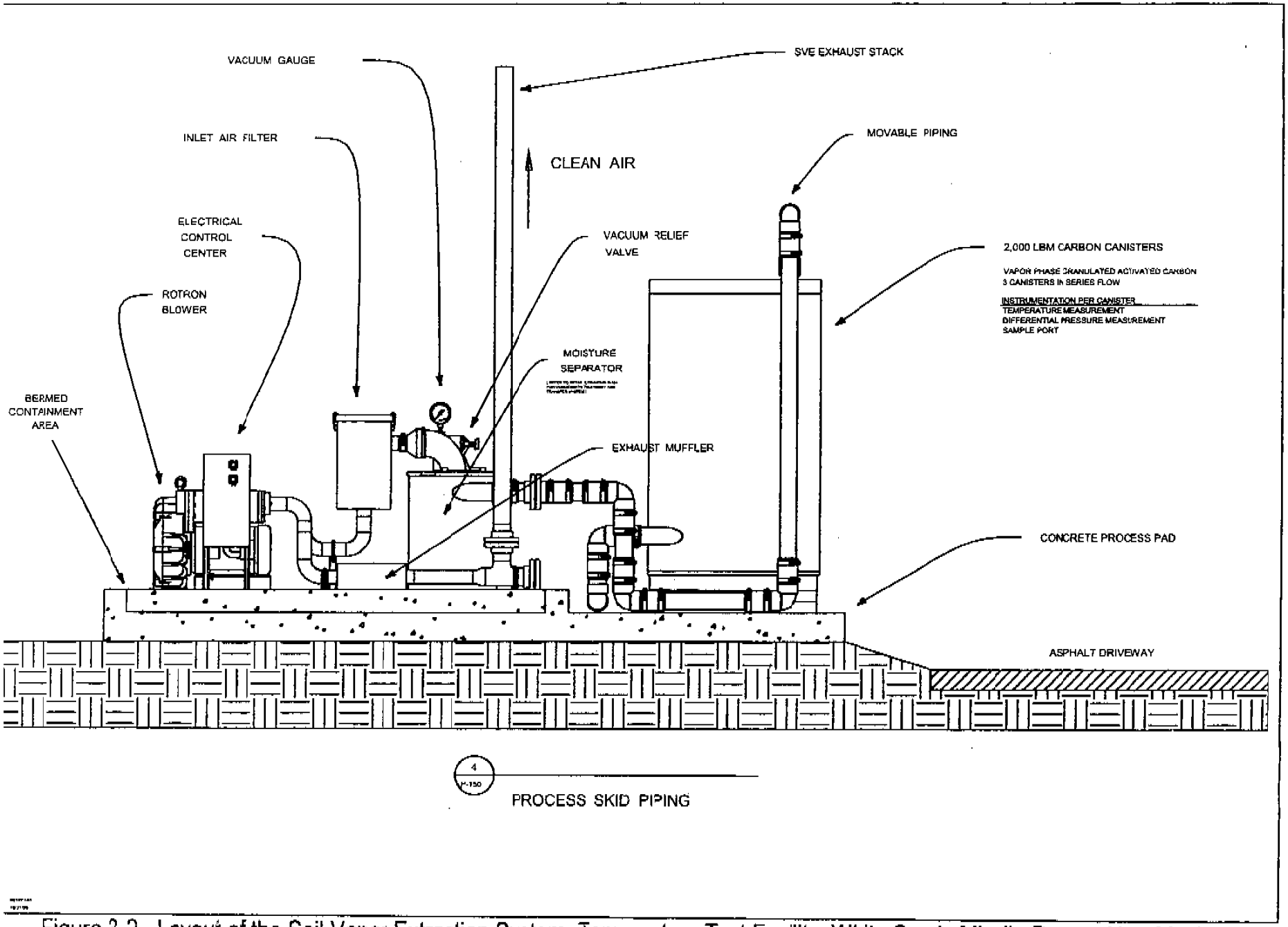


Figure 3-2. Layout of the Soil Vapor Extraction System, Temperature Test Facility, White Sands Missile Range, New Mexico

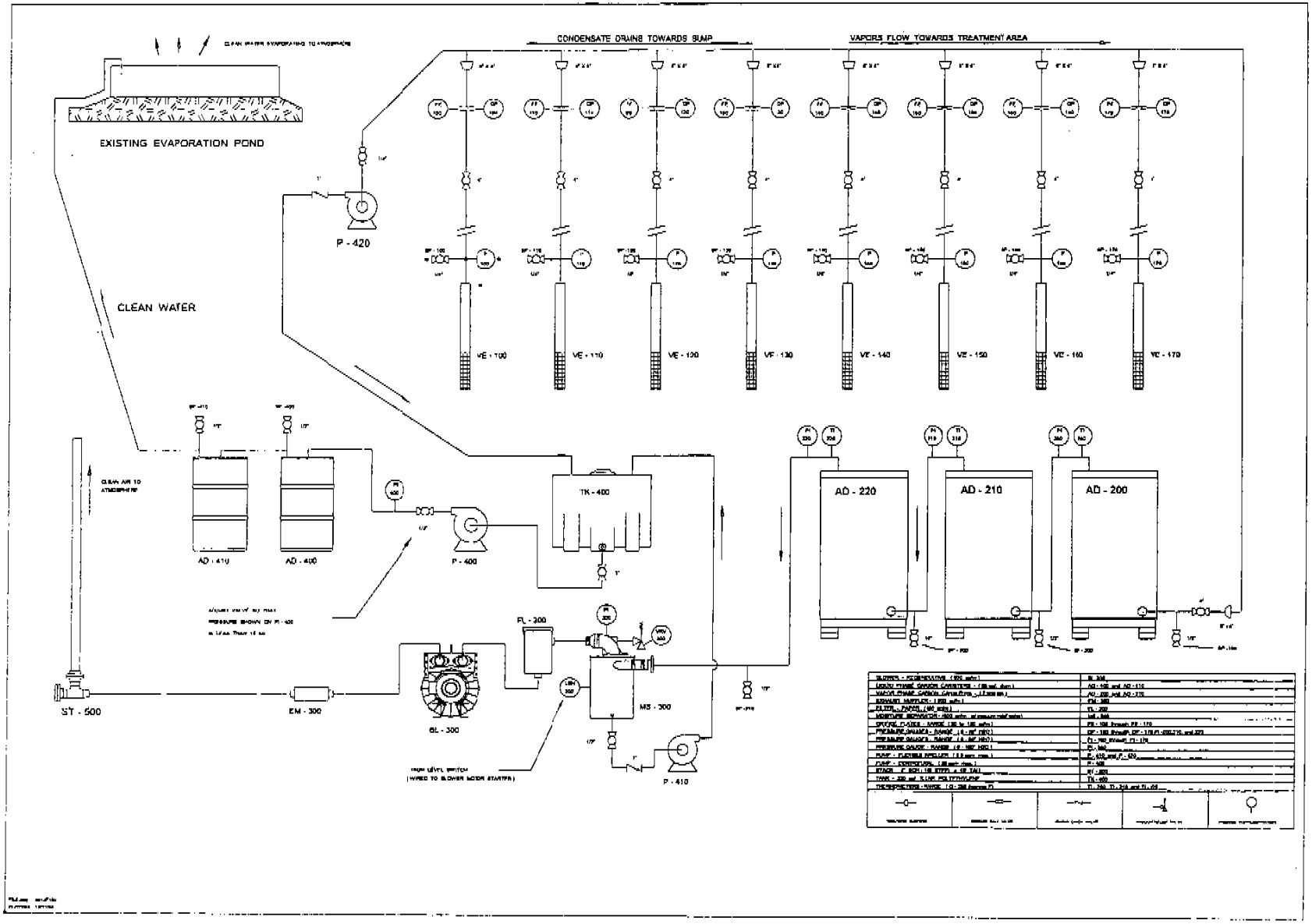


Figure 3-3. Soil Vapor Extraction System Piping and Instrumentation Diagram, Temperature Test Facility, White Sands Missile Range, New Mexico

ATTACHMENT 2

Laboratory Analytical Data on CD

January 2008

Abandonment of Monitor and Vapor Wells Associated with SWMU 104 (WTS)

LETTER REPORT

The following letter report was prepared under Contract W9124Q-04-D-0012, TO No. 03.

1. TITLE

Abandonment of monitor and vapor wells associated with SWMU 104, (IRP site WSMR-41)

2. DATE

January 2008

3. INTRODUCTION

The Temperature Test Facility (TTF) was designed to simulate extreme weather conditions in order to test the ability of mechanical equipment to perform in adverse weather. The location of TTF is approximately 2.5 miles east of the Main Post area (NW ¼, NE ¼, section 21, T22S, R5E) and is south of Range Road #2 (Nike Avenue). TTF became fully operational in January of 1984. The remediated contaminant plume is referred to as Solid Waste Management Unit (SWMU) 104, a Post-closure Care Unit, in table A of the New Mexico Environment Department's (NMED) 2006 Annual Fee Letter. The site is also referred to as Solid Waste Management Unit (SWMU) 108 (Methylene Chloride Spill-Vapor Extraction) by the US Army for funding purposes.

4. BACKGROUND

The TTF cooling system was initially filled with methylene chloride (MeCl) which, in July 1983, leaked within TTF prior to completion of construction. Crews flushed the MeCl from the building to a lined evaporation pond. It was later discovered that the pond liner had failed, releasing wastewater containing MeCl and other volatile organic compounds (VOCs) to the subsurface. The quantity of this release is unknown. Also contributing to the subsurface MeCl contamination were releases from faulty valves in a leaking underground interceptor tank. Details of the MeCl contamination and subsequent investigations are documented in both the *Final Contamination Assessment Report* (Geoscience Consultants, Ltd., May 1987) and the *Resource Conservation and Recovery Act (RCRA) Facility Investigation Report* (Woodward-Clyde Federal Services, March 1996).

In 1990, the NMED Hazardous and Radioactive Materials Bureau (HRMB) -- now referred to as the Hazardous Waste Bureau [HWB] -- gave approval for WSMR to install an RCRA subtitle C impermeable cap over the former evaporation pond and surrounding area. Closure certification for the site was granted by NMED-HRMB on 22 October 1991. A post-closure care permit (permit number: NM2750211235-PCC) was then issued on 30 September 1993. The permit required monthly inspection and groundwater level measurements along with semi-annual groundwater monitoring. This permit was effective for 30 years from the date of issue.

WSMR initiated a remedial action at TTF in 1995 with the installation of a soil vapor extraction (SVE) system. The SVE system was effective at removing MeCl and other VOCs from the vadose zone beneath the RCRA cover. WSMR coordinated a formal shutdown of the SVE system with NMED-HWB in October 2002. For 2 years prior to shutdown, VOCs had <u>not</u> been detected at any of the sampling locations among the active extraction wells (*Revised Work Plan for the Clean Closure Demonstration*, BAE Systems & WTS, February 2005).

Soil and vapor sampling was conducted for the WSMR TTF Clean Closure Demonstration Project between 17 May and 9 June 2005. The investigation and analytical results are discussed in the *Final Clean Closure Demonstration Report* (URS Group Inc., October 2005). Based on the results of this investigation, WSMR proposed clean closure of SWMU 104/108. In correspondence dated 24 January 2006, NMED stated that "before approval of clean closure can be granted allowing unrestricted land use [WSMR] must address

NMED's concern regarding the potential for subsurface vapors to adversely impact indoor air quality if a building were to be constructed at the site" (correspondence attached).

To address NMED's concern, WSMR conducted risk screening and modeling to evaluate the potential for vapor intrusion to indoor air at the site of the methylene chloride plume identified as SWMU 108 and WSMR-41. Based on the risk screening and Johnson and Ettinger modeling conducted, WSMR identified no unacceptable risks associated with subsurface vapor-phase contamination at the TTF. This modeling was discussed in the *Revised Addendum for the Clean Closure Demonstration Report* (URS Group Inc. & WTS, November 2006).

Via correspondence dated 8 August 2007, WSMR notified NMED-HWB in regards to ceasing all routine monthly monitoring and maintenance activities at TTF, and the abandonment of all remaining monitor and vapor wells associated with SWMU 104. A copy of the correspondence referenced within this report is included as Appendix A.

5. DISCUSSION

The final groundwater monitoring event occurred in November 2006. The next groundwater monitoring event would have taken place in May 2007. WSMR and NMED had verbally agreed that further sampling was not necessary. WSMR continued inspection activities at TTF though June 2007. Inspection forms are included as Appendix B. Abandonment activities took place over 8 days beginning 26 November and concluding 12 December 2007. During the course of abandonment work, 34 well appurtenances were removed and 4,330 feet of well length was backfilled with bentonite/cement grout. Two wells were not abandoned, so they could be utilized for monitoring the regional water table. The two remaining wells are designated "NW" and "E-3;" total depth 254.8 and 233.2 feet below top of casing, respectively. The following table lists the wells which were abandoned.

Well Name	Description (from various documents)	Appurtenance Removed	Depth plugged
95-01	vapor well	1 (nested well)	132
95-01A	vapor well		103
95-01B	vapor well		78
95-02	vapor well	1 (nested well)	139
95-02A	vapor well		124
95-02B	vapor well		106
98-03	vapor well	1	10
98-04	vapor well	1	80
98-05	vapor well	1	80
98-06	vapor well	1	79
A	Located at site, not on initial list	1	80
19	vapor well, galvanized iron pipe	1	79
92-01	vapor well	1	115
ERC-1	vapor well	1	65
23	well, galvanized iron pipe	1	80
11	vapor well, galvanized iron pipe	1	61
16	vapor well, galvanized iron pipe	1	68
18	vapor well, galvanized iron pipe	1	50
25	well, galvanized iron pipe	1	71
14	vapor well, galvanized iron pipe	1	73
29	well, galvanized iron pipe	1	54

Well Name	Description (from various documents)	Appurtenance Removed	Depth plugged
24	well, galvanized iron pipe	1	71
21	vapor well, galvanized iron pipe	1	78
98-01	vapor well	1	80
98-02	vapor well	1	78
E-1	monitor well, PVC	1	230
E-2	monitor well, PVC	1	231
E-4	monitor well, PVC	1	238
92-02	vapor well	1	97
20	vapor well, galvanized iron pipe	1	78
95-03	vapor well	1 (nested well)	128
95-03A	vapor well		107
95-03B	vapor well		80
95-05	vapor well	1 (nested well)	124
95-05A	vapor well		81
95-04A	vapor well	1 (nested well)	66
95-04B	vapor well		111
22	well, galvanized iron pipe	1	78
27	well, galvanized iron pipe, marked "B"	1	78
?	vapor well	1	77
S	well, iron pipe	1	255
Piezometer	PVC well known as NE	1	237
Totals		**34**	**4,330**

6. ANALYSIS

No samples were collected or analyzed for this activity. Analytical results from both groundwater and soil samples can be found in the prior investigative activities summarized in section 4, above.

7. CONCLUSIONS

During the course of abandonment work, 34 well appurtenances were removed and 4,330 feet of well length was backfilled with bentonite/cement grout. Based on visual inspection and records research, no other wells remain except for the two which were purposefully left for regional water table monitoring. The two remaining wells are designated "NW" and "E-3."

8. RECOMMENDATIONS

WTS recommends WSMR continue discussions with NMED relating to the status of remaining SWMUs associated with TTF. The draft RCRA permit published by NMED on 11 June 2007 lists SWMUs located on WSMR. However, the list is not entirely correct regarding SWMU description or regulatory status.

9. WTS TASK MANAGER AND TASK COORDINATOR / PHONE NO.:

Task Manager	Fred Bourger	575-678-3426
Task Coordinator	James Thompson	575-678-1941

APPENDIX A

Correspondence Referenced

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

January 24, 2006

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: FINAL CLEAN CLOSURE DEMONSTRATION REPORT FOR THE METHYLENE CHLORIDE SPILL AT THE TEMPERATURE TEST FACILITY WHITE SANDS MISSILE RANGE EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has completed its review of the *Final Clean Closure Report, Methylene Chloride Spill Area, Vapor Extraction at the Temperature Test Facility*, dated October 2005.

Before approval of clean closure can be granted allowing unrestricted land use, White Sands Missile Range (WSMR) must address NMED's concern regarding the potential for subsurface vapors to adversely impact indoor air quality if a building were to be constructed at the site. WSMR must address this concern within 60 days of receipt of this letter. If this issue is addressed to NMED's satisfaction, the TTF will be eligible for clean closure status

In the future, WSMR must present, in their summary tables, soil vapor data in ug/m^3 rather than parts per million vapor (ppmv). NMED compares detected vapor concentrations to the Environmental Protection Agency's (EPA's) Region 6 Human Health Medium-Specific

Screening Levels.
If you have any questions concerning this letter, please contact Cheryl Frischkorn of my staff at 505-428-2550.

Sincerely,

John E. Kieling
Manager
Permits Management Program

JEK:caf

cc: *D. Cobrain, NMED HWB
C. Frischkorn, NMED HWB
L. King, EPA Region 6 (6PD-N)
Jose Gallegos, White Sands Missile Range

File: Reading File & WSMR 2006 File

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 476-6001
Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

CINDY PADILLA
DEPUTY SECRETARY

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

July 6, 2007

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: CLOSURE CERTIFICATION/VERIFICATION
TEMPERATURE TEST FACILITY (TTF)
SOLID WASTE MANAGEMENT UNIT 108
WHITE SANDS MISSILE RANGE
EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has received and reviewed all required closure certification documentation submitted by the Department of the Army (the Permittee) concerning solid waste management unit (SWMU) 108 at the Temperature Test Facility (TTF). NMED has concluded that the Closure Certification Statement and the survey plat for SWMU 108 satisfies the closure requirements specified in 40 CFR 265.115 and 40 CFR 265.116, respectively.

NMED staff visited the TTF to verify closure of the permitted unit in April 26, 2006. NMED has determined that the inspection of the former surface impoundment and the photographs provided by the Permittee sufficiently demonstrate the current condition of the unit. Based on this information, NMED has confirmed the Permittee's completion of closure of the former surface impoundment (SWMU 108) at the TTF.

The Permittee's Closure Certification Statement, dated May 22, 2007 also included SWMU 104. This SWMU is not a regulated unit and, as a result, is not subject to the same closure requirements as SWMU 108.

If you have any questions concerning this letter, please contact Cheryl Frischkorn at 505-476-6058.

Sincerely,

John E. Kieling
Manager
Permits Management Program

cc: D. Cobrain, NMED
C. Frischkorn, NMED
J. Gallegos, WSMR
File: WSMR 2007 File

File Copies:
WSMR-41 Project File
IRP NMED Correspondence File
Admin Record
EC File

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 476-6001
Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

CINDY PADILLA
DEPUTY SECRETARY

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

July 11, 2007

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: CORRECTION
CLOSURE CERTIFICATION/VERIFICATION
TEMPERATURE TEST FACILITY (TTF)
SOLID WASTE MANAGEMENT UNIT 104
WHITE SANDS MISSILE RANGE
EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) sent at letter, dated July 6, 2007, that incorrectly identified the regulated unit that was recently closed at the Temperature Test Facility (TTF) as solid waste management unit (SWMU) 108 instead of SWMU 104. This letter corrects the inaccurate information in the July 6, 2007 letter.

The NMED has received and reviewed all required closure certification documentation submitted by the Department of the Army (the Permittee) concerning SWMU 104 at the Temperature Test Facility (TTF). NMED has concluded that the Closure Certification Statement and the survey plat for SWMU 104 satisfies the closure requirements specified in 40 CFR 265.115 and 40 CFR 265.116, respectively.

NMED staff visited the TTF to verify closure of the permitted unit in April 26, 2006. NMED has determined that the inspection of the former surface impoundment and the photographs provided

by the Permittee sufficiently demonstrate the current condition of the unit. Based on this information, NMED has confirmed the Permittee's completion of closure of the former surface impoundment (SWMU 104) at the TTF.

The Permittee's Closure Certification Statement, dated May 22, 2007 also erroneously included SWMU 108. SWMU 108 is not a regulated unit and, as a result, is not subject to the same closure requirements as SWMU 104.

If you have any questions concerning this letter, please contact Cheryl Frischkorn at 505-476-6058.

Sincerely,

John E. Kieling
Manager
Permits Management Program

cc: D. Cobrain, NMED
C. Frischkorn, NMED
J. Gallegos, WSMR
File: WSMR 2007 File

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

August 8, 2007

REPLY TO
ATTENTION OF

Directorate of Public Works

Mr. James Bearzi
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Closure Certification/Verification Temperature Test Facility (TTF) Solid Waste Management Unit 104 White Sands Missile Range EPA ID No. NM2750211235 [IRP Site WSMR-41]

Dear Mr. Bearzi:

White Sands Missile Range (WSMR) has received the NMED letter July 11, 2007 with subject as above which provides closure approval for the TTF site (WSMR-41; SWMU 104). Based on the statements therein, WSMR will:

- Immediately cease the routine monthly monitoring and maintenance activities at the site;
- Prepare to abandon the existing on-site monitoring and vapor extraction wells as soon as practicable. This action will complete all planned and required actions at the site.

As discussed previously with Ms. Cheryl Frischkorn of your office, two of the wells are being transferred to the custody of the Range Hydro geologist to serve as long-term groundwater level monitoring points. These wells are outside the former zone of contamination.

The following certification is provided as required by our permit and according to NMAC 20.4.1.900, incorporating 40 CFR 270.11:

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

Copies furnished to Ms. Cheryl Frischkorn, NMED-HWB; Mr. Chuck Hendrickson, Region VI EPA; Mr. Bill Davis, U.S. Army Environmental Center; Mr. John Kieling, NMED-HWB; and White Sands Technical Services, LLC.

Should you have any questions regarding this matter, please contact Mr. Jose Gallegos of our Environmental Compliance office at (505) 678-1007.

Sincerely,

Thomas A. Ladd

THOMAS A. LADD
Director, Public Works

APPENDIX B

TTF Inspection Forms

Temperature Test Facility Inspection Form

Date of Inspection: 18 Jan 2007 **Inspector:** J. Thompson

	Yes	No
1. Gate closed? (Gates allowed open during working hours)	☒	☐
2. Gate locked? (Gates allowed open during working hours)	☒	☐
3. If gate not locked, is lock present?	☒	☐
4. Are keys in TTF key locker (Building #21139)?	☒	☐

	Satisfactory	Unsatisfactory
5. Fence in condition		
a. Fence	☒	☐
b. Gates	☒	☐
c. Signs	☒	☐
6. Groundwater monitoring well conditions		
a. Wells locked	☒	☐
b. Concrete pad condition	☒	☐
c. Well covers tight	☒	☐
7. Cap condition		
a. Traffic on cap	☒	☐
b. Weeds on cap	☒	☐
c. Weeds around cap	☒	☐
d. Lack of erosion	☒	☐
e. Drainage ditches clean	☒	☐
f. Animal activity	☒	☐
g. Spotlights on TTF	☒	☐
h. Settlement of cap	☒	☐
i. Trash on cap	☒	☐
8. Benchmark present and clear of debris	☒	☐
9. Vapor extraction wells capped	☒	☐

Inspector's Signature: J. Thompson

Re-inspection date, if necessary: _____

Temperature Test Facility Inspection Form

Date of Inspection: 18 Jan 2007 **Inspector:** J. Thompson

Comments: NA

Actions Taken: NA

- ✓ All unsatisfactory observations are to be immediately reported to the WSMR Environmental Services Division.
- ✓ All unsatisfactory observations must be fixed and re-inspected within 30 days.
- ✓ One copy of this inspection form will be maintained on site for three years from the date of inspection.
- ✓ One copy of this inspection form shall be kept on file with the WSMR Environmental Services Division for the remainder of the post-closure care period.
- ✓ Cap and well repairs will be conducted with the same materials and construction techniques used during the initial construction. Any modifications to these techniques or materials must be approved in writing by the NMED-HWB.

Temperature Test Facility Inspection Form

Date of Inspection: 15 Feb 2007 **Inspector:** James Thompson

	Yes	No
1. Gate closed? (Gates allowed open during working hours)	X	
2. Gate locked? (Gates allowed open during working hours)	X	
3. If gate not locked, is lock present?	X	
4. Are keys in TTF key locker (Building #21139)?	X	

	Satisfactory	Unsatisfactory
5. Fence in condition		
a. Fence	X	
b. Gates	X	
c. Signs	X	
6. Groundwater monitoring well conditions		
a. Wells locked	X	
b. Concrete pad condition	X	
c. Well covers tight	X	
7. Cap condition		
a. Traffic on cap	X	
b. Weeds on cap	X	
c. Weeds around cap	X	
d. Lack of erosion	X	
e. Drainage ditches clean	X	
f. Animal activity	X	
g. Spotlights on TTF	X	
h. Settlement of cap	X	
i. Trash on cap	X	
8. Benchmark present and clear of debris	X	
9. Vapor extraction wells capped	X	

Inspector's Signature: J. Thompson

Re-inspection date, if necessary: —

Temperature Test Facility Inspection Form

Date of Inspection: 15 Feb 2007 **Inspector:** James Thompson

Comments: None.

Actions Taken: Cleaned drainage ditch.

- ✓ All unsatisfactory observations are to be immediately reported to the WSMR Environmental Services Division.
- ✓ All unsatisfactory observations must be fixed and re-inspected within 30 days.
- ✓ One copy of this inspection form will be maintained on site for three years from the date of inspection.
- ✓ One copy of this inspection form shall be kept on file with the WSMR Environmental Services Division for the remainder of the post-closure care period.
- ✓ Cap and well repairs will be conducted with the same materials and construction techniques used during the initial construction. Any modifications to these techniques or materials must be approved in writing by the NMED-HWB.

Temperature Test Facility Inspection Form

Date of Inspection: 3/15/07 **Inspector:** George ESQUEDA

	Yes	No
1. Gate closed? (Gates allowed open during working hours)	✓	
2. Gate locked? (Gates allowed open during working hours)	✓	
3. If gate not locked, is lock present?	✓	
4. Are keys in TTF key locker (Building #21139)?	✓	

	Satisfactory	Unsatisfactory
5. Fence in condition		
a. Fence	✓	
b. Gates	✓	
c. Signs	✓	
6. Groundwater monitoring well conditions		
a. Wells locked	✓	
b. Concrete pad condition	✓	
c. Well covers tight	✓	
7. Cap condition		
a. Traffic on cap	✓	
b. Weeds on cap	✓	
c. Weeds around cap	✓	
d. Lack of erosion	✓	
e. Drainage ditches clean	✓	
f. Animal activity	✓	
g. Spotlights on TTF	✓	
h. Settlement of cap	✓	
i. Trash on cap	✓	
8. Benchmark present and clear of debris	✓	
9. Vapor extraction wells capped	✓	

Inspector's Signature: George Esqueda

Re-inspection date, if necessary: _____

Temperature Test Facility Inspection Form

Date of Inspection: 3/15/07 **Inspector:** GEORGE ESQUEDA

Comments: NONE

Actions Taken:

- ✓ All unsatisfactory observations are to be immediately reported to the WSMR Environmental Services Division.
- ✓ All unsatisfactory observations must be fixed and re-inspected within 30 days.
- ✓ One copy of this inspection form will be maintained on site for three years from the date of inspection.
- ✓ One copy of this inspection form shall be kept on file with the WSMR Environmental Services Division for the remainder of the post-closure care period.
- ✓ Cap and well repairs will be conducted with the same materials and construction techniques used during the initial construction. Any modifications to these techniques or materials must be approved in writing by the NMED-HWB.

Temperature Test Facility Inspection Form

Date of Inspection: 4-9-07 **Inspector:** George Esqueda

	Yes	No
1. Gate closed? (Gates allowed open during working hours)	☒	☐
2. Gate locked? (Gates allowed open during working hours)	☒	☐
3. If gate not locked, is lock present?	☒	☐
4. Are keys in TTF key locker (Building #21139)?	☒	☐

	Satisfactory	Unsatisfactory
5. Fence in condition		
a. Fence	☒	☐
b. Gates	☒	☐
c. Signs	☒	☐
6. Groundwater monitoring well conditions		
a. Wells locked	☒	☐
b. Concrete pad condition	☒	☐
c. Well covers tight	☒	☐
7. Cap condition		
a. Traffic on cap	☒	☐
b. Weeds on cap	☒	☐
c. Weeds around cap	☒	☐
d. Lack of erosion	☒	☐
e. Drainage ditches clean	☒	☐
f. Animal activity	☒	☐
g. Spotlights on TTF	☒	☐
h. Settlement of cap	☒	☐
i. Trash on cap	☒	☐
8. Benchmark present and clear of debris	☒	☐
9. Vapor extraction wells capped	☒	☐

Inspector's Signature: George Esqueda

Re-inspection date, if necessary: _____

Temperature Test Facility Inspection Form

Date of Inspection: 4-9-07 **Inspector:** George ESQUEDA

Comments: NO NOTE

Actions Taken:

- ✓ All unsatisfactory observations are to be immediately reported to the WSMR Environmental Services Division.
- ✓ All unsatisfactory observations must be fixed and re-inspected within 30 days.
- ✓ One copy of this inspection form will be maintained on site for three years from the date of inspection.
- ✓ One copy of this inspection form shall be kept on file with the WSMR Environmental Services Division for the remainder of the post-closure care period.
- ✓ Cap and well repairs will be conducted with the same materials and construction techniques used during the initial construction. Any modifications to these techniques or materials must be approved in writing by the NMED-HWB.

Temperature Test Facility Inspection Form

Date of Inspection: 5-2-07 **Inspector:** George Esqueda

	Yes	No
1. Gate closed? (Gates allowed open during working hours)	X	
2. Gate locked? (Gates allowed open during working hours)	X	
3. If gate not locked, is lock present?	X	
4. Are keys in TTF key locker (Building #21139)?	X	

	Satisfactory	Unsatisfactory
5. Fence in condition		
a. Fence	X	
b. Gates	X	
c. Signs	X	
6. Groundwater monitoring well conditions		
a. Wells locked	X	
b. Concrete pad condition	X	
c. Well covers tight	X	
7. Cap condition		
a. Traffic on cap	X	
b. Weeds on cap	X	
c. Weeds around cap	X	
d. Lack of erosion		
e. Drainage ditches clean	X	
f. Animal activity	X	
g. Spotlights on TTF	X	
h. Settlement of cap	X	
i. Trash on cap	X	
8. Benchmark present and clear of debris	X	
9. Vapor extraction wells capped	X	

Inspector's Signature: George Esqueda

Re-inspection date, if necessary: _____

Temperature Test Facility Inspection Form

Date of Inspection: 5-2-07 **Inspector:** George Esqueda

Comments: NONE

Actions Taken:

- ✓ All unsatisfactory observations are to be immediately reported to the WSMR Environmental Services Division.
- ✓ All unsatisfactory observations must be fixed and re-inspected within 30 days.
- ✓ One copy of this inspection form will be maintained on site for three years from the date of inspection.
- ✓ One copy of this inspection form shall be kept on file with the WSMR Environmental Services Division for the remainder of the post-closure care period.
- ✓ Cap and well repairs will be conducted with the same materials and construction techniques used during the initial construction. Any modifications to these techniques or materials must be approved in writing by the NMED-HWB.

Temperature Test Facility Inspection Form

Date of Inspection: 6/12/07 **Inspector:** George ESQUEDA

	Yes	No
1. Gate closed? (Gates allowed open during working hours)	☑	☐
2. Gate locked? (Gates allowed open during working hours)	☑	☐
3. If gate not locked, is lock present?	☑	☐
4. Are keys in TTF key locker (Building #21139)?	☑	☐

	Satisfactory	Unsatisfactory
5. Fence in condition		
a. Fence	☑	☐
b. Gates	☑	☐
c. Signs	☑	☐
6. Groundwater monitoring well conditions		
a. Wells locked	☑	☐
b. Concrete pad condition	☑	☐
c. Well covers tight	☑	☐
7. Cap condition		
a. Traffic on cap	☑	☐
b. Weeds on cap	☑	☐
c. Weeds around cap	☑	☐
d. Lack of erosion	☑	☐
e. Drainage ditches clean	☑	☐
f. Animal activity	☑	☐
g. Spotlights on TTF	☑	☐
h. Settlement of cap	☑	☐
i. Trash on cap	☑	☐
8. Benchmark present and clear of debris	☑	☐
9. Vapor extraction wells capped	☑	☐

Inspector's Signature: George Esqueda

Re-inspection date, if necessary: _____

Temperature Test Facility Inspection Form

Date of Inspection: 6/12/07 **Inspector:** GEORGE ESQUEDA

Comments: NONE

Actions Taken: N/A

- ✓ All unsatisfactory observations are to be immediately reported to the WSMR Environmental Services Division.
- ✓ All unsatisfactory observations must be fixed and re-inspected within 30 days.
- ✓ One copy of this inspection form will be maintained on site for three years from the date of inspection.
- ✓ One copy of this inspection form shall be kept on file with the WSMR Environmental Services Division for the remainder of the post-closure care period.
- ✓ Cap and well repairs will be conducted with the same materials and construction techniques used during the initial construction. Any modifications to these techniques or materials must be approved in writing by the NMED-HWB.

7. SWMUs 157, 158 and 159: Oscura Range Center Landfills (WSMR 05)

7.1 Summary

WSMR-05 consisted of three separate landfill areas located near the Oscura Range Center (ORC) in the northeastern portion of WSMR (Figure 7-1, Appendix 7A, pg. 7A-1). The three landfills were designated as SWMU 157 (Landfill A), 158 (Landfill B), and 159 (Landfill C) and were listed on the WSMR HSWA Corrective Action Module of the RCRA Part B Permit. SWMUs 157 and 159 were listed as Corrective Action Units under the 1989 RCRA permit, which was in effect during the investigation and corrective measures activities conducted at SWMUs 157, 158 and 159. SWMU 158 was listed on the permit as an Operating Unit and was given the further designation of Land Disposal Unit – 19 (LDU-19). The three SWMUs were designated as WSMR-05 under WSMR's Installation Restoration Program (IRP). In the December 2009 WSMR RCRA permit, SWMUs 157 and 159 are identified as SWMUs requiring corrective action, and SWMU 158 is identified as a hazardous waste management unit for which clean closure is complete.

The *Plan of Action Landfill Debris Removal Oscura Range Center* (Radian, 1998) report indicated that all waste debris was removed from SWMUs 157 and 158 (LDU-19) in June 1998. Confirmation samples were collected and analyzed for TPH, PCBs, and total RCRA metals. Only metals were detected and all concentrations were below NMED SSLs for residential land use.

SWMU 159 was the focus of the *RCRA Facility Investigation Report, Former Oscura Range Center Construction Landfill* (BAE, 2004c). The SWMU 159 RFI was conducted in 2002 to determine if leachate from SWMU 159 had contaminated soil beneath the landfill. The investigation included a geophysical survey and surface/subsurface soil sampling. Results determined that nothing more than the reported construction debris and metallic debris from spent rocket components were disposed in the landfill and soil sample analysis indicated that leachate had not contaminated soil beneath the landfill or the ramp area. However, WSMR proposed to remove the debris and clean close the site to eliminate the need for long-term monitoring and to ensure that no future contaminant release would occur.

The *Accelerated Corrective Action Completion Report: Oscura Range Center WSMR-05 Landfill A (SWMU 157) and Landfill C (SWMU 159)* (WTS, 2007a) report summarized the 1998 corrective measures that were conducted at SWMU 157 and

compared the results of the confirmatory samples to the 2006 NMED SSLs. The report confirmed that the constituent concentrations in the confirmatory samples were below the NMED SSLs. The objective of the Accelerated Corrective Action (ACA) was to obtain clean closure of the covered construction landfill near the ORC, SWMU 159. Results of the ACA indicated that the SWMU 159 landfill debris was removed and disposed off-site at an approved landfill. Confirmation sample results indicated no contamination present beneath the former landfill site, and no additional landfill cells were discovered on site. Results of the SWMU 159 ACA in 2006 and the SWMU 157 corrective measures conducted in 1998 indicated that these sites should be recommended for clean closure.

On October 24, 2007, the NMED approved the ACA report and stated WSMR must submit a petition for corrective action complete status for SWMUs 157 and 159. The NMED response indicated all the waste was removed from both landfills and confirmation soil sampling demonstrated that no residual constituents were detected above residential New Mexico Soil Screening Levels (Appendix 7C, pg. 7C-1). Landfill C (SWMU 159) was backfilled with clean fill, returned to contour, and revegetated. Landfill A (SWMU 157) was backfilled and vegetation was allowed to re-establish itself at the site.

The *Closure Report for the Oscura Range Center Landfill "B" SWMU 158 (LDU-19)* (WTS, 2007b) was submitted in 2007 to summarize corrective measures conducted during June 1998 at SWMU 158. Debris and contaminated soil were removed from SWMU 158. The objective of the corrective measures conducted by WSMR was to obtain clean closure of SWMU 158 and remove the landfill from the list of SWMUs designated in the WSMR RCRA permit. Confirmation sample results indicated that there was no contamination present at the former landfill site. The results of the 1998 confirmatory samples were compared to the 2006 NMED residential SSLs in the Closure Report. In addition, the Closure Report included a Closure Certification and Plat of Survey. Results of the corrective measures indicated that the site should be recommended for clean closure.

In a letter dated April 15, 2008, the NMED indicated that closure requirements for SWMU 158 had been satisfied. NMED staff visited the Landfill B (SWMU 158) and verified closure of the permitted unit. NMED confirmed that WSMR had completed closure of the former ORC SWMU 158 (Appendix 7C, pg. 7C-3).

7.2 Site Description and Operational History

7.2.1 Site Description

WSMR-05 consisted of three separate landfill (Landfills A, B, and C) areas located near the ORC in the northeastern portion of WSMR. The ORC was located just south of Range Road 8 and west of Range Road 11. The ORC Landfills were located within the Tularosa Basin. The lithology of the area is typical of basin fill sediments in the Tularosa Basin associated with alluvial-fluvial deposition interfingered with lacustrine deposits.

No surface water bodies are present at or near the former landfills. Groundwater flows from the mountains recharge areas toward the central portion of the basin. Groundwater near the center of the Tularosa Basin is generally non-potable due to high TDS. Based on groundwater wells that have been monitored at the ORC bombing range, the groundwater flow in the ORC area is to the south-southwest.

7.2.2 Operational History

SWMU 157 (Landfill A) was located south of the communications building at the ORC cantonment area. Waste at SWMU 157 consisted of insulated wire, scrap metal, wood, tires, paper, and miscellaneous office debris. All waste debris was removed in June 1998 and confirmation samples collected indicated no contamination at the site following debris removal and that the site was eligible for clean closure.

SWMU 158 (Landfill B) was located one-half mile south of the ORC cantonment area. Wastes observed at SWMU 158 prior to cleanup included wood debris, tires, metallic debris, and a trailer with spent flares. Accounts form facility personnel indicated that debris was dumped at this site until the early 1980s. All waste debris was removed in June 1998 when debris was removed from SWMU 158, at the same time the debris was removed from SWMU 157. Confirmation samples indicated no contamination was left at the site following debris removal and was eligible for clean closure. SWMU 158 is listed as an Operating Unit under the RCRA permit and was given the designation of Land Disposal Unit - 19 (LDU-19).

The SWMU 159 landfill consisted of approximately 3 acres of bladed ground with a small amount of visible waste on the surface. Beginning in February 1987, ORC disposed of scrap metal from spent missiles, concrete foundations, and other

construction debris in a trench approximately 8 ft to 10 ft deep, 200 ft long and 15 ft wide. Use of the trench for disposal was halted later in 1987 and the debris was covered with approximately 3 ft of native soil, compacted and bladed. A RFI was completed in 2002 and the results indicated that there were no COPCs associated with the landfill. WSMR conducted an ACA in June-July 2006, which included removal of debris from the determined extent of the SWMU 159 trench followed by confirmation soil sampling. The results of the confirmation sampling indicated that the unit was eligible for clean closure.

7.3 Land Use

7.3.1 Current

Landfills A, B and C were closed and abandoned with no foreseeable future use. However, the land surrounding the site is actively used for WSMR's military missions.

7.3.2 Future/Proposed

There are no planned future land uses proposed for the former landfills. However, WSMR is an integral part of the defense system of the United States; therefore, the Range will remain active for the foreseeable future.

7.4 Investigative Activities

7.4.1 Summary

Wastes and soil were removed from SWMUs 157 (Landfill A) and SWMU 158 (Landfill B) in 1998. Confirmation samples were collected following the 1998 removal actions. The results of the confirmation samples indicated that there was no residual contamination at either site.

Surface soil samples were collected at SWMU 159 (Landfill C) in 1997, a geophysical survey was conducted at SWMU 159 in 1998, and a RFI was performed in 2002. The objective of the environmental investigation at Landfill C was to determine whether leachate had contaminated underlying soil. Although the results of the RFI at SWMU 159 indicated that there were no contaminants of potential concern in soil at the site, WSMR proposed to remove the debris and any impacted soils in order to avoid long-term monitoring and to achieve clean closure. Debris was removed from the

determined extent of the SWMU 159 trench during the ACA performed in June-July 2006. Confirmation samples collected following the removal actions indicated that the SWMU met the criteria for clean closure.

7.4.2 Investigation #1: Surface Soil Collection (SWMU 159) (BAE, 2004c)

7.4.2.1 *Non-sampling Data Collection*

No non-sampling data were reported for this sampling event.

7.4.2.2 *Sampling Data Collection*

Two surface soil samples (ORC-LF03-SS01 and ORC-LF03-SS02) were collected from the SWMU 159 landfill area on August 13, 1997. A report of findings was not produced and, therefore, the exact sampling locations were unknown. The soil was analyzed for total metals (RCRA 8 plus copper, magnesium, and manganese), total phosphorus, pesticides, PCBs, herbicides, VOCs, and SVOCs.

7.4.2.3 *Data Gaps*

No data gaps were identified.

7.4.2.4 *Results and Conclusions*

The analytical results of the surface soil sampling at SWMU 159 was provided in an Appendix to the 2004 RFI report for SWMU 159 (refer to Section 7.4.5) . A table summarizing the detected constituents is provided as Table 7-1 (Appendix 7B, pg. 7B-1).

No concentrations of pesticides, PCBs or herbicides were detected above reporting limits. The only VOCs detected were acetone and methylene chloride, common laboratory contaminants. The only SVOCs detected were two phthalates, which are also common laboratory contaminants. With the exception of cadmium, mercury, and selenium, all of the metals analyzed were detected in the two surface soil samples collected. The 2007 ACA report stated that the total metals concentrations were below the NMED residential SSLs (WTS, 2007a).

7.4.3 Investigation #2: Geophysical Survey, SWMU 159 (BAE, 2004c)

7.4.3.1 *Non-sampling Data Collection*

A geophysical survey was conducted at SWMU 159 on April 27 and May 6, 1998. Two measurement parameters, soil conductivity (milliSiemen/meter) and an In-Phase response (parts per thousand) were used as investigative tools. The report on the geophysical survey was provided in an Appendix to the 2004 RFI report for SWMU 159. The area was partitioned using a grid of 50 ft centers and an EM-31 ground conductivity meter was applied at the surface. Based on the results of the EM-31, an EM-61 high precision metal locator was used to map areas of interest.

7.4.3.2 *Sampling Data Collection*

No sampling data were collected as part of the geophysical survey.

7.4.3.3 *Data Gaps*

No data gaps in the geophysical survey were identified.

7.4.3.4 *Results and Conclusions*

The EM-61 was used to delineate large quantities of metal in a strip approximately 200 ft long by 25 ft wide, which was interpreted as the landfill cell. These dimensions incorporated the “scatter” that was picked up by the survey instrument to a maximum extent of 25 ft, including the lowest detected response from the survey instrument that could not reliably be determined as part of the landfill cell. The highest response in the center of the geophysical anomaly was up to 15 ft across. From this, it was inferred that the actual width of the trench was closer to 15 ft. In addition, the EM-61 identified a ramp that was supposedly used for vehicle access to the trench. The geophysical report was used during the SWMU 159 RFI as a guide in the placement of soil borings.

7.4.4 Investigation #3: Landfill Debris Removal (SWMUs 157 and 158) (Radian, 1998)

7.4.4.1 *Non-sampling Data Collection*

The *Plan of Action, Landfill Debris Removal Oscura Range Center* (Radian, 1998) describes the work performed at two (2) landfills at the ORC of WSMR. Landfill 1

corresponds to SWMU 158 and Landfill 2 is SWMU 157. Debris was removed from SWMUs 157 and 158 during June 1998. The landfill locations are shown on Figures 7-1 and 7-2 (Appendix 7A, pgs. 7A-1 and 7A-2, respectively).

- Materials contained in Landfill 1 (SWMU 158) were exposed and without soil cover and consisted predominantly of wood and metal debris, tires, flare casings, and part of an old trailer (Photograph 7-1, Appendix 7A, pg. 7A-6). All materials were considered non-hazardous. Volume of the waste materials prior to excavation was approximately 60 cu yds, excluding the trailer structure. Excavation and debris removal was conducted within the main area of the landfill (approximately 20 yards X 20 yards) and extended outward to encompass surrounding debris. The surrounding debris extended approximately 100 yards north, 50 yards south, and 30 yards east and west of the main landfill site. Debris was transported to the municipal landfill located in Alamogordo, NM for disposal (Photograph 7-2, Appendix 7A, pg. 7A-6). The trailer structure was removed by Oscura Bombing Range personnel.

- Landfill 2 (SWMU 157) occupied a small pit in a cleared area located approximately 100 yards south of Building 31775. Materials contained in the landfill were exposed and without soil cover and consisted predominantly of wooden pallets, metal spools of communications wire, old appliances and general trash debris (Photograph 7-3, Appendix 7A, pg. 7A-7). Volume of the waste materials prior to excavation was approximately 50 cu yds. All materials were considered non-hazardous. Excavation and debris removal was conducted within the main area of the landfill (approximately 10 yards X 10 yards) and extended outward to encompass surrounding debris. The surrounding debris extended approximately 50 yards in all directions from the main landfill pit. Excavated debris was transported to the municipal landfill located in Alamogordo, NM for disposal (Photograph 7-4, Appendix 7A, pg. 7A-7).

7.4.4.2 *Sampling Data Collection*

Ten confirmation soil samples were collected from each landfill area after all debris was removed, as follows and as shown on Figure 7-3 (Appendix 7A, pg. 7A-3):

- SWMU 157 (Landfill 2) – S-9 through S-18, plus S-18Q (a quality assurance sample);and

- SWMU 158 (Landfill 1) – S-29 through S-38, plus S-38Q (a quality assurance sample).

The sample locations were determined in the field, based on a biased sampling approach that identified specific points within each area where chemical contamination was most likely to be found. These samples were analyzed for TPH (Diesel Range Organics [DRO] and Gasoline Range Organics [GRO]), PCBs and total RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, silver and mercury).

Ten background soil samples (S-19 through S-28) were collected at discrete non-contaminated locations in the vicinity of the landfill sites, as shown on Figure 7-3, (Appendix 7A, pg. 7A-3). These samples were analyzed for total RCRA metals.

In addition to the investigation samples, samples were collected for waste characterization and compared to the UTSs.

7.4.4.3 *Data Gaps*

No data gaps were identified within the summary report for this investigation.

7.4.4.4 *Results and Conclusions*

Background Upper Tolerance Limits (UTL) were calculated to contain 95% of all possible sample measurements with a probability of 95%, as described in this Plan of Action document. The calculated UTLs are provide in Table 7-2 (Appendix 7B, Page 7B-1), and the results of the background soil analyses used to calculate these values are summarized in Table 7-3 (Appendix 7B, pgs. 7B-2). UTLs were calculated following the statistical methods described in *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Interim Final Guidance* (USEPA, April 1989), *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Addendum to Interim Final Guidance* (USEPA, June 1992) and *Guidance Document for Verification of Soil Remediation* (Michigan DEQ; April 1994).

The approved Work Plan indicated that the confirmatory samples collected from each landfill would be compared to the UTLs to determine if further excavation would be warranted. No TPH or PCBs were detected in soils from either landfill excavation. As indicated in Table 7-4 (Appendix 7B, pg. 7B-3), some of the metals detected exceeded

their respective UTLs. Thus, additional excavation would be required to achieve background concentrations in soils at the landfills.

As an alternative to excavating soils to meet background levels, the confirmatory sample results were compared to the USEPA Region III Risk Based Concentration (RBC) values for industrial/commercial land use and to the USEPA Soil Screening DAF 20 level in order to determine if site conditions following debris removal represented a significant risk to human health and the environment. Based on the data comparisons shown in Table 7-4 (Appendix 7B, pg. 7B-3), the investigation concluded the following:

- None of the samples had constituent concentrations that exceeded the USEPA Region III Industrial RBC.
- Only one sample (S-9 at SWMU 157) exceeded the USEPA DAF 20 SSL for only one constituent (silver).
- Eight samples (5 samples at SWMU 157 and 3 samples at SWMU 158) had metals concentrations that exceeded one or more of the calculated background UTLs.

Based on the location of the site areas in a semi-arid, controlled access, industrial location, and the concentration of detected analytes, the investigation recommended no further action at all sites.

7.4.5 Investigation #4: RFI, Former Oscura Range Center Construction Landfill (SWMU 159) (BAE, 2004c)

The objective of the RFI was to determine whether leachate resulting from infiltrating surface water had contaminated soil beneath the SWMU 159 landfill. The approach and implementation to meet the objective consisted of the collection of soil samples from beneath the landfill cell and the ramp area south of the cell.

7.4.5.1 *Non-sampling Data Collection*

The sampling locations selected for the RFI were based on information collected during the 1998 geophysical survey, information collected during a July 27, 1999

interview with a then-supervisor of the WSMR Up-Range Operations Group, and observations of differences in the vegetative cover at the site.

A general human health risk analysis was performed based on the data collected during the surface soil sampling and the RFI. The results of this analysis are described in Section 7.6.1. Based on the analytical results from the RFI, comparison to background results, and guidance from the technical background document, no COPCs were identified at the SWMU 159. The air, soil, and surface water, and groundwater exposure pathways were all determined to be incomplete. No further risk assessment was warranted based on these findings.

A Screening Level Ecological Risk Assessment Site Assessment Checklist (NMED 2000) was completed for SWMU 159. The checklist was based on evidence gathered during the RFI and previous investigations. Additionally, a wildlife biologist conducted a pedestrian biological survey of the SWMU 159 site. The completed checklist and biologist's survey report were included in an Appendix to the RFI report. Based on these results of the survey and checklist, a full Ecological Assessment was not warranted.

7.4.5.2 *Sampling Data Collection*

In March 2002, 15 soil borings were drilled at SWMU 159 for the collection of subsurface soil samples. Eight soil borings (0159-SB01 through 0159-SB08) were placed along the edge of the interpreted landfill cell (Figure 7-4, Appendix 7A, pg. 7A-4) and augered at a 40º angle to vertical so that depth specific samples could be collected beneath the landfill cell without augering directly through the landfill (Table 7-5, Appendix 7B, pg. 7B-5). The soil boring and sample locations were positioned to provide adequate coverage over the length of the landfill. Five vertical soil borings (0159-SB09 through 0159-SB13) were augered through the ramp area south of the landfill cell. In addition, two soil borings (0159-SB14 and 0159-SB15) were augered north of the area, which was interpreted from the geophysical survey as not being affected by past excavations. Samples were collected from these two borings at depth specific intervals for comparison as background soil chemistry. All samples were analyzed for VOCs, SVOCs, TPH, pesticides, herbicides, total phosphorus, explosive residues, perchlorate, PCBs, and total metals.

7.4.5.3 *Data Gaps*

No data gaps were identified within the summary report for this investigation.

7.4.5.4 *Results and Conclusions*

With the exception of SB-02, no landfill debris was encountered in the borings at SWMU 159. According to the RFI report, the absence of landfill debris verified that the assumed width of the landfill cell was no more than approximately 15 ft, as indicated by the geophysical survey and information obtained from facility personnel. A small amount of concrete was encountered at the 5 ft interval in SB-02.

No debris was encountered in the borings advanced in the ramp area. Based on information obtained during the geophysical survey, the deepest known depth of debris in this area was 3 ft bgs. Based on this information, sampling depth at the five soil borings in the ramp area was decreased to 6 to 7 ft bgs from the originally planned 9 to 10 ft bgs.

Table 7-6 (Appendix 7B, pg. 7B-6) provides the inorganic analytical results from the two background soil borings (SB-14 and SB-15) compared to NMED SSLs or the EPA Region VI HHSSL. Background arsenic was detected at 4.4 mg/kg, above the NMED SSL (3.9 mg/kg), at SB-15 (15.0 ft bgs). All other detected analytes in the background soil samples were below their respective SSLs.

Table 7-7 (Appendix 7B, pg. 7B-7) lists inorganic analytical results from the landfill cell soil borings. With the exception of arsenic, all detections were below respective screening levels. Arsenic was detected at or above the NMED SSL of 3.9 mg/kg in SB-02, SB-05, and SB-08 at 15.0 ft bgs (4.1 mg/kg, 3.9 mg/kg, and 3.9 mg/kg respectively). The mean background result for arsenic at the 15.0 ft interval is 4.1 mg/kg, which indicates the arsenic results were most likely naturally occurring concentrations.

Table 7-8 (Appendix 7B, pg. 7B-8) summarizes the TPH and VOC results for the samples collected from beneath the landfill cell. TPH were not detected. Acetone, methylene chloride, and trichlorofluoromethane were detected in some samples, but all were below regulatory limits. Acetone (used in cleaning laboratory glassware) and methylene chloride (used in SVOC extractions) are common laboratory cross-contaminants at low levels. Methylene chloride was also detected in the method

blanks for all of these samples indicating possible laboratory cross-contamination. These VOC analytes were also detected in samples collected from background borings. No other VOCs were detected in the landfill cell samples.

Table 7-9 (Appendix 7B, pg. 7B-9) provides the SVOC results for the samples collected beneath the landfill cell. The only SVOC detections were phthalates (emitted by plastics), which can be common laboratory cross-contaminants picked up during the extraction process. All of the DEHP detections were estimated due to detection below the laboratory reporting limit and were below SSLs. No other SVOCs were detected in the landfill cell soil borings. No PCBs, pesticides, herbicides or explosives were detected (Tables 7-10, 7-11 and 7-12, pgs. 7B-10 – 7B-12).

Table 7-13 (Appendix 7B, pg. 7B-12) summarizes analytical results for the inorganic constituents in samples collected within the ramp area south of the landfill cell. No inorganic constituents were detected above the NMED SSLs or EPA Region VI Human health soil screening levels (HHSSLs).

Table 7-14 (Appendix 7B, pg. 7B-13) summarizes the TPH and VOC results for the samples collected from the ramp area. TPH were not detected. Acetone and methylene chloride were detected in some or all of the samples collected. However, all were below NMED SSLs. Both acetone and methylene chloride are common laboratory cross-contaminants and both were detected in samples collected from the background borings. No other VOCs were detected.

SVOC analytical results collected from soil borings within the ramp area of SWMU 159 are presented in Table 7-15 (Appendix 7B, pg. 7B-14). The only SVOC detections were phthalates, which can be common laboratory cross-contaminants picked up during the extraction process. All detections were estimated due to detection below the laboratory reporting limit and were below SSLs. No other SVOCs were detected in samples collected from the ramp area. No PCBs, or pesticides, herbicides or explosives were detected (Tables 7-16, 7-17 and 7-18, respectively, Appendix 7B, pgs. 7B-15 through 7B-17).

In summary, the results of this investigation indicated that leachate had not contaminated soil beneath the landfill or the ramp area. The landfill cell was located based on a geophysical survey conducted in 1998 and interviews with facility personnel. Based on the geophysical survey, the landfill was defined as being approximately 200 ft long, 15 ft wide, and 8 ft to 10 ft deep.

All collected soil samples were analyzed for VOCs, SVOCs, TPH, pesticides, herbicides, total phosphorus, explosive residues, perchlorate, PCBs, and total metals. None of the soil samples contained detectable concentrations of pesticides, herbicides, explosive residues, TPH, or perchlorate. Minor concentrations of a few VOCs and SVOCs were detected, but were likely attributable to laboratory contamination. Only one analyte, arsenic, was determined to be present above NMED SSLs. All other detections were well below their respective SSLs. However, arsenic was determined to be within background concentrations. All of the inorganic analytes detected beneath the landfill cell and ramp area, with the exception of total phosphorus, were determined to be within background concentrations. The total phosphorus concentrations could be the result of natural variations of soil nutrients across the site. The known materials disposed of in the landfill include construction debris and possible metallic debris from missiles. Elevated levels of phosphorus would not be expected to be associated with these wastes.

In addition, this RFI determined that no exposure pathways (air, soil, surface water, or groundwater) to humans exist at the site. Based on the SLERA, a full Ecological Assessment is not warranted. Although the RFI showed that there was no contamination associated with SWMU 159, WSMR proposed to remove the debris and clean close the site to eliminate the need for long term monitoring and to ensure that no future contaminant releases would occur.

7.4.6 Investigation #5: Accelerated Corrective Action Completion Report, Landfill A (SWMU 157) and Landfill C (SWMU 159) (WTS, 2007a)

7.4.6.1 *Non-sampling Data Collection*

Corrective Measures for Landfill 2 (Landfill A, SWMU 157) were initiated in June 1998. Debris from Landfill 2 (Landfill A, SWMU 157) and contaminated soil was excavated and removed offsite to an approved landfill (Photographs 7-3 and 7-4, Appendix 7A, pg 7A-7). Details of the remediation were included in the after action report titled *Plan of Action Landfill Debris Removal Oscura Range Center* (Radian, 1998), which was submitted to the NMED HWB prior to submittal of the ACA report. Prior to debris removal, an archaeological resources survey was conducted at the site and submitted to the New Mexico State Historic Preservation Office for approval (HSR, 1998). No additional soil samples were collected as part of the ACA. The ACA Report provides a copy of the 1998 analytical reports in an Appendix and includes a table comparing the 1998 confirmatory soil sample results to the 2006 NMED SSLs; a copy of this table is

provided as Table 7-19 (Appendix 7B, pg. 7B-17). As indicated on Table 7-19, none of the metals concentrations detected in the SWMU 157 confirmation samples exceeded the NMED residential SSLs.

The ACA at SWMU 159 was developed to ensure the ecosystem remained a self-sustaining natural habitat posing no significant human health or ecological risk. The objectives of the ACA at SWMU 159 included excavation of the waste materials for disposal at an approved offsite disposal facility in order to obtain clean closure for the site.

From June 19,2006 through July 7, 2006, WSMR completed SWMU 159 corrective measures, including the removal and proper disposal of potential contaminant sources and verifying through confirmation sample collection that no contamination above NMED SSLs remained at the site. The excavated material was visually inspected for potentially hazardous material; no potentially hazardous material was observed. The actual dimensions of the final excavation, following complete debris removal, were 200 ft long by 20-30 ft wide by 10-20 ft deep (Appendix 7A, Figure 7-5, Page 7A-5). A total of 1,720 cu yds of debris were removed and disposed offsite at the Mesa Verde 2 Landfill in Alamogordo, NM. The vast majority of debris excavated from the landfill included concrete with rebar, unidentifiable scrap metal, and wood (Photographs 7-5 through 7-8, Appendix A, pg. 7-8 – 7-9).

7.4.6.2 *Sampling Data Collection*

Twelve confirmation soil samples (OSRC-0159-CS-001 through -012) were collected from the base and sidewalls of the Landfill C (SWMU 159) trench following excavation. The base and sidewalls of the trench were sampled approximately every 10-20 ft. One sample was collected from each of the east and west ends of the trench. In addition, two background soil samples (OSRC-0159-CS-017 and -018) were collected. The excavations remained open until laboratory analyses confirmed that no contaminants in confirmation samples were present above NMED SSLs.

More than 1,000 cu yds of clean landfill overburden was removed from the trench prior to the removal actions and stockpiled on site for later backfilling. Two composite samples (ORSC-0203-CS-015 and -016) were collected from the stockpile for analysis of VOCs, SVOCs, PCBs, perchlorate, and total RCRA metals for characterization purposes. As an additional check after the trench was backfilled with the overburden

soil, 3 random surface samples and 3 random subsurface samples were collected for TPH and total RCRA metals analyses.

7.4.6.3 *Data Gaps*

No data gaps were identified within the summary report for this investigation.

7.4.6.4 *Results and Conclusions*

In June 1998, debris from SWMU 157 and contaminated soil was excavated and removed for offsite disposal. Debris was excavated in a 10 yard by 10 yard area of the landfill pit and extended to 50 yards in all directions from the pit for surface debris removal. All debris was transported to the municipal landfill in Alamogordo, NM. Confirmation samples were collected and analyzed for TPH, PCBs, and total RCRA metals. There were no TPH or PCBs detections. Several metals were detected at concentrations that were below the NMED SSLs for residential land use (Tables 7-4 and 7-19). Based on confirmation sample results (collected in 1998), no analytes of concern were detected at concentrations above current NMED SSLs at SWMU 157.

At SWMU 159, 1,720 cu yds of debris were removed and disposed at the Mesa Verde 2 Landfill in Alamogordo, NM in June-July 2006. The vast majority of debris excavated from the landfill included concrete with rebar, unidentifiable scrap metal, and wood. Excavation continued until visible evidence of no waste material was present. No debris was observed to be potentially hazardous. As stated previously, twelve confirmation soil samples were collected from the base and sidewalls of the excavation after debris removal, two background soil samples were collected, and samples were collected from the fill material. The results of these analyses are summarized in Table 7-20 (Appendix 7B, pg. 7B-18). Results indicated that no VOCs, SVOCs, or PCBs were detected. Several inorganics and perchlorate were detected at concentrations below residential soil screening levels. The open trench was backfilled using clean soil and the site was contoured to resemble the surrounding topography. The immediate area was hydroseeded following backfill and contouring.

Results of the ACA indicated that the SWMU 159 landfill debris was removed and disposed off-site at an approved landfill. Confirmation sample results indicated no contamination present beneath the former landfill site. No additional landfill cells were discovered on site. Results of SWMU 159 ACA and SWMU 157 corrective measures indicated that these sites are eligible for clean closure.

7.4.7 Investigation #6: *Closure Report for the Oscura Range Center Landfill "B", SWMU 158 (LDU-19)* (WTS, 2007b)

The purpose of this Closure Report was to summarize the corrective measures that were conducted during June 1998, summarized in the report titled, *Plan of Action Landfill Debris Removal Oscura Range Center* (Radian 1998), and described previously in Section 7.4.4 of this petition in order to demonstrate that SWMU 158 meets the criteria for clean closure. The Closure Report includes the 1998 Radian report as an Appendix in which SWMU 158 was also referred to as Landfill #1.

7.4.7.1 *Non-sampling Data Collection*

No non-sampling data were collected for this report. A reference is made to an archeological survey that was conducted in 1998 in the vicinity of SWMU 158 and a nearby septic system (HSR, 1998). A mapped archeological site, Site LA 121, 612, was identified in the vicinity of the septic system. The archeological site is shown on Figure 7-3 (Appendix 7A, pg. 7A-3). No archeological concerns were identified for SWMU 158.

A Closure Certification and Plat of Survey were provided as an Appendix to the Closure Report for SWMU 158. These documents were required because SWMU 158 (LDU-19) was listed as an Operating Unit in the 2006 Annual Fee letter for WSMR.

7.4.7.2 *Sampling Data Collection*

No additional samples were collected for this report. The Closure Report provided a comparison of the data collected in 1998 to the 2006 NMED residential SSLs (the data were previously compared to the Industrial/Commercial criteria that were in effect at the time that the Radian report was submitted). The table summarizing these data comparisons is provided as Table 7-21 (Appendix 7B, pg. 7B-19). As shown on the table, the concentrations of constituents detected in the confirmatory samples were below the residential SSLs.

7.4.7.3 *Data Gaps*

No data gaps were identified.

7.4.7.4 *Results and Conclusions*

The objective of the corrective measures conducted by WSMR was to obtain clean closure of the ORC Landfill "B" (SWMU 158) and removal of the landfill from the list of SWMUs designated in the WSMR IRP and the WSMR RCRA permit. In June 1998, debris and contaminated soil were removed and disposed of offsite. None of the constituents detected in confirmation samples collected in 1998 exceeded the 2006 NMED residential SSLs. Following corrective measures, there was no evidence of contamination at the former landfill site. Therefore, the Closure Report stated that SWMU 158 was recommended for clean closure.

7.5 Site Conceptual Model

7.5.1 Nature and Extent of Contamination

As described in the previous investigations, landfill debris was removed from SWMUs 157, 158 and 159 and transported offsite to an approved landfill for disposal. Based on confirmation sample results, no analytes of concern were detected at concentrations above regulatory levels. Groundwater was not encountered during excavation of debris or during the completion of soil borings. No groundwater monitoring wells were installed at the SWMU locations, however, the depth to groundwater at the nearby ORC Bombing Range, (monitoring wells OMW-1, OMW-2A, OMW-3 and OMW-4), was approximately 200 ft bgs. Depth to ground water at the SWMU locations was expected to be similar to that observed at the bombing range (200 ft bgs). Groundwater at the ORC Bombing Range was sampled on a periodic basis with TDS ranging from 3,000 mg/l to 4,000 mg/l. Based upon groundwater levels measured within completed WSMR wells and piezometers groundwater flow in the area was determined to be to the south-southwest (BAE, 2004c).

7.5.2 Environmental Fate

A site assessment was performed under the SWMU 159 (Landfill C) RFI and serves to characterize the environmental fate of any potential landfill contaminant releases in relation to human and ecological receptors. Since SWMUs 157 and 158 were in close proximity to Landfill C, contained similar landfill debris and were in an area of comparable geology/lithology, any potential landfill contaminant releases in relation to human and ecological receptors would be consistent with SWMU 159. The RFI determined that no routes (air, soil, surface water, or ground water) for exposure to

human health exist at the site and concluded, based on the *Screening Level Ecological Risk Assessment* (NMED, 2000), a full Ecological Assessment was not warranted.

7.6 Site Assessments

7.6.1 Human Health Screening and Risk Assessments

The only human health screening risk assessment was performed for SWMU 159, based on the data collected during the 2002 RFI. All analytical results from the RFI for SWMU 159 were compared to their respective screening levels (NMED residential SSLs or EPA Region VI HHSSLs). With the exception of two arsenic detections, no analytes were in concentrations greater than their respective screening levels. Arsenic was detected in one of the landfill cell soil borings (ORCSB-02 at 15.0 ft bgs) at 4.1 mg/kg, above the NMED SSL of 3.9 mg/kg. Arsenic was detected in two other borings (ORCSB-05 and ORCSB-08 at 15.0 ft bgs) at the NMED SSL of 3.9 mg/kg. Arsenic was also detected above the SSL in the background boring SB-15 (15.0 ft bgs) at 4.4 mg/kg. Based on the *t*-distribution, there was no evidence that the background samples for arsenic and the landfill cell samples came from different populations. As stated in the *Technical Background Document for Development of Soil Screening Levels* (NMED, 2000), any contaminants exhibiting concentrations in excess of the SSLs represent the initial soil COPC list for a given site. Based on the analytical results from the RFI, comparison to background results, and guidance from the technical background document, no COPCs were identified at the SWMU 159.

The air exposure pathway was considered incomplete because there were no identified COPCs, the landfill was covered with clean fill material, and the surface samples collected during August 1997 revealed no analyte concentrations in excess of regulatory screening levels. The pathway for exposure to soil contaminants was considered incomplete because there were no identified COPCs, the landfill was covered with fill material, the site was unoccupied, and there were no residents, workers, schools, or daycare facilities within two miles of SWMU 159. The surface water exposure pathway was considered incomplete because the closest ephemeral water body is an arroyo, which lies approximately 500 ft to the southwest of SWMU 159, and there are no perennial water bodies near the site.

Groundwater monitoring wells had not been installed at SWMU 159, but groundwater at the ORC Bombing Range, located approximately 1.5 miles to the west of SWMU 159, had been sampled on a semi-annual basis. Groundwater at the bombing range is

approximately 200 ft bgs. Water was not encountered in borings that were advanced to 30 ft bgs at SWMU 159. Depth to groundwater at SWMU 159 is expected to be similar to that observed at the bombing range (200 ft bgs). The groundwater exposure pathway at SWMU 159 was considered incomplete because there were no identified COPCs, the expected depth to groundwater is approximately 200 ft bgs, and the presence of clays beneath the landfill would retard movement of contaminants if present.

7.6.2 Ecological Screening and Risk Assessments

The only ecological screening risk assessment performed was for SWMU 159, based on the 2002 RFI data. A *Screening Level Ecological Risk Assessment Site Assessment Checklist* (NMED, 2000) for SWMU 159. This checklist was completed based on evidence gathered during the RFI investigation and previous investigations (surface soil samples, personnel interview, and geophysical survey). Additionally, a wildlife biologist conducted a biological pedestrian survey of the SWMU 159 site. Results of the survey were included in the biologist's Site Visit Report that was included as an Appendix to the RFI Report. Based on the completed *Screening Level Ecological Risk Assessment Checklist* (NMED, 2000), the report concluded that a full Ecological Assessment was not warranted.

7.6.3 Other Applicable Assessments

Prior to debris removal at SWMU 157, an archaeological resources survey was conducted and submitted to the New Mexico State Historic Preservation Office for approval (HSR, 1998). The intent of the survey was to monitor earth-disturbing and clean-up activities at the site.

7.7 No Further Action Proposal

7.7.1 Rationale

All debris was removed from Landfill A (SWMU 157) and Landfill B (SWMU 158) in June 1998. Confirmation sampling indicated that no residual contamination above the NMED SSLs remained at either site following debris removal. In 2006, WSMR completed the removal and proper disposal of debris from Landfill C (SWMU 159). Confirmation sampling following the removal action verified that no contamination above NMED SSLs remained at the site.

In correspondence dated October 24, 2007 (Appendix 7C, Page 7C-1), the NMED acknowledged completion of its review of the *Accelerated Corrective Action Completion Report for Oscura Range Center Landfill A (SWMU 157) and Landfill C (SWMU 159)* dated June 2007. The NMED confirmed that all the waste had been removed from both landfills and confirmation soil sampling demonstrated that no residual constituents were detected above residential New Mexico Soil Screening Levels. The correspondence stated that WSMR must submit a petition for corrective action complete for SWMUs 157 and 159.

In correspondence dated April 15, 2008 (Appendix 7C, pg. 7C-3), the NMED indicated that all closure requirements, including the Certification of Closure and survey plat, for SWMU 158 (ORC Landfill B) were satisfied. NMED inspected and verified the closure of the regulated unit on March 26, 2008 and confirmed the WSMR completion of closure.

Based on these results, application is hereby made to perform a Class III modification to remove SWMUs 157, 158, and 159 from the White Sands HSWA permit in accordance with 40 CFR 264.514 and 270.42, and 20 NMAC 4.1.

7.7.2 Criterion

SWMUs 157, 158, and 159 are proposed for NFA based on NMED NFA Criterion 5. The SWMU has been characterized and remediated in accordance with current applicable state and federal regulations, and the available data indicated that contaminants pose an acceptable level of risk under current and projected land use.

Appendices

Appendix 7A – Figures and Photographs

Appendix 7B – Analytical Results Tables

Appendix 7C - Correspondence

Appendix 7A

SWMU 157, 158 and 159
Figures and Photographs

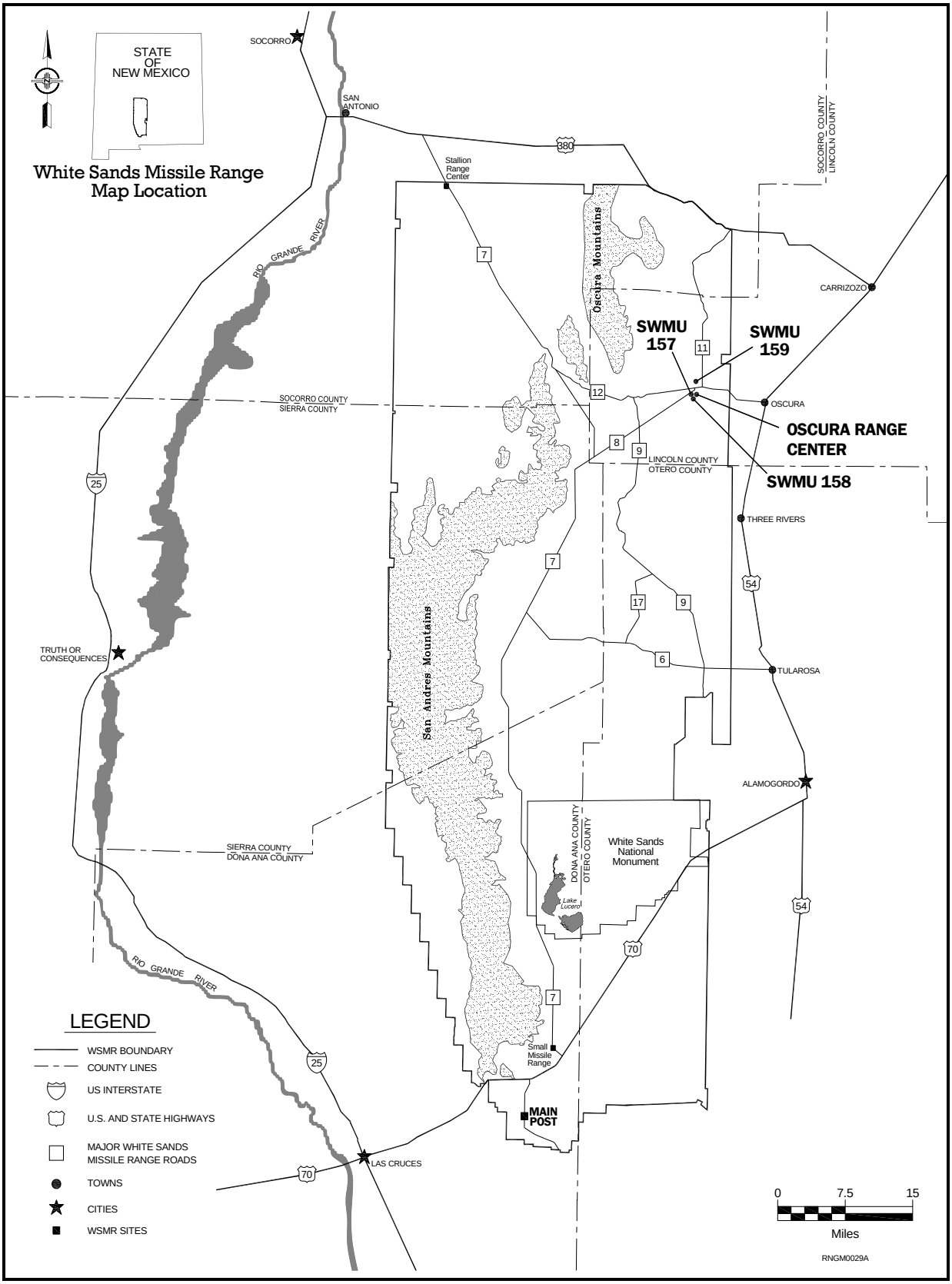


Figure 7-1 Location of the Former Oscura Range Center Landfills (SWMUs 157-159)

Source: WTS, 2007a

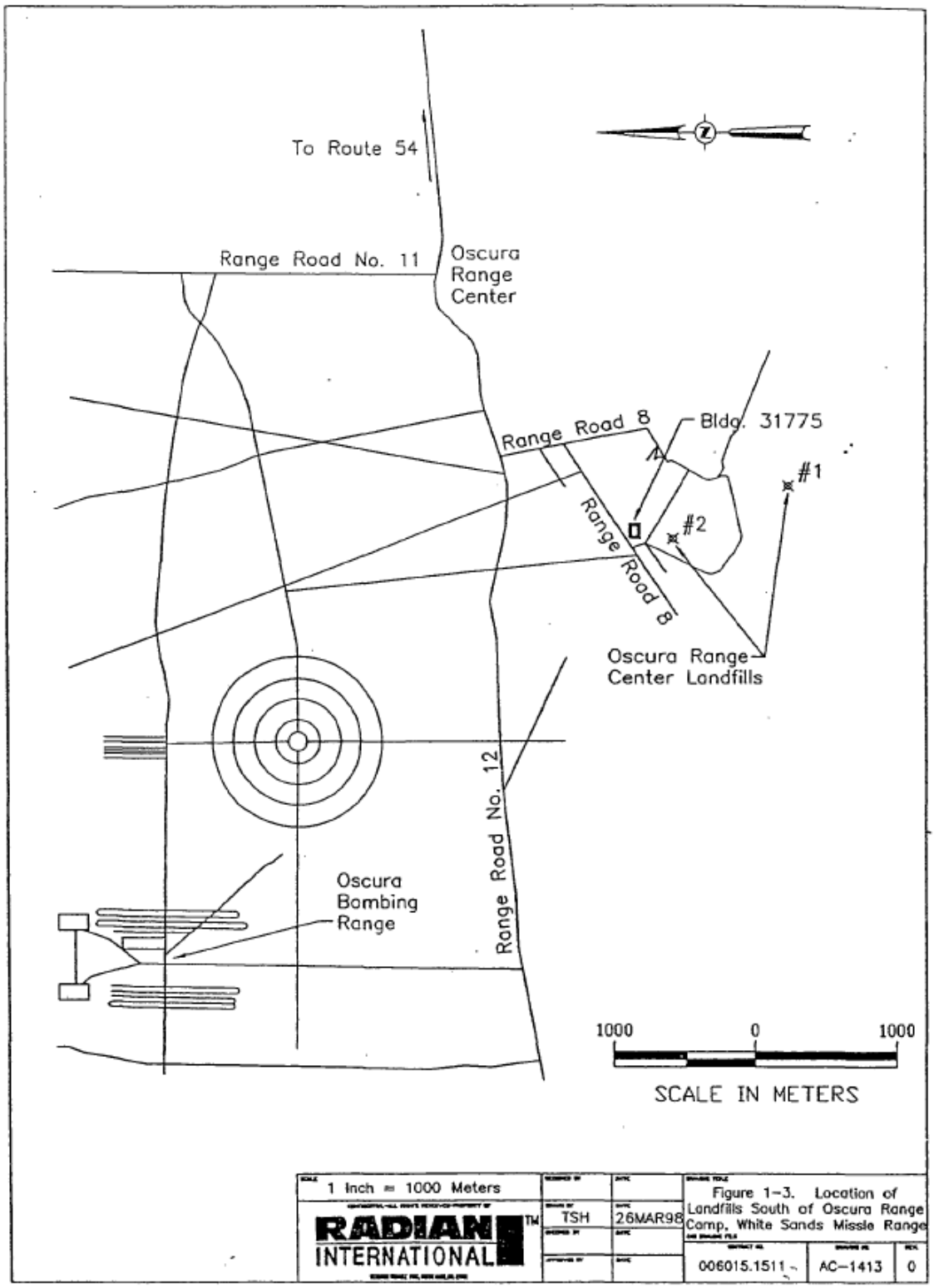


Figure 7-2 Location of Former Oscura Range Center Landfills 1 (SWMU 158) and 2 (SWMU 157)

Source: Radian, 1998

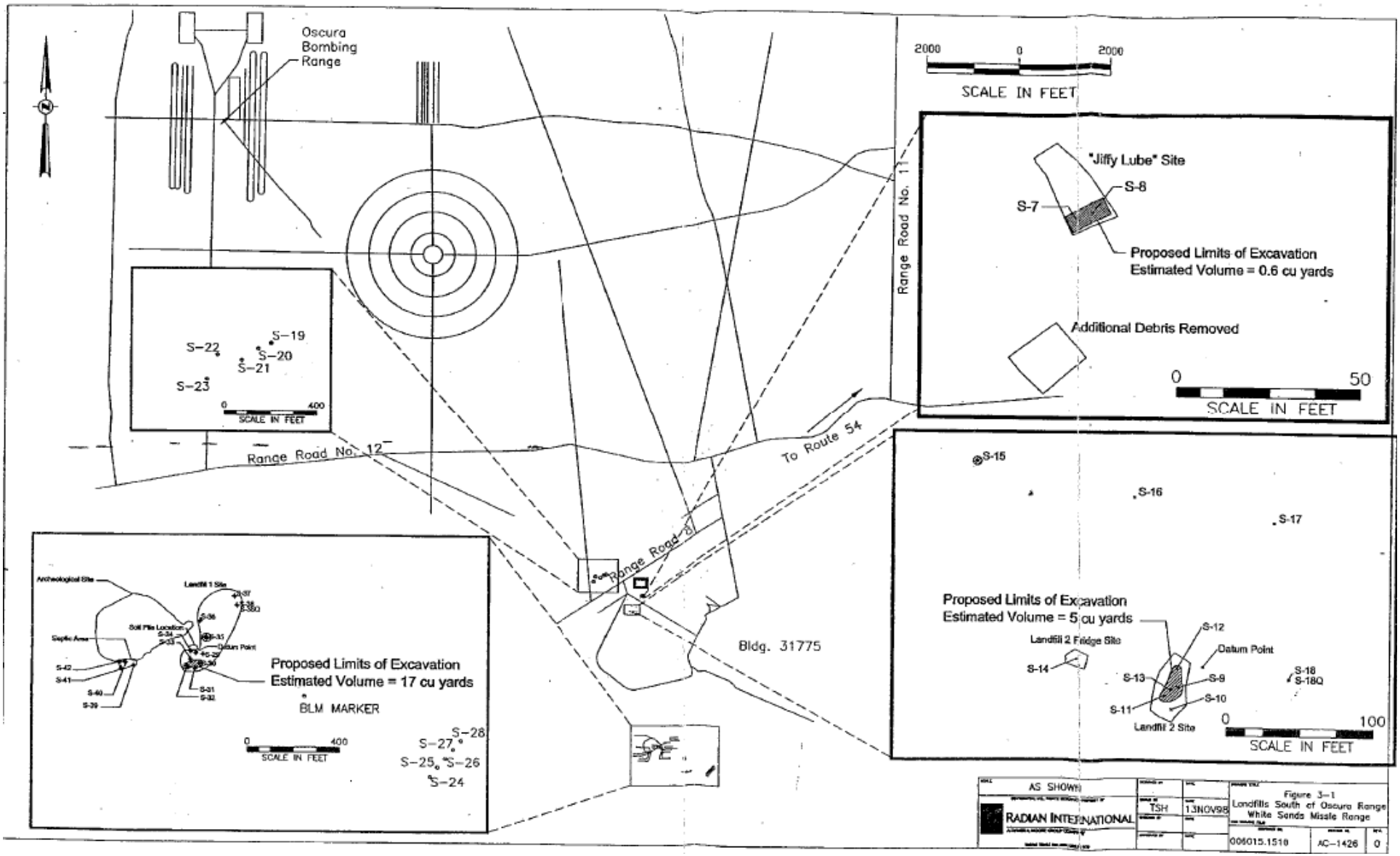


Figure 7- 3 Confirmatory Sample Locations, Landfill 1(SWMU 158) and Landfill 2 (SWMU 157) Investigation #3, 1998

Source: Radian, 1998

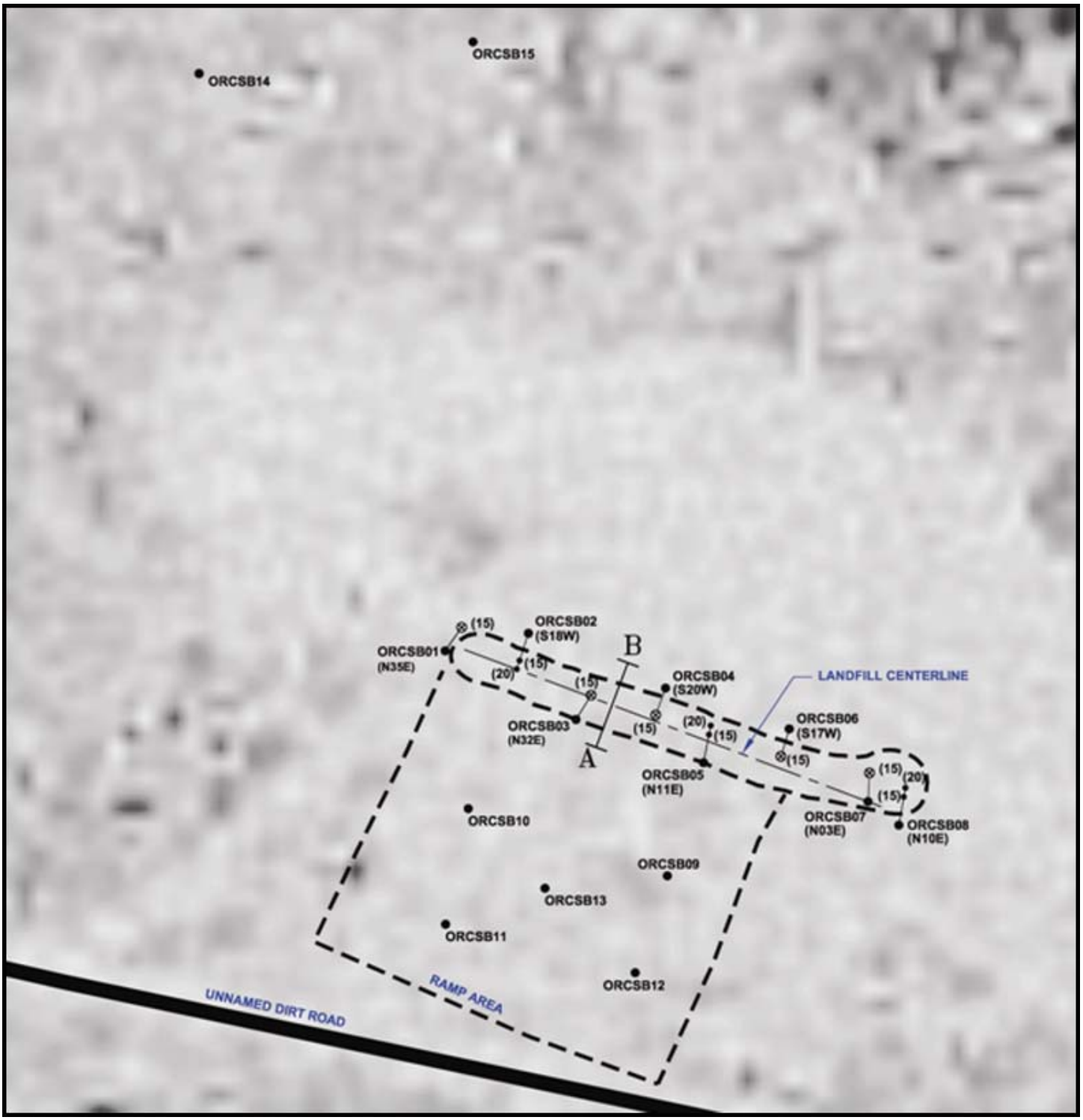


Figure 7- 4 Approximate RFI Sampling Locations at SWMU 159 Investigation #4, 2002

Source: BAE, 2004c

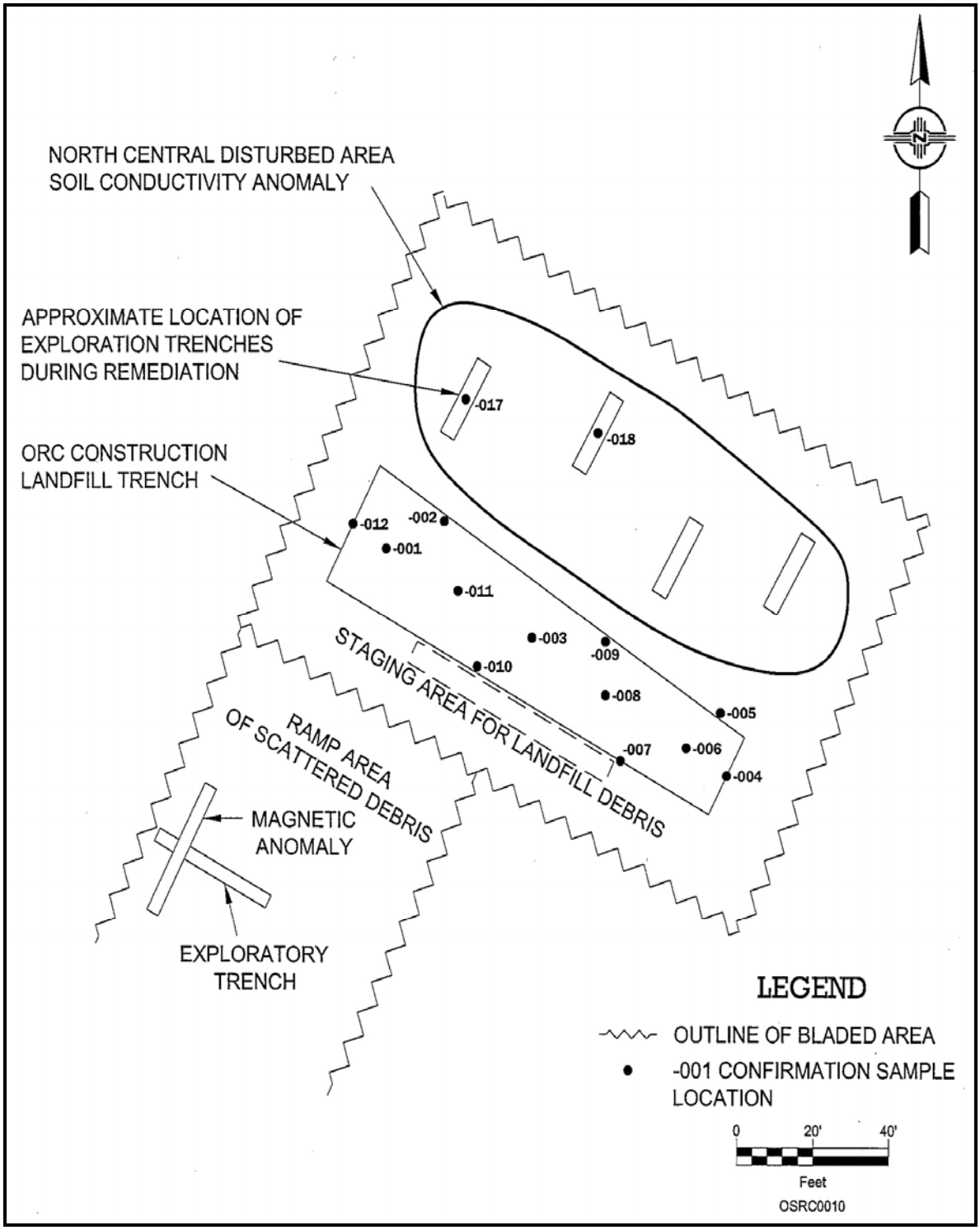
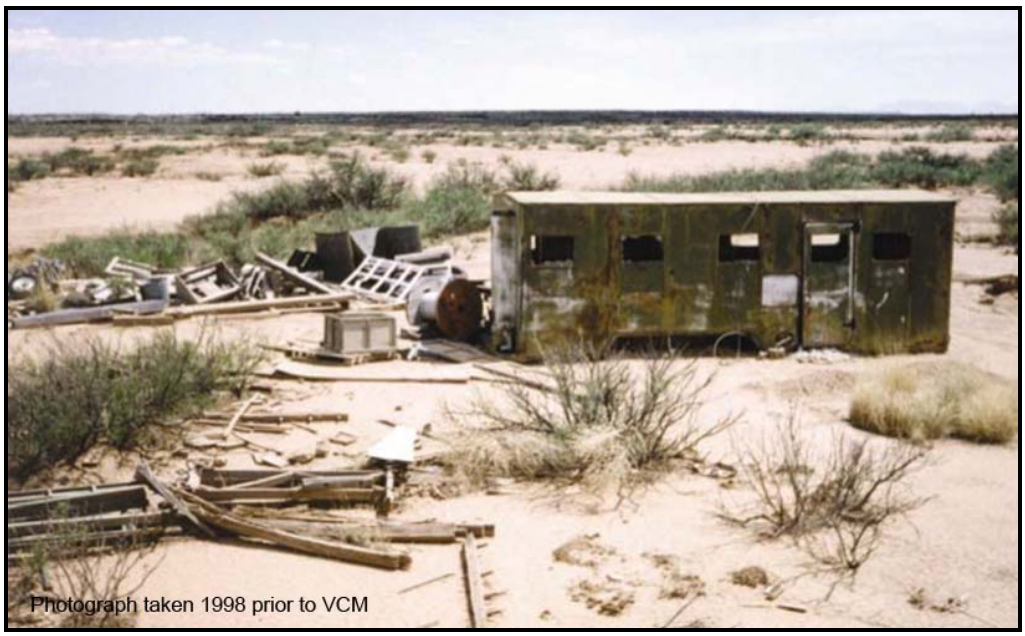


Figure 7- 5 Approximate Location of Remediation Activities at SWMU 159

Source: WTS, 2007a



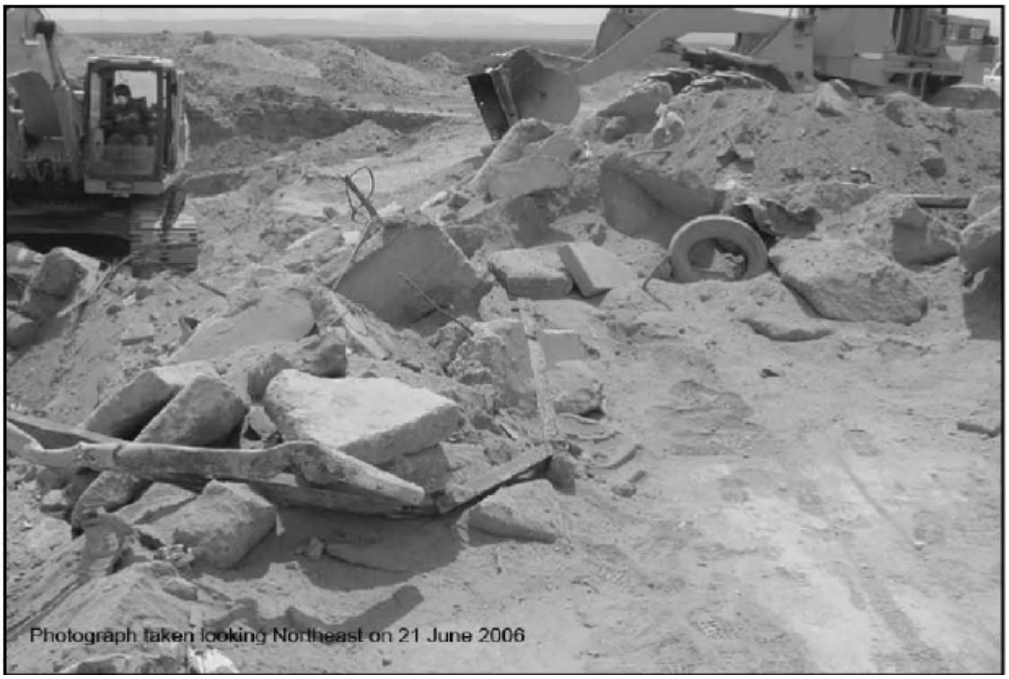
Photograph 7-1 SWMU 158 (LDU-19) Debris Prior to Corrective Measures

Photograph 7-2 SWMU 158 (LDU-19) Following Debris Removal and Backfill

Photograph 7-3 SWMU 157 Debris Prior To Corrective Measures

Photograph 7-4 SWMU 157 Following Debris Removal

Photograph 7-5 Location of SWMU 159



Photograph 7-6 Debris Pile from SWMU 159

Photograph 7-7 SWMU 159 Trench Following Excavation

Photograph 7-8 SWMU 159 Site Following Completion Grading

Appendix 7B

SWMU 157, 158 and 159
Analytical Result Tables

Table 7-1. Detected Constituents in Surface Soil for SWMU 159, Investigation #1, 1997

Source: Radian, 1998

Analyte	Detection Limit (mg/kg)	Sample ID:	ORC-LF03-SS01	ORC-LF03-SS02
		Date:	8/13/1997	8/13/1997
Total Arsenic	1.3	mg/kg	4	3.9
Total Barium	25	mg/kg	280	270
Total Chromium	2.5	mg/kg	25	26
Total Copper	1.3	mg/kg	18	20
Total Lead	4	mg/kg	23	26
Total Magnesium	25	mg/kg	8600	8900
Total Manganese	1.3	mg/kg	510	430
Total Phosphorus	2.5	mg/kg	690	800
Total Silver	1.3	mg/kg	1.3	1.3
Acetone	0.1	mg/kg	0.35	0.32
Methylene Chloride	0.005	mg/kg	0.015	0.015
bis(2-Ethylhexyl)phthalate	330	mg/kg	1500	<330
Di-n-butyl phthalate	330	mg/kg	470	470

Notes:

Samples analyzed for Total Metals, Phosphorus, Pesticides and PCBs, Chlorinated herbicides, VOCs and SVOCs. Only detected constituents are shown.

Detections of Acetone, Methylene Chloride, bis(2-Ethylhexyl)phthalate and Di-n-butyl phthalate were attibuted to laboratory contamination

Table 7-2. Background UTL Calculated Values: Oscura Range Center, SWMU 157 and 158, Investigation #2, 1998

Source: Radian, 1998

Analyte	Calculated UTL Value (mg/kg)	Confirmation Soil Sample Detection Limits (mg/kg)
Arsenic	4.07	<2.7
Barium	301.76	<0.19
Cadmium	1.02	<0.40
Chromium	29.66	<0.56
Lead	5.70	<0.64
Mercury	0.54	<0.10
Selenium	4.07	<0.32
Silver	4.07	<0.40

Table 7-3. Background UTL Calculated Values: Oscura Range Center, SWMU 157 and 158, Investigation #3, 1998

Source: Radian, 1998

Sample No.	Total Barium	Total Chromium	Total Mercury	Total Silver	Total Arsenic	Total cadmium	Total Lead	Total Selenium
Background Samples								
Detection Limit Ranges	<2.0 mg/kg	<5.0 mg/kg	<2.0 mg/kg	<2.0 mg/kg	<2.0 mg/kg	<0.50 mg/kg	<1.2-4.8 mg/kg	<2.0 mg/kg
ORC-19JUN98-S-19	180 mg/kg	19 mg/kg	0.22 mg/kg	ND	ND	ND	ND	ND
ORC-19JUN98-S-20	170 mg/kg	20 mg/kg	0.34 mg/kg	ND	ND	ND	ND	ND
ORC-19JUN98-S-21	180 mg/kg	21 mg/kg	0.18 mg/kg	ND	ND	ND	ND	ND
ORC-19JUN98-S-22	210 mg/kg	25 mg/kg	0.18 mg/kg	ND	ND	ND	1.8 mg/kg	ND
ORC-19JUN98-S-23	190 mg/kg	21 mg/kg	0.24 mg/kg	ND	ND	ND	ND	ND
ORC-19JUN98-S-24	240 mg/kg	21 mg/kg	0.12 mg/kg	ND	ND	ND	1.5 mg/kg	ND
ORC-19JUN98-S-25	230 mg/kg	15 mg/kg	0.17 mg/kg	ND	ND	ND	4.8 mg/kg	ND
ORC-19JUN98-S-26	240 mg/kg	15 mg/kg	ND	ND	ND	ND	2.4 mg/kg	ND
ORC-19JUN98-S-27	260 mg/kg	14 mg/kg	0.42 mg/kg	ND	ND	ND	2.6 mg/kg	ND
ORC-19JUN98-S-28	220 mg/kg	22 mg/kg	ND	ND	ND	ND	2.4 mg/kg	ND

ND – Not detected above the detection limit range

Table 7-4. Results of 1998 Confirmatory Samples, SWMU 157 and 158, Investigation #3, 1998

Source: Radian, 1998

Sample No.	Detected Analyte (mg/Kg)	UTL Value (mg/Kg)	RBC Value (mg/Kg)	SSL Value (mg/Kg)	Exceedances	Remedial Option
ORC-19JUN98·S-7 SWMU 157	Se 3.4 Ba 220 Cr 27 Pb 9.5	Se 4.07 Ba 301.76 Cr 29.66 Pb 5.70	Se 10,000 Ba 14,000 Cr 1,000 Pb (NA)	Se 5 Ba 1,600 Cr 38 Pb 400	Se=None Ba=None Cr=None Pb= UTL	Excavate Additional Soil or Site Restoration
ORC-19JUN98-S-8 SWMU 157	Se 3.7 Ba 230 Cr 21 Hg 0.33 Pb 150	Se 4.07 Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Se 10,000 Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Se 5 Ba 1,600 Cr 38 Hg 2.0 Pb 400	Se=None Ba = None Cr=None Hg=None Pb=UTL	Excavate Additional Soil or Site Restoration
ORC-19JUN98-S-9 SWMU 157	Ag 250 Ba 200 Cd 3.9 Cr 20 Pb 27	Ag 4.07 Ba 301.76 Cd 1.02 Cr 29.66 Pb 5.70	Ag 10,000 Ba 14,000 Cd 1,000 Cr 1,000 Pb (NA)	Ag 34 Ba 1,600 Cd 8 Cr 38 Pb 400	Ag=UTL, SSL Ba = None Cd=UTL Cr=None Pb=UTL	Excavate Additional Soil
ORC-19JUN98-S-10 SWMU 157	Pb 3.7 Ba 81 Cr 7.4	Pb 5.7 Ba 301.76 Cr 29.66	Pb (NA) Ba 14,000 Cr 1,000	Pb 400 Ba 1,600 Cr 38	Pb=None Ba = None Cr = None	Site Restoration
ORC-19JUN98-S-ll SWMU 157	Ba 270 Cd 3.6 Cr 23 Pb 60	Ba 301.76 Cd 1.02 Cr 29.66 Pb 5.70	Ba 14,000 Cd 1,000 Cr 1,000 Pb (NA)	Ba 1,600 Cd 8 Cr 38 Pb 400	Ba=None Cd=UTL Cr=None Pb=UTL	Excavate Additional Soil or Site Restoration
ORC-19JUN98-S-12 SWMU 157	Cd 1.0 Se 3.9 Ba 250 Cr 26 Pb 15	Cd 1.02 Se 4.07 Ba 301.76 Cr 29.66 Pb 5.70	Cd 1,000 Se 10,000 Ba 14,000 Cr 1,000 Pb (NA)	Cd 8 Se 5 Ba 1,600 Cr 38 Pb 400	Cd=None Se=None Ba=None Cr = None Pb=UTL	Excavate Additional Soil or Site Restoration
ORC-19JUN98-S-13 SWMU 157	Cd 1.0 Ba 250 Cr 23 Hg 0.54 Pb 11	Cd 1.02 Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Cd 1,000 Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Cd 8 Ba 1,600 Cr 38 Hg 2.0 Pb 400	Cd=None Ba = None Cr = None Hg = None Pb=UTL	Excavate Additional Soil or Site Restoration
ORC-19JUN98-S-14 SWMU 157	Pb 4.2 Ba 170 Cr 16 Hg 0.24	Pb 5.70 Ba 301.76 Cr 29.66 Hg 0.54	Pb (NA) Ba 14,000 Cr 1,000 Hg (NA)	Pb 400 Ba 1,600 Cr 38 Hg 2.0	Pb =None Ba=None Cr = None Hg = None	Site Restoration
ORC-19JUN98-S-15 SWMU 157	Ba 240 Cr 20 Hg 0.20 Pb 7.4	Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Ba 1,600 Cr 38 Hg 2.0 Pb 400	Ba=None Cr = None Hg=None Pb=UTL	Excavate Additional Soil or Site Restoration
ORC-19JUN98-S-16 SWMU 157	Ag 3.5 Ba 200 Cr 25 Hg 0.22 Pb 5.4	Ag 4.07 Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Ag 10,000 Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Ag 34 Ba 1,600 Cr 38 Hg 2.0 Pb 400	Ag=None Ba=None Cr = None Hg=None Pb=None	Site Restoration
ORC-19JUN98-S-17 SWMU 157	Pb 2.9 Ba 230 Cr 20	Pb 5.70 Ba 301.76 Cr 29.66	Pb (NA) Ba 14,000 Cr 1,000	Pb 400 Ba 1,600 Cr 38	Pb=None Ba = None Cr=None	Site Restoration
ORC-19JUN98-S-18 SWMU 157	Ba 230 Cr 22 Hg 0.12 Pb 4.4	Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Ba 1,600 Cr 38 Hg 2.0 Pb 400	Ba=None Cr = None Hg=None Pb=None	Site Restoration
ORC-19JUN98-S-29 SWMU 158	Pb 3.8 Ba 240 Cr 20 Hg 0.31	Pb 5.70 Ba 301.76 Cr 29.66 Hg 0.54	Pb (NA) Ba 14,000 Cr 1,000 Hg (NA)	Pb 400 Ba 1,600 Cr 38 Hg 2.0	Pb=None Ba = None Cr=None Hg=None	Site Restoration

Table 7-4. Results of 1998 Confirmatory Samples, SWMU 157 and 158, Investigation #3, 1998

Source: Radian, 1998

Sample No.	Detected Analyte (mg/Kg)	UTL Value (mg/Kg)	RBC Value (mg/Kg)	SSL Value (mg/Kg)	Exceedances	Remedial Option
ORC-19JUN98-S-30 SWMU 158	Ba 220 Cr 20 Hg 0.31 Pb 5.2	Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Ba 1,600 Cr 38 Hg 2.0 Pb 400	Ba=None Cr = None Hg=None Pb =UTL	Excavate Additional Soil or Site Restoration
ORC-19JUN98-S-31 SWMU 158	Ba 260 Cr 21 Hg 0.52 Pb 4.9	Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Ba 1,600 Cr 38 Hg 2.0 Pb 400	Ba=None Cr=None Hg=None Pb=None	Site Restoration
ORC-19JUN98-S-32 SWMU 158	Ba 260 Cr 25 Hg 0.92	Ba 301.76 Cr 29.66 Hg 0.54	Ba 14,000 Cr 1,000 Hg (NA)	Ba 1,600 Cr 38 Hg 2.0	Ba=None Cr=None Hg=·UTL	Excavate Additional Soil or Site Restoration
ORC-191UN98-S-33 SWMU 158	Ba 230 Cr 22 Hg 0.19 Pb 5.7	Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Ba 1,600 Cr 38 Hg 2.0 Pb 400	Ba=None Cr=None Hg = None Pb = None	Site Restoration
ORC-191UN98-S-34 SWMU 158	Pb 3.7 Ba 230 Cr 24 Hg 0.15	Pb 5.70 Ba 301.76 Cr 29.66 Hg 0.54	Pb (NA) Ba 14,000 Cr 1,000 Hg (NA)	Pb 400 Ba 1,600 Cr 38 Hg 2.0	Pb =None Ba = None Cr = None Hg=None	Site Restoration
ORC-19JUN98-S-35 SWMU 158	Cd 1.3 Ba 250 Cr 24 Hg 0.13 Pb 8.2	Cd 1.02 Ba 301.76 Cr 29.66 Hg 0.54 Pb 5.70	Cd 1,000 Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Cd 8 Ba 1,600 Cr 38 Hg 2.0 Pb 400	Cd=UTL Ba=None Cr=None Hg=None Pb=UTL	Excavate Additional Soil or Site Restoration
ORC-19JUN98-S-36 SWMU 158	Pb 1.4 Ba 260 Cr 22 Hg 0.29	Pb 5.70 Ba 301.76 Cr 29.66 Hg 0.54	Pb (NA) Ba 14,000 Cr 1,000 Hg(NA)	Pb 400 Ba 1,600 Cr 38 Hg 2.0	Pb=None Ba = None Cr = None Hg=None	Site Restoration
ORC-19JUN98-S-37 SWMU 158	Pb 3.2 Ba 200 Cr 21 Hg 0.10	Pb 5.7 Ba 301.76 Cr 29.66 Hg 0.54	Pb (NA) Ba 14,000 Cr 1,000 Hg (NA)	Pb 400 Ba 1,600 Cr 38 Hg 2.0	Pb=None Ba = None Cr=None Hg=None	Site Restoration
ORC-19JUN98-S-38 SWMU 158	Ba 230 Cr 26 Hg 0.53	Ba 301.76 Cr 29.66 Hg 0.54	Ba 14,000 Cr 1,000 Hg (NA)	Ba 1,600 Cr 38 Hg 2.0	Ba=None Cr=None Hg = None	Site Restoration
ORC-19JUN98-S-39	Ba 290 Cr 29 Hg 0.18	Ba 301.76 Cr 29.66 Hg 0.54	Ba 14,000 Cr 1,000 Hg (NA}	Ba 1,600 Cr 38 Hg 2.0	Ba=None Cr=None Hg=None	Site Restoration
ORC-19JUN98-S-40	Se 3.3 Ba 250 Cr 28 Hg 0.14	Se 4.07 Ba 301.76 Cr 29.66 Hg 0.54	Se 10,000 Ba 14,000 Cr 1,000 Hg (NA)	Se 5.0 Ba 1,600 Cr 38 Hg 2.0	Se=None Ba=None Cr=None Hg=None	Site Restoration
ORC-19JUN98-S-41	Ba 260 Cr 22 Hg 0.16 Pb 4.6	Ba 301.76 Cr 29.66 Hg 0.S4 Pb 5.70	Ba 14,000 Cr 1,000 Hg (NA) Pb (NA)	Ba 1,600 Cr 38 Hg 2.0 Pb 400	Ba=None Cr = None Hg=None Pb=None	Site Restoration
ORC-19JUN98-S-42	Se 4.2 Ba 270 Cr 24 Hg 0.11	Se 4.07 Ba 301.76 Cr 29.66 Hg 0.54	Se 10,000 Ba 14,000 Cr 1,000 Hg (NA)	Se 5.0 Ba 1,600 Cr 38 Hg 2.0	Se=None Ba=None Cr = None Hg=None	Site Restoration

Table 7-5. Soil Borings for the RFI at ORC Construction Landfill, SWMU 159, Investigation # 4, 2002

Source: BAE, 2004c

Soil Boring / Total Depth	Soil Boring Angle	Sample Depth Interval - From Angle	Sample Depth Interval - Corrected to Vertical	Sample #
Landfill Cell				
SB-01/20ft Bearing: N35E	40°	19-20	15	0159-SB01(15.0)
SB-02/26ft Bearing: S18W	40°	19-20	15	0159-SB02(15.0)
		25-26	20	0159-SB02(20.0)
SB-03/20ft Bearing: N32E	40°	19-20	15	0159-SB03(15.0)
SB-04/20ft Bearing: S20W	40°	19-20	15	0159-SB04(15.0)
SB-05/26ft Bearing: N11E	40°	19-20	15	0159-SB05(15.0)
		25-26	20	0159-SB05(20.0)
SB-06/20ft Bearing: S17W	40°	19-20	15	0159-SB06(15.0)
SB-07/20ft Bearing: N3E	40°	19-20	15	0159-SB07(15.0)
SB-08/26ft Bearing: N10E	40°	19-20	15	0159-SB08(15.0)
		25-26	20	0159-SB08(20.0)
Ramp Area				
SB-09/7ft	Vertical	6-7	7	0159-SB09(7.0)
SB-10/7ft	Vertical	6-7	7	0159-SB10(7.0)
SB-11/7ft	Vertical	6-7	7	0159-SB11(7.0)
SB-12/7ft	Vertical	6-7	7	0159-SB12(7.0)
SB-13/7ft	Vertical	6-7	7	0159-SB13(7.0)
Background				
SB-14/30ft	Vertical	6-7	7	0159-SB14(7.0)
		14-15	15	0159-SB14(15.0)
		19-20	20	0159-SB14(20.0)
SB-15/20ft	Vertical	6-7	7	0159-SB15(7.0)
		14-15	15	0159-SB15(15.0)
		19-20	20	0159-SB15(20.0)

Table 7-6. Inorganic Analytical Results from the Background Soil Borings, RFI, SWMU 159, Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL mg/kg	SB014 (7.0) mg/kg	SB15 (7.0) mg/kg	SB14 (15.0) mg/kg	SB15 (15.0) mg/kg	SB14 (20.0) mg/kg	SB15 (20.0) mg/kg
Arsenic	3.9	3.3	2.7	3.8	**4.4**	3.3	3
Barium	5,200	361 N	147 N	215 N	244 N	327 N	242 N
Cadmium	70	<4.1	<4.3	<4.2	<5.1	<4.4	<4.1
Chromium	210*	21.2	19.1	30	37.2	27.5	15.9
Copper	2,800	10.5	10	15.3	21.4	12.8	9.7
Lead	400	8.1	8.2	11	14.1	9.3	8.1
Magnesium	NE	7730 E	6640 E	10200 E	14800 E	10200 E	7860 E
Manganese	7,800	296	516	407	577	292	311
Selenium	380	<0.82 N	<0.86 N	0.84 N	<1 N	<0.88 N	<0.81 N
Silver	380	<0.08	<0.09	<0.08	<0.1	<0.09	<0.08
Mercury	6.5	<0.03	<0.04	<0.04	<0.04	<0.04	<0.04
Perchlorate	7.8*	<0.044	<0.044	<0.044	<0.051	<0.048	<0.043
Total Phosphorus	NE	2400	360	450	750	430	360

< - Not Detected (less than the given laboratory reporting limit)

NE - A screening level has not been established

Italics -Result is greater than the laboratory reporting limit

Bold - Result is greater than the NMED Residential Soil Screening Level

* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels

N - Spiked sample recovery not within control limits

E - The reported value is estimated because of the presence of interference

Table 7-7. Inorganic Analytical Results from the Landfill Cell Soil Borings, RFI, SWMU 159, Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL mg/kg	SB01 (15.0) mg/kg	SB02 (15.0) mg/kg	SB02 (20.0) mg/kg	SB03 (15.0) mg/kg	SB04 (15.0) mg/kg	SB05 (15.0) mg/kg	SB05 (20.0) mg/kg	SB06 (15.0) mg/kg	SB07 (15.0) mg/kg	SB08 (15.0) mg/kg	SB08 (20.0) mg/kg
Arsenic	3.9	3.4	**4.1**	3.3	3.6	3.5	**3.9**	3.4	3.1	3.4	**3.9**	3.5
Barium	5,200	153	304 N	255 N	169	296 N	219	237	129 N	190	148	336
Cadmium	70	<4.4	<4.3	<4.3	<4.5	<4.4	<4.2	<4.3	<4.7	<4.3	<4.3	<4
Chromium	210*	19.7 N	32.8	17.9	25.7 N	23.3	26.7 N	17.4 N	19.9	23.8 N	20.8 N	13.7 N
Copper	2,800	12.7	17.5	11.1	14.5	11.4	13.3	9.8	11.3	13.1	13.1	7.6
Lead	400	10.2	12.3	9.2	11	9.9	10.7	9.3	8.9	9.7	10	7.8
Magnesium	NE	10200	12900 E	9900 E	11000	8440 E	9610	7790	9370 E	10000	10000	6500
Manganese	7,800	353	391	283	389	374	394	327	290	296	320	255
Selenium	380	<0.87	<0.85 N	<0.85 N	<0.9	<0.89 N	<0.83	<0.85	<0.94 N	<0.87	<0.86	<0.81
Silver	380	<0.09	<0.09	<0.08	<0.09	<0.09	<0.08	<0.09	<0.09	<0.09	<0.09	<0.08
Mercury	6.5	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perchlorate	7.8*	<0.044	<0.045	<0.044	<0.045	<0.044	<0.044	<0.043	<0.047	<0.046	<0.046	<0.040
Total Phosphorus	NE	1600	1700	1700	1800	1600	1600	1100	1800	1600	1600	1800

< - Not Detected (less than the given laboratory reporting limit)
NE - A screening level has not been established
Italics -Result is greater than the laboratory reporting limit
Bold - Result is greater than the NMED Residential Soil Screening Level
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels
N - Spiked sample recovery not within control limits
E - The reported value is estimated because of the presence of interference

Table 7-8. VOC Analytical Results from the Landfill Cell Soil Borings, RFI, SWMU 159
Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB01 (15.0) µg/kg	SB02 (15.0) µg/kg	SB02 (20.0) µg/kg	SB03 (15.0) µg/kg	SB04 (15.0) µg/kg	SB05 (15.0) µg/kg	SB05 (20.0) µg/kg	SB06 (15.0) µg/kg	SB07 (15.0) µg/kg	SB08 (15.0) µg/kg	SB08 (20.0) µg/kg
1,1,1-Trichloroethane	5.1E+5	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
1,1,2,2-Tetrachloroethane	3.6E+3	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
1,1,2-Trichloroethane	7.9E+3	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
1,1-Dichloroethane	5.6E+5	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
1,1-Dichloroethene	8.1E+3	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
1,2-Dichloroethane	3.3E+3	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
1,2-Dichloropropane	3.5E+2*	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
2-Butanone	3.7E+6	<11	<62	<50	<12	<54	<11	<11	<53	<12	<110	<10
2-Hexanone	NE	<11	<62	<50	<12	<54	<11	<11	<53	<12	<110	<10
4-Methyl-2-pentanone	NE	<11	<62	<50	<12	<54	<11	<11	<53	<12	<110	<10
Acetone	1.6E+6*	*9 J*	*31 J*	*22 J*	*14*	*25 J*	*8J*	*11*	*23 J*	*8 J*	*58 J*	*8 J*
Benzene	6.4E+3	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Bromodichloromethane	9.6E+3	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Bromoform	6.2E+4	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Bromomethane	3.7E+3	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Carbon disulfide	3.6E+5*	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Carbon tetrachloride	1.6E+3	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Chlorobenzene	1.4E+5	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Chloroethane	3.0E+3**	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Chloroform	3.8E+2	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Chloromethane	1.2E+4	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
cis-1,2-Dichloroethene	4.1E+4	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
cis-1,3-Dichloropropene	NE	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Dibromochloromethane	1.0E+3*	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Dichlorodifluoromethane	9.0E+4	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Ethylbenzene	6.8E+4	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
m,p-Xylene	6.3E+4^	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Methylene chloride	8.9E+3*	*21 B*	*14 BJ*	*11 BJ*	*16 B*	*12 BJ*	*19 B*	*19 B*	*13 BJ*	*15 B*	*40 B*	*16 B*
o-Xylene	6.3E+4^	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Styrene	1.7E+6*	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Tetrachloroethene	4.9E+4	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Toluene	1.8E+5	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
trans-1,2-Dichloroethene	6.0E+4	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Trans-1,3-Dichloropropene	NE	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Trichloroethene	1.6E+4	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Trichlorofluoromethane	3.9E+5*	*4*	<19	<15	2J	<16	*4*	*4*	<16	3J	<33	*3*
Vinyl chloride	2.1E+2	<3	<19	<15	<4	<16	<3	<3	<16	<4	<33	<3
Total Petroleum Hydrocarbons	**NMED SSL mg/kg**	**SB01 (15.0) mg/kg**	**SB02 (15.0) mg/kg**	**SB02 (20.0) mg/kg**	**SB03 (15.0) mg/kg**	**SB04 (15.0) mg/kg**	**SB05 (15.0) mg/kg**	**SB05 (20.0) mg/kg**	**SB06 (15.0) mg/kg**	**SB07 (15.0) mg/kg**	**SB08 (15.0) mg/kg**	**SB08 (20.0) mg/kg**
Diesel Range Organics	NE	<28	<28	<27	<28	<27	<27	<27	<29	<29	<28	<27
Gasoline Range Organics	NE	<5.6	<5.6	<5.5	<5.7	<5.4	<5.5	<5.3	<5.9	<5.8	<5.6	<5.3
Motor Oil	NE	<110	<110	<110	<110	<110	<110	<110	<120	<120	<110	<110

< - Not Detected - less than the given laboratory reporting limit
Italics - Result is greater than the laboratory reporting limit.
* Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels.
** -Not Established by New Mexico or EPA Region VI. Level given is from the EPA Region IX Preliminary Remediation Goals.
^ - Level is based on Total Xylenes (m,p, and o).
J - Analyte was detected below the reporting limit. Reported concentration is an estimate.
B - Analyte was also detected in the method blank for that sample.
NE - A screening level has not been established.

Table 7-9. SVOC Analytical Results from the Landfill Cell Soil Borings, RFI, SWMU 159
Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB01 (15.0) µg/kg	SB02 (15.0) µg/kg	SB02 (20.0) µg/kg	SB03 (15.0) µg/kg	SB04 (15.0) µg/kg	SB05 (15.0) µg/kg	SB05 (20.0) µg/kg	SB06 (15.0) µg/kg	SB07 (15.0) µg/kg	SB08 (15.0) µg/kg	SB08 (20.0) µg/kg
1,2,4-Trichlorobenzene	5.2E+6	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
1,2-Dichlorobenzene	337E+5*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
1,2-Diphenylhydrazine	6.1E+3	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
1,3-Dichlorobenzene	1.2E+4	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
1,4-Dichlorobenzene	3.2E+4	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2,2'-oxybis (1-Chloropropane)	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2,4,5-Trichlorophenol	6.1E+6	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2,4,6-Trichlorophenol	4.4E+5	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2,4-Dichlorophenol	1.8E+5	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2,4-Dimethylphenol	1.2E+6*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2,4-Dinitrophenol	1.2E+5	<740	<750	<730	<760	<720	<730	<710	<780	<780	<740	<710
2,4-Dinitrotoluene	1.2E+5	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2,6-Dinitrotoluene	6.1E+4*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2-Chloronaphthalene	3.9E+6*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2-Chlorophenol	6.4E+4*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2-Methylnaphthalene	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2-Methylphenol	3.1E+6*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2-Nitroaniline	3.7E+3*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
2-Nitrophenol	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
3,3'-Dichlorobenzidine	1.1E+4	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
3-Nitroaniline	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
4,6-Dinitro-2-methylphenol	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
4-Bromophenyl phenylether	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
4-Chloro-3-methylphenol	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
4-Chloroaniline	2.4E+5*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
4-Chlorophenyl phenylether	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
4-Methylphenol	3.1E+5*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
4-Nitroaniline	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
4-Nitrophenol	4.9E+5*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Acenaphthene	2,800,000	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Acenaphthylene	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Anthracene	1.6E+7	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Benzidine	21	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Benzo[a]anthracene	6.2E+3	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Benzo[a]pyrene	6.2E+2	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Benzo[b]fluoranthene	6.2E+3	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Benzo[g,h,I]perylene	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Benzo[k]fluoranthene	6.2E+4	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Benzoic acid	1.0E+8*	<740	<750	<730	<760	<720	<730	<710	<780	<780	<740	<710
Benzyl alcohol	1.8E+7*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Bis (2-Chloroethoxy)methane	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
bis(2-Chloroethyl)ether	4.4E+3	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
bis(2-Ethylhexyl)phthalate	6.0E+3	90 J	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Butylbenzylphthalate	2.4E+5*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Carbazole	2.4E+4*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350

Table 7-9. SVOC Analytical Results from the Landfill Cell Soil Borings, RFI, SWMU 159
Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB01 (15.0) µg/kg	SB02 (15.0) µg/kg	SB02 (20.0) µg/kg	SB03 (15.0) µg/kg	SB04 (15.0) µg/kg	SB05 (15.0) µg/kg	SB05 (20.0) µg/kg	SB06 (15.0) µg/kg	SB07 (15.0) µg/kg	SB08 (15.0) µg/kg	SB08 (20.0) µg/kg
Chrysene	6.1E+5	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Di-n-butylphthalate	NE	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	250 J
Di-n-octylphthalate	1.2E+6*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Dibenz[a,h]anthracene	6.2E+2	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Dibenzofuran	2.9E+5	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Diethylphthalate	4.9E+7	150 J	<370	<370	150 J	<360	150 J	200 J	<390	160 J	130 J	140 J
Dimethylphthalate	1.0E+8	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Fluoranthene	2.3E+6	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Fluorene	2.1E+6	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Hexachlorobenzene	3.0E+3	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Hexachlorobutadiene	1.2E+4	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Hexachlorocyclopentadiene	4.2E+5	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Hexachloroethane	6.1E+4	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Indeno[1,2,3-cd]pyrene	6.2E+3	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Isophorone	5.1E+6	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
N-Nitroso-di-n-propylamine	70*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
N-Nitrosodiphenylamine	9.9E+5	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Naphthalene	5.3E+4	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Nitrobenzene	1.7E+4	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Pentachlorophenol	3.0E+3*	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Phenanthrene	1.8E+6	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350
Phenol	3.7E+7	<370	<370	<370	<380	<360	<370	<350	<390	<390	<370	<350

< - Not Detected - less than the given laboratory reporting limit
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels
** - Not Established by New Mexico or EPA Region VI. Level given is from the EPA Region IX Preliminary Remediation Goals
^ - Level is based on Total Xylenes (m,p, and o)
B - Analyte was also detected in the method blank for that sample
J - Analyte was detected below the reporting limit. Reported concentration is an estimate.
NE - A screening level has not been established
Italics - Result is greater than the laboratory reporting limit.

Table 7-10. Pesticide and PCB Analytical Results from the Landfill Cell Soil Borings, RFI, SWMU 159
Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB01 (15.0) µg/kg	SB02 (15.0) µg/kg	SB02 (20.0) µg/kg	SB03 (15.0) µg/kg	SB04 (15.0) µg/kg	SB05 (15.0) µg/kg	SB05 (20.0) µg/kg	SB06 (15.0) µg/kg	SB07 (15.0) µg/kg	SB08 (15.0) µg/kg	SB08 (20.0) µg/kg
4,4'-DDD	2.4E+4	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
4,4'-DDE	1.7E+4	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
4,4'-DDT	1.7E+4	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
Aldrin	2.9E+2	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
alpha-BHC	9.0E+2	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
alpha-Chlordane	NE	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
Aroclor-1016	3.9E+3	<37	<37	<36	<38	<36	<36	<35	<39	<38	<37	<35
Aroclor-1221	2.2E+3	<73	<74	<73	<75	<72	<73	<70	<78	<77	<73	<70
Aroclor-1232	2.2E+3	<37	<37	<36	<38	<36	<36	<35	<39	<38	<37	<35

Table 7-10. Pesticide and PCB Analytical Results from the Landfill Cell Soil Borings, RFI, SWMU 159
Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB01 (15.0) µg/kg	SB02 (15.0) µg/kg	SB02 (20.0) µg/kg	SB03 (15.0) µg/kg	SB04 (15.0) µg/kg	SB05 (15.0) µg/kg	SB05 (20.0) µg/kg	SB06 (15.0) µg/kg	SB07 (15.0) µg/kg	SB08 (15.0) µg/kg	SB08 (20.0) µg/kg
Aroclor-1242	2.2E+3	<37	<37	<36	<38	<36	<36	<35	<39	<38	<37	<35
Aroclor-1248	1.1E+3	<37	<37	<36	<38	<36	<36	<35	<39	<38	<37	<35
Aroclor-1254	1.1E+3	<37	<37	<36	<38	<36	<36	<35	<39	<38	<37	<35
Aroclor-1260	1.1E+3	<37	<37	<36	<38	<36	<36	<35	<39	<38	<37	<35
beta-BHC	3.2E+3	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
delta-BHC	NE	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
Dieldrin	3.0E+2	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
Endosulfan I	NE	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
Endosulfan II	NE	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
Endosulfan sulfate	NE	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
Endrin	1.8E+4	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
Endrin aldehyde	NE	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
Endrin ketone	NE	<3.7	<3.7	<3.6	<3.8	<3.6	<3.6	<3.5	<3.9	<3.8	<3.7	<3.5
gamma-BHC (Lindane)	4.4E+3	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
gamma-Chlordane	NE	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
Heptachlor	1.1E+3	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
Heptachlor epoxide	53*	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	<2	<2	<1.9	<1.8
Methoxychlor	3.1E+5*	<19	<19	<19	<19	<18	<19	<18	<20	<20	<19	<18
Toxaphene	4.4E+3	<190	<190	<190	<190	<180	<190	<180	<200	<200	<190	<180

< - Not Detected - less than the given laboratory reporting limit
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels
NE - A screening level has not been established

Table 7-11. Herbicide Analytical Results from the Landfill Cell Soil Borings, RFI, SWMU 159
Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB01 (15.0) µg/kg	SB02 (15.0) µg/kg	SB02 (20.0) µg/kg	SB03 (15.0) µg/kg	SB04 (15.0) µg/kg	SB05 (15.0) µg/kg	SB05 (20.0) µg/kg	SB06 (15.0) µg/kg	SB07 (15.0) µg/kg	SB08 (15.0) µg/kg	SB08 (20.0) µg/kg
2,4,5-T	6.1E+5*	<3	<3	<2.9	<3	<2.9	<2.9	<2.8	<3.1	<3.1	<3	<2.8
2,4,5-TP	4.9E+5*	<3	<3	<2.9	<3	<2.9	<2.9	<2.8	<3.1	<3.1	<3	<2.8
2,4-D	6.9E+5*	<3	<3	<2.9	<3	<2.9	<2.9	<2.8	<3.1	<3.1	<3	<2.8
2,4-DB	4.9E+5*	<3	<3	<2.9	<3	<2.9	<2.9	<2.8	<3.1	<3.1	<3	<2.8
Dicamba	1.8E+6*	<3	<3	<2.9	<3	<2.9	<2.9	<2.8	<3.1	<3.1	<3	<2.8
Dichlorprop	NE	<3	<3	<2.9	<3	<2.9	<2.9	<2.8	<3.1	<3.1	<3	<2.8
Dinoseb	6.1E+4*	<3	<3	<2.9	<3	<2.9	<2.9	<2.8	<3.1	<3.1	<3	<2.8

< - Not Detected - less than the given laboratory reporting limit.
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels.
NE - A screening level has not been established.

Table 7-12. Explosive Analytical Results from the Landfill Cell Soil Borings, RFI, SWMU 159 Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL mg/kg	SB01 (15.0) mg/kg	SB02 (15.0) mg/kg	SB02 (20.0) mg/kg	SB03 (15.0) mg/kg	SB04 (15.0) mg/kg	SB05 (15.0) mg/kg	SB05 (20.0) mg/kg	SB06 (15.0) mg/kg	SB07 (15.0) mg/kg	SB08 (15.0) mg/kg	SB08 (20.0) mg/kg
1,3,5-Trinitrobenzene	1.8E+3*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-Dinitrobenzene	6.1*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,6-Trinitrotoluene	31	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-Dinitrotoluene	1.2E+2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-Dinitrotoluene	61*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Amino-4,6-Dinitrotoluene	NE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Nitrotoluene	3.7E+2**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
3-Nitrotoluene	3.7E+2**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Amino-2,6-Dinitrotoluene	NE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Nitrotoluene	3.7E+2**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HMX	3.1E+3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	17	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RDX	44	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetryl	NE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

< - Not Detected - less than the given laboratory reporting limit
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels.
NE - A screening level has not been established.

Table 7-13. Inorganic Analytical Results from the Ramp Area Soil Borings, RFI, SWMU 159 Investigation # 4, 2002

Source: BAE, 2004c

Analyte	NMED Residential SSL	SB09 (7.0)	SB10 (7.0)	SB11 (7.0)	SB12 (7.0)	SB13 (7.0)
Arsenic	3.9	3.2	3.3	2.6	2.5	3
Barium	5,200	317 N	154 N	137 N	177 N	221 N
Cadmium	70	<4.6	<4.8	<4.6	<4.1	<4.4
Chromium	210*	25.9	26.2	22.2	18.9	23.9
Copper	2,800	12.4	11.1	10.6	8.5	12.3
Lead	400	9.6	9.5	8.1	7.3	9.6
Magnesium	NE	8310 E	9260 E	7200 E	6170 E	8430 E
Manganese	7,800	335	350	315	248	394
Selenium	380	<0.91 N	<0.95 N	<0.92 N	<0.82 N	<0.87 N
Silver	380	<0.09	<0.1	<0.09	<0.08	<0.09
Mercury	6.5	<0.04	<0.04	<0.04	<0.04	<0.03
Perchlorate	7.8*	<0.045	<0.044	<0.045	<0.045	<0.044
Total Phosphorus	NE	1700	1500	1600	340	990

< - Not Detected - less than the given laboratory reporting limit
NE - A screening level has not been established.
Italics - Result is greater than the laboratory reporting limit.
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels.
N - Spiked sample recovery not within control limits.
E - The reported value is estimated because of the presence of interference.

Table 7-14. VOC Analytical Results from the Ramp Area Soil Borings, RFI, SWMU 159 Investigation # 4, 2002
Source: BAE, 2004c

Analyte	NMED SSL µg/kg	SB09 (7.0) µg/kg	SB10 (7.0) µg/kg	SB11 (7.0) µg/kg	SB12 (7.0) µg/kg	SB13 (7.0) µg/kg
1,1,1-Trichloroethane	5.1E+5	<17	<17	<17	<21	<3
1,1,2,2-Tetrachloroethane	3.6E+3	<17	<17	<17	<21	<3
1,1,2-Trichloroethane	7.9E+3	<17	<17	<17	<21	<3
1,1-Dichloroethane	5.6E+5	<17	<17	<17	<21	<3
1,1-Dichloroethene	8.1E+3	<17	<17	<17	<21	<3
1,2-Dichloroethane	3.3E+3	<17	<17	<17	<21	<3
1,2-Dichloropropane	3.5E+2*	<17	<17	<17	<21	<3
2-Butanone	3.7E+6	<57	<56	<57	<69	<11
2-Hexanone	NE	<57	<56	<57	<69	<11
4-Methyl-2-pentanone	NE	<57	<56	<57	<69	<11
Acetone	1.6E+6*	32 J	31 J	<57	<69	<11
Benzene	6.4E+3	<17	<17	<17	<21	<3
Bromodichloromethane	9.6E+3	<17	<17	<17	<21	<3
Bromoform	6.2E+4	<17	<17	<17	<21	<3
Bromomethane	3.7E+3	<17	<17	<17	<21	<3
Carbon disulfide	3.6E+5*	<17	<17	<17	<21	<3
Carbon tetrachloride	1.6E+3	<17	<17	<17	<21	<3
Chlorobenzene	1.4E+5	<17	<17	<17	<21	<3
Chloroethane	3.0E+3**	<17	<17	<17	<21	<3
Chloroform	3.8E+2	<17	<17	<17	<21	<3
Chloromethane	1.2E+4	<17	<17	<17	<21	<3
cis-1,2-Dichloroethene	4.1E+4	<17	<17	<17	<21	<3
cis-1,3-Dichloropropene	NE	<17	<17	<17	<21	<3
Dibromochloromethane	1.0E+3*	<17	<17	<17	<21	<3
Dichlorodifluoromethane	9.0E+4	<17	<17	<17	<21	<3
Ethylbenzene	6.8E+4	<17	<17	<17	<21	<3
m,p-Xylene	6.3E+4^	<17	<17	<17	<21	<3
Methylene chloride	8.9E+3*	15 BJ	12 BJ	18 B	18 BJ	7 B
o-Xylene	6.3E+4^	<17	<17	<17	<21	<3
Styrene	1.7E+6*	<17	<17	<17	<21	<3
Tetrachloroethene	4.9E+4	<17	<17	<17	<21	<3
Toluene	1.8E+5	<17	<17	<17	<21	<3
trans-1,2-Dichloroethene	6.0E+4	<17	<17	<17	<21	<3
trans-1,3-Dichloropropene	NE	<17	<17	<17	<21	<3
Trichloroethene	1.6E+4	<17	<17	<17	<21	<3
Trichlorofluoromethane	3.9E+5*	<17	<17	<17	<21	<3
Vinyl chloride	2.1E+2	<17	<17	<17	<21	<3
Total Petroleum Hydrocarbons	**NMED SSL mg/kg**	**SB09 (7.0) mg/kg**	**SB10 (7.0) mg/kg**	**SB11 (7.0) mg/kg**	**SB12 (7.0) mg/kg**	**SB13 (7.0) mg/kg**
Gasoline Range Organics	NE	<5.7	<5.6	<5.7	<5.6	<5.6
Diesel Range Organics	NE	<29	<28	<28	<28	<28
Motor Oil	NE	<110	<110	<110	<110	<110

< - Not Detected - less than the given laboratory reporting limit
Italics - Result is greater than the laboratory reporting limit.
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels.
** -Not Established by New Mexico or EPA Region VI. Level given is from the EPA Region IX Preliminary Remediation Goals.
^ - Level is based on Total Xylenes (m,p, and o).
B - Analyte was also detected in the method blank for that sample.
J - Analyte was detected below the reporting limit. Reported concentration is an estimate.
NE - A screening level has not been established.

Table 7-15. SVOC Analytical Results from the Ramp Area Soil Borings, RFI, SWMU 159 Investigation # 4, 2002
Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB09 (7.0) µg/kg	SB10 (7.0) µg/kg	SB11 (7.0) µg/kg	SB12 (7.0) µg/kg	SB13 (7.0) µg/kg
1,2,4-Trichlorobenzene	5.2E+6	<380	<370	<380	<370	<370
1,2-Dichlorobenzene	337E+5*	<380	<370	<380	<370	<370
1,2-Diphenylhydrazine	6.1E+3	<380	<370	<380	<370	<370
1,3-Dichlorobenzene	1.2E+4	<380	<370	<380	<370	<370
1,4-Dichlorobenzene	3.2E+4	<380	<370	<380	<370	<370
2,2'-oxybis(1-Chloropropane)	NE	<380	<370	<380	<370	<370
2,4,5-Trichlorophenol	6.1E+6	<380	<370	<380	<370	<370
2,4,6-Trichlorophenol	4.4E+5	<380	<370	<380	<370	<370
2,4-Dichlorophenol	1.8E+5	<380	<370	<380	<370	<370
2,4-Dimethylphenol	1.2E+6*	<380	<370	<380	<370	<370
2,4-Dinitrophenol	1.2E+5	<770	<750	<760	<740	<740
2,4-Dinitrotoluene	1.2E+5	<380	<370	<380	<370	<370
2,6-Dinitrotoluene	6.1E+4*	<380	<370	<380	<370	<370
2-Chloronaphthalene	3.9E+6*	<380	<370	<380	<370	<370
2-Chlorophenol	6.4E+4*	<380	<370	<380	<370	<370
2-Methylnaphthalene	NE	<380	<370	<380	<370	<370
2-Methylphenol	3.1E+6*	<380	<370	<380	<370	<370
2-Nitroaniline	3.7E+3*	<380	<370	<380	<370	<370
2-Nitrophenol	NE	<380	<370	<380	<370	<370
3,3'-Dichlorobenzidine	1.1E+4	<380	<370	<380	<370	<370
3-Nitroaniline	NE	<380	<370	<380	<370	<370
4,6-Dinitro-2-methylphenol	NE	<380	<370	<380	<370	<370
4-Bromophenyl-phenylether	NE	<380	<370	<380	<370	<370
4-Chloro-3-methylphenol	NE	<380	<370	<380	<370	<370
4-Chloroaniline	2.4E+5*	<380	<370	<380	<370	<370
4-Chlorophenyl-phenylether	NE	<380	<370	<380	<370	<370
4-Methylphenol	3.1E+5*	<380	<370	<380	<370	<370
4-Nitroaniline	NE	<380	<370	<380	<370	<370
4-Nitrophenol	4.9E+5*	<380	<370	<380	<370	<370
Acenaphthene	2,800,000	<380	<370	<380	<370	<370
Acenaphthylene	NE	<380	<370	<380	<370	<370
Anthracene	1.6E+7	<380	<370	<380	<370	<370
Benzidine	21	<380	<370	<380	<370	<370
Benzo[a]anthracene	6.2E+3	<380	<370	<380	<370	<370
Benzo[a]pyrene	6.2E+2	<380	<370	<380	<370	<370
Benzo[b]fluoranthene	6.2E+3	<380	<370	<380	<370	<370
Benzo[g,h,I]perylene	NE	<380	<370	<380	<370	<370
Benzo[k]fluoranthene	6.2E+4	<380	<370	<380	<370	<370
Benzoic acid	1.0E+8*	<770	<750	<760	<740	<740
Benzyl alcohol	1.8E+7*	<380	<370	<380	<370	<370
bis(2-Chloroethoxy)methane	NE	<380	<370	<380	<370	<370
bis(2-Chloroethyl)ether	4.4E+3	<380	<370	<380	<370	<370
bis(2-Ethylhexyl)phthalate	6.0E+3	<380	<370	<380	<370	<370
Butylbenzylphthalate	2.4E+5*	<380	<370	<380	<370	<370
Carbazole	2.4E+4*	<380	<370	<380	<370	<370

Table 7-15. SVOC Analytical Results from the Ramp Area Soil Borings, RFI, SWMU 159
Investigation # 4, 2002
Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB09 (7.0) µg/kg	SB10 (7.0) µg/kg	SB11 (7.0) µg/kg	SB12 (7.0) µg/kg	SB13 (7.0) µg/kg
Chrysene	6.1E+5	<380	<370	<380	<370	<370
Di-n-butylphthalate	NE	<380	<370	<380	120 J	270 J
Di-n-octylphthalate	1.2E+6*	<380	<370	<380	<370	<370
Dibenz[a,h]anthracene	6.2E+2	<380	<370	<380	<370	<370
Dibenzofuran	2.9E+5	<380	<370	<380	<370	<370
Diethylphthalate	4.9E+7	<380	<370	<380	<370	<370
Dimethylphthalate	1.0E+8	<380	<370	<380	<370	<370
Fluoranthene	2.3E+6	<380	<370	<380	<370	<370
Fluorene	2.1E+6	<380	<370	<380	<370	<370
Hexachlorobenzene	3.0E+3	<380	<370	<380	<370	<370
Hexachlorobutadiene	1.2E+4	<380	<370	<380	<370	<370
Hexachlorocyclopentadiene	4.2E+5	<380	<370	<380	<370	<370
Hexachloroethane	6.1E+4	<380	<370	<380	<370	<370
Indeno[1,2,3-cd]pyrene	6.2E+3	<380	<370	<380	<370	<370
Isophorone	5.1E+6	<380	<370	<380	<370	<370
N-Nitroso-di-n-propylamine	70*	<380	<370	<380	<370	<370
N-Nitrosodiphenylamine	9.9E+5	<380	<370	<380	<370	<370
Naphthalene	5.3E+4	<380	<370	<380	<370	<370
Nitrobenzene	1.7E+4	<380	<370	<380	<370	<370
Pentachlorophenol	3.0E+3*	<380	<370	<380	<370	<370
Phenanthrene	1.8E+6	<380	<370	<380	<370	<370
Phenol	3.7E+7	<380	<370	<380	<370	<370

< - Not Detected - less than the given laboratory reporting limit
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels
** - Not Established by New Mexico or EPA Region VI. Level given is from the EPA Region IX Preliminary Remediation Goals
^ - Level is based on Total Xylenes (m,p, and o)
Italics - Result is greater than the laboratory reporting limit

Table 7-16. Pesticide and PCB Analytical Results from the Ramp Area Soil Borings, RFI, SWMU 159
Investigation # 4, 2002
Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB09 (7.0) µg/kg	SB10 (7.0) µg/kg	SB11 (7.0) µg/kg	SB12 (7.0) µg/kg	SB13 (7.0) µg/kg
4,4'-DDD	2.4E+4	<3.8	<3.7	<3.8	<3.7	<3.7
4,4'-DDE	1.7E+4	<3.8	<3.7	<3.8	<3.7	<3.7
4,4'-DDT	1.7E+4	<3.8	<3.7	<3.8	<3.7	<3.7
Aldrin	2.9E+2	<2	<1.9	<1.9	<1.9	<1.9
alpha-BHC	9.0E+2	<2	<1.9	<1.9	<1.9	<1.9
alpha-Chlordane	NE	<2	<1.9	<1.9	<1.9	<1.9
Aroclor-1016	3.9E+3	<38	<37	<38	<37	<37
Aroclor-1221	2.2E+3	<76	<74	<75	<73	<73
Aroclor-1232	2.2E+3	<38	<37	<38	<37	<37
Aroclor-1242	2.2E+3	<38	<37	<38	<37	<37

Table 7-16. Pesticide and PCB Analytical Results from the Ramp Area Soil Borings, RFI, SWMU 159
Investigation # 4, 2002
Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB09 (7.0) µg/kg	SB10 (7.0) µg/kg	SB11 (7.0) µg/kg	SB12 (7.0) µg/kg	SB13 (7.0) µg/kg
Aroclor-1248	1.1E+3	<38	<37	<38	<37	<37
Aroclor-1254	1.1E+3	<38	<37	<38	<37	<37
Aroclor-1260	1.1E+3	<38	<37	<38	<37	<37
beta-BHC	3.2E+3	<2	<1.9	<1.9	<1.9	<1.9
delta-BHC	NE	<2	<1.9	<1.9	<1.9	<1.9
Dieldrin	3.0E+2	<3.8	<3.7	<3.8	<3.7	<3.7
Endosulfan I	NE	<2	<1.9	<1.9	<1.9	<1.9
Endosulfan II	NE	<3.8	<3.7	<3.8	<3.7	<3.7
Endosulfan sulfate	NE	<3.8	<3.7	<3.8	<3.7	<3.7
Endrin	1.8E+4	<3.8	<3.7	<3.8	<3.7	<3.7
Endrin aldehyde	NE	<3.8	<3.7	<3.8	<3.7	<3.7
Endrin ketone	NE	<3.8	<3.7	<3.8	<3.7	<3.7
gamma-BHC (Lindane)	4.4E+3	<2	<1.9	<1.9	<1.9	<1.9
gamma-Chlordane	NE	<2	<1.9	<1.9	<1.9	<1.9
Heptachlor	1.1E+3	<2	<1.9	<1.9	<1.9	<1.9
Heptachlor epoxide	53*	<2	<1.9	<1.9	<1.9	<1.9
Methoxychlor	3.1E+5*	<20	<19	<19	<19	<19
Toxaphene	4.4E+3	<200	<190	<190	<190	<190

< - Not Detected - less than the given laboratory reporting limit
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels
NE - A screening level has not been established

Table 7-17. Herbicide Analytical Results from the Ramp Area Soil Borings, RFI, SWMU 159
Investigation # 4, 2002
Source: BAE, 2004c

Analyte	NMED Residential SSL µg/kg	SB09 (7.0) µg/kg	SB10 (7.0) µg/kg	SB11 (7.0) µg/kg	SB12 (7.0) µg/kg	SB13 (7.0) µg/kg
2,4,5-T	6.1E+5*	<3.1	<3	<3	<3	<3
2,4,5-TP	4.9E+5*	<3.1	<3	<3	<3	<3
2,4-D	6.9E+5*	<3.1	<3	<3	<3	<3
2,4-DB	4.9E+5*	<3.1	<3	<3	<3	<3
Dicamba	1.8E+6*	<3.1	<3	<3	<3	<3
Dichlorprop	NE	<3.1	<3	<3	<3	<3
Dinoseb	6.1E+4*	<3.1	<3	<3	<3	<3

< - Not Detected - less than the given laboratory reporting limit.
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels.
NE - A screening level has not been established.

Table 7-18. Explosive Analytical Results from Ramp Area, RFI, SWMU 159
Investigation # 4, 2002
Source: BAE, 2004c

Analyte	NMED Residential SSL mg/kg	SB09 (7.0) mg/kg	SB10 (7.0) mg/kg	SB11 (7.0) mg/kg	SB12 (7.0) mg/kg	SB13 (7.0) mg/kg
1,3,5-Trinitrobenzene	1.8E+3*	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-Dinitrobenzene	6.1*	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,6-Trinitrotoluene	31	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-Dinitrotoluene	1.2E+2	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-Dinitrotoluene	61*	<0.5	<0.5	<0.5	<0.5	<0.5
2-Amino-4,6-Dinitrotoluene	NE	<0.5	<0.5	<0.5	<0.5	<0.5
2-Nitrotoluene	3.7E+2**	<0.5	<0.5	<0.5	<0.5	<0.5
3-Nitrotoluene	3.7E+2**	<0.5	<0.5	<0.5	<0.5	<0.5
4-Amino-2,6-Dinitrotoluene	NE	<0.5	<0.5	<0.5	<0.5	<0.5
4-Nitrotoluene	3.7E+2**	<0.5	<0.5	<0.5	<0.5	<0.5
HMX	3.1E+3	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	17	<0.5	<0.5	<0.5	<0.5	<0.5
RDX	44	<0.5	<0.5	<0.5	<0.5	<0.5
Tetryl	NE	<0.5	<0.5	<0.5	<0.5	<0.5

< - Not Detected - less than the given laboratory reporting limit
* - Not Established by New Mexico. Level given is from the EPA Region VI Human Health Specific Screening Levels.
NE - A screening level has not been established.

Table 7-19. Comparison of 1998 Confirmation Sample Results to 2006 NMED SSLs, ACA, SWMU 157
Investigation # 5
Source: ACA Report, 2007

Sample ID	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Mercury mg/kg	Selenium mg/kg	Silver mg/kg
Detection Limit	2.0	2.0	0.50	5.0	1.2 – 4.8	2.0	2.0	2.0
NMED Residential SSL	3.9	15,600	39	234*	400	23	391	391
ORC-16JUN98-S-7	ND	220	ND	27	9.5	ND	3.4	ND
ORC-16JUN98-S-8	ND	230	ND	21	150	0.33	3.7	ND
ORC-16JUN98-S-9	ND	200	3.9	20	27	ND	ND	250
ORC-16JUN98-S-10	ND	81	ND	7.4	3.7	ND	ND	ND
ORC-16JUN98-S-11	ND	270	3.6	23	60	ND	ND	ND
ORC-16JUN98-S-12	ND	250	1.0	26	15	ND	3.9	ND
ORC-16JUN98-S-13	ND	250	1.0	23	11	0.54	ND	ND
ORC-16JUN98-S-14	ND	170	ND	16	4.2	0.24	ND	ND
ORC-16JUN98-S-15	ND	240	ND	20	7.4	0.20	ND	ND
ORC-16JUN98-S-16	ND	200	ND	25	5.4	0.22	ND	3.5
ORC-16JUN98-S-17	ND	230	ND	20	2.9	ND	ND	ND
ORC-16JUN98-S-18	ND	230	ND	22	4.4	0.12	ND	ND

ND Not Detected * NMED SSL for Hexavalent Chromium

Table 7-20. Confirmation Sample Results from the ORC Landfill C, ACA, SWMU 159
Investigation # 5, 2006
Source: WTS, 2007a

Sample ID	Sample Type	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Mercury mg/kg	Selenium mg/kg	Silver mg/kg	Perchlorate µg/kg
	NMED SSL Residential	**3.9**	**15,600**	**39**	**234***	**400**	**23**	**391**	**391**	**7,800****
OSRC-0159-CS-001	confirmation	<1.00	133	1.35	19.6	17.9	<0.0400	<1.00	0.852	1.9
OSRC-0159-CS-002	confirmation	<1.00	114	1.16	17.2	15.0	<0.0400	<1.00	0.961	0.53J
OSRC-0159-CS-003	confirmation	<1.00	<1.00	1.09	10.9	14.5	<0.0400	<1.00	<0.200	0.44J
OSRC-0159-CS-103	confirmation	<1.00	108	1.33	18.1	16.3	<0.0400	<1.00	0.741	1.5
OSRC-0159-CS-004	confirmation	<1.00	198	0.922	14.9	11.1	<0.0400	<1.00	<0.200	1.5
OSRC-0159-CS-005	confirmation	<1.00	168	1.27	19.8	17.3	<0.0400	<1.00	<0.200	2.1
OSRC-0159-CS-006	confirmation	<1.00	101	1.14	16.7	17.9	<0.0400	<1.00	<0.200	1.3
OSRC-0159-CS-007	confirmation	<1.00	197	1.31	19.9	18.0	<0.0400	<1.00	<0.200	1.3
OSRC-0159-CS-008	confirmation	<1.00	224	1.46	23.4	20.5	<0.0400	<1.00	<0.200	1.3
OSRC-0159-CS-009	confirmation	<1.00	136	1.23	19.7	17.6	<0.0400	<1.00	<0.200	1.5
OSRC-0159-CS-010	confirmation	<1.00	235	1.45	22.7	23.0	<0.0400	<1.00	<0.200	1.3
OSRC-0159-CS-110	confirmation	<1.00	178	1.60	24.9	26.9	<0.0400	<1.00	<0.200	2.2
OSRC-0159-CS-011	confirmation	<1.00	162	1.47	22.5	22.7	<0.0400	<1.00	<0.200	0.59J
OSRC-0159-CS-012	confirmation	<1.00	175	0.984	16.0	12.8	<0.0400	<1.00	<0.200	2.2
OSRC-0159-CS-015	overburden	<1.00	<1.00	<0.500	<1.00	<1.00	<0.0400	<1.00	<0.200	0.87J
OSRC-0159-CS-016	overburden	<1.00	200	1.70	16.8	14.5	<0.0400	<1.00	<0.200	1.5
OSRC-0159-CS-017	background	<1.00	132	1.07	17.0	12.8	<0.0400	<1.00	<0.200	1.8
OSRC-0159-CS-018	background	<1.00	111	1.17	17.8	12.2	<0.0400	<1.00	<0.200	2.0
OSRC-0159-BS-001	background	<1.00	224	0.981	13.8	12.1	<0.0400	<1.00	1.44	NA
OSRC-0159-BS-002	background	<1.00	380	1.25	18.1	14.9	<0.0400	<1.00	1.14	NA
OSRC-0159-BS-003	background	<1.00	77.2	1.01	15.3	13.0	<0.0400	<1.00	1.10	NA
OSRC-0159-BS-004	background	<1.00	117	1.52	22.9	18.7	<0.0400	<1.00	0.995	NA
OSRC-0159-FS-001	fill sample	<1.00	140	0.954	16.9	12.1	<0.0400	<1.00	<0.200	NA
OSRC-0159-FS-002	fill sample	<1.00	190	1.12	18.3	13.7	<0.0400	<1.00	<0.200	NA
OSRC-0159-FS-003	fill sample	<1.00	163	0.934	16.3	10.9	<0.0400	<1.00	<0.200	NA
OSRC-0159-FS-004	fill sample	<1.00	163	0.846	15.1	10.0	<0.0400	<1.00	<0.200	NA
OSRC-0159-FS-005	fill sample	<1.00	138	0.848	15.7	11.3	<0.0400	<1.00	<0.200	NA
OSRC-0159-FS-006	fill sample	<1.00	159	1.04	17.8	12.1	<0.0400	<1.00	<0.200	NA

Notes: * NMED SSL for Hexavalent Chromium. ** NMED SSL Not Established. EPA Region VI Human Health Medium Specific Residential Screening Level given. NA Not Analyzed

Table 7-21. Comparison of 1998 Confirmation Sample Results to 2006 NMED SSLs, SWMU 158, LDU-19 Investigation # 6

Source: Radjan 1998 and WTS 2007b

Sample ID	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Mercury mg/kg	Selenium mg/kg	Silver mg/kg
Detection Limit	2.0	2.0	0.50	5.0	1.2 – 4.8	2.0	2.0	2.0
NMED Residential SSL	3.9	15,600	39	234*	400	23	391	391
ORC-16JUN98-S-29	ND	240	ND	20	3.8	0.31	ND	ND
ORC-16JUN98-S-30	ND	220	ND	20	8.2	0.31	ND	ND
ORC-16JUN98-S-31	ND	260	ND	21	4.9	0.52	ND	ND
ORC-16JUN98-S-32	ND	260	ND	25	ND	0.92	ND	ND
ORC-16JUN98-S-33	ND	230	ND	22	5.7	0.19	ND	ND
ORC-16JUN98-S-34	ND	230	ND	24	3.7	0.15	ND	ND
ORC-16JUN98-S-35	ND	250	1.3	24	8.2	0.13	ND	ND
ORC-16JUN98-S-36	ND	260	ND	22	1.4	0.29	ND	ND
ORC-16JUN98-S-37	ND	200	ND	21	3.2	0.10	ND	ND
ORC-16JUN98-S-38	ND	230	ND	26	ND	0.53	ND	ND
ORC-16JUN98-S-39	ND	290	ND	29	ND	0.18	ND	ND
ORC-16JUN98-S-40	ND	250	ND	28	ND	0.14	3.3	ND
ORC-16JUN98-S-41	ND	260	ND	22	4.6	0.16	ND	ND
ORC-16JUN98-S-42	ND	270	ND	24	ND	0.11	4.2	ND

Notes: ND Not Detected * NMED SSL for Hexavalent Chromium

Appendix 7C

SWMUs 157, 158 and 159
Correspondence

October 24, 2007

NMED

Approval of Accelerated Corrective Action Report

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

RON CURRY
Secretary

CINDY PADILLA
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

October 24, 2007

T.A. Ladd
U.S. Army Garrison White Sands
100 Headquarters Avenue (B. 1510)
ATTN: IMSW-WSM-PW
White Sands Missile Range, NM 88002

RE: **APPROVAL OF THE ACCELERATED CORRECTIVE ACTION COMPLETION REPORT FOR OSCURA RANGE CENTER LANDFILLS A (SWMU 157) & C (SWMU 159) WHITE SANDS MISSILE RANGE EPA ID NO. NM2750211235 WSMR-07-003**

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has completed its review of the Department of the Army's (the Permittee) *Accelerated Corrective Action Completion Report for Oscura Range Center Landfill A (SWMU 157) and Landfill C (SWMU 159)* (the Report), dated June 2007. All the waste was removed from both landfills and confirmation soil sampling demonstrated that no residual constituents were detected above residential New Mexico Soil Screening Levels. Landfill C was backfilled with clean fill, returned to contour, and re-vegetated. Landfill A was backfilled and vegetation was allowed to re-establish itself at the site. NMED hereby approves the Report. The Permittee must submit a petition for corrective action complete status for SWMUs 157 and 159.

If you have any questions regarding this letter, please contact Cheryl Frischkorn of my staff at (505) 476-6058.

Sincerely,

John E. Kieling
Program Manager
Permits Management Program
Hazardous Waste Bureau

cc: J. Kieling, NMED HWB
D. Cobrain, NMED HWB
C. Frischkorn, NMED HWB
Jose Gallegos, WSMR

File: WSMR 2007 and Reading File
WSMR-07-003

April 15, 2008

NMED
SWMU 158 Closure Verification

WSMR Environment & Safety Tech Lib
2 8800 00027785 6

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary

JON GOLDSTEIN
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

April 15, 2008

T.A. Ladd
U.S. Army Garrison White Sands
100 Headquarters Avenue (B. 1510)
ATTN: IMSW-WSM-PW
White Sands Missile Range, NM 88002

RE: CLOSURE VERIFICATION
FORMER OSCURA RANGE CENTER LANDFILL B
SOLID WASTE MANAGEMENT UNIT (SWMU) 158
WHITE SANDS MISSILE RANGE
EPA ID NO. NM2750211235

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has received and reviewed all required closure certification documentation submitted by the Department of the Army (the Permittee) concerning former Oscura Range Center Landfill B (SWMU 158). NMED acknowledges the Permittee's closure certification statement contained in the *Closure Report for Oscura Range Center Landfill "B" (SWMU 158)(LUU-19)* (Closure Report), dated June 2007. NMED has concluded that the Certification of Closure and the survey plat (Appendix B of the Closure Plan) for SWMU 158 satisfies the closure requirements specified in 40 CFR 265.115 and 40 CFR 265.116, respectively.

NMED staff visited the former Oscura Range Center Landfill B (SWMU 158) to verify closure of the permitted unit on March 26, 2008. NMED has determined that the inspection of the

former landfill and the photographs provided by the Permittee sufficiently demonstrate the current condition of the unit. Based on this information, NMED has confirmed the Permittee's completion of closure of the former Oscura Range Center Landfill B (SWMU 158).

If you have any questions please call Cheryl Frischkorn of my staff at 505-476-6058.

Sincerely,

John E. Kieling
Program Manager
Permits Management Program
Hazardous Waste Bureau

cc: D. Cobrain NMED HWB
C. Frischkorn, NMED HWB
Jose Gallegos, WSMR
File: WSMR 2008 and Reading File

Cazares, Karen Mrs CTR USA IMCOM

From: Gallegos, Jose A Mr CIV USA IMCOM
Sent: Tuesday, April 15, 2008 9:51 AM
To: 'fbourger@ws-tech.com'; 'wlittle@ws-tech.com'; Cazares, Karen Mrs CTR USA IMCOM; Martinez, Alice J CIV USA IMCOM; Davis, Golden F Mr CIV USA SA
Cc: Peters, Robert Mr CIV USA IMCOM; Giblin, Joel T CIV USA IMCOM; Tyler, Yvonne B Ms CIV USA IMCOM
Subject: FW: closure verification [SWMU-158; IRP Site WSMR-05 Closure Approval from NMED dated 15 Apr 08] (UNCLASSIFIED)

Attachments: Glacier Bkgrd.jpg; closure_verification_4.15.08.pdf; approval_accelerated_ca_complete_rpt_SWMUs 157&159_10.24.07.pdf

Glacier Bkgrd.jpg (3 KB) closure_verification_4.15.08.p.. approval_accelerated_ca_complete

Classification: UNCLASSIFIED

Caveats: FOUO
Handling: The message content is UNCLASSIFIED when separated from attachment.

Fred/William

Attached is the SWMU 158 closure approval from NMED. This along with NMED's 24 Oct 07 letter approving corrective action at SWMUs 157 and 159 completes restoration actions at IRP site WSMR-05. Only thing left to do is the NFA Petition (or Corrective Action Completion Petition). The petition is currently planned as part of the PBA contract.

Karen/Alice/Bill

You should already have the Oct 07 letter in your files (emailed 25 Oct 07). I attached the letter for your reference. Please file the 15 Apr 08 letter in your files as well.

Thx
Jose

-----Original Message-----
From: Frischkorn, Cheryl, NMENV (mailto:cheryl.frischkorn@state.nm.us)
Sent: Tuesday, April 15, 2008 9:21 AM
To: Gallegos, Jose A Mr CIV USA IMCOM
Cc: Cobrain, Dave, NMENV; Kieling, John, NMENV; Martinez, Cynthia, NMENV
Subject: closure verification (SWMU-158; IRP Site WSMR-05 Closure Approval from NMED dated 15 Apr 08)

Jose.....this will be in the mail today. Call with any questions.

Cheryl Frischkorn
HWB-RCRA Permits Management Program
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505
PHONE: 505.476.6058
MAIN PHONE: 505.476.6000
FAX: 505.476.6030

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Classification: UNCLASSIFIED
Caveats: FOUO

8. SWMU 167: Malpais Site

8.1 Summary

During a 1999 WSMR Range-wide aboveground storage tank (AST) survey, a leaking diesel AST was identified at the Malpais site. The tank capacity was approximately 2,000 gal. Once identified, the NMED Chief of the Groundwater Protection and Remediation Bureau was notified on February 3, 1999 of the release in accordance with Chapter 6.2, Section 1203 of Title 20 in the New Mexico Code. The AST had not been in use for approximately 10 years when it was discovered in 1999.

A *Soil and Preliminary Groundwater Investigation* (MEVATEC, 1999b) identified significant concentrations of diesel in the subsurface at two Malpais site locations, one beneath the AST and the other beneath the north end of the product lines. Based on the results of this investigation, WSMR proposed the removal of source area soils with a TPH concentration above 1,000 mg/kg, which met abatement requirements set forth in NMAC, Chapter 6, Part 2, Section 4103 A & B. The site was added to the WSMR HSWA Corrective Action Module of the RCRA Part B Permit (Federal ID No. NM2750211235) as SWMU 167 by the NMED Hazardous Waste Bureau in June 2000.

Following the previous investigations, the NMED required that an evaluation of Methyl tert butyl ether (MTBE) and lead be performed at the site. A RFI was performed in 2002. The *RCRA Facility Investigation* (RFI) Report (MEVATEC, 2002a) indicated that diesel was the only petroleum product released at SWMU 167. No MTBE was detected in any samples. The distribution of diesel in the subsurface was concentrated beneath the former AST location and a likely former generator location at the north end of the product lines, which was consistent with the findings of previous investigations. The RFI also indicated that diesel contamination had not impacted groundwater at the Malpais site. No dissolved organics were detected in groundwater at the site, and the groundwater is not potable due to high salinity. The human health risk assessment noted that since concentrations in both soil and groundwater at the Malpais site do not exceed Tier I risk based screening levels (RBSL), no further action was recommended. Similarly, the ecological risk assessment indicated a low risk to the environment. The RFI report recommended remediation of soils in the immediate vicinity of each release site with a TPH remediation level of 5,000 ppm based on 1993 New Mexico Oil Conservation Division guidelines.

Following completion of the RFI, WSMR proceeded with remediation of SWMU 167 as a voluntary corrective action (VCA) in order to expedite closure of the site. The New Mexico Environment Department (NMED) was officially notified of WSMR's intent and provided with the *Work Plan for the Voluntary Corrective Action at the Malpais Site on White Sands Missile Range* in March 2004. A cleanup criterion of 880 mg/kg TPH-DRO was established based on the NMED's TPH Screening Guidelines (NMED, 2003) for residential exposure to diesel #2. Contaminated soil was excavated from both areas impacted by releases at the site and disposed of offsite. Following collection of confirmation samples ensuring that the cleanup criterion was met, the excavations were backfilled with clean fill. A VCA Report submitted to NMED on September 2004 for soil removal and other related field activities, summarized the soil excavation activities at the two identified release areas. Based on the results of the program, No Further Action was proposed.

On January 24, 2006, the NMED approved the VCA report and required no further investigation at the Malpais site. The NMED response indicated that SWMU 167 was eligible for NFA determination and that WSMR must submit a separate petition for a Class 3 permit modification request to remove SWMU from its permit (Appendix 8C, pg. 8C-6).

8.2 Site Description and Operational History

8.2.1 Site Description

The Malpais site (SWMU 167) served as a support installation for WSMR's ongoing military mission. SWMU 167consisted of a diesel AST located approximately 40 miles northwest of Alamogordo, NM on the northeastern portion of the Range along the southern edge of the Malpais lava flow (Figure 8-1 Appendix 8A, page 8A-1). The SWMU 167 site plan is provided in Figure 8-2 (Appendix 8A, Page 8A-2). The diesel AST and associated product line were likely used to provide fuel for a field generator (Photograph 8-1 Appendix 8A, pg 8A-6). With technological advances and a shift at WSMR to the use of mobile support facilities, the need for the site ceased and was abandoned in approximately 1989.

8.2.2 Operational History

Prior to 1989, the former AST at SWMU 167 was reportedly used to fuel field equipment and a site generator. During a WSMR Range-wide survey, the AST at

Malpais was observed to have leaked. The NMED was notified following the discovery and the AST contents, the AST, concrete pedestals and product lines were removed in February 1999. The site was added to the HSWA Corrective Action Module of the RCRA Part B Permit (Federal ID No. M2750211235) as SWMU 167 by the NMED HWB in June 2000.

8.3 Land Use

8.3.1 Current

SWMU 167 is currently an abandoned site with no foreseeable future use. However, the land surrounding the site is actively used for WSMR's military missions. The AST and associated product lines were removed in 1999 and impacted soil was removed in 2004. The excavated area was backfilled with clean fill.

8.3.2 Future/Proposed

There are no future land uses proposed for the Malpais Site. However, WSMR is an integral part of the defense system of the United States; therefore, the Range will remain active for the foreseeable future.

8.4 Investigative Activities

8.4.1 Summary

Environmental investigations at the site detected the presence of several typical diesel fuel constituents and delineated two distinct release areas. These investigations did not show that contamination had spread to the groundwater, which was located as shallow as 26 ft bgs at the time of the initial investigations in 1999. Following completion of a RFI, WSMR proposed to remediate the site as a VCA. This option was selected to expedite closure of the site, as investigations did not describe a complex spill scenario and an obvious remedy was available.

8.4.2 Investigation #1: Source Removal and Initial Characterization (MEVATEC, 1999b)

8.4.2.1 *Non-sampling Data Collection*

Following the identification of the AST release, the AST contents (approximately 450 gal of diesel), the AST, associated concrete pedestals, and approximately one cubic yard of contaminated surface soil were removed on February 3, 1999. The ground surface in the area of excavation was covered with surrounding soil until further investigation was completed. On February 18, 1999, the product lines from the AST were removed.

8.4.2.2 *Sampling Data Collection*

Following removal of the AST and product lines, a series of hand auger investigations was conducted to identify the extent of the release. Characterization samples were collected starting at the apparent points of release then proceeded away from these points in the cardinal directions. Each hand augered boring was completed to a depth beneath identifiable contamination or refusal. Seven locations were advanced as part of this initial investigation in the vicinity of the former tank (Center, North, South, East, East-1, East-2, and West) (Figure 8-2, Appendix 8A, pg 8A-2). Soil samples were collected at approximate 5-ft intervals in each boring for TPH analyses using EPA Method 8015 modified for DRO. Based on the results, the horizontal extent of the release was determined to be 12 ft to 15 ft in all directions from the former tank. The vertical extent was not fully defined.

Following removal of the product lines in February 1999, three confirmatory samples (L-S, L-C, and L-N) were collected from approximately 2 ft beneath the former product lines for TPH-DRO analyses (Figure 8-2, Appendix 8A, p. 8A-2). To further delineate the contamination at the north end of the product lines, a total of 10 hand auger borings (L-center, L-north, L-north-2, L-North-3, L-east, L-east-2, L-south, L-south-2, L-west, and L-west-2) were advanced in March 1999.

8.4.2.3 *Data Gaps*

The vertical extent of contamination was not fully defined by the preliminary hand auger investigations. In addition, there was no available information on the depth to groundwater or groundwater quality at the site.

8.4.2.4 *Results and Conclusions*

The preliminary hand auger investigations identified releases of diesel fuel at the location of the former AST and at the north end of the product line. Concentrations of TPH-DRO in soil beneath the former tank ranged from 6 mg/kg to 10,000 mg/kg (Center, depth 14.5-15.0 ft). TPH-DRO was present in soils beneath the tank above 100 mg/kg at 24-25 ft bgs. Concentrations of TPH-DRO in soil beneath the north end of the former product lines and former generator ranged from 5 mg/kg to 17,100 mg/kg (L-north-2, depth 4.0-4.5 ft). TPH-DRO was present in soil at 6,360 mg/kg at 14.5-15.0 ft bgs in the center of the contamination at the north end of the product lines. The results of this investigation are provided in Tables 8-1, 8-2 and 8-3 (Appendix 8B, pgs. 8B-1 – 8B-2). Based on these results, it was determined that additional investigation using a drill rig was required to determine the vertical extent of contamination.

8.4.3 Investigation #2: Soil and Preliminary Groundwater Investigation (MEVATEC, 1999b)

8.4.3.1 *Non-sampling Data Collection*

Prior to initiating the drilling investigation in May 1999, utility and UXO clearances were performed. Once the locations for SB-01 through SB-04 were selected, a level loop and level rod were used to determine ground surface elevation relative to the concrete foundation of Building 31152, which was assumed to be 100 ft. The piezometers were used only to determine the potentiometric surface at the site (i.e., no soil or groundwater samples were collected).

A WSMR Biologist completed surveys to evaluate erosion potential at the proposed soil borings locations at the Malpais Site. Based on the site conditions, investigation activities were not anticipated to increase the erosion potential of the site and the minimal disturbance associated with the soil borings was expected to naturally attenuate through re-colonization of plants and soil deposition.

A qualitative evaluation of potential exposure pathways was provided. Based on the data and site conditions, the report concluded that the soil, groundwater, surface water, and air pathways were all considered incomplete.

8.4.3.2 *Sampling Data Collection*

A phased approach was used for the investigation of SWMU 167. Four soil borings (SB-01 through SB-04) were completed for the installation of piezometers (31152-SB-01 through 31152-SB-04) at 90 degree angles to and approximately 200 yards from the former tank location. The piezometers were used only to determine depth to groundwater and groundwater gradient; no soil or groundwater samples were collected from the piezometer locations.

Following completion of the piezometers, five soil borings were advanced at the former AST location (31152-SB-05 through 31152-SB-09) and five were advanced at the north end of the former product line (31152-SB-10 through 31152-SB-14). All borings were completed to approximately 25 ft bgs. Soil borings SB-05 and SB-10 were completed in the center of each release site and were used to collect grab groundwater samples directly from the interior of the augers (31152-SB-05-GB and 31152-SB-10-GB). The remaining borings were located at the suspected outer edges of the contamination. Soil samples were collected at five-foot intervals in each boring for chemical analysis. Once the potentiometric surface was defined and the approximate extent of diesel contamination was identified, an upgradient monitor well (MW-01) was completed north of the release area to evaluate groundwater quality. Soil collected from soil borings SB-05 through SB-14 and groundwater grab samples collected from the boreholes for SB-05 and SB-10 were analyzed for TPH-DRO concentrations using EPA Method 8015. Groundwater samples collected from upgradient well MW-01 were analyzed for conventional groundwater quality parameters.

8.4.3.3 *Data Gaps*

No gaps in the analytical data were reported.

8.4.3.4 *Results and Conclusions*

Data obtained from the piezometers indicated that groundwater beneath SWMU 167 was encountered at approximately 24.3 to 27.9 ft bgs. Analysis of potentiometric data showed that groundwater flow at the Malpais site is to the south-southeast with hydraulic gradient estimates ranging from 0.028 to 0.032 ft/ft.

As indicated in Table 8-4 (Appendix 8B, pg. 8B-3), elevated TPH were detected to a depth of 15 ft bgs in 31152-SB-05 (4,400 mg/kg) located in the center of the release area beneath the former tank and to a depth of 15 ft bgs in 3112-SB-10 (7,900 mg/kg) located in the center of the release area beneath the north end of the former product lines. No TPH were detected in the other borings near or around the former AST or former product lines.

No TPH were detected in groundwater collected from the SB-10 borehole, and TPH were detected at a concentration of 0.7 mg/L in groundwater collected from the SB-05 borehole. However, groundwater collected from a soil boring is not representative of true groundwater conditions and is not considered valid data for purposes of characterization.

Results for the analysis of groundwater from background well 31152-MW-01 are presented in Table 8-5 (Appendix 8B, pg 8B-3). The results of the groundwater analysis indicate that the groundwater beneath the site is of poor quality (TDS 16,000 mg/L). The report stated that since TDS concentrations are above 10,000 mg/L, the sample results were not subject to the numerical water quality standards of 20 NMAC 6.2.3103. However, other federal and state requirements for protection of human health and the environment did apply, including the prohibition on deliberate contaminant releases to waters with TDS concentrations greater than 10,000 mg/L.

Based on investigation results, it was concluded that diesel contamination at the site is generally located beneath the former tank location and beneath the north end of the product lines. Diesel contamination in soil was detected between the ground surface and approximately 17.5 ft bgs. A low detection of TPH-DRO was identified in groundwater from the borehole beneath the center of the release area for the former AST site. However, the detection of TPH in groundwater from the borehole was attributed to cross contamination during drilling.

Based on the data and site conditions, the report concluded that the soil, groundwater, surface water, and air pathways were all considered incomplete. In addition, two remedial alternatives were considered, natural attenuation and source removal. Removal of the source area was recommended as the most feasible and rational alternative. The report recommended the removal of all soil with TPH concentrations exceeding 1,000 mg/kg.

8.4.4 Investigation #3: Follow-Up Investigation and Groundwater Sampling (MEVATEC, 2001)

A follow-up investigation was conducted in February and April 2001. The purpose of this follow-up investigation was to install a monitor well (31152-MW-02) downgradient of the release area and to advance three additional soil borings (31152-SB-15, 31152-SB-16, and 31153-SB-16) at locations most likely to be representative of the highest diesel contamination (Figure 8-3, Appendix 8A, pg 8A-3). The investigation provided supplemental data used for the development of a RFI Work Plan that was entitled *Work Plan for RCRA Facility Investigation at the Denver and Malpais Sites on White Sands Missile Range* (MEVATEC, 2001).

8.4.4.1 *Non-sampling Data Collection*

There was no non-sampling data collection for this event.

8.4.4.2 *Sampling Data Collection*

In February 2001, a down-gradient monitor well (MW-02) and three additional soil borings (SB-15, SB-16, and SB-17) were completed for this investigation (Figure 8-3, Appendix 8A, pg 8A-3). Subsurface soil samples were collected from each of the three soil borings. Groundwater samples were collected from up-gradient monitor well MW-01 and downgradient monitor well MW-02 in April 2001. Soil and groundwater samples were analyzed for VOCs and SVOCs using EPA methods 8260 and 8270, respectively. In accordance with an agreement between WSMR and the NMED, the analytical results for the soil samples were compared to the SSLs adjusted for a DAF of 20, as listed in the NMED's *Technical Background Document for Development of Soil Screening Levels,* dated December 18, 2000 (NMED, 2000a).

8.4.4.3 *Data Gaps*

No gaps in the analytical data were reported.

8.4.4.4 *Results and Conclusions*

Naphthalene and phenanthrene, both possible components of diesel fuel, were detected above reporting limits in soil from SB-15 through SB-17. One naphthalene concentration, 0.93 mg/kg, detected in the 9.5 to 10 ft sample from 31152-SB-15, exceeded the DAF 20 value of 0.2 mg/kg (NMED, 2000). Phenanthrene was the only

other diesel component detected in soil. None of the phenanthrene detections exceeded the DAF 20 value of 80,000 mg/kg. No organic compounds were detected in groundwater collected from MW-01 and MW-02.

The results of the site investigations indicted that diesel contamination at the site was located in two locations, beneath the former AST location and beneath the north end of the product lines. Based upon the results of soil and groundwater sampling, the extent of contamination had been determined to be from the surface to a depth of approximately 17.5 ft. Following completion of this site investigation, the NMED HWB requested that the Malpais site be evaluated for MTBE and lead.

8.4.5 Investigation #4: RCRA Facility Investigation (MEVATEC, 2002a)

8.4.5.1 *Non-sampling Data Collection*

Following the previously described site investigations, the NMED HWB requested that the Malpais site be evaluated for MTBE and lead. A RCRA Facility Investigation Work plan was prepared, submitted, and approved by NMED in November 2001 (Appendix 8C, pg.8C-1).

As detailed in the RFI report, human health and ecological risk analyses were performed following the Risk Based Decision Making Process (RBDMP) for petroleum releases, developed by the NMED. The data used for the risk analyses were collected during the 2002 RFI. More information on these risk analyses is provided in Section 8.6.

A Tier 1 evaluation for risk to human health was completed. This evaluation provided a conservative comparison of observed site contaminant concentrations to applicable RBSLs. The contaminants of concern in soil were detected at levels below Tier 1 RBSLs. No COCs were detected in groundwater. The RFI report concluded that the COC concentrations in soil and groundwater were protective of human health.

A SLERA, a site assessment checklist, and a Site Visit Report were completed to evaluate potential ecological risks for the site. Based on the information collected, the RFI report concluded that there is no reasonable potential for detrimental impact to potential ecological receptors.

8.4.5.2 *Sampling Data Collection*

Ten soil borings (SB-18 through SB-27) were advanced and sampled in February 2002 (Figure 8-4, Appendix 8A, pg. 8A-4). The borings were advanced to 25 ft bgs and soil samples were collected at each boring location at the surface and at 5 ft intervals to total depth. Since the purpose of the investigation was to characterize the release for MTBE and lead, these borings were located within the former AST release area and within the release area at the north end of the former product lines (former generator location), near previous boring locations. Two additional downgradient monitor wells (MW-03 and MW-04) were also installed as part of the RFI. In April 2002, groundwater samples were collected from the two newly installed wells and the existing up-gradient well (MW-01) and downgradient well (MW-02).

Soil samples were analyzed for VOCs (including MTBE), SVOCs (including phenanthrene and naphthalene, which were detected during the previous investigation), RCRA metals (including lead), and TPH-DRO. Groundwater samples were analyzed for total and dissolved RCRA metals (including lead), VOCs (including MTBE), SVOCs, TPH-DRO, and standard groundwater physical parameters and dissolved anions.

8.4.5.3 *Data Gaps*

No data gaps were reported.

8.4.5.4 *Results and Conclusions*

The analytical results for soils are summarized in Tables 8-6 through 8-10 (Appendix 8B, pgs 8B-4 through 8B-10). As indicated in the previous investigations, the borings located in the center of the two release areas had the highest concentrations of detected TPH-DRO. Soil data collected from SB-21, located at the center of the area under the former AST, showed concentrations of TPH-DRO at 14,000 and 12,000 ppm for samples collected at 4-6 ft bgs and 9-11 ft bgs, respectively. Data from adjacent boring SB-20 indicated elevated concentrations of TPH-DRO in soil samples collected between 4 ft and 16 ft bgs, and data from SB-18 indicated elevated concentrations of TPH-DRO in soil samples collected between 4 ft and 11 ft bgs. Data from SB-25 at the center of the release near the former generator, showed concentrations of TPH-DRO of 12, 000 and 11,000 ppm in soil samples collected from 4 to 6 ft bgs and 9 to 11 ft bgs, respectively. Data collected from SB-23 and SB-26 also indicated elevated

concentrations of TPH-DRO for soil samples collected from intermediate depths. No MTBE detections were identified in any soil samples. Very low concentrations of common laboratory contaminants (acetone and methylene chloride) were detected in most samples. Two phthalates (bis[2-ethylhexyl]phthalate and di-n-butylphthalate), also common laboratory contaminants, were frequently detected at low levels. Generally, soil samples with high diesel concentrations also had elevated concentrations of SVOCs and low concentrations of VOCs. Impacted soils at the former AST were from borings SB-18, SB-20, and SB-21, and impacted soils at the former generator location were from borings SB-23, SB-25, and SB-27.

The report concluded that no data collected in the areas with the highest diesel contamination (SB-21 and SB-25) exceeded NMED SSLs for Industrial/Occupational Soils (NMED, 2000a). Detected concentrations of RCRA metals and organics were compared to the screening levels and were all below Industrial/Occupational Soil screening levels.

Detected constituent concentrations in soil were also compared to the DAF-20 in order to evaluate the potential for contaminant migration to groundwater. Lead concentrations were consistently detected above the DAF 20 screening level of 0.2 mg/kg. The report concluded that detections of lead did not positively correlate with high concentrations of diesel. It was determined that the detected lead concentrations were not deposited with fuels and that they represented native conditions.

Naphthalene was detected at concentrations of 1,300 to 6,400 µg/kg in soil collected at SB-24. This exceeds the 0.2 mg/kg (200 µg/kg) DAF 20 screening level. Pyrene was detected above the DAF 20 screening level of 0.6 mg/kg (600 µg/kg) in soil samples collected from SB-26. The report concluded that both naphthalene and pyrene are possible components of diesel and are not indicative of the release of a hazardous waste.

DRO were detected in only one of the four groundwater wells. MW-04 had a concentration of 0.27 mg/L, which is just above the detection limit of 0.25 mg/L. MW-02, the closest downgradient well to the release, had no detections of DRO. No other VOCs or SVOCs associated with diesel were detected in groundwater at the site. Acetone and methylene chloride were detected in groundwater at the site, but these constituents were also detected in the field blank, and methylene chloride was detected in both trip blanks.

The RFI report concluded that the contamination is primarily concentrated beneath the former AST and generator. The report also indicated that although significant concentrations of TPH-DRO, as high as 14,000 ppm, were present in soil, diesel contamination had not impacted groundwater. Further, groundwater beneath the site is non-potable and is not usable for livestock due to its high salinity (18,000 to 39,000 ppm TDS).

As discussed in Section 8.6, human health and ecological risk analyses were performed using the RBDMP for petroleum releases. A NMED Tier 1 evaluation was performed for each of the contaminated portions of the site. All of the soil and groundwater data used for the analyses were collected during the 2002 RFI. For the human health evaluation, all resident and child adult pathways were determined to be incomplete. In addition, all exposure scenarios for commercial workers were incomplete. The groundwater ingestion pathway was also determined to be incomplete because no drinking or irrigation water wells were located within a 20-mile radius of the site. The only complete exposure pathway identified for groundwater was a construction worker working outdoors at a 15-ft excavation depth who could inhale vapors from contaminated groundwater (even though no VOCs were detected above their detection limits). Construction workers could also be exposed to contaminated subsurface soil during site cleanup activities. Therefore, the “soil ingestion, inhalation, and dermal contact” pathway was also determined to be complete. All off-site pathways were incomplete.

Representative concentrations were calculated for comparison to the RBSLs. None of the representative constituent concentrations in soil or groundwater exceeded the RBSLs. Therefore, there were no risks associated with exposure to site soils or groundwater via the potentially complete exposure pathways. In addition, the ecological risk analysis determined that there was no reasonable potential for detrimental impact to potential ecological receptors due to the small size of the spills and the lack of any sensitive habitats or species of concern.

In a July 25, 2001 letter to WSMR, the NMED HWB directed that site cleanup be conducted to meet the TPH criteria in Section IV of the *Guidelines for Remediation of Leaks, Spills, and Releases* (NMOCD, 1993). Based on the scoring system in this document, a total score of zero applied to the site, which led to a recommended TPH cleanup criterion of 5,000 ppm. The RFI report indicated that, using this cleanup criterion, only a small volume of soil would need to be removed under the former tank and former generator. The report indicated that the excavations would be conducted,

confirmation samples would be collected, and that the excavations would be backfilled and graded. These proposed remediation actions would be summarized in a remedial action work plan.

In a letter dated January 12, 2004, the NMED indicated that the RFI Report was acceptable, but required WSMR to address some issues specified in an attachment to the letter in the remedial action work plan (Appendix 8C, pg. 8C-3). These issues included requirements to submit a VCA Work Plan, comparison of constituent concentrations to residential cleanup criteria, use of TPH screening levels in the NMED's 2003 guidelines, and collection of samples from the walls of the excavations in addition to the excavation floors.

8.4.6 Investigation #5: Voluntary Corrective Action (BAE, 2004a)

8.4.6.1 *Non-sampling Data Collection*

In response to the findings identified within the RFI Report, WSMR initiated a VCA to address the diesel contamination and to expedite closure of the Malpais site. NMED was notified of WSMR's intent and was provided the *Work Plan for the Voluntary Corrective Action at the Malpais Site on White Sands Missile Range* (BAE, 2004a) in March 2004. The work plan outlined the approach for excavation of the two spill areas, abandonment of monitoring wells and piezometers, disposal of contaminated soils and collection of confirmation samples, and backfilling of the excavations.

Prior to initiating the field work, a cultural resource specialist conducted a site visit to ascertain the presence or absence of any archaeological features that would require special considerations for protection during field work. No features of cultural concern were identified and the survey report (included as an Appendix in the 2004 VCA Report) recommended that a determination of no effect be made. The report for the 2002 ecological survey that was performed by natural resource specialists to identify the presence of any threatened or endangered species or sensitive habitats in the vicinity of the site was included as an Appendix to the 2004 VCA report. None of the ecological elements investigated in 2002 were identified at the site.

A portable global positioning system (GPS) unit was used to locate the previously determined center of the two release areas (beneath the former AST and at the northwestern end of the former product lines where a generator was presumably staged) and to delineate the lateral boundaries of excavation, based on interpolation of

the results of previous investigations. Physical observations of soil, engineering judgment of the on-site supervisor, and the expertise of the excavation foreman were used to guide decisions to extend the excavations. A figure showing the approximate extent of excavations at the site is provided as Figure 8-5 (Appendix 8A, pg. 8A-5). A photograph of the excavation at the northwest end of the former product lines is provided as Photograph 8-2 (Appendix 8A, pg. 8A-6).

8.4.6.2 *Sampling Data Collection*

Based on the results of characterizations from previous investigations, two zones of diesel contamination were identified for separate excavation. One beneath the former AST and one at the northwestern end of the former product lines where equipment was presumably staged. Following the most conservative exposure scenario (residential), it was decided that the most protective clean-up goal available was the removal of all soil contaminated with DRO concentrations above 880 mg/kg, based on the NMED TPH Screening Guidelines (NMED, 2003) for diesel #2.

As part of the excavation program, soil samples were taken from the bottom of each excavation at a point approximately beneath the former points of release. Samples were collected from the bottom and sides of each excavation using an excavator bucket. If sample results indicated detections exceeding 880 mg/kg of TPH DRO for either excavation, the excavation was extended an additional 5 ft in depth and/or in a lateral direction and the bottom and/or sidewall was again sampled and analyzed following the same procedure.

During the field program, excavated contaminated soil was placed on a double lined temporary staging area near the excavation. The material was promptly transferred to a more permanent bermed double lined staging area. On completion of excavation and on receipt of confirmation sampling results for soil samples collected from the base of the excavation and sidewalls, the excavation sites were backfilled using clean fill material (Photograph 8-3, Appendix 8A, pg. 8A-7). Soil samples were collected from two borrow sources for TCLP RCRA metals. After receiving WSMR approval, both borrow sources were approved for use as clean backfill.

As part of the corrective action program, the four piezometers and three downgradient monitor wells (MW-02, MW-03 and MW-04) were abandoned. The upgradient well (MW-01) was preserved for future WSMR regional groundwater monitoring.

8.4.6.3 *Data Gaps*

No gaps in the analytical data were reported.

8.4.6.4 *Results and Conclusions*

- As stated previously, a DRO cleanup goal of 880 mg/kg was established based on the 2003 NMED TPH Screening Guidelines (NMED, 2003). The excavation at the former AST was ultimately extended to a depth of approximately 27 ft bgs and the excavation beneath the northwestern end of the former supply line reached a final depth of approximately 30 ft bgs. A continuous lean clay layer was encountered at the bottom of both excavations and no evidence of further contamination of in situ soils was noted. The approximate limits of the excavation are shown on Figure 8-5 (Appendix 8A, pg. 8A-5).

- As part of the excavation program, approximately 3,500 cu yds of diesel contaminated soil was removed from the Malpais site for off-site disposal at a licensed land farming facility (DP-1051). To verify that the cleanup objective was met confirmation soil samples were taken from each excavation and submitted for laboratory analysis of TPH-DRO prior to backfilling the excavation. The results of the confirmation soil samples are presented in Tables 8-11and 8-12 (Appendix 8B, pg. 8B-12). As shown in these tables, the residual TPH in soils were well below the cleanup criterion of 880 mg/kg. Once the analytical results were obtained and reviewed, the excavations were backfilled with clean fill from one of two borrow sources off-Range. Soil samples were collected from the borrow sources for TCLP RCRA metals analysis. After receiving WSMR approval, both borrow sources were approved for use as clean backfill.

- Based on the activities conducted for corrective action and results from confirmation sampling, the VCA report proposed NFA for site related conditions.

- The proposed recommendation was based on the following:

- The majority of diesel-contaminated soil resulting from the AST and associated piping at Malpais site was removed.

- Confirmation samples taken from excavation sidewalls and floors at the points most likely to have residual contamination demonstrated that no soil contaminated above the clean-up goal of 880 mg/kg TPH-DRO remains at the site. This cleanup goal was based on the NMED-established screening level for diesel #2 under the most conservative exposure scenario (residential) and is protective of human and environmental health.

- Contaminated soil was removed for proper disposal at an offsite permitted facility and replaced with clean backfill material.

- No evidence exists to suggest that contamination ever reached the saturated zone at the site. As all contaminated material and contaminant sources have been removed, the Malpais site no longer poses a risk to any receptor.

8.5 Site Conceptual Model

8.5.1 Nature and Extent of Contamination

As determined by the previous investigations, site characterization demonstrated that the sources of contamination at the Malpais site were the diesel releases from the former AST and associated piping. Two distinct release zones were identified and delineated: one beneath the former AST and a second beneath the northwestern end of the associated piping (location of the former generator).

During the remedial investigation, 23 soil samples beneath the generator location were found to be contaminated with at least one organic compound above detection limits. Five soil samples were found to be contaminated with at least one organic compound beneath the former AST location. None of the RBDMP organic compounds were detected in groundwater at the Malpais site and none were detected in soil above the RBDMP criteria.

It was estimated during the VCA planning phase that up to 4,200 cu yds of soil at SWMU 167 could be contaminated with diesel fuel at concentrations above the clean-up level. However, as detailed within the VCA report, 3,500 cu yds of diesel contaminated soil was removed from the SWMU 167 for off-site disposal at a licensed land farming facility. The extent of excavation is provided on Figure 8-5 (Appendix 8A, pg. 8A-5). The soil cleanup criterion was established as 880 mg/kg TPH-DRO based

on the 2003 NMED guidelines for residential exposure to diesel #2. The excavations were backfilled with clean fill and graded to match the surrounding ground surface.

8.5.2 Environmental Fate

A risk assessment was performed under the RFI and serves to characterize the environmental fate of the diesel spills in relation to human and ecological receptors. This risk assessment was conducted as a Tier 1 evaluation following the RBDMP for petroleum releases, developed by the NMED (NMED, 2000b).

As indicated in the RFI Report, the only complete exposure pathways for human intake were for construction workers exposed to contaminated material during site cleanup. However, representative concentrations in both soil and groundwater at SWMU 167 did not exceed Tier 1 risk-based screening levels. There are no drinking water supply wells or irrigation wells within 20 miles of the site. The ecological risk assessment determined that there was no reasonable potential for detrimental impact to potential ecological receptors due to the small size of the spills and the lack of any sensitive habitats or species of concern.

8.6 Site Assessments

8.6.1 Human Health Screening and Risk Assessments

Following the preliminary soil and groundwater assessment in 1999, a qualitative evaluation of potential exposure pathways was completed. Based on the data and site conditions, the report concluded that the soil, groundwater, surface water, and air pathways were all considered incomplete (MEVATEC, 1999b).

Human health and ecological risk analyses were performed using the RBDMP for petroleum releases (NMED 2000b). A NMED Tier 1 evaluation was performed for each of the contaminated portions of the site. All of the soil and groundwater data used for the analyses were collected during the 2002 RFI. For the human health evaluation, all resident and child adult pathways were determined to be incomplete. In addition, all exposure scenarios for commercial workers were incomplete. The groundwater ingestion pathway was also determined to be incomplete because no drinking or irrigation water wells were located within a 20-mile radius of the site. The only complete exposure pathway identified for groundwater was a construction worker working outdoors at a 15-ft excavation depth who could inhale vapors from

contaminated groundwater (even though no VOCs were detected above their detection limits). Construction workers could also be exposed to contaminated subsurface soil during site cleanup activities. Therefore, the "soil ingestion, inhalation, and dermal contact" pathway was also determined to be complete. All off-site pathways were incomplete.

Representative concentrations were calculated for comparison to the RBSLs. None of the representative constituent concentrations in soil or groundwater exceeded the RBSLs. Therefore, there were no risks associated with exposure to site soils or groundwater via the potentially complete exposure pathways. A formal human health risk assessment was not completed for SWMU 167 since the results of the screening analyses did not exceed action thresholds. In addition, further ecological risk assessment was not warranted.

8.6.2 Ecological Screening and Risk Assessments

Following the preliminary soil and groundwater assessment in 1999, a qualitative evaluation of potential exposure pathways was completed. Based on the data and site conditions, the report concluded that the soil, groundwater, surface water, and air pathways were all considered incomplete (MEVATEC, 1999b).

A SLERA, a site assessment checklist, and a Site Visit Report were completed based on the 2002 RFI data to evaluate potential ecological risks for the site. Based on the information collected, the RFI report concluded that there is no reasonable potential for detrimental impact to potential ecological receptors due to the small size of the spills and the lack of any sensitive habitats or species of concern. A formal ecological risk assessment was not completed for SWMU 167 since the results of the screening analyses did not exceed action thresholds.

8.6.3 Other Applicable Assessments

Prior to implementation of proposed field work under the VCA program, a site visit by a cultural resource specialist was conducted to identify archaeological features that could require special considerations for protection during field work. This survey was performed by Human Systems Research, Inc. in November 2003 and identified no features of cultural concern. This survey report was included in an Appendix to the RFI report (BAE, 2004d).

8.7 No Further Action Proposal

8.7.1 Rationale

In correspondence dated January 24, 2006, the NMED approved the VCA work plan and final VCA report (Appendix 8C, pg. 8C-6). In the correspondence, the NMED stated that SWMU 167 was eligible for a NFA determination. WSMR was required to submit a separate petition to NMED for a Class 3 permit modification request to remove SWMU 167 from its permit.

The majority of diesel contaminated soil resulting from the former AST and associated piping at Malpais site was removed. The cleanup goal of 880 mg/kg TPH-DRO was based on the NMED-established screening level for diesel #2 under the most conservative exposure scenario (residential) and is protective of human and environmental health.

Contaminated soil was excavated and properly disposed at an offsite permitted facility and replaced with clean backfill material. Based on groundwater data collected downgradient of the release sites, no contamination reached the saturated zone at the site. As all contaminated material and contaminant sources have been removed, the Malpais site no longer poses a risk to any receptor.

Based on these results, application is hereby made to perform a Class III modification to remove SWMU 167 from the White Sands HSWA permit in accordance with 40 CFR 264.514 and 270.42, and 20 NMAC 4.1.

8.7.2 Criterion

SWMU 167 is proposed for NFA based on NMED NFA Criterion 5. The SWMU has been characterized and remediated in accordance with current applicable state and federal regulations, and the available data indicated that contaminants pose an acceptable level of risk under current and projected land use.

Appendices

Appendix 8A – Figures and Photographs

Appendix 8B – Analytical Results Tables

Appendix 8C - Correspondence

Appendix 8A

SWMU 167
Figures and Photographs

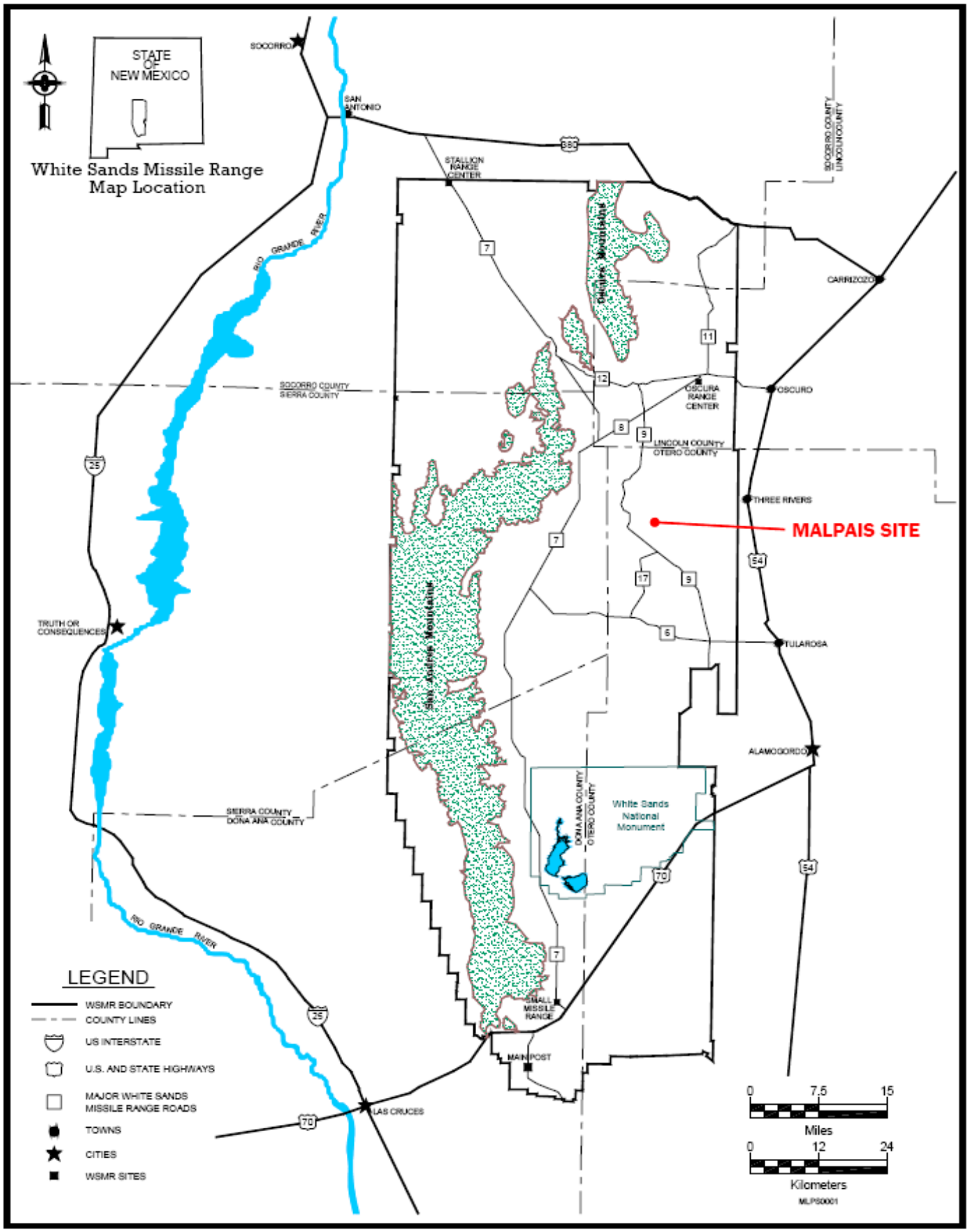


Figure 8-1 Location of the Malpais Site at WSMR

Source: BAE, 2004d

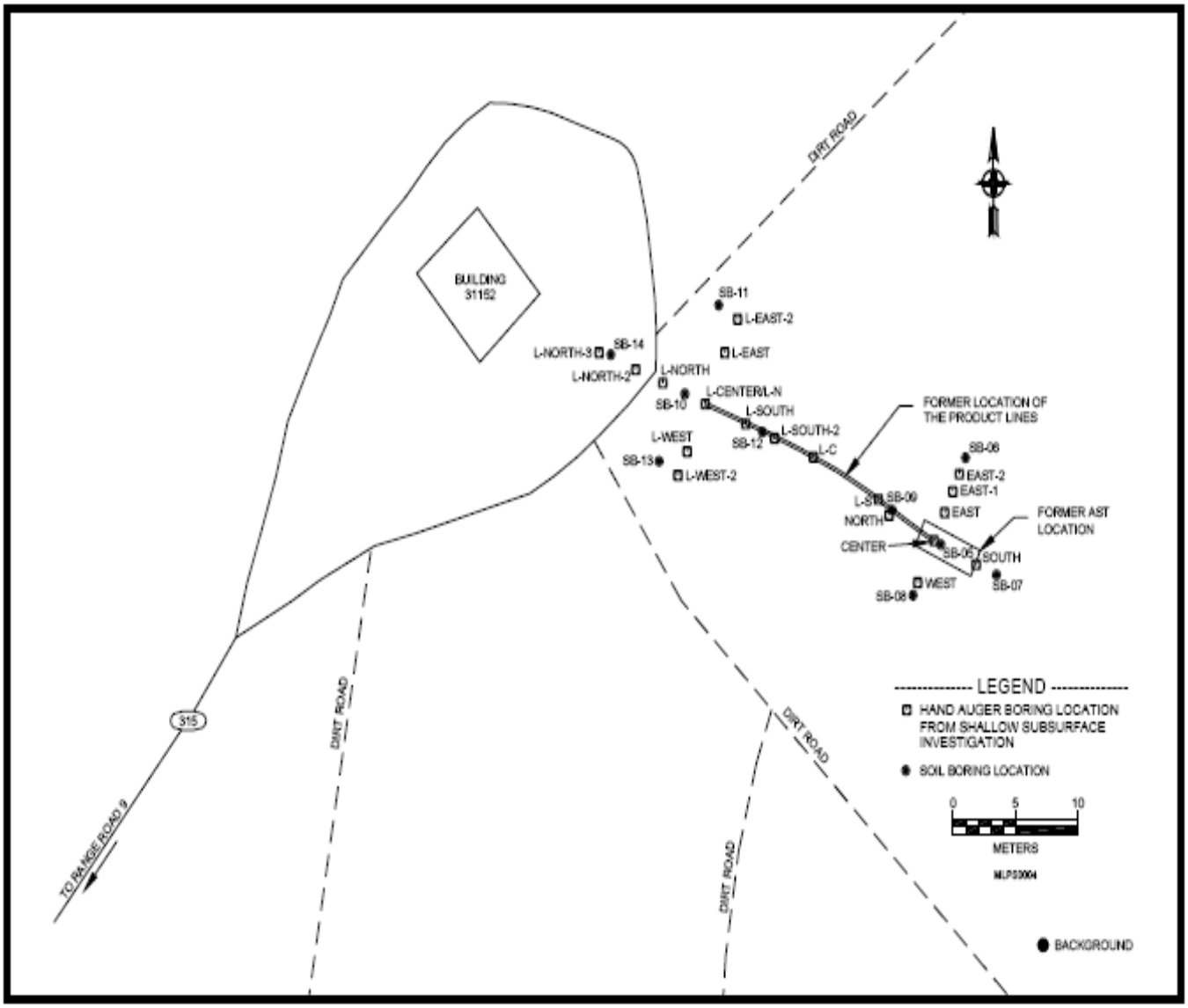


Figure 8-2 SWMU 167 Site Plan and Location of Hand Auger and Soil Borings

Source: MEVATEC, 2002a

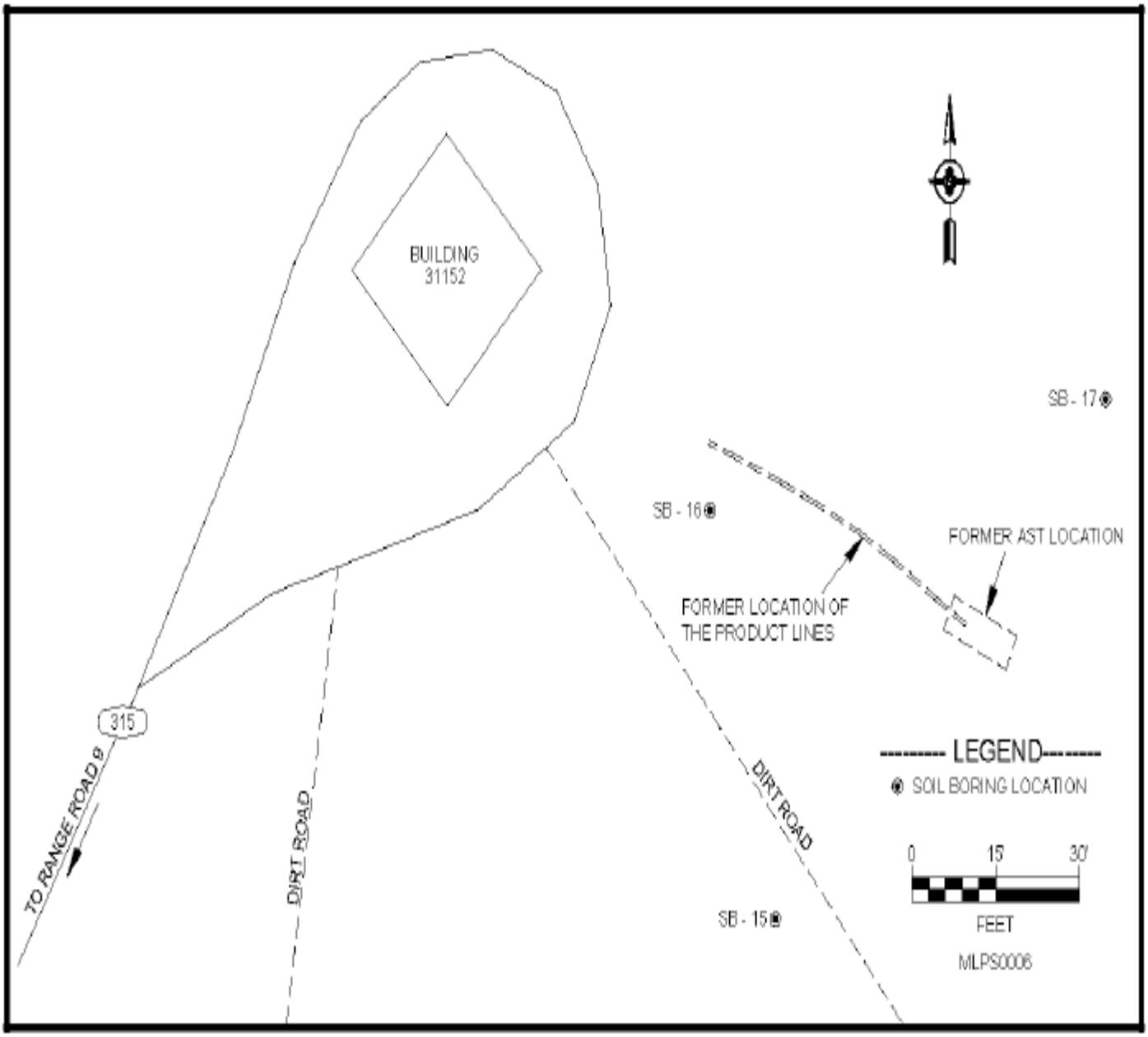


Figure 8-3 Soil Borings Installed During February 2001 Follow-Up Sampling - Malpais Site

Source: MEVATEC, 2002a

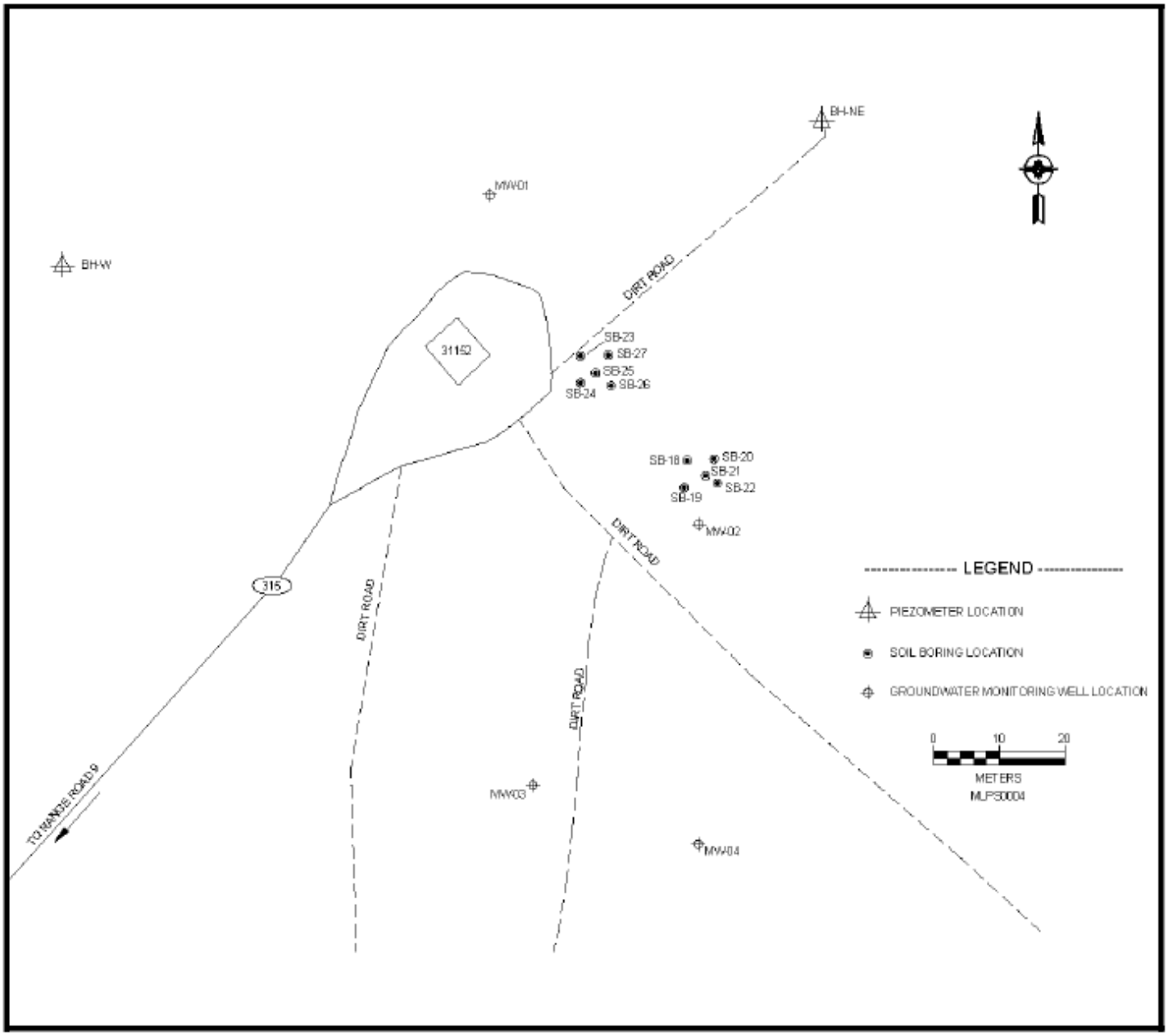


Figure 8-4 New Soil Boring and Wells Location Map - Malpais Site

Source: MEVATEC, 2002a

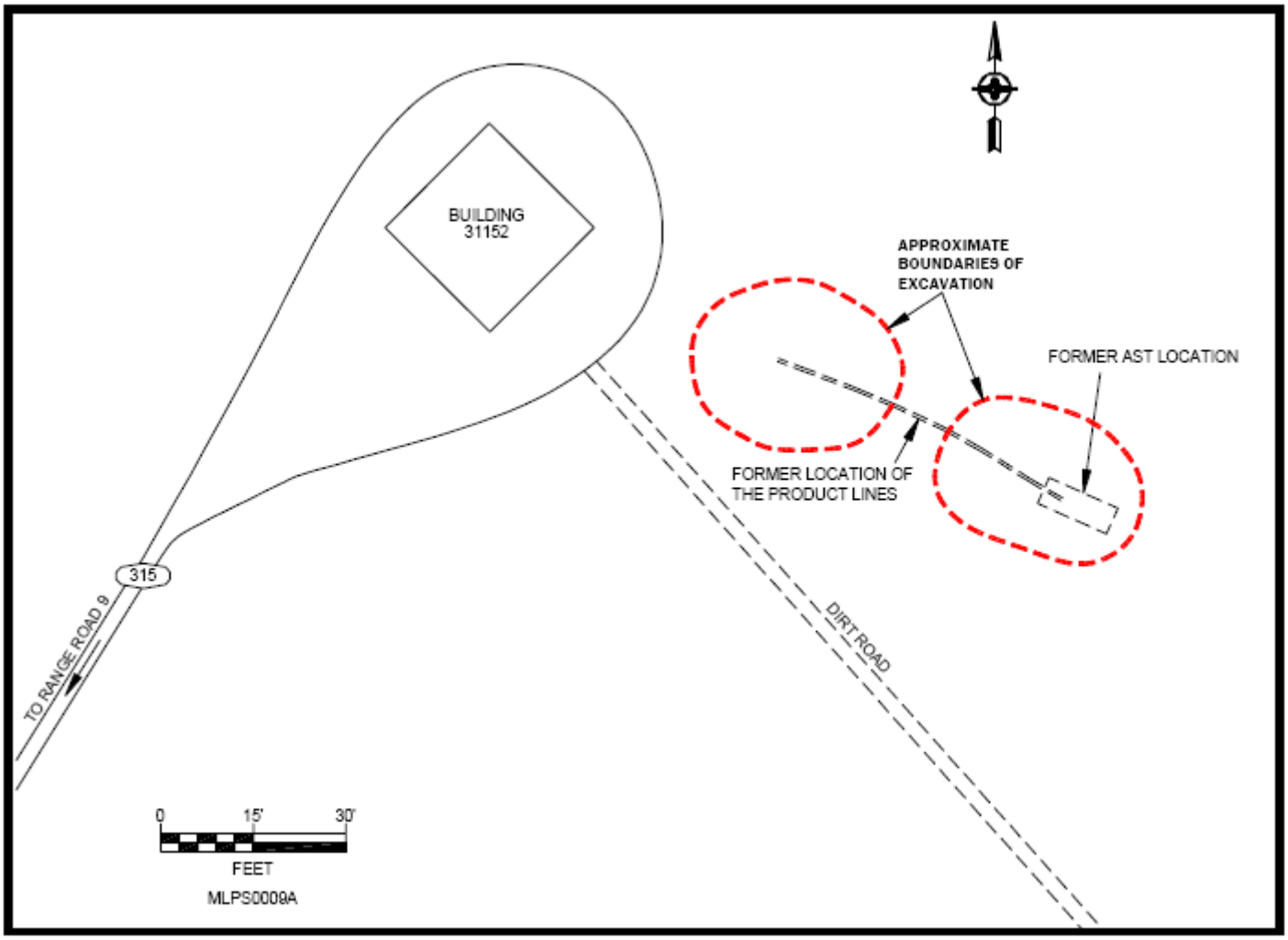


Figure 8-5 Approximate Extent of Excavations at the Malpais Site

Source: MEVATEC, 2002a

Photograph 8-1 View of the Former AST at the Malpais Site

Photograph 8-2 View of the Excavation of the NW End of the Product Line

Photograph 8-3 View of the Malpais Site Following Backfill

Appendix 8B

SWMU 167
Analytical Result Tables

Table 8-1. Investigation #1 - Diesel Range Hydrocarbons Detected below the Former AST

Source: MEVATEC, 1999b

Sample Identification	White Sands NR-MT-AA Chemistry Laboratory	
	Analytical Results mg/kg	Detection Limit mg/kg
Center Borehole		
Center, depth 2.0'-2.5'	1,030	**5**
Center, depth 4.5-5.0'	6,860	5
Center, depth 9.0'-9.5'	6,250	5
Center, depth 10.5'-11.0'	3,820	5
Center, depth 14.5'-15.0'	10,000	5
Center, depth 20.0'-20.5'	29	5
Center, depth 24.5'-25.0'	435	5
West Borehole		
West, depth 6"-12"	8	5
East Boreholes (East, East-1, & East-2)		
East, depth 6"-12"	840	5
East-1, depth 3.0'-3.5'	22	5
East-2, depth 9.5'-10.0'	23	5
East-2, depth 14.0'-15.0'	25	5
South Borehole		
South, depth 6"-12"	7	5
South, depth 9.5'-10.0'	12	5
South, depth 20.5'-21.0'	9	5
North Borehole		
North, depth 6"-12"	26	5
North, depth 4.5'-5.0'	7	5
North, depth 8.0'-8.5'	6	5

Table 8-2. Investigation #1 - Analytical results of Soil Samples Collected below the Former Product Lines

Source: MEVATEC, 1999b

Sample Identification	White Sands NR-MT-AA Chemistry Laboratory	
	Analytical Results mg/kg	Detection Limit mg/kg
L-S, depth 3.5'-4.0'	ND[1]	5
L-C, depth 3.5'-4.0'	8	5
L-N, depth 3.5'-4.0'	5,600	5

Note: [1]ND-non detection

Table 8-3. Investigation #1 - Diesel Range Hydrocarbons Detected below the North End of the Product Lines

Source: MEVATEC, 1999b

Sample Identification	White Sands NR-MT-AA Chemistry Laboratory	
	Analytical Results mg/kg	Detection Limit mg/kg
East Boreholes (L-east & L-east-2)		
L-east, depth 9.5'-10.0'	7	5
L-east-2, depth 4.5'-5.0'	10	5
L-east-2, depth 9.5'-10.0'	7	5
L-east-2, depth 14.5'-15.0'	6	5
L-east-2, depth 19.5'-20.0'	5	5
West Borehole (L-west & L-west-2)		
L-west, depth 6"-12"	6	5
L-west, depth 4.5'-5.0'	5	5
L-west, depth 9.5'-10.0'	279	5
L-west-2, depth 6"-12"	5	5
L-west-2, depth 4.5'-5.0'	5	5
L-west-2, depth 9.5'-10.0'	5	5
Center Borehole		
L-center, depth 9.5'-10.0'	352	5
L-center, depth 14.5'-15.0'	6,360	5
L-center, depth 19.5'-20.0'	6	5
L-center, depth 23.0'-23.5'	5	5
North Boreholes (L-north, L-north-2, & L-north-3)		
L-north, depth 4.5'-5.0'	13	5
L-north, depth 9.5'-10.0'	435	5
L-north-2, depth 4.0'-4.5'	17,100	5
L-north-3, depth 6"-12"	6	5
L-north-3, depth 4.5'-5.0'	8	5
L-north-3, depth 9.5'-10.0'	6	5
L-north-3, depth 14.5'-15.0'	6	5
South Boreholes (L-south & L-south-2)		
L-south, depth 4.5'-5.0'	5	5
L-south, depth 8.5'-9.0'	8	5
L-south-2, depth 6"-12"	5	5
L-south-2, depth 4.5'-4.0'	6	5

Table 8-4. Investigation #2 - Detected Diesel Range Hydrocarbons Collected from Soil Borings 05 – 014
Source: MEVATEC, 2002a

Sample Identification	Trace Analysis Inc.		White Sands NR-MT-AA Chemistry Lab	
	Analytical Results (mg/kg)	Detection Limit (mg/kg)	Analytical Results (mg/kg)	Detection Limit (mg/kg)
Soil Boring 05				
31152-SB-05-(4.5-5.0)	13,000	50	No Sample.	5
31152-SB-05-(9.5-10.0)	13,000	50	No Sample.	5
31152-SB-05-(14.5-15.0)	4,400	50	9,230	5
Soil Boring 06	**no detection above laboratory detection limits**			
Soil Boring 07	**no detection above laboratory detection limits**			
Soil Boring 08	**no detection above laboratory detection limits**			
Soil Boring 09	**no detection above laboratory detection limits**			
Soil Boring 10	**no detection above laboratory detection limits**			
31152-SB-10-(4.5-5.0)	3,500	50	No sample.	5
31152-SB-10-(9.5-10.0)	2,800	50	No sample.	5
31152-SB-10-(14.5-15.0)	7,900	50	No sample.	5
Soil Boring 11	**no detection above laboratory detection limits**			
Soil Boring 12	**no detection above laboratory detection limits**			
Soil Boring 13	**no detection above laboratory detection limits**			
Soil Boring 14	**no detection above laboratory detection limits**			

Table 8-5. Investigation #2 - Analytical Results Background Well MW-01
Source: MEVATEC, 2002a

Analytical Parameter	Trace Analysis Inc.		White Sands NR-MT-AA Chemistry Lab	
	Analytical Results (mg/L)	Detection Limit (mg/L)	Analytical Results (mg/L)	Detection Limit (mg/L)
Dissolved Metals				
Barium	<0.02	0.02	ND	0.5
Boron	0.27	0.01	Not analyzed	--
Iron	<0.003	0.003	Not analyzed	--
Lithium	<0.01	0.01	Not analyzed	--
Manganese	<0.001	0.001	Not analyzed	--
Strontium	52	0.20	Not analyzed	--
Uranium	0.0355	0.0008	Not analyzed	--
Dissolved Anion/Cations				
Alkalinaty, Total	190	5.0		
Calcium	850	1.0	2,400	1.0
Carbonate	<5.0	5.0		
Chloride	24,000	2.0	7,100	1.0
Bicarbonate	190	5.0	Not analyzed	--
Fluoride	6.2	0.2	Not analyzed	--
Magnesium	2,900	1.0	370	1.0
Potassium	120	1.0	8.0	1.0

Table 8-5. Investigation #2 - Analytical Results Background Well MW-01
Source: MEVATEC, 2002a

Analytical Parameter	Trace Analysis Inc.		White Sands NR-MT-AA Chemistry Lab	
	Analytical Results (mg/L)	Detection Limit (mg/L)	Analytical Results (mg/L)	Detection Limit (mg/L)
Sodium	13,000	1.0	2,100	1.0
Sulfate	9,600	2.0	2,100	1.0
Physical Characteristics and TPH				
Lab pH	7.6	--	6.7	--
TDS	16,000 mg/L	--	14,400 mg/L	--
TPH-DRO	<50.0 ug/L	50 ug/L	<0.1 ppm	0.1 ppm

Table 8-6. Investigation #4 - Analytical Results for Concentrations of DRO
Source: MEVATEC, 2002a

Boring	Depth – In feet					
	0.0-0.5	4.0-6.0	9.0-11.0	14.0-16.0	19.0-21.0	24.0-26.0
SB18	410	5400 D	3000 D	32 U	30 U	34 U
SB19	28 U	29 U	28 U	30 U	29 U	32 U
SB20	720 D	11000 D	7700 D	4100 D	29 U	34 U
SB21	26 U	14000 D	12000 D	290	29 U	34 U
SB22	27 U	62	880 D	29 U	30 U	29 U
SB23	27 U	8100 D	8500 D	29 U	29 U	30 U
SB24	27 U	28 U	2000 D	2800 D	29 U	30 U
SB25	28 U	12000 D	11000 D	880 D	28 U	31 U
SB26	27 U	2700 D	8600 D	28 U	30 U	28 U
SB27	31 U	27 U	29 U	30 U	28 U	30 U

LABORATORY FLAGS
D = The value reported derives from analysis of a diluted sample of the sample extract.
U = The analyst of interest was no detected to the limit of detection indicated.

Table 8-7. Investigation #4 -Summary of Detections of Metals in Soil Borings
Source: MEVATEC, 2002a

Soil Boring and Depth	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium
SB18-(0.0-0.5)	3.5	129	0.15 B	14.1	12.7	0.019 B	1
SB18-(4.0-6.0)	3.2	60.4		4.3	4.9		0.46 B
SB18-(9.0-11.0)	4.5	131		7	6.9		0.82 B
SB18-(14.0-16.0)	3.2	210	0.18 B	15.8	10.3		
SB18-(19.0-21.0)	2.7	118		12.6	9.3		1.2
SB18-(24.0-26.0)	3.1	130		20.2	16.8		0.71 B
SB19-(0.0-0.5)	4.3	154	0.27 B	19.8	14.8	0.031 B	0.7 B
SB19-(4.0-6.0)	3	64.9		4.5	5.1		0.31 B
SB19-(9.0-11.0)	2.3	118		7.6	6.5		0.62 B
SB19-(14.0-16.0)	3.7	360	0.1 B	15.8	9.4		0.68 B
SB19-(19.0-21.0)	3.9	91.6		12.4	11.6		0.5 B
SB19-(24.0-26.0)	5	82.1		17.3	24.1		1.5
SB20-(0.0-0.5)	3.1	119	0.09 B	14.2	11.2	0.015 B	0.64 B
SB20-(4.0-6.0)	2.8	66.1		4.1	4.8		

Table 8-7. Investigation #4 -Summary of Detections of Metals in Soil Borings
Source: MEVATEC, 2002a

Soil Boring and Depth	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium
SB20-(9.0-11.0)	3.3	134	0.05	7.8	6.1		0.68
SB20-(14.0-16.0)	2.7	520	0.19 B	10	5.9		0.37 B
SB20-(19.0-21.0)	2.6	79.6		10.8	9.1		0.38 B
SB20-(24.0-26.0)	2.4	46.3		36.5	11.2		1.1 B
SB21-(0.0-0.5)	1.6	81.5		7.5	8.8	0.01 B	0.7 B
SB21-(4.0-6.0)	3.3	68.8		4.4	5.3		0.82 B
SB21-(9.0-11.0)	3.7	121 *		6.6 E	6.3		0.54 B
SB21-(14.0-16.0)	3.4	159 *	0.09 B	13.3 E	10.1		0.82 B
SB21-(19.0-21.0)	3.8	94.9 *		11.1 E	10.8	0.015 B	0.64 B
SB21-(24.0-26.0)	3.2	6620 *		20.1 E	13.6		0.98 B
SB22-(0.0-0.5)	3.9	136 *	0.29 B	16.9 E	14.1	0.025 B	0.8 B
SB22-(4.0-6.0)	2	42.3 *	0.11 B	3.7 E	3.7		
SB22-(9.0-11.0)	3.5	136 *		6.5 E	5.8		0.43 B
SB22-(14.0-16.0)	4.3	248 *	0.09 B	10.1 E	8		0.48 B
SB22-(19.0-21.0)	4	79.9 *	0.08 B	12.5 E	11.8		0.34 B
SB22-(24.0-26.0)	2.9	31.7 *		9.3 E	7.4		0.56 B
SB23-(0.0-0.5)	4.2	151 *	0.37 B	19.2 E	16.2	0.032 B	0.65 B
SB23-(4.0-6.0)	3.5	83 *	0.06 B	4.7 E	5.3		
SB23-(9.0-11.0)	2.3	136 *	0.05 B	6.7 E	4.9		0.47 B
SB23-(14.0-16.0)	2.8	170 *	0.14 B	12.1 E	6.7		0.49 B
SB23-(19.0-21.0)	3.2	43.7 *		10.5 E	7.5		0.61 B
SB23-(24.0-26.0)	3.4	48.4 *		12.1 E	9.2	0.42	0.84 B
SB24-(0.0-0.5)	4.3	142	0.43 BN	18.3 E	15.9	0.026 BN	0.68 BN
SB24-(4.0-6.0)	3	66.4	0.05 BN	5.3 E	5.4		0.29 BN
SB24-(9.0-11.0)	1.5	97.2	0.14 BN	6.6 E	4.3		
SB24-(14.0-16.0)	3.1	195	0.18 BN	10.8 E	7.5		0.68 BN
SB24-(19.0-21.0)	2.7	33.6	0.14 BN	8.2 E	6.1		
SB24-(24.0-26.0)	3.4	48.8		11.4 E	8.6		0.62 BN
SB25-(0.0-0.5)	4.2	153	0.41 B	19.7	35.8	0.026 B	0.69 B
SB25-(4.0-6.0)	2.3	57.3	0.06 B	4.5	4.8		
SB25-(9.0-11.0)	2.5	99.1	0.06 B	5.5	5.2		0.61 B
SB25-(14.0-16.0)	2.5	224	0.24 B	11.4	6.7		0.46 B
SB25-(19.0-21.0)	2.3	65.7	0.16 B	6.9	6.3		0.28 B
SB25-(24.0-26.0)	3.3	42.8		17.5	9.7		1.2
SB26-(0.0-0.5)	4.2	156	0.46 N	20 E	16.4	0.024 BN	0.39 BN
SB26-(4.0-6.0)	1.8	51.7		3.8 E	4.4		
SB26-(9.0-11.0)	2.8	105	0.06 BN	5.3 E	4.8		
SB26-(14.0-16.0)	2.4	212	0.06 BN	7.4 E	5.3		0.3 BN
SB26-(19.0-21.0)	2	35.3		8.1 E	5.6		0.58 BN
SB26-(24.0-26.0)	4.8	273	0.12 BN	14.4 E	25.7		0.85 N
SB27-(0.0-0.5)	3.6	143	0.39 BN	18.8 E	26.2	0.018 BN	0.68 BN
SB27-(4.0-6.0)	2	53.1		4 E	4.7		0.36 BN
SB27-(9.0-11.0)	2.9	101		6 E	5.2		0.58 BN
SB27-(14.0-16.0)	2.4	151	0.21 BN	10.1 E	6.4		0.36 BN

Table 8-7. Investigation #4 -Summary of Detections of Metals in Soil Borings
Source: MEVATEC, 2002a

Soil Boring and Depth	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium
SB27-(19.0-21.0)	2.5	47.7	0.18 BN	7.9 E	6.3		
SB27-(24.0-26.0)	3.2	176	0.08 BN	12.8 E	8.9		0.55 BN
Field Blank		1.2 B		0.89 B			

LABORATORY FLAGS
B= The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).
N= Spiked sample recovery not within control limits.
*= Duplicate analysis within control limits. Applies to laboratory duplicate, not field duplicate.

Table 8-8. Investigation #4 - Positive Detections for Organics in Soil at the Former AST
Source: MEVATEC, 2002a

Soil Boring and Depth	Analyte	Results	Flag	Units	Detection Limit
SB18-(4.0-6.0)	2-Methylnaphthalene	5200		ug/kg	390
	Dibenzofuran	710		ug/kg	390
	Naphthalene	680		ug/kg	390
	Phenanthrene	3300		ug/kg	390
	1,2,4-Trimethylbenzene	210		ug/kg	35
	1,3,5-Trimethylbenzene	230		ug/kg	35
	4-Isopropyltoluene	110		ug/kg	35
	Xylene (total)	17	J	ug/kg	35
SB18-(9.0-11.0)	2-Methylnaphthalene	5100		ug/kg	370
	Dibenzofuran	580		ug/kg	370
	Naphthalene	570		ug/kg	370
	Phenanthrene	2300		ug/kg	370
	1,2,4-Trimethylbenzene	2	J	ug/kg	3
SB20-(4.0-6.0)	Acenaphthene	2000		ug/kg	400
	Dibenzofuran	1400		ug/kg	400
	Fluoranthene	130	J	ug/kg	400
	Fluorene	2300		ug/kg	400
	Naphthalene	2300		ug/kg	400
	Ethylbenzene	17		ug/kg	4
	Toluene	27		ug/kg	4
	2-Methylnaphthalene	19000	D	ug/kg	1600
	Phenanthrene	8200	D	ug/kg	1600
	1,2,4-Trimethylbenzene	4000	D	ug/kg	300
	1,3,5-Trimethylbenzene	1000	D	ug/kg	300
	4-Isopropyltoluene	640	D	ug/kg	300
	Xylene (total)	560	D	ug/kg	300
SB20-(9.0-11.0)	Acenaphthene	830		ug/kg	380
	Dibenzofuran	1100		ug/kg	380
	Fluorene	1700		ug/kg	380
	Naphthalene	2500		ug/kg	380
	Phenanthrene	5500		ug/kg	380
	1,2,4-Trimethylbenzene	210		ug/kg	4

Table 8-8. Investigation #4 - Positive Detections for Organics in Soil at the Former AST
Source: MEVATEC, 2002a

Soil Boring and Depth	Analyte	Results	Flag	Units	Detection Limit
	1,3,5-Trimethylbenzene	57		ug/kg	4
	4-Isopropyltoluene	20		ug/kg	4
	Ethylbenzene	3	J	ug/kg	4
	Isopropylbenzene	3	J	ug/kg	4
	n-Butylbenzene	46		ug/kg	4
	n-Propylbenzene	13		ug/kg	4
	Sec-Butylbenzene	12		ug/kg	4
	Xylene (total)	38		ug/kg	4
	2-Methylnaphthalene	18000	D	ug/kg	1500
SB20-(14.0-16.0)	Acenaphthene	400		ug/kg	400
	Dibenzofuran	770		ug/kg	400
	Fluorene	1000		ug/kg	400
	Naphthalene	990		ug/kg	400
	Phenanthrene	3000		ug/kg	400
	1,2,4-Trimethylbenzene	93		ug/kg	4
	1,3,5-Trimethylbenzene	29		ug/kg	4
	4-Isopropyltoluene	14		ug/kg	4
	Isopropylbenzene	2	J	ug/kg	4
	n-Propylbenzene	9		ug/kg	4
	Sec-Butylbenzene	9		ug/kg	4
	Xylene (total)	8		ug/kg	4
	2-Methylnaphthalene	6900	D	ug/kg	790
SB21-(4.0-6.0)	Dibenzofuran	1000		ug/kg	410
	Fluoranthene	180	J	ug/kg	410
	Naphthalene	1500		ug/kg	410
	1,2,4-Trimethylbenzene	1400		ug/kg	35
	1,3,5-Trimethylbenzene	600		ug/kg	35
	4-Isopropyltoluene	200		ug/kg	35
	Ethylbenzene	30	J	ug/kg	35
	Toluene	15	J	ug/kg	35
	Xylene (total)	560		ug/kg	35
	2-Methylnaphthalene	10000	D	ug/kg	810
	Phenanthrene	6500	D	ug/kg	810
SB21-(9.0-11.0)	Acenaphthene	1000		ug/kg	370
	Dibenzofuran	1400		ug/kg	370
	Fluoranthene	130	J	ug/kg	370
	Fluorene	2500		ug/kg	370
	Naphthalene	4400		ug/kg	370
	4-Isopropyltoluene	650		ug/kg	34
	Ethylbenzene	420		ug/kg	34
	Isopropylbenzene	210		ug/kg	34
	n-Butylbenzene	1200		ug/kg	34
	n-Propylbenzene	740		ug/kg	34

Table 8-8. Investigation #4 - Positive Detections for Organics in Soil at the Former AST
Source: MEVATEC, 2002a

Soil Boring and Depth	Analyte	Results	Flag	Units	Detection Limit
	Sec-Butylbenzene	440		ug/kg	34
	Toluene	130		ug/kg	34
	2-Methylnaphthalene	23000	D	ug/kg	1900
	Phenanthrene	8100	D	ug/kg	1900
	1,2,4-Trimethylbenzene	17000	D	ug/kg	340
	1,3,5-Trimethylbenzene	3400	D	ug/kg	340
	Xylene (total)	4700	D	ug/kg	340
SB21-(14.0-16.0)	2-Methylnaphthalene	150	J	ug/kg	410
	Phenanthrene	270	J	ug/kg	410
	1,2,4-Trimethylbenzene	1	J	ug/kg	4

LABORATORY FLAGS
J=The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.
D=The value reported derives from analysis of a diluted sample of the sample extract.

Table 8-9. Investigation #4 - Positive Detections for Organics in Soil at the Former Generator
Source: MEVATEC, 2002a

Soil Boring and Depth	Analyte	Results	Flag	Units	Detection Limit
SB23-(4.0-6.0)	Phenanthrene	340	J	ug/kg	400
	1,2,4-Trimethylbenzene	8		ug/kg	4
	1,3,5-Trimethylbenzene	36		ug/kg	4
	4-Isopropyltoluene	26		ug/kg	4
	Toluene	1	J	ug/kg	4
	Xylene (total)	1	J	ug/kg	4
SB23-(9.0-11.0)	Dibenzofuran	1100		ug/kg	380
	Naphthalene	2200		ug/kg	380
	Phenanthrene	2100		ug/kg	380
	1,2,4-Trimethylbenzene	1400		ug/kg	34
	1,3,5-Trimethylbenzene	490		ug/kg	34
	4-Isopropyltoluene	110		ug/kg	34
	Ethylbenzene	27	J	ug/kg	34
	Isopropylbenzene	44		ug/kg	34
	n-Butylbenzene	260		ug/kg	34
	n-Propylbenzene	140		ug/kg	34
	Sec-Butylbenzene	120		ug/kg	34
	Xylene (total)	400		ug/kg	34
	2-Methylnaphthalene	10000	D	ug/kg	760
31152-SB25-(9.0-11.0)	2-Methylnaphthalene	5600		ug/kg	390
	Dibenzofuran	910		ug/kg	390
	Naphthalene	710		ug/kg	390
	Phenanthrene	3000		ug/kg	390
	1,2,4-Trimethylbenzene	1600		ug/kg	35
	1,3,5-Trimethylbenzene	930		ug/kg	35
	4-Isopropyltoluene	330		ug/kg	35

Table 8-9. Investigation #4 - Positive Detections for Organics in Soil at the Former Generator
Source: MEVATEC, 2002a

Soil Boring and Depth	Analyte	Results	Flag	Units	Detection Limit
	Xylene (total)	350		ug/kg	35
31152-SB25-(14.0-16.0)	1,2,4-Trimethylbenzene	1	J	ug/kg	4
31152-SB26-(0.0-0.5)	Toluene	18		ug/kg	3
31152-SB26-(4.0-6.0)	Toluene	6		ug/kg	4
31152-SB26-(9.0-11.0)	Dibenzofuran	950		ug/kg	380
	Naphthalene	1100		ug/kg	380
	Phenanthrene	3400		ug/kg	380
	1,2,4-Trimethylbenzene	630		ug/kg	17
	1,3,5-Trimethylbenzene	870		ug/kg	17
	4-Isopropyltoluene	290		ug/kg	17
	Ethylbenzene	8	J	ug/kg	17
	Sec-Butylbenzene	23		ug/kg	17
	Toluene	21		ug/kg	17
	Xylene (total)	290		ug/kg	17
	2-Methylnaphthalene	7000	D	ug/kg	760
31152-SB26-(14.0-16.0)	Toluene	1	J	ug/kg	3
31152-SB26-(24.0-26.0)	Toluene	2	J	ug/kg	3

LABORATORY FLAGS
J=The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.
D=The value reported derives from analysis of a diluted sample of the sample extract.

Table 8-10. Investigation #4 – Detected Constituents in Groundwater
Source: MEVATEC, 2002a

Sample ID	Analyte	Results	Flag	Units	Detection Limit
MW-01	Barium	58.6	BE	ug/L	0.2
MW-01	Selenium	6.7	B	ug/L	2.8
MW-01	Silver	0.9	B	ug/L	0.3
MW-01	Diesel (C12-C24)	0.25	U	mg/L	0.25
MW-01	Lead	2.4	U	ug/L	10
MW-01	Bicarb, Alkalinity, HCO3	120		mg/L	4
MW-01	Alkalinity, Total as CaCO3	120		mg/L	4
MW-01	Chloride (Method 325.2)	23000		mg/L	5000
MW-01	Mercury	0.04	B	ug/L	0.04
MW-01	pH	6.6		gl elec @25C	0.1
MW-01	Total Dissolved Solids	29000		mg/L	2
MW-01	Sulfate Colormetric AA	260		mg/L	250
MW-01	Acetone	3	J	ug/L	5
MW-01 duplicate	Barium	92	BE	ug/L	0.2
MW-01 duplicate	Cadmium	0.51	BN	ug/L	0.5
MW-01 duplicate	Selenium	10	B	ug/L	2.8
MW-01 duplicate	Silver	0.65	B	ug/L	0.3
MW-01 duplicate	Diesel (C12-C26)	0.25	U	mg/L	0.25
MW-01 duplicate	Lead	2.4	U	ug/L	10

Table 8-10. Investigation #4 – Detected Constituents in Groundwater
Source: MEVATEC, 2002a

Sample ID	Analyte	Results	Flag	Units	Detection Limit
MW-01 duplicate	Bicarb, Alkalinity, HCO3	120		mg/L	4
MW-01 duplicate	Alkalinity, Total as CaCO3	120		mg/L	4
MW-01 duplicate	Chloride (Method 325.2)	24000		mg/L	5000
MW-01 duplicate	pH	6.6		gl elec @25C	0.1
MW-01 duplicate	Total Dissolved Solids	39000		mg/L	40
MW-01 duplicate	Acetone	2.2	J	ug/L	5
MW-01 duplicate-TB	Methylene chloride	0.8	B*J	ug/L	1
MW-02	Arsenic	13.2		ug/L	4.3
MW-02	Barium	419	E	ug/L	0.2
MW-02	Cadmium	2.7	BN	ug/L	0.5
MW-02	Chromium	36.4	N	ug/L	0.7
MW-02	Diesel (C12-C24)	0.25	U	mg/L	0.25
MW-02	Lead	30.1		ug/L	10
MW-02	Bicarb, Alkalinity, HCO3	57		mg/L	4
MW-02	Alkalinity, Total as CaCO3	57		mg/L	4
MW-02	Chloride (Method 325.2)	14000		mg/L	5000
MW-02	Mercury	0.06	B	ug/L	0.04
MW-02	pH	6.7		gl elec @25C	0.1
MW-02	Total Dissolved Solids	20000		mg/L	2
MW-02	Sulfate Colormetric AA	460		mg/L	250
MW-02-TB	Methylene Chloride	0.9	J	ug/L	1
MW-03	Arsenic	12.7		ug/L	4.3
MW-03	Barium	272	E	ug/L	0.2
MW-03	Cadmium	2.3	BN	ug/L	0.5
MW-03	Chromium	315	N	ug/L	0.7
MW-03	Lead	29.2		ug/L	2.4
MW-03	Selenium	27.7		ug/L	2.8
MW-03	Diesel (C12-C24)	0.25	U	mg/L	0.25
MW-03	Lead	29.2		ug/L	10
MW-03	Bicarb, Alkalinity, HCO3	140		mg/L	4
MW-03	Alkalinity, Total as CaCO3	140		mg/L	4
MW-03	Chloride (Method 325.2)	14000		mg/L	5000
MW-03	pH	6.7		gl elec @25C	0.1
MW-03	Total Dissolved Solids	18000		mg/L	40
MW-03	Sulfate Colormetric AA	620		mg/L	250
MW-04	Arsenic	33.1		ug/L	4.3
MW-04	Barium	6160	E	ug/L	0.2
MW-04	Cadmium	6.8	N	ug/L	0.5
MW-04	Chromium	663	N	ug/L	0.7
MW-04	Lead	76.6		ug/L	2.4
MW-04	Selenium	5.1	B	ug/L	2.8
MW-04	Diesel (C12-C24)	0.27		mg/L	0.25
MW-04	Lead	76.6		ug/L	10

Table 8-10. Investigation #4 – Detected Constituents in Groundwater

Source: MEVATEC, 2002a

Sample ID	Analyte	Results	Flag	Units	Detection Limit
MW-04	Bicarb, Alkalinity, HCO3	130		mg/L	4
MW-04	Alkalinity, Total as CaCO3	130		mg/L	4
MW-04	Chloride (Method 325.2)	16000		mg/L	5000
MW-04	pH	6.6		gl elec @25C	0.1
MW-04	Total Dissolved Solids	28000		mg/L	40
MW-04	Sulfate Colormetric AA	500		mg/L	250
MW-04	Diesel (C12-C24)	0.27		mg/L	0.25
Field Blk	2-Butanone	12		ug/L	5
Field Blk	Acetone	17		ug/L	5
Field Blk	Methylene Chloride	0.6	BJ	ug/L	1

LABORATORY FLAGS

[1] = The hydrocarbons present were greater than the diesel range.

B = The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrumental Detection Limit (IDL).

B* = The analyte of interest was detected in the method blank associated with the sample, as well as in the sample itself.

U = The analyte of interest was not detected to the limit of detection indicated.

Table 8-11. Investigation #5 - DRO Results for Confirmation Sampling Beneath the Former AST

Source: BAE, 2004a

Sample Identification	Analysis Method	Reporting Limit (mg/kg)	Analytical Result (mg/kg)
MALP-0167-EF-02F1(25.0-27.0)-0704	EPA 8015	30	30 U
MALP-0167-EW-02S1(16.0-18.0)-0704	EPA 8015	27	27 U
MALP-0167-EW-02W1(19.0-21.0)-0704	EPA 8015	30	30 U
MALP-0167-EW-02E1(19.0-21.0)-0704	EPA 8015	31	31 U
MALP-0167-EW-02N1(14.0-16.0)-0704	EPA 8015	28	32
MALP-0167-EW-12N2(14.0-16.0)-0704 (duplicate)	EPA 8015	28	28 U

mg/kg : milligrams per kilogram

U : analyte not detected above detection limit

As shown in Table 4-3 and 4-4, all confirmation samples taken had DRO concentrations below the 880 mh/kg clean-up goal. This serves to demonstrate that all soil contaminated with diesel at concentrations above the clean-up goal were successfully removed from the site.

Table 8-12. Investigation #5 - DRO Results for Confirmation Sampling Beneath the NW End of the Former Product Lines

Source: BAE, 2004a

Sample Identification	Analysis Method	Reporting Limit (mg/kg)	Analytical Result (mg/kg)
MALP-0167-EF-01F2(28.0-30.0)-0704	EPA 8015	30	30 U
MALP-0167-EW-01S3(19.0-23.0)-0704	EPA 8015	29	29 U
MALP-0167-EW-11S4(19.0-23.0)-0704 (duplicate)	EPA 8015	29	29 U
MALP-0167-EW-01E2(7.0-9.0)-0704	EPA 8015	27	27 U
MALP-0167-EW-01W2(16.0-18.0)-0704	EPA 8015	28	28 U
MALP-0167-EW-01N2(16.0-18.0)-0704	EPA 8015	28	660

mg/kg : milligrams per kilogram
U : analyte not detected above detection limit

Appendix 8C

SWMU 167
Correspondence

November 1, 2001

NMED

RFI Work Plan Approval Letter

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

WSMR Environment & Safety Tech Lib
2 8800 00018525 7

200-1C
C18-WP
2001

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 1, 2001

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army Whites Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: APPROVAL OF WORK PLAN FOR THE RCRA FACILITY INVESTIGATION AT THE DENVER AND MAPLAIS SITES ON WHITE SANDS MISSILE RANGE
WHITE SANDS MIISSILE RANGE
EPA ID No. NM2750211235
HWB-WSMR-00-007 & 008

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has reviewed the Work Plan for the RCRA Facility Investigation at the Denver and Malpais Sites on White Sands Missile Range, dated September 2001.

The comments in the July 25, 2001 Notice of Deficiency (NOD) letter were adequately addressed and a replacement Table 4-1 was corrected and faxed on October 30, 2001. Therefore, the Work Plan for the RCRA Facility Investigation at the Denver and Malpais Sites on White Sands Missile Range is hereby approved. Please begin implementation of the RCRA Facility Investigation (RFI) Work Plan according to the schedule specified in the plan within thirty (30) days of receipt of this letter. WSMR will have sixty (60) days after completion of the activities specified in the plan to prepare and submit to NMED a RFI Report that follows RFI guidance specified in Permit Section VIII and Hazardous Waste Bureau (HWB) Standard Operating Procedures (SOP) Manual [Section II.B.4.a.(3)], summarizing the results of the investigations.

If you have any questions concerning this letter, please call me at (505) 428-2550.

Sincerely,

Cheryl Frischkorn
Geologist/WSMR Project Leader
Permits Management Program

CAF:caf

cc: James P. Bearzi, NMED HWB
John Kieling, NMED HWB
David Cobrain, NMED HWB
Glenn von Gonten, NMED HWB
Pam Allen, NMED HWB
Julie Jacobs, NMED GWQB
Gene Forsythe, WSMR
David Neleigh, EPA Region 6 (6PD-N)

file: Reading and Red File-WSMR 2001

January 12, 2004

NMED

RFI Report Response Letter

WSMR Environment & Safety Tech Lib
2 8800 00028022 3

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

January 12, 2004

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: RCRA FACILITY INVESTIGATION REPORT FOR THE DENVER & MALPAIS SITES WHITE SANDS MISSILE RANGE EPA ID NO. NM2750211235 HWB-WSMR-02-009

Dear Mr. Ladd:

On September 24, 2003, the New Mexico Environment Department (NMED) determined that the White Sands Missile Range (WSMR) *RCRA Facility Investigation Report for Denver and Malpais Site*, submitted in July 2002 was administratively complete. NMED confirmed receipt of the fees paid by WSMR in January 2004.

In accordance with 20.4.2.200.A(7) NMAC and 20.1.4 NMAC, NMED has completed its technical review of the *RCRA Facility Investigation Report for Denver and Malpais Site.* Detailed in WSMR's report are the results of the investigations completed by WSMR to further characterize the impact of releases from the storage tanks at these sites. The RCRA Facility Investigation (RFI) Report for the Denver and Malpais sites is acceptable; however, several issues must be dealt with before WSMR submits its subsequent work plan addressing these sites. The specific issues are addressed in Attachment 1.

If you have any questions regarding this letter, please call me at (505) 428-2550.

Sincerely,

Cheryl Frischkorn
White Sands Missile Range Project Leader
Permits Management Program

cc: S. Y. Martin, NMED HWB
J. Kieling, NMED HWB
G. von Gonten, NMED HWB
C. Frischkorn, NMED HWB
L. King, EPA Region 6 (6PD-N)
[redacted]

File: Reading File & 2004 WSMR File

ATTACHMENT 1

ATTACHMENT 1

The following comments comprise NMED's technical review of White Sands Missile Range's (WSMR) RCRA Facility Investigation Report (RFI) for the Denver and Malpais Sites. WSMR must consider these comments while drafting a Voluntary Corrective Action (VCA) Work Plan for these sites.

COMMENT 1
Because the remedy is presumptive at both the Denver and Malpais sites, WSMR must submit a Voluntary Corrective Action (VCA) Work Plan describing the planned excavation of contaminated soils.

COMMENT 2
WSMR must not attempt to compare contaminant levels detected at Solid Waste Management Units (SWMUs) to industrial/occupational values. WSMR must compare values to residential clean up levels. Industrial/occupational values cannot be used until enforceable institutional controls and environmental covenants are established.

COMMENT 3
WSMR specifies on page 57 of the report that the TPH remediation action level will be 5000 ppm. WSMR must use the clean up levels specified in the *New Mexico Environment Department Total Petroleum Hydrocarbon (TPH) Screening Levels, June 24, 2003.* These guidelines can be found at:
http://www.nmenv.state.nm.us/HWB/hazwaste_home.html.
A copy of this guidance is enclosed as Attachment 2.

COMMENT 4
WSMR must avoid using statements like "naturally occurring background" if a statistical background study has not been completed for a specific area.

COMMENT 5
Section 5.0 (Summary and Conclusions) specifies that confirmation soil samples will be collected at the base of the excavations to determine if clean up levels have been achieved. WSMR must collect soil samples at the base of the excavations, as well as all sidewalls of the excavation pit to confirm that all diesel fuel contamination greater than 880 mg/kg TPH (Diesel #2 / crankcase oil) has been removed. Failure to do so could result in NMED requiring WSMR to complete additional sampling at both sites. The VCA Work Plan must include the details of WSMR's sampling strategy and methods for collecting and analyzing remedial excavation confirmation soil samples.

January 24, 2006

NMED

VCA Work Plan/VCA Report Approval and NFA Letter

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

January 24, 2006

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: FINAL VOLUNTARY CORRECTIVE ACTION REPORT FOR THE MALPAIS SITE WHITE SANDS MISSILE RANGE EPA ID NO. NM2750211235 HWB-WSMR-05-001

Dear Mr. Ladd:

The New Mexico Environment Department (NMED) has reviewed WSMR's September 2004 *Final Voluntary Corrective Action Report for the Malpais Site, White Sands Missile Range* and WSMR's preceding February 2004 *Work Plan for the Voluntary Corrective Action at the Malpais Site on White Sands Missile Range.*

In accordance with 20.4.2.200.A(7) NMAC and 20.1.4 NMAC, NMED has completed a technical review of these above mentioned documents. Based on information in the Final Voluntary Corrective Action (VCA) Report, the former above ground storage tank (AST) has been removed, the associated soil contamination has been excavated, and the area has been filled and graded. Therefore, NMED hereby approves these two documents and requires no further investigations pertaining to the Malpais Site at this time. SWMU 197 is now eligible for a No Further Action (NFA) determination. WSMR must submit a separate petition to NMED for a Class 3 permit modification request to remove SWMU 167 from its permit.

9. SWMU 168: Lance Missile Impact Site

9.1 Summary

On December 14, 1999, a Lance missile launched from WSMR impacted within the White Sands National Monument (WSNM) near Lake Lucero on property managed by the National Park Service (NPS). Propellant used in the Lance missile included Unsymmetrical Dimethylhydrazine (UDMH) and Inhibited Red Fuming Nitric Acid (IRFNA). The missile penetrated the ground surface and exposed the water table at approximately three ft bgs. The impact created a crater approximately 18 ft in diameter and 5 ft deep. The NMED designated the Lance missile impact site as SWMU 168.

The *Assessment Report for the Lance Missile Impact* (WSMR, 2000) indicated an initial assessment was conducted at the site on December 16, 1999 to provide a quick visual and chemical assessment of the impact site for the establishment of baseline conditions. Soil and water samples were collected and analyzed for contaminants of concern. The analysis revealed small amounts of contamination in soil and water with no visible debris on the surface. The conclusion drawn from the initial site visit was that the missile was below the surface of the water table. Due to the potentially hazardous conditions at the impact site, the initial ground inspection team was limited in time and could not conduct a detailed assessment. A follow-on assessment team was assembled once the WSMR environmental office deemed it safe to visit the site without protective suits or breathing apparatuses. The follow-on assessment was conducted at the impact site on March 16, 2000 to provide an in-depth analysis of the impact site including a detailed search and collection of debris, debris location, debris assessment, photography, crater definition, and soil and water conditions. Based on the location, number, and types of Lance missile pieces found, the recovery team determined that the Lance missile suffered considerable catastrophic structural damage at the surface plane, enough to rupture the propellant tanks at the surface. This indicated that most of the missile debris is shallow and the contamination released took place on or near the surface. Surface level contamination was measured and the analysis, which included soil and water samples from the crater, showed little or no contamination. Based on assessment findings and the fact that groundwater was unsuitable for both agriculture and drinking before the incident, the assessment recommended that WSMR take the position that no further environmental measurement is necessary. The report also recommended that WSMR should send a

team to the impact site to collect and remove all metallic debris in and around the crater.

A *RCRA Facility Investigation* (MEVATEC, 2002b) began in 2002 and consisted of a geophysical survey, soil boring/sampling, monitoring well installation/groundwater sampling, and crater water sampling. The geophysical survey determined that the bulk of the buried portion of the Lance missile was at the center of impact with the deepest debris being at approximately 9 ft bgs in a confining dry gypsum layer. Soil and water samples were analyzed for UDMH and breakdown products N-Nitrosodimethylamine (NDMA) and N-Nitrodimethylamine (DMN). None of the soil or water samples contained detectable concentrations of the fuel component UDMH or its breakdown products. The results of the investigation indicated that contamination from the Lance missile impact had not occurred. Based on these findings, the RFI report indicated that no routes of exposure to human health existed at the site. Any potential adverse effects posed by the Lance missile impact were lessened by the remote location of the site, the inaccessibility of this area of the WSNM to the public and the poor quality of the groundwater. The site is remote, unoccupied, and inaccessible to WSMR workers and the public. The closest drinking water supply wells are located approximately 7 miles southwest of the impact site on the alluvial fan deposits of the San Andres Mountains.

The WSMR RFI recommended all remaining Lance missile surface debris, survey stakes and all other debris material be removed from the impact site. The report also recommended emptying soil cuttings and development water at the site and backfilling the crater with surrounding soil. On June 9, 2003, the NMED agreed that no hazardous waste or hazardous constituents had been released to the soil or ground water as a result of the Lance missile crash. In addition, NMED was informed by the superintendent of WSNM, that the crater had been backfilled with soil cuttings, crater ejecta and surrounding soil, all remaining Lance missile surface debris had been removed, all material involved with the investigative activities had been removed, and the site had been restored to its original contour.

9.2 Site Description and Operational History

9.2.1 Site Description

SWMU 168, the Lance missile impact site (Photographs 9-1 and 9-2, Appendix 9A, pg.9A-4), was located within the WSNM in the alkali flats region approximately one

mile east of Lake Lucero (Figure 9-1, Appendix 9A, pg. 9A-1). WSNM, administered by the NPS, is located in the southeastern portion of WSMR and is 147,526 acres in area. The monument boundary encloses the gypsum dunes, alkali flats, and Lake Lucero. The impact site is located in an undeveloped area of the WSNM, with the nearest constructed feature being Range Road 7, which is approximately four miles from the impact site.

The missile's impact created a crater approximately 18 ft in diameter and 5 ft deep. Depth to groundwater at the impact site is approximately 3 ft bgs and has a TDS concentration of greater than 20,000 mg/l. The mineral gypsum is highly soluble and adds to the TDS concentration of the groundwater in this region.

9.2.2 Operational History

The area where the Lance missile landed within the WSNM was always protected land operated by the NPS, with no operational history. The Lance missile began testing at WSMR in 1965. Lance missiles were fielded in the 1970's and used by the United States and other NATO countries. Since the Lance missile has been replaced by a new generation of missiles, the remaining Lance missiles are used as targets for air defense systems undergoing development and production testing. Throughout the years WSMR has launched over 530 Lance missiles.

On December 14, 1999, a Lance missile, launched as a target, encountered unresolved internal technical problems causing the missile to conclude proper propulsion early. The missile was launched from LER-4 with an intended impact at a Lance WIT area, fell short and impacted in WSNM near Lake Lucero. The missile impacted the ground exposing the water table 3 to 4 ft below the surface.

9.3 Land Use

9.3.1 Current

The impact site is located in an undeveloped area of the WSNM. The site is remote, unoccupied, and inaccessible to WSMR workers and the public.

9.3.2 Future/Proposed

The impact site is located in an undeveloped and inaccessible area of the WSNM and there are no anticipated future land uses proposed for the area.

9.4 Investigative Activities

9.4.1 Summary

Initial assessment investigations determined that the impact with the ground was catastrophic to the integrity of the Lance missile and that remnants of liquid propellant tanks found indicate the tanks ruptured between the surface and a few ft bgs. Surface level contamination was measured and the analysis, which included soil and water samples from the crater, showed little or no contamination. During the RFI, additional soil and water samples were collected and analyzed for UDMH, NDMA, DNM, BTEX, and total RCRA metals. All analyte detections were well below their respective NMED residential SSLs. None of the soil or water samples contained detectable concentrations of the Lance missile fuel component, UDMH, or its breakdown components, NDMA or DMN.

9.4.2 Investigation #1: Initial Assessments (WSMR, 1999, WSMR, 2000a, WSMR, 2000b)

9.4.2.1 *Non-sampling Data Collection*

On December 16, 1999 an initial assessment of the impact site (SWMU 168) was conducted. The purpose of the initial assessment was to provide a quick-look visual and chemical assessment of the site for the establishment of baseline conditions. A two-person WSMR team was flown in by helicopter, wearing chemical protective suits and respiratory protection. Due to the potential hazard from the missile fuel, the initial recovery team effort was kept to an absolute minimum, and the team was on site for only 20 minutes to perform the reconnaissance and to collect soil and water samples. Since there was no debris visible on the surface, the initial conclusion drawn from the site visit was that the missile must be below the surface of the water table, possibly with the fuel tanks somewhat intact. Following the initial assessment, two additional sampling events (January 26 and February 28, 2000) were completed at SWMU 168 to provide further analysis of potential contamination.

On March 16, 2000, a follow-on assessment recovery team inspected the impact site. The purpose of the follow-on assessment was to provide an in-depth analysis of the ground impact site to include a detailed search and collection of debris, debris location, debris assessment, photography, crater definition, and soil and water conditions. The recovery team discovered Lance missile debris on the surface less than 20 ft from the crater, on the lip of the crater exposed to the air, and in the crater protruding out of the water. New findings and new facts were revealed based on the debris discovered during the follow-on assessment and the results of the chemical analyses from December 16, 1999, and January 26 and February 28, 2000. The conclusions of this assessment were as follows:

- Based on the location, number, and types of Lance missile pieces found, the recovery team deduced that the missile suffered considerable catastrophic structural damage at the surface plan, enough to rupture the liquid propellant tanks at the surface level.

- Based on empirical data, the impact with the ground was catastrophic to the integrity of the Lance missile. Calculations indicated that in the unlikely event that the missile was intact it would be no deeper than 23 ft. The simulated warhead was likely the only part located no deeper than 23 ft because the tanks were stripped and ripped apart at the surface.

- Empirical evidence indicated that any contamination due to the rupture of the tanks had taken place at the surface level to a few ft bgs. Although there was some indication initially that an intact missile was underground in the water table, this is not supported by the debris found during the follow-on assessment. Wind, rain, and erosion revealed debris that was not visible during the initial site visit. The debris in and around the crater indicated that the missile was not intact.

Finally, the team concluded that the environmental damage that the Lance missile could do had been done and the sample results indicated only negligible impacts immediately after the crash on or near the surface. Based on these findings, the team indicated that no further environmental assessment should be warranted.

9.4.2.2 *Sampling Data Collection*

The initial recovery team collected six soil samples (two background samples and one from each of the four compass points at the edges of the crater) and one water sample

from inside the crater. The samples were analyzed for IRFNA and UDMH. The water sample was also analyzed for TDS.

On January 26, 2000, six soil samples (two background soil samples and one from each of the four compass points at the edges of the crater) and three water samples (one background, and one shallow and one deep sample from inside the crater) were collected. The soil samples were analyzed for UDMH, IRFNA, and soil density. The groundwater samples were analyzed for IRFNA, UDMH, TDS, and pH.

On February 28, 2000, four soil samples were collected at the surface around the impact crater at the four compass points, two soil samples were collected at the surface approximately 150 ft east and west of the impact crater, two water samples were collected from standing water in the crater (one sample collected from the surface and one sample from a depth of approximately 4 ft) and one background water sample was collected from a 4 ft deep hand-augured boring located approximately 150 ft east of the crater. Soil and water samples were analyzed for UDMH, NDMA, and DMN; the water samples were also analyzed for water quality parameters. NDMA and DMN are the breakdown components of UDMH.

9.4.2.3 *Data Gaps*

No gaps in the analytical data were reported.

9.4.2.4 *Results and Conclusions*

The results of the December 14, 1999, January 26, 2000, and February 28, 2000 sampling events at the Lance Missile Impact Site are summarized in Table 9B-1, (Appendix 9B, pg 9B-1). The analysis of the soil and water samples obtained from the initial site assessment in December 1999 indicated minimal amounts of contamination from the impact. Low levels of UDMH and IRFNA were detected in surface soil from the southern and eastern edge of the crater and in water from inside the crater.

The laboratory analysis from samples collected on January 26, 2000 shows no detections of UDMH in either the soil or water samples. IRFNA was detected in the soil samples collected from all four points along the edge of the crater, ranging from 7.1 mg/kg to 10.2 mg/kg. IRFNA was detected in the background water sample and the crater water samples, ranging from 3.2 mg/kg to 8.7 mg/kg. Due to the expected dissociation of IRFNA, the laboratory analyzed for nitrate (breakdown component) and

reported it as IRFNA. Only slightly elevated levels of nitrate ions were detected above background for all samples. Based on these findings, WSMR proposed additional sampling and an environmental monitoring program to track any fuel contamination.

Laboratory analysis of samples collected on February 28, 2000 indicated that UDMH and NDMA were not detected in any of the collected samples. DMN was the only target compound detected at 0.09 µg/l in the two water samples collected from the crater. None of the contaminants were detected in the soil samples.

Laboratory results indicated only very low concentrations of contaminants associated with the Lance missile in soil and groundwater immediately after the crash, and concentrations in soil had diminished entirely within two months after the incident. Only a very low concentration the UDMH breakdown product DMN was detected in water in the crater two months after the incident. During the March 16, 2000 site assessment, WSMR determined that the missile was significantly damaged, the fuel tanks most likely ruptured on impact, and the impacts were likely limited to the upper 25 ft. Based on the analytical results and observations made during the March 16, 2000 site assessment, WSMR concluded that any environmental damage resulting from the failed missile's ground impact had already occurred and that no further environmental monitoring was warranted.

9.4.3 Investigation #2: RCRA Facility Investigation (MEVATEC, 2002b)

The RFI was conducted in February and March 2002 and consisted of a surface geophysical survey, soil boring/sampling, monitoring well installation/groundwater sampling, and crater water sampling. The WSNM issued a Special Use Permit (Appendix 9C, pg. 9C-1) to WSMR for access to install and operate subsurface drilling analysis and testing equipment at the missile impact site.

9.4.3.1 *Non-sampling data Collection*

The geophysical survey was conducted to locate and identify missile debris buried at the impact site. An EM-61 metal detector and a magnetometer were used to determine the nature and extent of the impact debris. The most significant result of the survey was the correspondence between the EM-61 and magnetometer in the center fo the survey grid (located over the impact crater to just north of the crater). The survey determined that the deepest object was at approximately 9.7 ft beneath the center of the impact crater. This debris was located in a dry compacted gypsum

confining layer. The anomalies identified by both methods are shown on Figure 9-2, (Appendix 9A, Page 9A-2).

9.4.3.2 *Sampling Data Collection*

On March 19-26, 2002, 16 soil borings were advanced using a hollow-stem auger drilling rig to collect subsurface soil samples and install groundwater monitor wells (SB-01 through SB-08 and LMW-01 through LMW-08). Three additional borings were advanced using a hand auger (HA-01 through HA-03) in the vicinity of outlying. All sampling locations are shown on Figure 9A-2 (Appendix 9A, pg. 9A-2). Soil borings and monitor wells were positioned such that samples were collected from locations where contamination would likely be present (i.e., within soils surrounding the impact crater, within water exposed within the crater, and within groundwater downgradient of the crater).

Eight soil borings were completed to refusal (approximately 10 to 11 ft bgs) at the compass points around the impact crater. Soil samples were collected from each boring starting at the surface and continuing to depth at 5 ft intervals for a total of 3 soil samples per boring. The first set of four soil borings were completed at a distance of 5 ft from the crater lip directly north, south, east, and west of the crater. The second set of four soil borings were completed at a distance of 10 ft from the crater lip directly northeast, southeast, northwest, and southwest of the crater. The hand auger samples were collected at specific locations out from the crater that corresponded to magnetic anomalies identified in the geophysical survey. In addition, soil samples were collected from the installation of the monitoring wells upgradient of the impact site (LMW-02 and LMW-03) and analyzed for background concentrations. A total of 30 primary soil samples were collected and analyzed. Groundwater samples were collected on May 13-14, 2002. Soil and groundwater samples were analyzed for metals, UDMH, DMN, NDMA, and BTEX. Soil samples were also analyzed for TCLP RCRA metals, and groundwater samples were also analyzed for groundwater quality parameters, including dissolved chloride, dissolved sulfate, nitrate, TDS, pH, specific conductance, and alkalinity.

9.4.3.3 *Data Gaps*

No gaps in the analytical data were reported.

9.4.3.4 *Results and Conclusions*

Table 9-3 (Appendix 9B, pg. 9B-5) lists analytical results from soil sampling at the Lance missile impact site as compared to NMED SSLs. Samples from 0168-LMW02 and 0168-LMW03 represent background conditions at the site. None of the samples were detected in concentrations above respective NMED SSLs. All samples collected had no detectable concentrations of UDMH, NDMA, or DMN. Benzene was detected in the HA02 sample (one sample only) at 0.007 mg/kg. This detection was just above the laboratory detection limit of 0.004 mg/kg and is likely laboratory contamination. There were no detections of toluene, ethylbenzene, or xylene. Concentrations of total RCRA metals were consistent with background concentrations.

With the exception of sulfate, chloride, and TDS, all groundwater detections were well below respective New Mexico WQCC Standards. Sulfate was detected above the WQCC standard of 600 mg/l ranging from 16,000 mg/l to 44,000 mg/l. Chloride was detected above the WQCC standard of 250 mg/l ranging from 440 mg/l to 1,100 mg/l. TDS was detected above the 10,000 mg/l WQCC standard ranging from 23,000 mg/l to 63,000 mg/l. These concentrations were consistent with the high dissolved solids concentrations expected in waters of the Tularosa Basin as discussed in Sections 9.2.1. The analytical laboratory reported UDMH, NDMA, DMN, BTEX as all less than respective laboratory reporting limits (ND-Not Detected). All detected RCRA metals concentrations were below their respective WQCC standards (Table 9-3, Appendix 9B, pg.9B-5).

The results of this investigation indicate that contamination from the Lance missile impact has not occurred. Given the analytical data from the soil samples and water samples collected during the RFI, no contaminants of concern (UDMH, NDMA, or DMN) were detected. This indicates that a release from the Lance missile to the surrounding soil and the saturated interval has not occurred or has dissipated through chemical reactions as follows:

- The propellant tanks ruptured upon impact causing a vigorous reaction between the IRFNA and UDMH. A hydrazine nitrate salt reaction product would slowly hydrolyze in water to form dilute nitrate compounds. However, nitrate was only detected in the sample from LMW-09 (2.0 mg/l).

- If only IRFNA was released, it would react with any oxidizable material present to form compounds. The IRFNA would likely dissipate through dilution in water forming a weak acidic nitrate solution.
- If only UDMH were released, it would react with any reducible compounds present in the environment to form a hydrazine-salt. UDMH is water soluble, so it would be expected to dilute in the ground water.

The RFI report recommended the following actions for site closure:

- Empty contents of the soil cuttings drums into the impact crater.
- Empty well development water, purge water, and decontamination water at the impact site.
- Close impact crater by shoveling crater ejecta and surrounding soil to the specification of the WSNM.
- Remove all Investigation-derived Waste (IDW) drums from the site.
- Remove all remaining Lance missile surface debris, survey stakes, and all other debris material associated with the RFI.

9.5 Site Conceptual Model

9.5.1 Nature and Extent of Contamination

The geophysical survey indicated that the most significant instrument response was very near the crater boundaries (Figure 9-2, Appendix 9A, pg. 9A-2). As shown on the cross-section in Figure 9-3, Appendix 9A, pg. 9A-3, the majority of the Lance missile debris was located from the center of the impact crater to approximately 10 ft north of the lip of the crater. From approximately 2.5 ft to approximately 7 ft bgs, the uncompacted gypsum sand and silt is saturated with groundwater. The compacted gypsum interval from approximately 7 ft to 11.5 ft bgs is unsaturated (dry). The deepest debris from the Lance missile is within this dry interval. Based on available data, the compact gypsum stopped the penetration of the missile causing debris to come to rest no deeper than 9.7 ft bgs, which is much shallower than the estimate from the Follow-On Assessment estimate of 23 ft bgs.

The RFI work plan originally specified eight soil borings around the impact crater to be augered and sampled to a depth of 25 ft bgs. Additionally, “nests” of monitoring wells were planned to sample ground-water at shallow, intermediate, and deeper depths. However, auger refusal was encountered at approximately 10 ft bgs. Therefore, all soil borings and monitoring wells were not completed past this interval. It was determined that this depth and below represented a “boundary layer” that would act to retard possible contaminant migration. The lithology of the site (as described in RFI Section 4.2.1) and information provided by the geophysical survey indicating that missile debris was no deeper than 9.7 ft bgs supports this determination (Figure 9-3, Appendix 9A, pg.9A-3).

Depth to groundwater ranged from 1.82 to 2.41 ft bgs. The groundwater flow direction was reportedly to N70W. However, the gradient of 0.0004 was so shallow that groundwater gradient at the impact site is near horizontal.

9.5.2 Environmental Fate

Analytical results from the RFI were compared to respective screening levels (NMED residential SSLs and WQCC Standards). All collected soil and water samples were analyzed for UDMH, NDMA, DNM, BTEX, and total RCRA metals and all detections were well below NMED residential SSLs or WQCC standards. The Lance missile propellant, UDMH, and its breakdown components, NDMA and DMN, were not detected above their laboratory reporting limits in any soil or groundwater samples. With the exception of sulfate, chloride, and TDS, no analytes were detected in ground water in concentrations greater than their respective WQCC standards. The detected concentrations of sulfate, chloride, and TDS are consistent with the high dissolved solids concentrations expected in waters of the Tularosa Basin. The RFI report concluded that no routes (air, soil, surface water, or ground water) for exposure to human health exist at the site.

As stated in the Technical Background Document for Development of Soil Screening Levels (NMED, 2000), any contaminants exhibiting concentrations in excess of the SSLs represent the initial soil COPC list for a given site. Based on the analytical results from this investigation and guidance from the technical background document, there are no COPCs identified at the Lance missile impact of WSNM (SWMU 168).

9.6 Site Assessments

9.6.1 Human Health Screening and Risk Assessments

A formal human health risk assessment was not completed for SWMU 168 since the results of the RFI analyses did not exceed action thresholds and potential adverse effects posed by the Lance missile impact are lessened by the remote location of the site, the inaccessibility of this area of the WSNM to the public, and the quality of the groundwater. The closest drinking water supply wells are located approximately 7 miles southwest of the impact site. As detailed in the RFI, all analytical results were compared to NMED residential SSLs and WQCC Standards. No contaminants were detected in soil samples above the respective NMED residential SSLs. The RFI determined that no routes for exposure to human health exist at the site.

- Air exposure pathway was considered incomplete since no COPC concentrations exceeded screening levels.
- Soil exposure pathway was considered incomplete since no COPCs were identified at this site. In addition, the site is unoccupied and located within a relatively inaccessible area of the WSNM (no residents, workers, schools, or daycare facilities within two miles of SWMU 168).
- The surface water exposure pathway was considered incomplete since the closest intermittent water body is Lake Lucero, which lies approximately one mile to the west of the impact site and there are no intermittent or ephemeral streams leading away from the site.
- The groundwater exposure pathway was considered incomplete since the groundwater gradient at the site is 0.0004, which is nearly horizontal indicating very low flow to stagnant conditions at the site. Also, due to the high TDS concentrations the groundwater would not be considered for potable or non-potable uses.

9.6.2 Ecological Screening and Risk Assessments

The RFI findings indicated that an ecological risk assessment would not be warranted. No COPCs were identified at the Lance impact site and UDMH, NDMA, or DMN were not detected above the laboratory reporting limits at the site. The one benzene

detection (0.007 mg/kg) was well below the EPA Region IV Recommended Ecological Screening Value (RESV) of 0.05 mg/kg. With the exception of chromium and selenium, the detected RCRA metals were below the EPA Region IV RESVs. The chromium and selenium concentrations were within the background concentrations detected at the site.

9.7 No Further Action Proposal

In correspondence dated June 9, 2003 (Appendix 9C, pg. 9C-5), the NMED agreed with WSMR that no hazardous waste or hazardous constituents had been released to the soil or groundwater as a result of the Lance missile crash. In the correspondence, the NMED stated that the superintendant of WSNM informed them that the crater had been backfilled with soil cuttings, crater ejecta, and surrounding soil. All remaining Lance missile surface debris was removed, all material involved with the investigative activities was removed and the site had been restored to its original contour.

Information collected from site investigations indicated that potential adverse effects posed by the Lance missile impact were lessened by the remote location of the site, the inaccessibility of this WSNM area to the public and the poor quality of ground water. Demography, land use, groundwater use and surface water use do not pose health risks to humans. The site is remote, unoccupied, and inaccessible to WSMR workers and the public. The closest drinking water supply wells are located approximately seven miles southwest of the impact site on the alluvial fan deposits of the San Andres Mountains.

Based on these results, application is hereby made to perform a Class III modification to remove SWMU 168 from the White Sands HSWA permit in accordance with 40 CFR 264.514 and 270.42, and 20 NMAC 4.1.

9.7.1 Criterion

SWMU 168 is proposed for NFA based on NMED NFA Criterion 5. The SWMU has been characterized and remediated in accordance with current applicable state and federal regulations, and the available data indicated that contaminants pose an acceptable level of risk under current and projected land use.

Appendices

Appendix 9A – Figures and Photographs

Appendix 9B – Analytical Results Tables

Appendix 9C - Correspondence

Appendix 9A

SWMU 168
Figures and Photographs

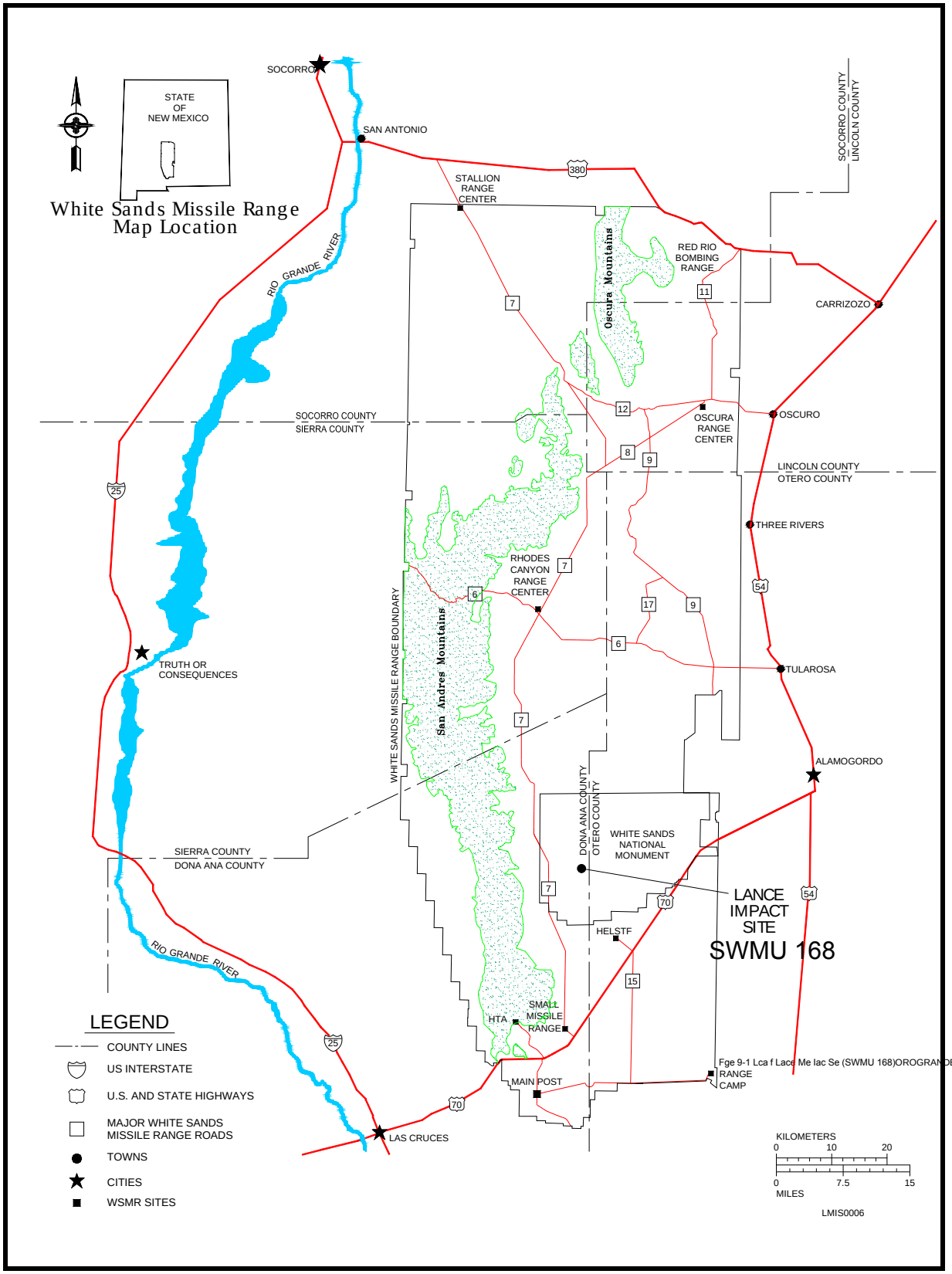


Figure 9-1 Location of Lance Missile Impact Site (SWMU 168)

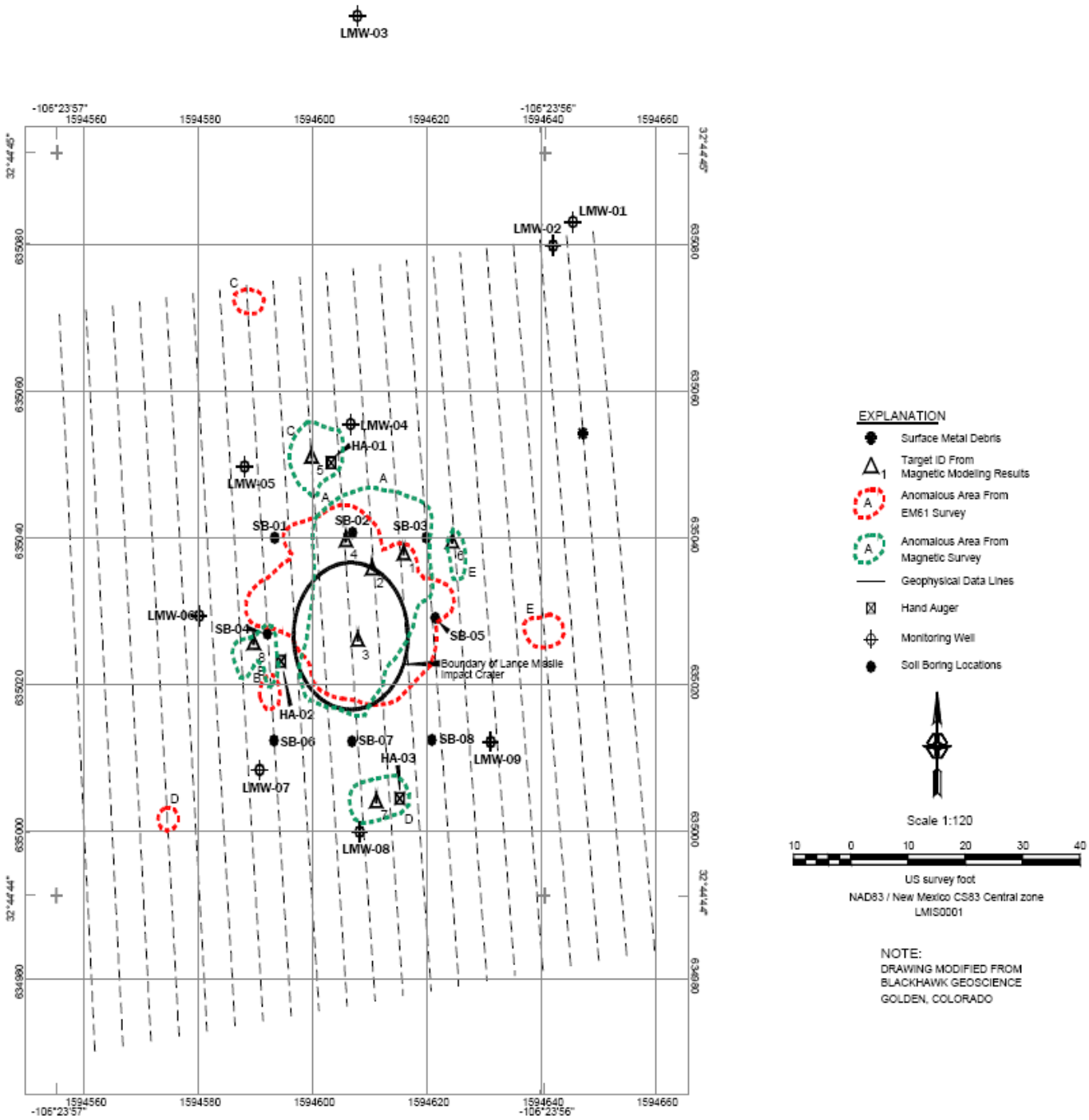


Figure 9-2 Soil Borings and Monitoring Well Locations

Source: MEVATEC, 2002b

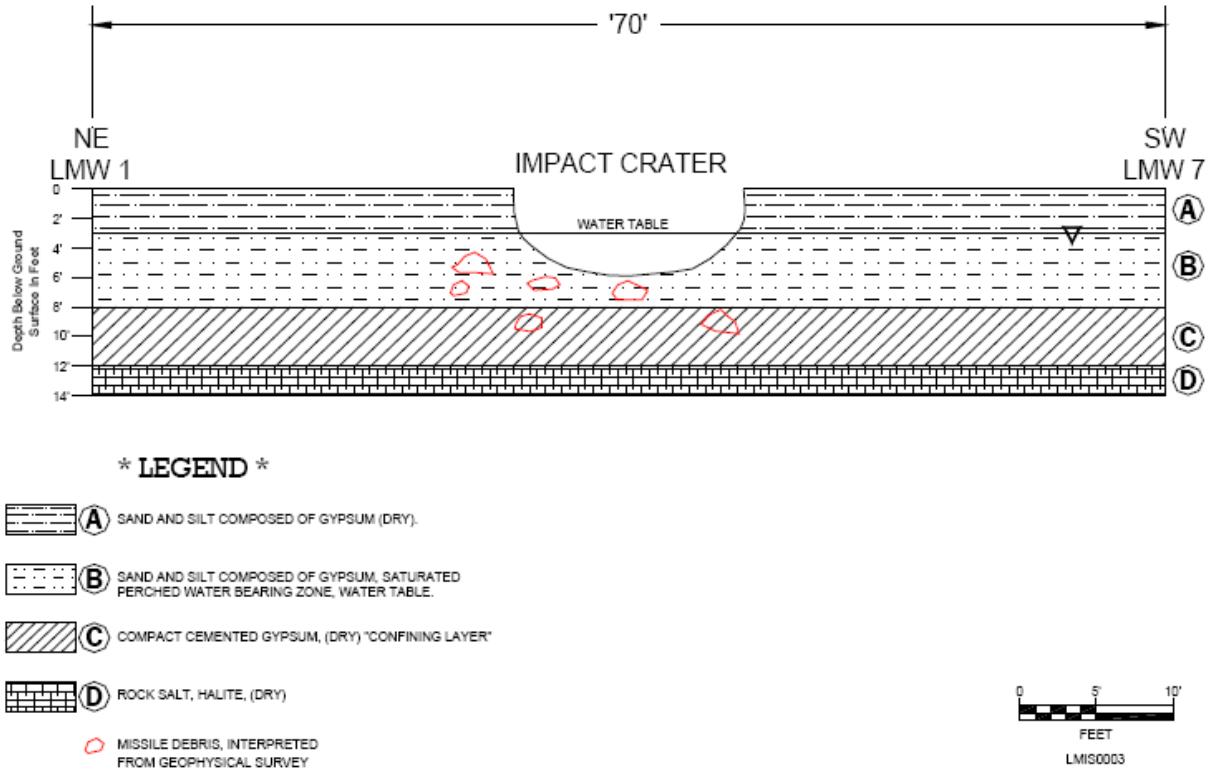
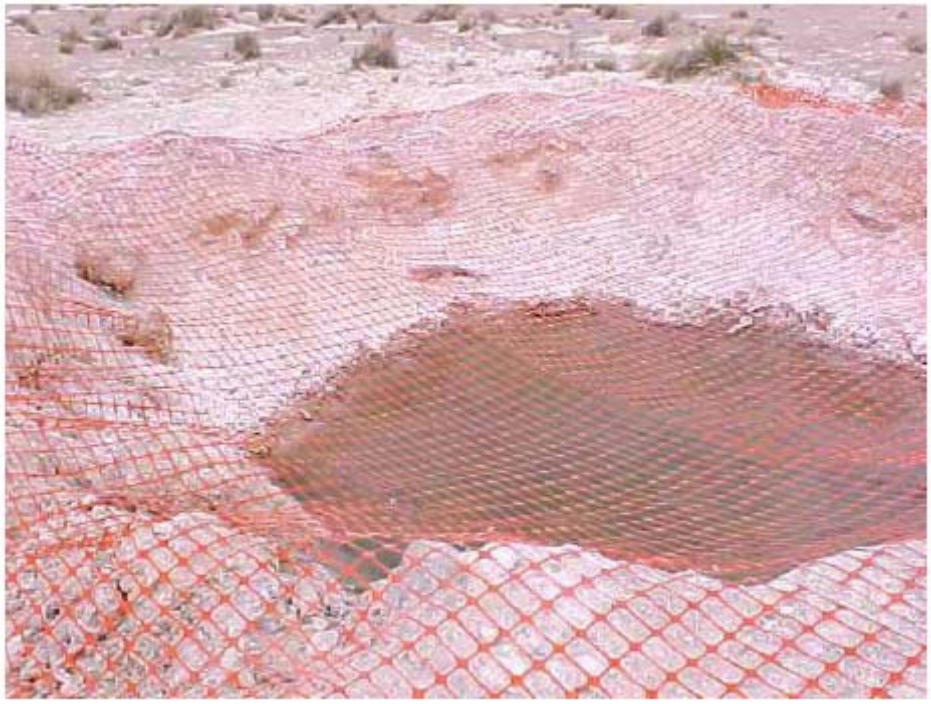
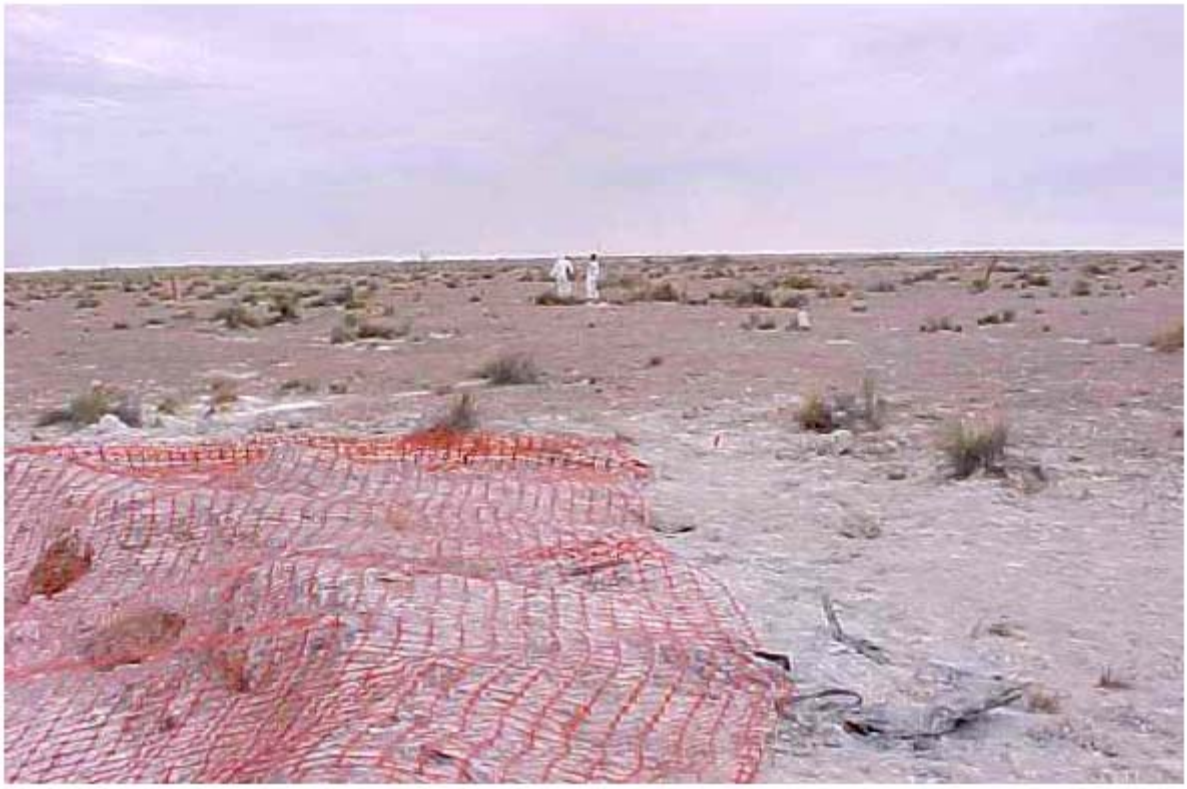


Figure 9-3 Cross-Section of the Lance Missile Impact Site

Source: MEVATEC, 2002b



Photograph 9-1 Lance Missile Impact Crater (SWMU 168)



Photograph 9-2 Alkali Flats Area of WSNM

Appendix 9B

SWMU 168
Analytical Result Tables

Tables 9-1. Results for Initial Soil and Water Assessments, 1999-2000, SWMU 168 - Lance Missile Impact Site

Source: March 15, 2000 Letter from WSMR to the NMED HRMB.

Soil Sample Designation	1001 - N Edge of Crater	1002 W Edge of Crater	1003 S Edge of Crater	1004 E Edge of Crater	69 - BG #1, Crater Area	70 - BG #2, Crater Area	71 - N Edge of Crater	73 - W Edge of Crater	75 - S Edge of Crater	77 - E Edge of Crater	Soil-BG1-3	Soil-BG2-3	Soil-E1	Soil - E3	Soil - E4	Soil-W1	Soil-W3	Soil-W4	Soil-S1	Soil-S3	Soil-S4	Soil-N1	Soil-N3	Soil-N4	Soil B1-1	Soil B1-4	Soil B2-1	Soil B2-4
Date	16-Dec-99	16-Dec-99	16-Dec-99	16-Dec-99	26-Jan-00	26-Jan-00	26-Jan-00	26-Jan-00	26-Jan-00	26-Jan-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00
UDMH (mg/kg)	<1	<1	7	36	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	NA	NA	<0.059	NA	NA	<0.060	NA	NA	<0.060	NA	NA	<0.060	NA	NA	<0.063	NA	<0.061	NA
IRFNA (mg/kg)	<1	<1	9	19	7.2	7.1	7.5	10.2	9.5	8.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Soil Density (g/cc)	NA	NA	NA	NA	1.20	1.14	1.09	1.05	1.31	1.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrodimethylamine (µg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.3	NA	NA	NA	<0.3	NA	<0.3	NA	NA	<0.3	NA	<0.3	NA	<0.3
N-Nitrosodimethylamine (µg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<420	<410	NA	<410	<0.3	NA	<410	NA	<0.3	<410	<0.3	NA	<410	<0.3	NA	<0.3	NA	<0.3

Water Sample Designation	1005, Sample #1, Crater	79-BG, Crater Area	80 - Top Sample, Crater	81 - Bottom Sample, Crater	Water-BG-1-1	Water-BG-1-2	Water-BG-1	Water-BG-1-4	Water-SUR-1	WATERSUR-3	WATERSUR-4	Water-DP-1	WATERDP-3	WATERDP-4
Date	16-Dec-99	26-Jan-00	26-Jan-00	26-Jan-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00	28-Feb-00
UDMH (mg/L)	0.7	<0.1	<0.1	<0.1	NA	NA	<0.010	NA	<0.010	NA	NA	<0.010	NA	NA
IRFNA (mg/L)	9	3.8	3.2	8.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TDS (mg/L)	9,100	3,160	4,820	12,000	7,160	NA	NA	7,470	NA	13,600	13,800	NA	NA	NA
pH (s.u.)	NA	7.0	7.2	7.8	7.57	NA	NA	8.13	NA	7.94	8.35	NA	NA	NA
N-Nitrodimethylamine (µg/L)	NA	NA	NA	NA		NA	NA	<0.01	NA	NA	0.09	NA	NA	0.09
N-Nitrosodimethylamine (µg/L)	NA	NA	NA	NA	<10	<10	<10	<0.01	<10	<10	<0.01	<10	<10	<0.01
Chloride (mg/L)	NA	NA	NA	NA	250	NA	NA	229	NA	290	302	NA	NA	NA
Carbonate Alkalinity (mg/L)	NA	NA	NA	NA	<1.00	NA	NA	<2	NA	<1.00	<2	NA	NA	NA
Specific Conductance (µmhos/cm)	NA	NA	NA	NA	8,000	NA	NA	8,540	NA	14,400	14,670	NA	NA	NA
Fluoride (mg/L)	NA	NA	NA	NA	45	NA	NA	1.23	NA	110	3.48	NA	NA	NA
Bicarbonate Alkalinity (mg/L)	NA	NA	NA	NA	830	NA	NA	77.6	NA	90.0	102	NA	NA	NA
Nitrate (mg/L)	NA	NA	NA	NA	<0.050	NA	NA	1.79	NA	2.38	1.68	NA	NA	NA
Sulfate	NA	NA	NA	NA	4,500	NA	NA	4,950	NA	9,300	9,190	NA	NA	NA

Notes:
UDMH = Unsymmetrical Dimethylhydrazine
IRFNA = Inhibited Red Fuming Nitric Acid
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
g/cc = grams per cubic centimeter
mg/L = milligrams per liter
µg/L = micrograms per liter
s.u. = standard units
µmhos/cm = micromhos per centimeter

Samples collected on December 16, 1999 and January 26, 2000 were analyzed byt eh Applied Environments Test Branch Chemistry Laboratory (MT-AA-E). Samples collected on February 28, 2000 were split and sent to four laboratories.
The UDMH analysis for Soil-E1, Soil-W1, Soil-S1, Soil-N1, Water-BG-1, Water-SUR-1, and Water-DP-1 from the 2-28-00 sampline event were peformed by NASA-WSTF.
N-Nitrosodimethylamine analysis for Soil-BG1-3, Soil-BG2-3, Soil E3, Soil W3, Soil S3, Soil N3, Water BG-1-1, Water BG-1-2, WATERSUR-3, and WATERDP-3 and the general groundwater quality parameters for Water-BG-1-1 and WATERSUR-3 from the 2-28-00 sampling event were analyzed by GPL Laboratories, LLLP.
N-Nitrodimethylamine and N-Nitrosodimethylamine analysis for Soil-B1-4, Soil-B2-4, Soil E4, Soil W4, Soil S4, Soil N4, Water BG-1-4, WATERSUR-4 WATERDP-4 and the general groundwater quality parameters for Water-BG-1-4 and WATERSUR-4 from the 2-28-00 sampling event were analyzed by Southwest Research Institute.

Table 9-2. Analytical Results from the Impact Crater Soil Borings

Analytes	NMED SSL	0168-SB01			0168-SB02			0168-SB03			0168-SB04			0168-SB05		
		0.0-0.5	5.0-7.0	9.0-9.8	0.0-0.5	4.0-6.0	9.0-9.5	0.0-0.5	5.0-7.0	8.0-8.6	0.0-0.5	5.0-7.0	9.0-9.7	0.0-0.5	4.0-6.0	9.0-9.5
Volatiles (mg/kg)																
Unsymmetrical Dimethylhydrazine UDMH	NE	<0.063	<0.081	<0.090	<0.061	<0.073	<0.082	<0.064	<0.076	<0.089	<0.066	<0.069	<0.067	<0.063	<0.069	<0.061
Nitrosodimethylamine NDMA	0.095	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nitrodimethylamine DMN	NE	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzene	6.4	<0.004	<0.004	<0.005	<0.004	<0.004	<0.005	<0.004	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Toluene	180	<0.004	<0.004	<0.005	<0.004	<0.004	<0.005	<0.004	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Ethylbenzene	68	<0.004	<0.004	<0.005	<0.004	<0.004	<0.005	<0.004	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Xylenes	63	<0.004	<0.004	<0.005	<0.004	<0.004	<0.005	<0.004	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
RCRA Metals (mg/kg)																
Arsenic	3.9	1.1	1.2	1.0B	1.3	1.4	1.1B	<0.40	0.57B	<0.60	0.60B	1.3	0.67B	0.53B	1.7	<0.40
Barium	5,200	27.1	18.9B	46.2	44.8	23.0	12.6B	31.3	21.2B	5.2B	22.8	26.5	6.9B	18.5B	115	2.1B
Cadmium	70	0.12B	0.15B	0.12B	0.19B	0.09B	0.07B	0.07B	0.06B	<0.07	<0.06	0.09B	0.07B	0.05B	0.27B	<0.05
Chromium	230	1.3	1.0B	3.6	3.6	1.0B	2.2	0.70B	0.99B	0.76B	1.1B	0.39B	2.1	0.98	6.7	0.63B
Lead	400	1.1	0.69B	2.3	3.9	0.91B	1.5	0.79B	0.59B	0.61B	1.2	1.3	1.3	1.0	4.3	0.34B
Selenium	380	0.41B	0.87B	0.97B	0.41B	1.1B	0.67B	0.45B	0.94B	<0.39	0.76B	1.1B	0.29B	<0.26	1.3	<0.26
Silver	380	0.10B	<0.03	<0.04	<0.03	<0.03	<0.04	<0.03	<0.03	<0.04	<0.03	<0.011	<0.009	<0.03	<0.03	<0.03
Mercury	6.5	<0.010	<0.011	<0.014	<0.007	<0.010	<0.014	<0.007	<0.012	<0.014	<0.011	<0.03	<0.03	<0.010	<0.011	<0.011
TCLP Metals (mg/l)																
Arsenic	5.0*	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043
Barium	100.0*	0.277B	0.0684B	0.0449B	0.153B	0.0604B	0.0813B	0.135B	0.667B	0.0431B	0.107B	0.0439B	0.089B	0.182B	0.108B	0.0544B
Cadmium	1.0*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	5.0*	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Lead	5.0*	<0.024	<0.024	<0.024	<0.024	<0.024	0.024B	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024
Selenium	1.0*	<0.028	<0.028	<0.028	0.031B	<0.028	0.0312B	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Silver	5.0*	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Mercury	0.2*	0.00032B	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	<0.0002	<0.002	<0.0002

< Less than the indicated laboratory reporting limit.
NE Not Established.
* Maximum Concentration of Contaminants for Toxicity Characteristic.
B The reported value was less than the laboratory reporting limit but greater than the instrument detection limit.

Table 9-2. Analytical Results from the Impact Crater Soil Borings (*continued*)

Analytes	NMED SSL	0168-SB06			0168-SB07			0168-SB08			0168-HA01	0168-HA02	0168-HA03
		0.0-0.5	4.0-6.0	9.0-9.5	0.0-0.5	4.0-6.0	9.0-9.5	0.0-0.5	4.0-6.0	9.0-9.7	(2.0-3.0)	(5.0-6.0)	(9.0-10.0)
Volatiles (mg/kg)													
UDMH	NE	<0.065	<0.074	<0.060	<0.062	<0.076	<0.061	<0.062	<0.073	<0.063	<0.072	<0.076	<0.077
NDMA	0.095	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
DMN	NE	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzene	6.4	<0.004	<0.004	<0.004	<0.003	<0.004	<0.004	<0.003	<0.004	<0.004	<0.004	0.007	<0.004
Toluene	180	<0.004	<0.004	<0.004	<0.003	<0.004	<0.004	<0.003	<0.004	<0.004	<0.004	<0.004	<0.004
Ethylbenzene	68	<0.004	<0.004	<0.004	<0.003	<0.004	<0.004	<0.003	<0.004	<0.004	<0.004	<0.004	<0.004
Xylene	63	<0.004	<0.004	<0.004	<0.003	<0.004	<0.004	<0.003	<0.004	<0.004	<0.004	<0.004	<0.004
RCRA Metals (mg/kg)													
Arsenic	3.9	0.99	1.2	<0.46	0.80B	0.83B	0.83B	<0.38	1.4	<0.48	1.6	0.88B	<0.47
Barium	5,200	34.2	40.5	8.8B	8.4B	29.8	28.4	11.0B	9.2B	11.5B	61.9	33.2	17.6B
Cadmium	70	0.06B	0.09B	<0.05	<0.05	<0.05	0.10B	0.06B	0.13B	0.08B	0.17B	0.10B	0.09B
Chromium	230	1.1	3.9	0.96B	0.83B	2.7	1.9	0.68B	2.7	2.0	4.6	2.0	0.71B
Lead	400	0.84B	1.9	0.78B	0.78B	1.5	1.5	0.70B	2.0	1.4	3.4	1.6	0.76B
Selenium	380	0.37B	0.85B	0.56B	0.69B	0.89B	0.71B	<0.25	0.84B	0.55B	4.5	0.91B	0.64B
Silver	380	<0.03	<0.03	0.05B	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.010	<0.011	<0.011B
Mercury	6.5	<0.007	<0.008	<0.009	<0.010	<0.013	<0.008	<0.010	<0.010	<0.013	<0.04	<0.03	<0.03
TCLP Metals (mg/l)													
Arsenic	5.0*	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043
Barium	100.0*	0.170B	0.113B	0.0591B	0.156B	0.0938B	0.0918B	0.117B	0.0986B	0.0573B	0.121B	0.070B	0.0829B
Cadmium	1.0*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	5.0*	<0.007	<0.007	<0.007	<0.007	<0.007	0.0447	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Lead	5.0*	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024
Selenium	1.0*	<0.028	0.0305B	<0.028	<0.028	0.0315B	<0.028	<0.028	<0.028	<0.028	0.0297B	<0.028	<0.028
Silver	5.0*	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Mercury	0.2*	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

< Less than the indicated laboratory reporting limit.
NE Not Established.
* Maximum Concentration of Contaminants for Toxicity Characteristic.
B The reported value was less than the laboratory reporting limit but greater than the instrument detection limit.

Table 9-2. Analytical Results from the Impact Crater Soil Borings (*continued)*

Analytes mg/kg	NMED SSL	0168-LMW02 (background)			0168-LMW03 (background)		
		0.0-0.5	5.0-7.0	10.0-11.0	0.0-0.5	4.0-6.0	9.0-9.6
Volatiles (mg/kg)							
UDMH	NE	<0.060	<0.075	<0.057	<0.064	<0.075	<0.060
NDMA	0.095	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
DMN	NE	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzene	6.4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Toluene	180	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Ethylbenzene	68	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Xylene	63	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
RCRA Metals (mg/kg)							
Arsenic	3.9	<0.39	1.2	<0.39	0.70 B	3.0	<0.39
Barium	5,200	11.1B	27.7	19.3	24.6	21.6	3.5B
Cadmium	70	0.05B	0.08B	0.05B	0.14B	0.10B	0.08B
Chromium	230	0.53B	1.4	1.0	1.4	0.87B	0.74B
Lead	400	0.59B	1.0	0.78B	1.4	1.6	0.86B
Selenium	380	0.28B	0.53B	<0.26	0.60B	3.0	0.40B
Silver	380	<0.03	<0.03	<0.03	<0.012	<0.011	<0.010
Mercury	6.5	<0.009	<0.011	<0.009	<0.03	<0.03	<0.03
TCLP Metals (mg/l)							
Arsenic	5.0*	<0.043	<0.043	<0.043	<0.043	0.0647B	<0.043
Barium	100.0*	0.153B	0.734B	<0.0547B	0.131	0.0519B	0.0594B
Cadmium	1.0*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	5.0*	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Lead	5.0*	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024
Selenium	1.0*	<0.028	<0.028	<0.028	<0.028	0.0292B	<0.028
Silver	5.0*	<0.003	<0.003	<0.003	<0.003	0.003B	<0.003
Mercury	0.2*	<0.0002	<0.0002	<0.0002	<0.002	<0.0002	<0.0002

< Less than the indicated laboratory reporting limit.
NE Not Established.
* Maximum Concentration of Contaminants for Toxicity Characteristic.
B The reported value was less than the laboratory reporting limit but greater than the instrument detection limit.

Table 9-3. Analytical Results from the Lance Impact Site Water Sampling

Analytes	WQCC Std.	LMW-02	LMW-03	LMW-04	LMW-05	LMW-06	LMW-07	LMW-08	LMW-09	Surface Water in Crater
Volatiles (mg/l)										
UDMH	NE	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
NDMA	NE	<0.00001	<0.00001	<0.00001	<0.00001	0.000005J	<0.00001	<0.00001	<0.00001	<0.00001
DMN	NE	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Benzene	0.01	<0.02	<0.02	<0.02	<0.001	<0.001	<0.02	<0.001	<0.001	<0.001
Toluene	NE	<0.02	<0.02	<0.02	<0.001	<0.001	<0.02	<0.001	<0.001	<0.001
Ethylbenzene	0.75	<0.02	<0.02	<0.02	<0.001	<0.001	<0.02	<0.001	<0.001	<0.001
Xylene	0.62	<0.02	<0.02	<0.02	<0.001	<0.001	<0.02	<0.001	<0.001	<0.001
Total RCRA Metals (mg/l)										
Arsenic	NE	0.0263	0.021	0.0063B	0.0107	0.0106	0.0306	0.0112	0.0266	<0.0043
Barium	NE	0.359	0.138B	0.117B	0.218	0.266	0.206	0.202	0.527	0.0048B
Cadmium	NE	0.0034B	0.0024B	0.00076B	0.0011B	0.0014B	0.0047B	0.0013B	0.0024B	<0.0005
Chromium	NE	0.0361	0.0469	0.0095B	0.0396	0.0139	0.121	0.0191	0.0268	<0.0007
Lead	NE	0.0254	0.0066B	0.0052B	0.0104	0.0091B	0.0277	0.0096B	0.035	<0.0024
Selenium	NE	0.0167	0.0102	0.0061B	0.0074B	0.0096B	0.0183	0.0062B	0.0174	0.0038B
Silver	NE	<0.0003	0.00095B	<0.0003	<0.0003	<0.0003	<0.0011	<0.0003	<0.0003	<0.0003
Mercury	NE	<0.0004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
Dissolved RCRA Metals (mg/l)										
Arsenic	0.1	0.0086B	0.0056B	0.0062B	<0.0043	0.0067B	0.0058B	0.0053B	0.0126	0.0054B
Barium	1.0	0.0072B	0.0049B	0.0078B	0.0091B	0.0089B	0.0059B	0.012B	0.0178B	0.0067B
Cadmium	0.01	<0.0005	0.00054B	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00059B	0.00071B
Chromium	0.05	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007
Lead	0.05	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024
Selenium	0.05	0.0043B	<0.0028	0.0054B	0.0038B	0.0064B	0.0058B	0.0044B	0.0113	0.0069B
Silver	0.05	<0.0003	0.00035B	0.00052B	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Mercury	0.002	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
Nutrients, Physical Characteristics, and Ions (mg/l)										
Nitrate	10.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	<2.0
Sulfate	600	**21,000**	**61,000**	**41,000**	**23,000**	**17,000**	**44,000**	**23,000**	**13,000**	**16,000**
Bicarbonate	NE	120	160	100	120	110	150	120	110	84
Carbonate	NE	<4	28	<4	<4	<8	<4	<4	<8	32
Chloride	250	**620**	**810**	**740**	**580**	160	**690**	**450**	**440**	**1,100**
Conductance#	NE	32,000	51,000	42,000	27,000	23,000	41,000	26,000	21,000	21,000
pH	6-9	8.1	8.6	8.3	8.6	7.7	8.3	8.2	7.5	8.9
TDS	1,000	**38,000**	**63,000**	**55,000**	**34,000**	**25,000**	**57,000**	**30,000**	**23,000**	**23,000**

< Less than the indicated laboratory reporting limit.
NE Not Established.
Units for conductance are micromhos per centimeter (µmhos/cm).
Bold Detection in bold is higher than the New Mexico Standard.
B The reported value was less than the laboratory reporting limit but greater than the instrument detection limit.

Appendix 9C

SWMU 168
Correspondence

February 1, 2002

WSNM
Special Use Permit

Form 10-114
Rev. DEC. 99

UNITED STATES DEPARTMENT OF THE INTERIOR
National Park Service

Special Use Permit

Name of Use **Access; install & operate groundwater testing facilities** Date Permit Reviewed 20__ _____

Reviewed 20 __ _____
Reviewed 20 __ _____
Expires **2002** __

Long Term ___ Permit # Region Park Type No. #

Short Term **X** _____

Name of Area

Gene Forsythe
White Sands Missile Range of **White Sands Missile Range** **505-678-xxxx**
Name or Permittee Address Phone

is hereby authorized during the period from (Time **0001hrs** day **1** Month **Feb** 20**02**), through (Time **2359hrs** day **31** Month **May** 20**02**), to use the following described land or facilities in the above named area:

National Park Service lands immediately surrounding the Lance Missile impact site of December 1999. Approximate coordinates of site are (UTM) 368.92E, 3624.01N.

For the purpose(s) of:

Access to install, connect, and operate subsurface drilling analysis and testing equipment, for the purpose of capturing and testing groundwater for possible contamination.

Authorizing legislation or other authority (RE - DO-53): **16 U.S.C. 1 et seq.; 42 U.S.C. 9601 et seq.**

NEPA Compliance: CATEGORICALLY EXCLUDED **X** EA/FONSI ___ EIS ___ OTHER APPROVED PLANS ___

PERFORMANCE BOND: Required ___ Not Required **X** Amount $_____

LIABILITY INSURANCE: Required ___ Not Required ___ Amount $_____

ISSUANCE of this permit is subject to the conditions on the reverse hereof and appended pages and when appropriate to the payment to the U.S. Dept. of the Interior, National Park Service of the sum of $

The undersigned hereby accepts this permit subject to the terms, covenants, obligations, and reservations, expressed or implied herein.

PERMITTEE _____ _____
Signature Date

Authorizing Official _____, James A. Mack _____
Signature Superintendent Date

Additional Authorizing Official _____, _____ _____
(If Required) Signature Title Date

CONDITIONS OF THIS PERMIT

1. The permittee shall exercise this privilege subject to the supervision of the Superintendent, and shall comply with all applicable laws and regulations of the area.

2. The issuance of this permit will grant White Sands Missile Range (WSMR) access to National Park Service (NPS) property to conduct those activities necessary to perform the work set forth in the attached statement of work entitled "Work Plan".

3. All personnel and equipment will be transported to the site by helicopter. Any vehicles brought to the site will be limited to traveling within the established work zone. The zone will be clearly delineated by an NPS representative prior to the commencement of work.

4. WSMR will provide portable toilets for personnel assigned to the site.

5. The NPS reserves the right to stop work being performed on NPS property should the NPS determine that such work has or will negatively impact any NPS resources.

6. WSMR personnel and contractors must be apprised of, and be familiar with, the contents of this permit. A copy of this permit will be available on-site during all phases of the associated work.

7. Any monitoring wells will be installed in accordance with industry standards and as approved by the NPS. The wells will be located with NPS approval: (a) so as not to negatively impact any NPS resources, including but not limited to natural, cultural, and infrastructure resources; (b) to most effectively delineate the contamination identified, in order to minimize the number of wells required to be installed on NPS property; and (c) in accordance with National Historical Preservation Act (NHPA), section 106 clearance.

   Unless the NPS requires otherwise in writing, monitoring wells will be completed with metal locking covers. Covers and aprons will be painted desert tan. Duplicate keys will be provided to the NPS at time of installation. Each well will have a permanent label (beneath the cover) with well number and any other identifying information.

   All wells will be located by UTM format to the nearest meter. The data will be provided in the final report.

   All laboratory analytical data from sampling events conducted by WSMR on NPS lands will be provided to the NPS within 30 days after sample collection.

8. This permit does not authorize any use, activity, or purpose other than those expressly herein described.

9. Assignment - This permit may not be transferred or assigned without the consent of the Superintendent, in writing.

10. This permit does not grant any property rights, easements, rights-of-ways, etc.

11. PREVENTION OF DAMAGE AND RESTORATION OF SITE: WSMR shall take adequate measures as directed and approved by NPS to prevent or minimize damage to all Park resources during all activities including, but not limited to well installation and sampling. This may include but not be limited to restoration, soil conservation and erosion protection measures, landscaping, and repairing roads, trails, signs, etc. Any trees damaged or removed will be replanted as directed by NPS. All work on Park lands shall be completed to the satisfaction of NPS.

12. QUALITY CONTROL: An NPS representative will observe all activities on NPS property, or those activities that are or may be impacting NPS property and resources. WSMR or their contractor will provide helicopter access for the NPS representative to conduct these quality control activities as requested. The Department of Interior Office of Aircraft Services (OAS) must approve all helicopters transporting NPS employees.

13. REIMBURSEMENT FOR NPS PERSONNEL: WSMR will compensate the NPS for all hours worked by NPS personnel under this Special Use Permit. NPS will provide WSMR a Bill for Collection for all associated costs.

14. REGULATORY REQUIREMENTS: All site work will be conducted and implemented in accordance with all Federal, state, and local regulations and requirements, including the Comprehensive Environmental Response, Compensation and Liability Act, CERCLA, 42 U.S.C sections 9601 et seq., and the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R Part 300 et seq., and shall be consistent with the NPS mission (see e.g., 16 USC Sections 1 et. seq.).

15. WSMR shall make available to the NPS, all information in its possession that is relevant to Site Work and all other related environmental work, in a timely fashion. Five copies of identified information will be delivered by WSMR to the NPS point of contact within 30 days of completion of the work.

16. SAFETY: All applicable Federal, state, and local health and safety regulations and standards, including those cited in 29 Code of Federal Regulations (CFR) 1910.120, will be adhered to while performing any work on NPS property.

17. Upon NPS request, WSMR will close all wells and restore the area in accordance with State, EPA, and NPS requirements.

18. Future access to NPS property or any modifications to this permit will require a written amendment issued by the NPS.

19. All work and investigations on NPS property requires a minimum 48-hour notice to the NPS point of contact.

20. The NPS point of contact for all aspects of this permit will be James A. Mack, Superintendent, White Sands National Monument. His alternate will be Bill Conrod, Chief of Resources Management, White Sands National Monument. Either can be contacted at (505) 679-2599, or by mail at P.O. Box 1086, Holloman AFB, NM 88330-1086.

21. Damages - The permittee shall pay the United States for any damage resulting from this use which would not reasonably be inherent in the use which the permittee is authorized to make of the land described in this permit.

22. Benefit - Neither Members of, nor Delegates to Congress, or Resident Commissioners shall be admitted to any share or part of this permit or derive, either directly or indirectly, any pecuniary benefits to arise therefrom: Provided, however, that nothing herein contained shall be construed to extend to any incorporated company, if the permit be for the benefit of such corporation.

23. Revocation - This permit may be terminated upon breach of any of the conditions herein or at the discretion of the Superintendent.

24. The permittee is prohibited from giving false information; to do so will be considered a breach of conditions and be grounds for revocation [Re: 36 CFR 2.32(a)(4)].

25. Permittee will comply with applicable public health and sanitation standards and codes.

26. This agreement is made upon the express condition that the United States, its agents and employees shall be free from all liabilities and claims for damages and/or suits for or by reason of any injury, or death to any person or property of the Permittee, its agents or employees, or third parties, from any cause or causes whatsoever while in or upon said premises or any part thereof during the term of this agreement or occasioned by any occupancy or use of said premises or any activity carried on by the Permittee in connection herewith, and the Permittee hereby covenants and agrees to indemnify, defend, save and hold harmless the United States, its agents and employees from all liabilities, charges, expenses and costs on account of or by reason of any such injuries, deaths, liabilities, claims, suits or losses however occurring or damages growing out of the same.

27. Permittee shall present to the National Park Service for review and approval any reports, studies, analyses or other deliverable derived in whole or in part from information or data gathered under this permit.

28. EMERGENCY ACCESS: The use of any vehicle, outside of the identified work zone, is not permitted unless specifically authorized by the Superintendent in advance. Such authorized use will then be restricted to the surveyed route.

    In the event of an emergency, the park will be notified at once and will arrange for evacuation of the injured party through contact with WSMR Security at (505) 678-1234. WSMR security will dispatch medical personnel to the scene.

Version 01/31/2002 12:48 PM

June 9, 2003

NMED

RFI Report Response Letter

WSMR Environment & Safety Tech Lib
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State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

June 9, 2003

Thomas A. Ladd, Director
Environment and Safety Directorate
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 88002-5000

SUBJECT: RCRA FACILITY INVESTIGATION OF THE LANCE MISSILE IMPACT SITE (SWMU 169) ON THE WHITE SANDS NATIONAL MONUMENT WHITE SANDS MISSILE RANGE EPA ID NO. NM2750211235 HWB-WSMR-03-003

Dear Mr. Ladd:

On April 13, 2003 the New Mexico Environment Department (NMED) determined that the White Sands Missile Range (WSMR) *RCRA Facility Investigation of the Lance Missile Impact Site on the White Sands National Monument*, submitted in November of 2002 was administratively complete. NMED confirmed receipt of the fees paid by WSMR on May 14, 2003.

In accordance with 20.4.2.200.A(7) NMAC and 20.1.4 NMAC, NMED has completed a technical review of *RCRA Facility Investigation of the Lance Missile Impact Site on the White Sands National Monument.* Detailed in WSMR's report are the results of the investigation completed by WSMR to further characterize the geology and hydrogeology of the impact area and extent of possible soil and ground water contamination

Based on our review of the report, NMED agrees with WSMR that no hazardous waste or hazardous constituents have been released to the soil or ground water as a result of the Lance

cy Javier
Gene, Subj

missile crash.

NMED was informed in a call to James Mack, superintendent of White Sands National Monument, that the crater has been backfilled with soil cuttings, crater ejecta and surrounding soil, all remaining Lance missile surface debris has been removed, all material involved with the investigative activities has been removed, and the site has been restored to its original contour.

If you have any questions regarding this letter, please call me at (505) 428-2550.

Sincerely,

Cheryl Frischkorn
White Sands Missile Range Project Leader
Permits Management Program

cc: J. Bearzi, NMED HWB
J. Kieling, NMED HWB
D. Cobrain, NMED HWB
G. von Gonten, NMED HWB
C. Frischkorn, NMED HWB
L. King, EPA Region 6 (6PD-N)
Gene Forsythe, White Sands Missile Range
Bill Conrod, White Sands National Monument

File: Reading File & 2003 WSMR File

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