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Calendar Year 2005

# Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii



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Prepared by  
Sandia National Laboratories  
Albuquerque, New Mexico 87185

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**Calendar Year 2005**  
**Annual Site**  
**Environmental Report**  
**Tonopah Test Range, Nevada &**  
**Kauai Test Facility, Hawaii**

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**ABSTRACT**

Tonopah Test Range (TTR) in Nevada and Kauai Test Facility (KTF) in Hawaii are government-owned, contractor-operated facilities operated by Sandia Corporation, a wholly-owned subsidiary of Lockheed Martin Corporation. The U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA), through the Sandia Site Office (SSO), in Albuquerque, NM, administers the contract and oversees contractor operations at TTR and KTF. Sandia Corporation manages and conducts operations at TTR in support of DOE/NNSA's Weapons Ordnance Program and has operated the site since 1957. Westinghouse Government Services subcontracts to Sandia Corporation in administering most of the environmental programs at TTR. Sandia Corporation operates KTF as a rocket preparation launching and tracking facility. This Annual Site Environmental Report (ASER) summarizes data and the compliance status of the environmental protection and monitoring program at TTR and KTF through Calendar Year (CY) 2005. The compliance status of environmental regulations applicable at these sites include state and federal regulations governing air emissions, wastewater effluent, waste management, terrestrial surveillance, and Environmental Restoration (ER) cleanup activities. Sandia Corporation is responsible only for those environmental program activities related to its operations. The DOE/NNSA, Nevada Site Office (NSO) retains responsibility for the cleanup and management of ER TTR sites. Currently, there are no ER Sites at KTF. Environmental monitoring and surveillance programs are required by DOE Order 450.1, *Environmental Protection Program* (DOE 2005) and DOE Order 231.1A, *Environment, Safety, and Health Reporting* (DOE 2004a).

Calendar Year 2005 Annual Site Environmental Report  
Sandia National Laboratories, Tonopah Test Range, Nevada &  
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## NOTE TO THE READER

The goals for the TTR and KTF Annual Site Environmental Reports are to present summary environmental performance, compliance with environmental standards and requirements, and to highlight significant facility programs. In addition, DOE views this document as a valuable tool for maintaining a dialogue with our community about the environmental health of these sites.

We are striving to improve the quality of the contents as well as include information that is important to you. Please provide feedback, comments, or questions to:

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ACRONYMS AND ABBREVIATIONS .....	iii
TTR & KTF EXECUTIVE SUMMARY .....	S-1
1.0 TTR INTRODUCTION .....	1-1
1.1 TTR History and Operations .....	1-2
1.2 Site Description and Demographics .....	1-4
1.3 Regional Geology, Hydrology, Climate, and Fauna .....	1-5
1.4 Clean Slate and Double Track Sites.....	1-6
2.0 TTR COMPLIANCE SUMMARY .....	2-1
2.1 Compliance Status with Federal Regulations .....	2-2
2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).....	2-2
2.1.2 Emergency Planning and Community Right-to-Know Act (EPCRA) .....	2-2
2.1.3 Resource Conservation and Recovery Act (RCRA).....	2-2
2.1.4 Federal Facility Compliance Act (FFCA) .....	2-2
2.1.5 Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990 .....	2-4
2.1.6 Clean Water Act (CWA) .....	2-4
2.1.7 Safe Drinking Water Act (SDWA).....	2-5
2.1.8 Toxic Substances Control Act (TSCA).....	2-5
2.1.9 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) .....	2-5
2.1.10 National Environmental Policy Act (NEPA) .....	2-5
2.1.11 Endangered Species Act (ESA) .....	2-6
2.1.12 Migratory Bird Treaty Act (MBTA) .....	2-6
2.1.13 Cultural Resources Acts.....	2-6
2.1.14 Environmental Compliance Executive Orders (EOs).....	2-6
2.2 2005 Audits .....	2-8
2.3 2005 Issues and Actions for TTR .....	2-8
2.4 Environmental Permits .....	2-9
2.5 Occurrence Reporting.....	2-9
3.0 TTR ENVIRONMENTAL PROGRAMS INFORMATION .....	3-1
3.1 ER Project Activities .....	3-2
3.2 Waste Management Programs .....	3-6
3.3 Spill Prevention Control and Countermeasures (SPCC) Plan .....	3-6
3.4 NEPA Program.....	3-6
3.5 Environmental Monitoring Performed by Outside Agencies .....	3-8
3.6 Summary of Release Reporting.....	3-8
4.0 TTR ENVIRONMENTAL MONITORING.....	4-1
4.1 Terrestrial Surveillance .....	4-2
4.1.1 Program Objectives .....	4-2
4.1.2 Regulatory Standards and Comparisons.....	4-2
4.1.3 Statistical Analyses .....	4-2
4.1.4 Sampling Locations .....	4-3
4.1.5 Radiological Parameters and Results .....	4-3
4.1.6 Non-Radiological Parameters and Results .....	4-7
4.2 Water Monitoring.....	4-7
4.2.1 Production Well Monitoring.....	4-7
4.2.2 Sewage System and Septic Tank Monitoring .....	4-8
4.2.3 Storm Water Monitoring.....	4-9

4.3	Radiological Air Monitoring.....	4-9
4.4	Non-Radiological Air Emissions .....	4-10
5.0	2005 ANNUAL SITE ENVIRONMENTAL REPORT FOR KAUAI TEST FACILITY .....	5-1
5.1	Facilities and Operations .....	5-2
5.2	2005 Rocket Launches.....	5-2
5.3	Demographics.....	5-4
5.4	Compliance Summary.....	5-4
5.5	Environmental Program Activities .....	5-11
5.6	Environmental Surveillance and Monitoring Activities .....	5-11
6.0	TTR & KTF REFERENCES .....	6-1
APPENDIX A	Terrestrial Surveillance Results and Sampling Location Maps for TTR.....	A-1

**FIGURES**

1-1	Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada .....	1-3
1-2	Location of Facilities Operated by SNL/NSO at TTR.....	1-6
4-1	Tonopah Test Range TLD Exposure (2001-2005) .....	4-8
5-1	Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area.....	5-3

**TABLES**

1-1	Project Roller Coaster Test Information.....	1-7
2-1	2005 SARA Title III (or EPCRA) Reporting Requirements Applicable to TTR .....	2-4
2-2	Protected Species Potentially Occurring in Nye County, Nevada.....	2-7
2-3	Summary of Environmental Audits Performed at TTR in 2005 .....	2-9
2-4	2005 Summary of Permit Ownership at TTR .....	2-10
3-1	DOE/NNSA/NSO ER Project TTR CAUs and CASs 2005 Status.....	3-3
3-2	Sandia Corporation TTR RCRA-Regulated Hazardous Waste Shipped Off-site in 2005.....	3-7
3-3	Non-RCRA-Regulated Hazardous or Toxic Waste Shipped Off-site in 2005.....	3-7
3-4	Recycled Regulated Hazardous or Toxic Waste Shipped Off-site in 2005. ....	3-7
4-1	Decision Matrix for Determining Priority Action Levels .....	4-3
4-2	On-site Terrestrial Surveillance Locations at TTR.....	4-4
4-3	Off-site Terrestrial Surveillance Locations at TTR .....	4-4
4-4	Perimeter Terrestrial Surveillance Locations at TTR .....	4-5
4-5	Summary Statistics for Soil Locations .....	4-6
4-6	Summary Statistics for Soil Locations Noted as Priority-2 .....	4-7
4-7	Summary Statistics for Soil Locations Noted as Priority-3 .....	4-7
4-8	Summary Statistics for TLDs by Location Class .....	4-7
4-9	Production Well Monitoring at TTR .....	4-9
4-10	Calculated Dose Assessment Results for On-site Receptor .....	4-10
5-1	Permits in Place at SNL/KTF .....	5-4
5-2	2005 SARA Title III (or EPCRA) Reporting Requirements Applicable to SNL/KTF .....	5-6
5-3	Threatened and Endangered Species Potentially Occurring on SNL/KTF .....	5-7
6-1	State of Nevada Administrative Code (NAC) Applicable to the TTR .....	6-8



## ACRONYMS AND ABBREVIATIONS

<b>A</b>	AEA	Atomic Energy Act
	ACM	Asbestos Containing Material
	AEC	U.S. Atomic Energy Commission
	AIRFA	American Indian Religious Freedom Act
	ARPA	Archaeological Resources Protection Act
	ASER	Annual Site Environmental Report
	AST	aboveground storage tank
<b>B</b>	BLM	U.S. Bureau of Land Management
	BMP	Best Management Practice
	BSA	Bulk Storage Areas
<b>C</b>	CAA	Clean Air Act
	CAAA	Clean Air Act Amendments
	CAS	Corrective Action Site
	CAU	Corrective Action Unit
	CEMP	Community Environmental Monitoring Program
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFR	Code of Federal Regulations
	COD	chemical oxygen demand
	CWA	Clean Water Act
	CY	calendar year
	<b>D</b>	D&D
DMR		Discharge Monitoring Report
DoD		U.S. Department of Defense
DOE		U.S. Department of Energy
DOE/AL		U.S. Department of Energy, Albuquerque Operations Office
DRI		Desert Research Institute, Water Resource Center, University of Nevada System
DU		depleted uranium
<b>E</b>	EA	environmental assessment
	EDE	effective dose equivalent
	EHS	extremely hazardous substance
	EIS	Environmental Impact Statement
	EM	Environmental Management (Department)
	EMS	Environmental Management System
	EO	Executive Order
	EPA	U.S. Environmental Protection Agency
	EPCRA	Emergency Planning and Community Right-to-Know Act
	ER	Environmental Restoration
	ERDA	U.S. Energy Research and Development Administration
	ES&H	Environment, Safety, and Health
	ESA	Endangered Species Act
<b>F</b>	FFCA	Federal Facilities Compliance Act
	FFACO	Federal Facilities Agreement and Consent Order
	FIDLER	field instrument for the detection of low-energy radiation
	FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
	FONSI	Finding of No Significant Impact
<b>H</b>	HAR	Hawaii Administrative Rules
	HQ	headquarters
<b>I</b>	ISMS	Integrated Safety Management System

<b>K</b>	KTF	Kauai Test Facility
<b>L</b>	LDR LLW LOB	Land Disposal Restriction low-level waste Launch Operations Building
<b>M</b>	MAB MBTA MDA MOA MEI MSDS MST MW	Missile Assembly Building Migratory Bird Treaty Act minimum detectable activity Memorandum of Agreement maximally exposed individual Material Safety Data Sheet Missile Service Tower mixed waste
<b>N</b>	NAC NAEG NAFB NDEP NEPA NESHAP NFA NHPA NNSA NPDES NPL NSP NSPS NSO NTS NTTR NV	Nevada Administrative Code Nevada Applied Ecology Group Nellis Air Force Base (Range Complex) Nevada Department of Environmental Protection National Environmental Policy Act National Emission Standards for Hazardous Air Pollutants No Further Action National Historic Preservation Act National Nuclear Security Administration National Pollutant Discharge Elimination System National Priorities List Non-covered Source Permit New Source Performance Standard Nevada Site Office Nevada Test Site Nevada Test and Training Range Nevada
<b>P</b>	PA PCB PMRF PMS PPE PSD PVC	Preliminary Assessment polychlorinated biphenyl Pacific Missile Range Facility portable monitoring station personal protective equipment Prevention of Significant Deterioration polyvinylchloride
<b>Q</b>	QA	quality assurance
<b>R</b>	R&D RCRA ROD RQ RY	research and development Resource Conservation and Recovery Act Record of Decision Reportable Quantity reporting year
<b>S</b>	SAIC SARA SDWA SHPO SNL SNL/KTF SNL/NM SOC SPCC	Science Applications International Corporation Superfund Amendments and Reauthorization Act Safe Drinking Water Act State Historic Preservation Office Sandia National Laboratories Kauai Test Facility Sandia National Laboratories, New Mexico Synthetic Organic Compounds Spill Prevention, Control, and Countermeasures

	SSO	Sandia Site Office
	STARS	Strategic Targeting System
	SVOC	semi-volatile organic compound
	SWPPP	Storm Water Pollution Prevention Plan
<b>T</b>	TLD	thermoluminescent dosimeter
	TQ	threshold quantity
	TRPH	total recoverable petroleum hydrocarbon
	TRI	Toxic Release Inventory
	TSCA	Toxic Substances Control Act
	TSD	treatment, storage, and disposal (facility)
	TTR	Tonopah Test Range
<b>U</b>	USAF	U.S. Air Force
	USFS	U.S. Forest Service
	USGS	U.S. Geological Survey
	UST	underground storage tank
<b>V</b>	VOC	volatile organic compound

### Units of Measure

°C	Celsius degree	m	meter
cm	centimeter	m <sup>2</sup>	square meter
°F	Fahrenheit degree	m <sup>3</sup>	cubic meter
ft	feet	mg	milligram
g	gram	mi	mile
in.	inch	ppm	parts per million
km	kilometer	yd	yard
kg	kilogram	yd <sup>3</sup>	cubic yard
yr	year	lb	pound
Std Dev	standard deviation		

### Radioactivity Measurements

Ci	curie (unit of radioactivity)	pCi/g	picocurie per gram
mrem	millirem (unit of radiation dose)	rem	roentgen equivalent man (unit of radiation dose)
mrem/yr	millirem per year		
mR/yr	milliroentgen per year	mSv	millisievert (unit of radiation dose)
pCi	picocurie	µg/m <sup>2</sup>	microgram per square meter
µR/hr	microroentgen per hour	µg/g	microgram per gram

### Chemical Abbreviations

Am-241	americium-241	Cs-137	cesium-137
Pu-238	plutonium-238	Pu-239	plutonium-239
Pu-240	plutonium-240	U <sub>tot</sub>	uranium, total

### Approximate Conversion Factors for Selected SI (Metric) Units

<b>Multiply Si (metric) unit</b>	<b>by</b>	<b>To obtain U.S. customary unit</b>
Celsius (°C)	$^{\circ}\text{F} = 9/5 \text{ }^{\circ}\text{C} + 32$	Fahrenheit (°F)
centimeter (cm)	0.39	inch (in.)
cubic meter (m <sup>3</sup> )	35	cubic feet (ft <sup>3</sup> )
gram (g)	0.035	ounce (oz)
hectare (ha)	2.5	acre
kilogram (kg)	2.2	pound (lb)
kilometer (km)	0.62	mile (mi)
liter (L)	0.26	gallon (gal)
meter (m)	3.3	feet (ft)
milligram per liter (mg/L)	1	parts per million (ppm)
microgram per gram (mg/g)	1	parts per million (ppm)
square kilometer (km <sup>2</sup> )	0.39	square mile (mi <sup>2</sup> )

# TTR & KTF

# EXECUTIVE SUMMARY



## Tonopah Test Range Environmental Programs:

- Waste Management
- Environmental Restoration Project
- Terrestrial Surveillance
- Water Quality
- Air Quality
- National Environmental Policy Act Activities

## Kauai Test Facility Environmental Programs:

- National Environmental Policy Act Activities
- Water Quality
- Air Quality
- Terrestrial Surveillance

Sandia National Laboratories (SNL) (a wholly-owned subsidiary of Lockheed Martin Corporation) at Tonopah Test Range (TTR) and Kauai Test Facility (KTF) are government-owned, contractor-operated facilities owned by the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA). The DOE/NNSA/Sandia Site Office (SSO) in Albuquerque, New Mexico executes the DOE/NNSA direction. This report was prepared in accordance with, and as required, by DOE Order 450.1, *Environmental Protection Program* (DOE 2005) and DOE Order 231.1A, *Environment, Safety, and Health Reporting* (DOE 2004). This report summarizes data from environmental protection and monitoring programs at TTR and KTF for Calendar Year 2005. It also discusses Sandia Corporation's compliance with environmental statutes, regulations, and permit provisions and highlights other significant environmental programs and efforts at TTR and KTF. This report is a key component of Sandia Corporation and DOE's effort to keep the public informed about environmental conditions throughout the DOE/NNSA complex.

### **Tonopah Test Range**

Sandia Corporation conducts operations at TTR in support of the DOE/NNSA's Weapons Ordnance Program. Sandia Corporation's activities involve research and development and testing of weapon components and delivery systems. Many of these activities require a remote test range with a long flight corridor for air drops and rocket launches. Other activities include explosive tests and gun firings.

### **Environmental Programs**

The following environmental programs are in place at TTR:

- Waste management,
- Environmental Restoration (ER),
- Terrestrial surveillance,
- Water quality monitoring,
- Air quality compliance, and
- National Environmental Policy Act (NEPA).

### **Waste Management**

Waste generated at TTR in 2005 included hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA) and non-hazardous industrial and sanitary waste. All hazardous waste was shipped to permitted treatment, storage, and

disposal facilities. (Sandia Corporation does not handle waste generated by ER activities.)

### **ER Project**

ER activities at TTR are conducted through the DOE/NNSA, Nevada Site Office (NSO). ER sites remaining to be remediated/closed at TTR include areas impacted from target tests and detonations, including non-impacted surface debris, and areas impacted by ordnance, depleted uranium and heavy metals.

### **Terrestrial Surveillance**

Soil samples were collected from 14 off-site, eight perimeter, and 22 on-site locations in 2005. Soil is the only terrestrial medium sampled at TTR. Samples are collected to detect air-deposited pollutants or contaminants that may have transported and deposited as a result of surface water runoff.

In 2005, soils were analyzed for radiological and non-radiological constituents, as is done periodically (SNL 2006a). The results showed no anomalies that required further investigation.



Longleaf Phlox

### **Water Quality**

Waste monitoring results confirmed that all permit conditions set by the State of Nevada were met in 2005. However additional monitoring for Di (2-ethylhexyl) Phthalate was required by the state because it was detected above the detection limit in a sample. The result was below the maximum contaminant level.

Water quality samples are routinely taken from Production Well 6, which supplies potable water for Sandia Corporation's Main Compound at TTR. In 2005, the Water and Fire protection upgrade project was nearly completed. Well 6 was rehabilitated, all water distribution system lines, valves, and hydrants were replaced, a new elevated water storage tower was constructed, and a water treatment facility (sodium hypochlorite injection, pH adjustment, and arsenic removal) was nearly finished. The entire system is expected to come on-line in early 2006.

### **Air Quality**

Radiological air emissions are regulated by National Emission Standards for Hazardous Air Pollutants. The only radionuclide sources at TTR are the three Clean Slate Sites, which are sources of diffused radionuclide emissions as a result of the re-suspension of contaminated soils. These sites are currently being addressed by DOE/NNSA/NSO under the ER Project. The calculated dose for the maximally exposed individual was 0.024 millirem/year (mrem/yr), which is approximately 400 times less than the 10 mrem/yr standard set by the U.S. Environmental Protection Agency. Based on this value, an annual dose assessment is not required to be calculated for the TTR site.

TTR's Class II Air Quality Permit requires emission reports from significant non-radionuclide sources. At TTR, these sources include the screening plant and portable screen. In 2005, there were no measurable emissions as the screens were not used.

### **NEPA**

At TTR, NEPA compliance is coordinated between Sandia Corporation and DOE/NNSA/SSO. Compliance is also supported with the assistance of the Desert Research Institute, a branch of the University of Nevada System. A total of nine NEPA reviews were processed during 2005. One NEPA review was completed by SNL/NM. Seven NEPA checklists were submitted to SSO for review and were found to be categorically excluded. One NEPA checklist is pending a decision with the Nellis Air Force Base.

### **Kauai Test Facility**

KTF is operated by Sandia Corporation as a rocket preparation, launching, and tracking facility for DOE/NNSA, as well as in support of other U.S.

Military agencies. SNL/KTF exists as a facility within the boundaries of the U.S. Department of Defense Pacific Missile Range Facility. SNL/KTF, located on the island of Kauai at the north end of the Pacific Missile Range Facility near Nohili Point, has been an active rocket-launching facility since 1962. There were four rockets launched from SNL/KTF in 2005.

The following environmental programs are in place at KTF:

- Air quality compliance,
- NEPA,
- Water quality monitoring, and
- Terrestrial surveillance (every five years).

### **Air Quality**

As required by the EPA, the 2004 Annual Fee and Monitoring Report (air emissions) was submitted to the State of Hawaii at the end of February 2005 (SNL 2006b). In 2005, the total usage reported to the State of Hawaii was 18,556 gallons of diesel fuel. Sandia Corporation was in compliance with all air quality regulations in 2005.

### **NEPA**

In 2005, the DOE/NNSA/SSO determined it was time to review and update the Site-Wide Environmental Assessment for KTF. This review and update is expected to begin in 2006.

### **Water Quality**

Septic tanks do not require permitting or sampling, but as a best management practice, Sandia Corporation periodically performs sampling. No contaminants were identified above the reporting limits.



Small Rocket Launch at KTF

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chapter one

# TTR INTRODUCTION



## In This Chapter ...

TTR History and Operations  
Site Description and Demographics  
Regional Geology, Hydrology, Climate, and Fauna  
Clean Slate and Double Track Sites

## *Environmental Snapshot*

*The climate at the Tonopah Test Range is typical of high desert, mid-latitude locations, with large diurnal and seasonal changes in temperature, and little total rainfall. Temperature extremes on the test range can vary from a high near 40 °C (104 °F) in the summer and approach -30 °C (-22 °F) in the winter.*

Sandia Corporation (a subsidiary of Lockheed Martin Corporation through its contract with the U.S. Department of Energy [DOE]), National Nuclear Security Administration (NNSA), Sandia Site Office (SSO), operates the Tonopah Test Range (TTR) in Nevada.

Sandia Corporation's TTR is located on approximately 280 square miles (179,200 acres) within the boundaries of the Nevada Test and Training Range (NTTR) withdrawal and is used to support DOE/NNSA and U.S. Air Force (USAF) activities and missions. TTR is owned by the DOE/NNSA, and is overseen by the SSO in Albuquerque, New Mexico. Westinghouse Government Service performs most environmental program functions on behalf of Sandia Corporation, including environmental media sampling, wastewater effluent and drinking water monitoring, spill response, and waste management operations. Westinghouse Government Service also supports TTR during tests by operating optics equipment, recovering test objects, and performing radiography.

This Annual Site Environmental Report (ASER) is prepared in accordance with the following DOE Orders that pertain to environmental protection and management:

- DOE Order 450.1, *Environmental Protection Program* (DOE 2005);
- DOE Order 231.1A, *Environment, Safety, and Health Reporting* (DOE 2004a);
- DOE Order 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003);
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001a);
- DOE Order 5400.5, Chg 2, *Radiation Protection of the Public and the Environment* (DOE 1993); and
- SEN-22-90, *DOE Policy on Signatures of RCRA Permit Applications* (DOE 1990).

This ASER summarizes data from environmental protection and monitoring programs at TTR for 2005. The environmental programs summarized include waste management, air, water, terrestrial monitoring and surveillance, the Environmental Restoration (ER) Project, and the National Environmental Policy Act (NEPA). DOE Order 450.1 specifies the requirements for environmental monitoring conducted at and around the TTR site. The ASER

represents an important component of DOE and Sandia Corporation's effort to keep the public informed about environmental conditions at DOE/NNSA facilities.

Sandia Corporation's strategy for managing and implementing its Environment, Safety, and Health (ES&H) Program is described in the Integrated Safety Management System (ISMS). The ISMS program is structured around five safety management functions and provides the processes to assist line management in identifying and controlling hazards. Sandia Corporation is utilizing an Environmental Management System (EMS) as an enhancement of the ISMS. The EMS is that part of the ISMS that addresses environmental consequences of SNL/NM's activities, products, and services. In 2005, SNL/NM continued to work to improve environmental management (EM) based on best management practices (BMPs), bench marking, and process improvements. On December 2, 2005, Sandia declared to the DOE/NNSA/SSO that it had fully implemented an EMS in accordance with the requirements outlined in DOE Order 450.1.

## **1.1 TTR HISTORY AND OPERATIONS**

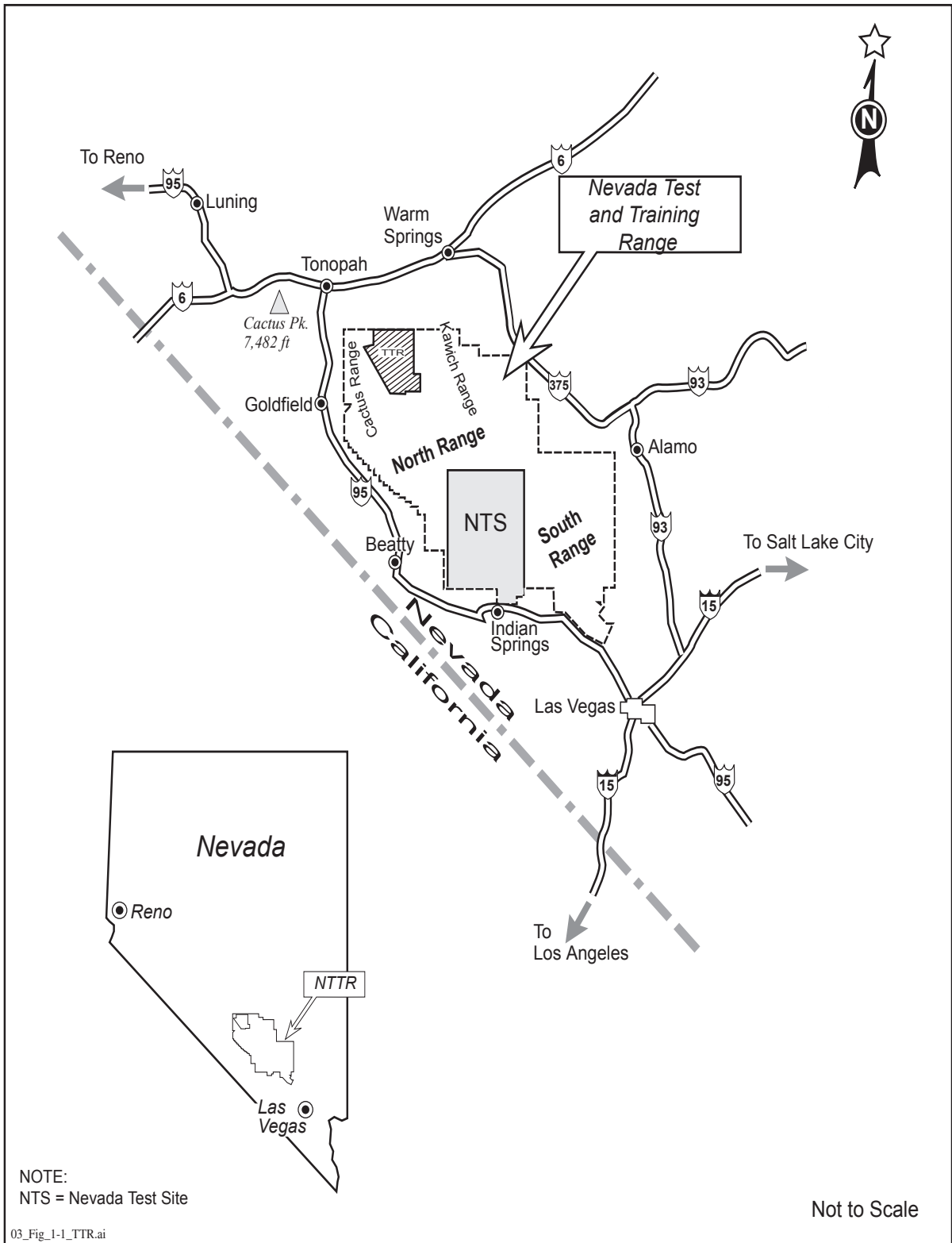
In 1940, President Roosevelt established the "Las Vegas Bombing and Gunnery Range" (now referred to as NTTR), which is part of the Nellis Air Force Base (NAFB) Complex. The NAFB Complex, located eight miles north of Las Vegas, Nevada, includes several auxiliary small arm ranges, and the NTTR—divided into a North Range and a South Range (Figure 1-1). The Nevada Test Site (NTS) is located between these two ranges. The entire NAFB Complex is comprised of approximately three million acres. TTR is located 32 miles southeast of Tonopah, Nevada.

### **TTR Site Characteristics**

The topography at TTR is characterized by a broad, flat, valley bordered by two north and south trending mountain ranges: the Cactus Range to the west (occurring mostly within the boundaries of TTR) and the Kawich Range to the east. Cactus Flat is the valley floor where the main operational area of TTR is located. An area of low hills outcrops in the south. Elevations within TTR range from 5,347 feet at the valley floor to 7,482 feet at Cactus Peak. The elevation within the town of Tonopah is 6,030 feet.

### **TTR Site Selection**

TTR was selected as a test range after similar facilities at the Salton Sea Test Base in California, as well as Yucca Flat on the NTS, became inadequate. By the mid-1950s, the atmosphere at the Salton Sea Test



**FIGURE 1-1.** Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada.

Base became permeated with haze, which limited visibility and hampered photography. Nevada's Yucca Flat site also became inadequate due to the increasing emphasis on low-altitude approaches and deliveries that required flat terrain and a long approach corridor. The TTR site was located in the northwest corner of the then Las Vegas Bombing and Gunnery Range. The site, which was approximately seven times the size of the Salton Sea Test Base, was well suited because it had immense areas of flat terrain needed for the increasing use of rockets and low-altitude, high-speed aircraft operations. A permit from the Air Force was obtained in 1956, and TTR became operational in 1957 to test new weapon systems. In the years following World War II, facilities that were built at TTR were originally designed and equipped to gather data on aircraft-delivered inert test vehicles under U.S. Atomic Energy Commission (AEC) cognizance (now DOE). Over the years, the facilities and capabilities at TTR were expanded to accommodate tests related to the DOE/NNSA's Weapons Ordnance Program.

### ***Operations Control Center***

The Main Compound in Area 3 is the heart of the test range activities. The Operations Control Center controls and coordinates all test functions and affords a 360-degree view of the site. During test operations, the test director, range safety officer, test project engineer, camera controller, and range communicator operate the consoles in the Operations Control Center to control and coordinate all test functions.

### ***TTR Activities***

Principal DOE activities at TTR include stockpile reliability testing; research and development (R&D) testing support of structural development; arming, fusing and firing systems testing; and testing nuclear weapon delivery systems. No nuclear devices are tested at TTR.

TTR is instrumented with a wide array of signal tracking equipment including video, high-speed cameras, radar tracking devices used to characterize ballistics, aerodynamics, and parachute performance on artillery shells, bomb drops, missiles, and rockets.

In recent years, specific test activities at TTR have consisted of the following:

- Air drops (trajectory studies of simulated weapons);
- Gun firings;
- Ground-launched rockets (study of aeroballistics and material properties);

- Air-launched rockets (deployed from aircraft);
- Explosive testing (e.g., shipping and storage containers);
- Static rocket tests (related to the Trident Submarine Program); and
- Ground penetrator tests.

These activities require a remote range for both public safety and to maintain national security. The majority of test activities at TTR occur within Cactus Flat, a valley with almost no topographical relief flanked by mountains and hills.

### ***Site Responsibility***

On October 1, 1997, a Memorandum of Agreement (MOA) was signed between DOE/SSO and the DOE/Nevada Site Office (NSO) in regards to operational test activities at TTR (DOE 1994). It was determined that DOE/SSO is responsible for the oversight of TTR; however, DOE/NSO will continue with the oversight of ER activities at TTR. Environmental program management, as discussed in this ASER, is a joint effort between TTR and Sandia National Laboratories, New Mexico (SNL/NM) employees and contractors with oversight from DOE/SSO. In April 2002, a Land Use Permit was signed between the USAF and NNSA entitled, "Department of the Air Force Permit to the National Nuclear Security Administration To Use Property Located On The Nevada Test and Training Range, Nevada." The current size of TTR is approximately 280 square miles (179,200 acres). Prior to the April 2002 lease agreement, the footprint was 335,655 acres.

## ***1.2 SITE DESCRIPTION AND DEMOGRAPHICS***

TTR is located within the NTTR at the northern boundary. The area north of the TTR boundary is sparsely populated public lands administered by both the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). The land is currently used to graze cattle. There is a substantial irrigated farming operation to the north of the range as well. To the east of TTR, and within the NTTR, is the Nevada Wild Horse Range, which is also administered by the BLM.

The nearest residents are located in the town of Goldfield (population 659), approximately 22 miles west of the site boundary. The town of Tonopah (population 4,400) is approximately 30 miles northwest of the site (DOC 2006). Las Vegas, Nevada is 140 miles from TTR. The total population within a 50-miles radius around TTR is

approximately 7,000, which includes the potential population at TTR if all housing units at the site were occupied.

### **1.3 REGIONAL GEOLOGY, HYDROLOGY, CLIMATE, AND FAUNA**

#### **Geology**

The regional area around TTR is located in the western part of the Basin and Range geophysical province. This area is marked by horst and graben topography, a system of mountains and down-dropped fault valleys formed through regional extension. TTR lies northeast of the Walker Lane, a zone of transcurrent faulting and shear, and the Las Vegas Valley shear zone to the southeast (Sinnock 1982).

The Cactus Range to the west of TTR is the remnants of a major volcanic center consisting of relatively young (six million-year-old) folded and faulted tertiary volcanics. This range is one of at least five northwest trending, raised structural blocks that lie along the Las Vegas Valley-Walker Lane lineaments (ERDA 1975).

#### **Surface Water**

Drainage patterns within and near TTR are intermittent (ephemeral stream channels) and end in closed basins. Ephemeral streams occasionally carry spring runoff to the center of Cactus Flat where there is a string of north-south trending dry lakebeds; however, due to the high rate of evaporation, little is recharged to the groundwater (DRI 1991).

There are several small springs within the Cactus and Kawich Ranges. Three springs occur within TTR boundaries: Cactus, Antelope, and Silverbow Springs. Water from these springs does not travel more than several tens of meters dissipating rapidly through evaporation and infiltration. The effect on the landscape is purely local.

#### **Groundwater**

TTR obtains its water from local wells. The U.S. Geological Survey (USGS) has recorded groundwater depths from 21 to 454 feet at the site. Groundwater is encountered at the Antelope Mine well in the Cactus Range at 21 feet and at the EH2 well near the TTR Airport at 454 feet. The depth to groundwater at the Area 9 well located at the north end of the site is approximately 131 feet. South of the Area 9 well, groundwater is encountered at 361 to 394 feet in Area 3. The static water level at the main water supply well (Well 6) is approximately 350 feet.

#### **Climate**

The climate at TTR is typical of high desert, mid-latitude locations, with large diurnal and seasonal changes in temperature, and little total rainfall. Temperature extremes on the test range can vary from a high near 40 °C (104 °F) in the summer and approach -30 °C (-22 °F) in the winter. July and August are the hottest months with daily highs ranging from 32 to 37 °C (90s °F) and temperatures between 10 and 15 °C (50s °F) at night. January conditions vary from highs 5 to 10°C (40s °F) to lows -7 to -11°C (teens °F). An eight-year climatology developed from data taken in the 1960s identifies a record high of 38.8°C (102 °F) and a record low of -31°C (-24 °F) (Schaeffer 1970).

Rainfall, though sparse, is dependent on elevation. Annual average rainfall on the desert floor is 4 inches with as much as 12 inches falling in the mountains (USAF 1999).

Winds are generally from the northwest in the winter and early spring, switching to southerly directions during the summer. The mountain/valley system channels the wind so that the wind seldom blows from the east or southwest directions. Dust storms are common in the spring, when monthly average wind speeds reach 6.7 m/s (15 miles an hour). During the spring and fall months, a diurnal cycle to the wind may be seen with northwest drainage winds for a time, and southerly winds by afternoon.

#### **Vegetation**

Temperature extremes and arid conditions of the high desert limit vegetation coverage. Sparse vegetation that occurs in Cactus Flat is predominantly range grasses and low shrubs typical of the Great Basin Desert flora (ERDA 1975; EG&G 1979).

Vegetation is divided into two basic types at the site by elevation—salt desert shrub in the low areas and northern desert shrub in the higher elevations (USAF 1999, DRI 1991). Salt desert shrub is characteristic of poorly drained soils and is common along dry lakebeds. Specific plants in this group include shadescale (*Atriplex confertifolia*), Russian thistle (*Salsola kali*), and sagebrush (*Artemisia tridentata*). Northern desert shrub, found in the Cactus Range, includes a variety of sagebrush, rabbitbrush (*Chrysothamnus nauseosus*), squirrel tail (*Elymus longifolius*), juniper (*Juniperus spp.*), and Nevada bluegrass (*Poa nevadensis*). Joshua tree (*Yucca brevifolia*) and juniper grow in the transition zone at the base of the mountains.

#### **Wildlife**

The Nevada Wild Horse Range and other wild horse land-use areas compose a significant portion

of the North Range with herds common in Cactus and Gold Flats, Kawich Valley, Goldfield Hills, and the Stonewall Mountains. Hundreds of wild horses (*Equus caballus*) graze freely throughout TTR and activities on-site have had little affect on the horse population or their grazing habits. The BLM routinely rounds up a portion of the herds for dispersal through the Horse Adoption Program.

Other mammals common to the area include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), kit fox (*Vulpes macrotis*), bobcat (*Zynx rufus*), coyote (*Canis latrans*), and gray fox (*Urocyon cinereoargenteus*). To a lesser extent, bighorn sheep (*Ovis canadensis*), mountain lion (*Felis concolor*), and burros (*Equus asinus*) are also present (USAF 1999, DRI 1991).

In general, the NTTR land withdrawal has provided a positive effect on local plant and animal life. Since much of the withdrawal area is undisturbed by human activity, large habitat areas are protected from the affects of public use.

#### 1.4 CLEAN SLATE AND DOUBLE TRACK SITES

In May and June 1963, Project Roller Coaster included a series of four nuclear weapons destruction tests that resulted in plutonium dispersal in the surrounding soils. Three of these tests were

conducted within the boundaries of TTR; the fourth was conducted on the NTTR just west of TTR. The three Project Roller Coaster test sites at TTR are referred to as Clean Slates 1, 2, and 3 (Figure 1-2). The fourth test site at NTTR is referred to as Double Tracks. In 1996, Double Tracks was closed after soil contamination was remediated to a level of less than or equal to 200 picocuries per gram (pCi/g) of transuranics.

Table 1-1 summarizes test information related to the four Project Roller Coaster sites. DOE/NNSA/NSO is responsible for the remediation of these and all other ER sites (see Chapter 3) at TTR. Sandia Corporation will continue to be responsible for environmental compliance at these sites.

The initial cleanup of each Clean Slate site was conducted shortly after each test. Test-related debris was bladed into a hole at test ground zero and backfilled. An initial fence was built around each test area where the soil contamination was set at approximately 1,000 micrograms per square meter ( $\mu\text{g}/\text{m}^2$ ) of plutonium. The soil survey was conducted on 61-meter grids with a hand-held survey meter or field instrument for the detection of low-energy radiation (FIDLER). In 1973, additional outer fences were set at 40 pCi/g of plutonium in soil also using the hand-held meter method. Soil sampling is conducted periodically at these sites and the areas are visually inspected twice a year to

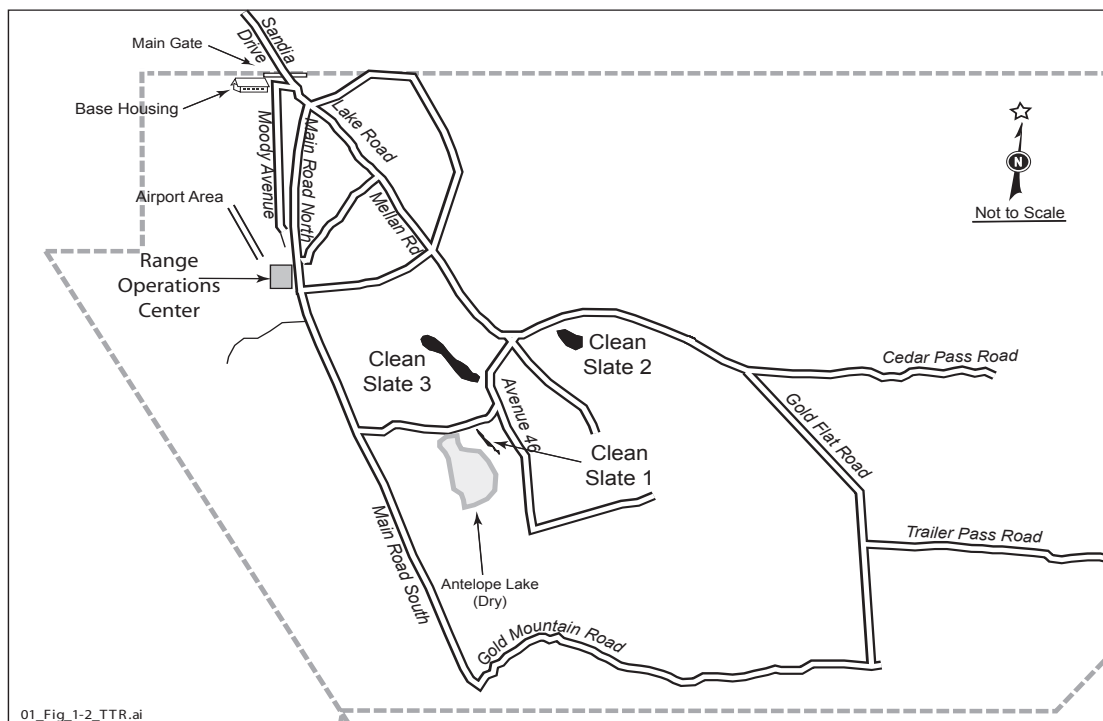


FIGURE 1-2. Location of Facilities Operated by SNL/NSO at TTR

**TABLE 1-1.** Project Roller Coaster Test Information

Test Name	Date of Test	Location	Status
Clean Slate 1	May 25, 1963	TTR	Interim Closure
Clean Slate 2	May 31, 1963	TTR	Remediation phase
Clean Slate 3	June 9, 1963	TTR	Remediation has not started
Double Tracks	May 15, 1963	NTTR, North Range (west of TTR)	Interim Closure

**NOTE:** TTR = Tonopah Test Range

NTTR = Nevada Test and Training Range

Source: Sampling and Analysis Plan for Clean Slate 1, September 1996 (IT 1996)

determine whether any fence repairs are required. Any horses that may wander inside the fenced areas are promptly relocated.

In 1977, an aerial radiological survey was performed by EG&G, Inc. for the Nevada Applied Ecology Group (NAEG) (EG&G 1995). The aerial radiological surveys were undertaken to supplement the FIDLER and previous soil sample measurements of transuranics. The objective was to determine the extent of surficial distribution of plutonium and other transuranic elements dispersed during the Project Roller Coaster tests. Radiation isopleths showing soil activity due to americium-241 (Am-241), plutonium-239 (Pu-239), and plutonium-240 (Pu-240) were drawn for each area. The cumulative area of the diffuse sources, as determined by the aerial radiological survey, is 20 million m<sup>2</sup> (approximately

4900 acres). The results of the survey found transuranic contamination outside the fenced area in the downwind direction (EG&G 1995).

#### ***Air Monitoring at ER sites***

Remediation activities were conducted at Clean Slate 1 in 1997. The Desert Research Institute (DRI) collected air monitoring data from several locations in the vicinity of Clean Slate 1 before, during, and after remediation activities. The data has been presented to DOE/NSO in the form of a draft report (DRI 1997), and awaits approval. DOE/NSO suspended air monitoring in April 2000 and will not resume until active remediation efforts at the Clean Slate sites begin again.



Antelope “Dry” Lake at TTR

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## chapter two

# TTR COMPLIANCE SUMMARY



### In This Chapter ...

Compliance Status with Federal Regulations  
2005 Audits  
2005 Issues and Actions for TTR  
Environmental Permits  
Occurrence Reporting

### *Environmental Snapshot*

*Chemical pesticides used at the Tonopah Test Range include herbicides, rodenticides, and insecticides, as required. All chemicals used are EPA-approved and applied in accordance with applicable label guidelines and regulations.*

Sandia Corporation is responsible for Environment, Safety, and Health (ES&H) compliance with federal environmental statutes, regulations, Executive Orders (EOs), and U.S. Department of Energy (DOE) Orders applicable to Tonopah Test Range (TTR).

This chapter discusses Sandia Corporation's responsibility and the status of ES&H compliance. Environmental audit summaries, occurrence reporting, and environmental permit status for 2005 are also presented in this chapter.

The State of Nevada administers most environmental regulations applicable to TTR. Specific state regulations listed in Chapter 6 include regulations governing air quality, solid and hazardous waste management, wildlife, water quality, and radiation control. Radionuclide air emission regulations are administered directly by the U.S. Environmental Protection Agency (EPA).

## **2.1 COMPLIANCE STATUS WITH FEDERAL REGULATIONS**

This section summarizes DOE and Sandia Corporation's compliance status with major environmental regulations, statutes, EOs, and DOE Orders that pertain to the environment.

Major federal laws applicable to environmental compliance at TTR are presented on page 2-3 (see shaded box).

### **2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**

CERCLA defines assessment activities and reporting requirements for inactive waste sites at federal facilities. As required by CERCLA, a Preliminary Assessment (PA) was submitted in 1988 for all facilities listed on the federal agency hazardous waste compliance docket. Sites with significant contamination were put on the National Priorities List (NPL) for cleanup (EPA 2006). There are no NPL or "Superfund" sites located at TTR.

Additional CERCLA requirements are given in the Superfund Amendments and Reauthorization Act (SARA) Title III for reportable quantity (RQ) releases and chemical inventory reporting. Sandia

Corporation at TTR was in full compliance with CERCLA, SARA, and RQ in 2005. Table 2-1 lists SARA Title III reporting requirements.

### **2.1.2 Emergency Planning and Community Right-to-Know Act (EPCRA)**

SARA Title III (also known as EPCRA) requires the submittal of a Toxic Release Inventory (TRI) report for chemical releases over a given threshold quantity (TQ). The release reporting limit for lead is 100 lbs. The TTR Firing Range released approximately 5,832 pounds of non-recovered lead in 2005. This information will be reported in the Reporting Year (RY) 2005 TRI Report (to be published in 2006).

### **2.1.3 Resource Conservation and Recovery Act (RCRA)**

Under the RCRA Hazardous Waste Permit Program (40 CFR 270), TTR is permitted as a "small quantity generator." Under this designation, hazardous waste can only be stored on-site for 180 days before it must be shipped off-site for treatment and disposal at an EPA-permitted facility. At TTR, hazardous waste shipments are scheduled to occur at least two to three times a year.

Sanitary solid waste, which is also regulated under RCRA, is disposed of at landfills on-site. There is one Class II sanitary landfill in operation at TTR operated by the U.S. Air Force (USAF) Operations and Maintenance contractor. The landfill is used cooperatively by all organizations at TTR.

**Underground Storage Tanks (USTs) and Aboveground Storage Tanks (ASTs) – RCRA, Subchapter I (40 CFR 280)** sets forth requirements for USTs that contain hazardous materials or petroleum products. The last five USTs (two diesel tanks and two gasoline tanks were removed from Area 3 at the site of a former gas station and one diesel tank was removed from Area 9 that had supplied generator fuel) were removed in August 1995. There are no ASTs requiring registration with the State of Nevada at TTR.

### **2.1.4 Federal Facility Compliance Act (FFCA)**

The FFCA amendments to RCRA specifically address Land Disposal Restriction (LDR) requirements for the treatment of mixed waste (MW) at federal

## Major Environmental Regulations & Statutes Applicable to TTR

### **Clean Air Act (CAA) and CAA Amendments (CAAA)**

Provides standards to protect the nation's air quality [http://www.epa.gov/oar/oaq\\_caa.html](http://www.epa.gov/oar/oaq_caa.html)

### **Clean Water Act (CWA)**

Provides general water quality standards to protect the nation's water sources and byways  
<http://www.epa.gov/region5/water/cwa.htm>

### **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**

Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances <http://www.epa.gov/region5/defs/html/cercla.htm>

### **Cultural resources acts**

Includes various acts that protect archeological, historical, religious sites, and resources  
[http://water.usgs.gov/eap/env\\_guide/cultural.html](http://water.usgs.gov/eap/env_guide/cultural.html)

### **Endangered Species Act (ESA)**

Provides special protection status for federally-listed endangered or threatened species  
<http://www.epa.gov/region5/defs/html/esa.htm>

### **Executive Orders (EOs)**

Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and greening the government through leadership in environmental management  
[http://www.archives.gov/federal\\_register/executive\\_orders/disposition.html](http://www.archives.gov/federal_register/executive_orders/disposition.html)

### **Federal Facility Compliance Act (FFCA)**

Directs federal agencies regarding environmental compliance <http://tis.eh.doe.gov/oepa/laws/ffca.html>

### **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)**

Controls the distribution and use of various pesticides <http://www.epa.gov/region5/defs/html/fifra.htm>

### **Migratory Bird Treaty Act (MBTA) of 1918**

Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests <http://tis.eh.doe.gov/oepa/laws/mbta.html>

### **National Emission Standards for Hazardous Air Pollutants (NESHAP)**

Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA  
<http://www.epa.gov/radiation/neshaps/>

### **National Environmental Policy Act (NEPA)**

Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making <http://tis.eh.doe.gov/NEPA/>

### **Resource Conservation and Recovery Act (RCRA)**

Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (USTs) <http://www.epa.gov/region5/defs/html/rcra.htm>

### **Safe Drinking Water Act (SDWA)**

Provides specific standards used for drinking water sources <http://www.epa.gov/safewater/sdwa/sdwa.html>

### **Superfund Amendments and Reauthorization Act (SARA)**

SARA, Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community  
<http://www.epa.gov/region5/defs/html/sara.htm>

### **Toxic Substance Control Act (TSCA)**

Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs) <http://www.epa.gov/compliance/civil/tsca/index.html>

**TABLE 2-1. 2005 SARA Title III (or EPCRA) Reporting Requirements Applicable to TTR**

Section	SARA Title III Section Title	Requires Reporting?		Description
		Yes	No	
302–303	Emergency Planning	X		Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/SSO, which distributes it to the required entities.
304	Emergency Notification		X	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2005.
311-312	Hazardous Chemical Storage Reporting Requirements	X		There are two “Community Right-to-Know” reporting requirements: (a) SNL/NM completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) TTR provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA’s alternative MSDS reporting, which is detailed in 40 CFR Part 370.21.
313	Toxic Chemical Release Forms	X		EPCRA, Section 313, requires that facilities that use toxic chemicals listed in SARA Title III over a threshold value must submit a TRI report. In 2005, a report was submitted for lead.

**NOTE:** MSDS = Material Safety Data Sheets (gives relevant chemical information)

□

TRI = Toxic Release Inventory

SSO = Sandia Site Office

NNSA = National Nuclear Security Administration

EPCRA = Emergency Planning and Community Right-to-Know Act

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

SARA = Superfund Amendments and Reauthorization Act lbs = pounds

DOE = U.S. Department of Energy

EPA = U.S. Environmental Protection Agency

facilities. Since TTR does not generate MW and currently has no MW stored on-site, this statute is not applicable to Sandia Corporation’s operations at TTR.

### 2.1.5 *Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990*

CAA and CAAA of 1990 requirements are regulated by the State of Nevada air quality regulations. Air emissions from non-radionuclide sources, such as a screening plant and a portable screen, are permitted under a Class II Air Quality Permit. Sandia Corporation tracks emissions and pays a fee to the State of Nevada based on the total standard tons emitted. Sandia Corporation met all air quality permit conditions in 2005.

### **National Emission Standards for Hazardous Air Pollutants (NESHAP) Compliance**

The EPA retains compliance authority for all radionuclide air releases, which are regulated by

NESHAP and implemented under 40 CFR 61, Subpart H. The Clean Slate sites, as discussed in Chapter 1, have been the only source of radionuclide air emissions at TTR. Continuous air monitoring was conducted from February 22, 1996 to February 25, 1997 (SNL 1997). The TTR Airport was determined to be the location of the maximally exposed individual (MEI). The result of 0.024 millirems per year (mrem/yr) was below the threshold of 0.1 mrem/yr for which continuous air monitoring would be required and approximately 400 times less than the EPA standard of 10 mrem/yr. The NESHAP Annual Report for 2005 and Chapter 4 of this report discuss these monitoring results (SNL 2006).

### 2.1.6 *Clean Water Act (CWA)*

Wastewater effluents and potable water supplies are regulated under the CWA and State of Nevada water pollution and sanitary waste systems regulations. The State of Nevada, Bureau of Health

Protection Services and the Nevada Department of Environmental Protection (NDEP) administers regulations relevant to wastewater discharges. At TTR, wastewater is discharged to the sewer system connected to the USAF sewage lagoon and to six septic tank systems.

There were no excursions or other permit violations in 2005 with respect to wastewater discharges; however, there was an event that was not reported to the State of Nevada through normal required reporting methods, but was reported to the State of Nevada by the Air Force. On December 2, 2005, the water system construction contractor (AAK) started draining the new elevated water storage tank into a sanitary sewer manhole from a nearby fire hydrant. This caused USAF Lift Stations 1 and 2 to over flow because their capacity was exceeded. The USAF responded and cleaned up the spill. Once notified of the spill, the AAK contractor shut off the flow of water. Approximately 1,500 gallons of wastewater spilled on the ground surrounding the lift stations. The State of Nevada was promptly notified by the USAF. The AAK resumed draining the storage tank at half the previous rate and the USAF disinfected the spill site with a sodium hypochlorite solution as recommended by the State of Nevada.

### ***Storm Water***

The issuance of a National Pollutant Discharge Elimination System (NPDES) storm water permit is generally based on whether or not storm water runoff is discharged to "Waters of the U.S." This definition includes rivers, lakes, streams, and swamps, as well as channels and arroyos that lead to waters that are currently used, have been used in the past, or may be susceptible for use in interstate or foreign commerce. The TTR site is primarily a closed basin with runoff evaporating or infiltrating to the ground. The USAF has permitted its airfield and Area 10 for storm water runoff and have cognizance over all storm water issues at the site. In November 2005, the Laircm construction project was included in the State of Nevada Storm Water General Permit NVR100000, confirmation number CSW-5462. A Storm Water Pollution Prevention Plan (SWPPP) will be used until the project is completed.

### ***2.1.7 Safe Drinking Water Act (SDWA)***

Sandia Corporation meets standards for drinking water as defined in the SDWA and State of Nevada public water supply and public water systems

regulations. Well 6 provides all drinking water for Sandia Corporation's operations at TTR and is operated under a permit issued by the State of Nevada. Chapter 4 of this report discusses monitoring activities. The entire Water Distribution System for the Area 3 compound was either refurbished or replaced during 2005. Well 6 was refurbished and upgraded, all of the water distribution system piping was replaced, and a new elevated water storage tower and treatment facility were constructed. Operators increased their State of Nevada certification level to Treatment Grade 2.

### ***2.1.8 Toxic Substances Control Act (TSCA)***

Compliance with TSCA at TTR primarily concerns the management of asbestos and polychlorinated biphenyls (PCBs). As defined by the TSCA, any material with greater than or equal to 500 parts per million (ppm) is considered a "PCB"; materials with greater than or equal to 50 ppm, but less than 500 ppm are considered as "PCB-contaminated." In 1993, sampling was performed on TTR transformers to determine if PCBs were present in the soil (IT 1993). All samples contained less than 50 ppm of PCBs.

Decontamination and demolition (D&D) operations conducted at TTR during 2005 generated 10 cubic yards (yd<sup>3</sup>) of asbestos containing material (ACM) waste.

### ***2.1.9 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)***

Chemical pesticides used at TTR include herbicides, rodenticides, and insecticides, as required. All chemicals used are EPA-approved and applied in accordance with applicable label guidelines and regulations. Sandia Corporation retains records of the quantities and types of pesticides that are used as well as Material Safety Data Sheets (MSDSs) for each pesticide. There were no violations of the FIFRA in 2005.

### ***2.1.10 National Environmental Policy Act (NEPA)***

NEPA requires federal agencies and other organizations that perform federally-sponsored projects to consider environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these issues,

and include this information in early project planning and decision-making. Additionally, if a proposed action is determined to have environmentally “significant” impacts, the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before making an irrevocable commitment of resources or funding. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to choose a course of action with the least environmental impacts. The DOE/National Nuclear Security Administration (NNSA) Sandia Site Office (SSO) coordinates NEPA compliance at SNL/TTR with Sandia National Laboratories, New Mexico (SNL/NM).

NEPA activities are discussed in Section 3.4.

#### **2.1.11 Endangered Species Act (ESA)**

The ESA applies to both private individuals and federal agencies. Federal agencies must ensure that any action authorized, funded, or carried out by them will not jeopardize the continued existence of a threatened or endangered species, or result in adverse modifications of its habitat. The ESA is addressed under the NEPA Program and Ecology Program. If potentially significant impacts to sensitive species or habitats are found as a result of the proposed action, an EA or an EIS must be prepared.

Table 2-2 lists all federal and state protected species occurring within Nye County; therefore, having the potential to occur at TTR.

#### **2.1.12 Migratory Bird Treaty Act (MBTA)**

The MBTA of 1918 implemented the 1916 Convention for the protection of migratory birds. The original statute implemented the agreement between the United States (U.S.) and Great Britain (for Canada) and later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and Russia. The MBTA prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests. Federal institutions are not exempt from the MBTA. New guidance is being developed by the U.S. Fish and Wildlife Service to assist federal institutions in interpreting this Act. At TTR, the MBTA is coordinated with NEPA compliance reviews and the Ecology Program.

#### **2.1.13 Cultural Resources Acts**

Federal cultural resources management responsibilities are applicable to activities at TTR. These include but are not limited to compliance with the following laws and their associated regulations:

- National Historic Preservation Act (NHPA)
- Archaeological Resources Protection Act (ARPA)
- American Indian Religious Freedom Act (AIRFA)

The DOE/NNSA/SSO is responsible for determining the level of applicability of cultural resources requirements. In 2005, Sandia Corporation’s operations did not impact any known cultural resources sites at TTR.

#### **Historical Building Assessment**

In 2004, DOE/NNSA/SSO initiated a consultation with the Nevada State Historic Preservation Office (SHPO) on 212 buildings at TTR. The SHPO did not concur with the DOE determination of eligibility for the 212 buildings. At the SHPO’s request, Sandia Corporation contracted with an architectural historian to evaluate the TTR buildings under National Register Criterion C. A revised report on the buildings at TTR will be submitted to the Nevada SHPO during 2006.

A consultation with the Nevada SHPO for rebuilding the TTR power system was initiated in 2004. A cultural resource inventory report was completed following an intensive archeological and historic inventory of the proposed project area. No historic properties were found within the proposed project area. As a result, in January 2005, the SHPO concurred with the DOE/NNSA/SSO determination that no historic properties would be affected by the proposed undertaking.

#### **2.1.14 Environmental Compliance EOs**

EO 11988, *Floodplain Management, as amended*, and EO 11990, *Protection of Wetlands, as amended*, require evaluation of the potential effects of actions taken in these environmentally sensitive areas. There are no floodplains or significant wetlands at TTR; however, some very limited wetlands exist in the vicinity of several springs. These provide an important source of drinking water for wildlife

**TABLE 2-2. Protected Species Potentially Occurring in Nye County, Nevada**

Common Name	Scientific Name	Federal Status	State of Nevada Status
<b>PLANTS</b>			
Sodaville Milkvetch	<i>Astragalus lentiginosus var. sesquimetricus</i>	---	State Protected
Halfring Milkvetch	<i>Astragalus mohavensis var. hemigrivus</i>	SOC	State Protected
Ash Meadows Milkvetch	<i>Astragalus phoenix</i>	Threatened	State Protected
Armored Hedgehog Cactus	<i>Echinocereus engelmannii var. armatus</i>	---	State Protected
Ash Meadows Sunray	<i>Enceliopsis nudicaulis var. corrugata</i>	Threatened	State Protected
Mojave Barrel Cactus	<i>Ferocactus cylindraceus var. lecontei</i>	---	State Protected
Sunnyside Green Gentian	<i>Frasera gypsicola</i>	SOC	State Protected
Ash Meadows Gumplant	<i>Grindelia fraxinopratensis</i>	Threatened	State Protected
Ash Meadows Mousetails	<i>Ivesia kingii var. eremica</i>	Threatened	State Protected
Ash Meadows Blazingstar	<i>Mentzelia leucophylla</i>	Threatened	State Protected
Amargosa Niterwort	<i>Nitrophila mohavensis</i>	Endangered	State Protected
Sand Cholla	<i>Opuntia pulchella</i>	---	State Protected
Williams Combleaf	<i>Polyctenium williamsiae</i>	---	State Protected
Blaine Pincushion	<i>Sclerocactus blainei</i>	SOC	State Protected
Tonopah Pincushion	<i>Sclerocactus nyensis</i>	---	State Protected
Hermit Cactus	<i>Sclerocactus polyancistrus</i>	---	State Protected
<b>INSECTS</b>			
Ash Meadows Naucorid	<i>Ambrysus amargosus</i>	Threatened	---
<b>FISH</b>			
White River Desert Sucker	<i>Catostomus clarki intermedius</i>	SOC	State Protected
Moorman White River Springfish	<i>Crenichthys baileyi thermophilus</i>	SOC	State Protected
Railroad Valley Springfish	<i>Crenichthys nevadae</i>	Threatened	State Protected
Devils Hole Pupfish	<i>Cyprinodon diabolis</i>	Endangered	State Protected
Ash Meadows Amargosa Pupfish	<i>Cyprinodon nevadensis mionectes</i>	Endangered	State Protected
Warm Springs Amargosa Pupfish	<i>Cyprinodon nevadensis pectoralis</i>	Endangered	State Protected
Pahrump Poolfish	<i>Empetrichthys latos latos</i>	Endangered	State Protected
White River Spinedace	<i>Lepidomeda albivallis</i>	Endangered	State Protected
Moapa Dace	<i>Moapa coriacea</i>	Endangered	State Protected
Lahontan Cutthroat Trout	<i>Oncorhynchus clarki henshawi</i>	Threatened	State Protected
Big Smoky Valley Speckled Dace	<i>Rhinichthys osculus lariversi</i>	---	State Protected
Ash Meadows Speckled Dace	<i>Rhinichthys osculus nevadensis</i>	Endangered	State Protected
Big Smokey Valley Tui Chub	<i>Siphateles bicolor ssp. 8</i>	SOC	State Protected
Hot Creek Valley Tui Chub	<i>Siphateles bicolor ssp. 5</i>	SOC	State Protected
Little Fish Lake Valley Tui Chub	<i>Siphateles bicolor ssp. 4</i>	---	State Protected
Railroad Valley Tui Chub	<i>Siphateles bicolor ssp. 7</i>	SOC	State Protected
<b>AMPHIBIANS</b>			
Amargosa Toad	<i>Bufo nelsoni</i>	---	State Protected
Columbia Spotted Frog	<i>Rana luteiventris</i> pop 3	Candidate	---
<b>REPTILES</b>			
Banded Gila Monster	<i>Heloderma suspectum cinctum</i>	SOC	State Protected
Desert Tortoise (Mojave Desert pop.)	<i>Gopherus agassizii</i>	Threatened	State Protected
<b>MAMMALS</b>			
Spotted Bat	<i>Euderma maculatum</i>	SOC	State Protected
Pygmy Rabbit	<i>Brachylagus idahoensis</i>	SOC	State Protected
American Pika	<i>Ochotona princeps</i>	---	State Protected
Kit Fox	<i>Vulpes macrotis</i>	---	State Protected
<b>BIRDS</b>			
Northern Goshawk	<i>Accipiter gentilis</i>	SOC	State Protected
Golden Eagle	<i>Aquila chrysaetos</i>	---	State Protected
Long-eared Owl	<i>Asio otus</i>	---	State Protected
Western Burrowing Owl	<i>Athene cunicularia hypugaea</i>	SOC	State Protected
Juniper Titmouse	<i>Baeolophus griseus</i>	---	State Protected
Ferruginous Hawk	<i>Buteo regalis</i>	SOC	State Protected
Swainson's Hawk	<i>Buteo swainsoni</i>	---	State Protected
Sage Grouse	<i>Centrocercus urophasianus</i>	---	State Protected
Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>	Threatened	State Protected
Mountain Plover	<i>Charadrius montanus</i>	Proposed Threatened	State Protected
Black Tern	<i>Chlidonias niger</i>	SOC	State Protected
Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>	Candidate	State Protected
Yellow Warbler	<i>Dendroica petechia</i>	---	State Protected
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	Endangered	State Protected
Prarie Falcon	<i>Falco mexicanus</i>	---	State Protected
Common Yellowthroat	<i>Geothlypis trichas</i>	---	State Protected
Greater Sandhill Crane	<i>Grus canadensis tabida</i>	---	State Protected
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	---	State Protected
Yellow-breasted Chat	<i>Icteria virens</i>	---	State Protected
Western Least Bittern	<i>Ixobrychus exilis hesperis</i>	SOC	State Protected
Loggerhead Shrike	<i>Lanius ludovicianus</i>	SOC	State Protected
Lewis' Woodpecker	<i>Melanerpes lewis</i>	---	State Protected
Long-billed Curlew	<i>Numenius americanus</i>	---	State Protected
Macgillivray's Warbler	<i>Oporornis tolmiei</i>	---	State Protected
Mountain Quail	<i>Oreortyx pictus</i>	---	State Protected
Flammulated Owl	<i>Otus flammeolus</i>	---	State Protected
Osprey	<i>Pandion haliaetus</i>	---	State Protected
Phainopepla	<i>Phainopepla nitens</i>	---	State Protected
White-faced Ibis	<i>Plegadis chihi</i>	SOC	State Protected
Vesper Sparrow	<i>Poocetes gramineus</i>	---	State Protected
Yuma Clapper Rail	<i>Rallus longirostris yumanensis</i>	Endangered	State Protected
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>	---	State Protected
Crissal Thrasher	<i>Toxostoma crissale</i>	---	State Protected
Orange-crowned Warbler	<i>Vermivora celata</i>	---	State Protected
Lucy's Warbler	<i>Vermivora luciae</i>	---	State Protected
Grey vireo	<i>Vireo vicinior</i>	---	State Protected

SOC = Species of Concern

in the area. Sandia Corporation complies with all applicable mandates stated in these EOs.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended, requires that to the greatest extent practicable and permitted by law, and consistent with the principles set forth in the Report on the National Performance Review (Gore 1993), each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. Sandia Corporation must include in the assessment of its operations any disproportionate impacts on minority or low-income populations within the area of influence of the Laboratories' operations.

EO 13148, *Greening the Government Through Leadership in Environmental Management*, requires federal agencies to ensure that "all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning processes, across all agency missions, activities, and functions." Among the primary agency goals is support to the development and implementation of environmental compliance audit programs and policies "that emphasize pollution prevention as a means to both achieve and maintain environmental compliance." Sandia Corporation is working under guidance from DOE/NNSA/SSO toward compliance with this EO.

EO 13101, *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition* requires all federal agencies to incorporate waste prevention and recycling into daily activities and participate in affirmative procurement. Waste minimization activities at TTR are discussed in Section 3.2.

EO 13149, *Greening the Government Through Federal Fleet and Transportation Efficiency*, encourages the reduction of petroleum consumption through improvements in fleet fuel efficiency and the use of alternative fuel vehicles (AFVs) and alternative fuels.

EO 13123, *Greening the Government Through Efficient Energy Management*, calls for improvements in Energy Management including the promotion of energy efficiency, water conservation, and the use of renewable energy products, and fostering markets for emerging technologies.

## 2.2 2005 AUDITS

Table 2-3 lists audits conducted in 2005, including an assessment made by Sandia Corporation.

## 2.3 2005 ISSUES AND ACTIONS FOR TTR

Sandia Corporation's ongoing self-assessments continue to look for potential compliance issues and subsequent follow-up actions.

### ***Federal Facility Agreement and Consent Order (FFACO) Compliance for ER Activities***

An ongoing action started in 1996 is the FFACO with the State of Nevada. This agreement was implemented in May 1996 between the State of Nevada, DOE, and the U.S. Department of Defense (DoD) (DoD/DOE/State of NV 1996). All DOE cleanup activities in the State of Nevada must be conducted in conformance with the requirements of this agreement. The FFACO is an enforceable agreement with stipulated penalties for violations. The ER sites for which DOE has assumed responsibility, and which are subject to the FFACO:

- NTS,
- Areas within TTR,
- Areas within the NTTR,
- Central Nevada Test Area, and
- Project Shoal Area (east of Carson City in Churchill County).

A summary of DOE/NNSA's ER sites in Nevada can be found in the FFACO report (DOD/DOE/State of NV 1996). The list of sites has been modified for consistency with NDEP requirements and grouped into Corrective Action Units (CAUs), which are listed by Corrective Action Site (CAS) numbers. Each CAU/CAS is listed in the FFACO under Appendices II (Corrective Action Sites/Units, this section includes inactive CAU/CASs), Appendix III (Corrective Action Investigations/Corrective Actions, this section includes active CAU/CASs), and Appendix IV (Closed Corrective action Units, this section lists CAU/CASs where corrective



actions are complete). The FFACO is updated every six months. A listing of ER sites located at TTR is shown in Chapter 3, Table 3-1.

## 2.4 ENVIRONMENTAL PERMITS

Environmental compliance permits for TTR include those for potable water supply, RCRA, and specific air emission units, such as screening plants. The permit application and registration of Sandia Corporation activities at TTR are issued

directly by the State of Nevada to either DOE/NNSA, Nevada Site Office (NSO) or DOE/NNSA/SSO and administered by Westinghouse Government Service on behalf of Sandia Corporation. Sandia Corporation and Westinghouse Government Service ensure that all permit conditions are met. Table 2-4 lists all permits and registrations in effect in 2005.

## 2.5 OCCURRENCE REPORTING

There were no reportable occurrences in 2005.

**TABLE 2-3.** Summary of Environmental Audits Performed at TTR in 2005

Type/Subject	Date	Audit Organization	Findings Summary
Programmatic Assessment Industrial Safety and Industrial Hygiene, Sandia National Laboratories/ TTR	August 1-4, 2005	NNSA/SSO	Two findings (Construction Contractor) related to new elevated water storage tank construction and five observations two (Construction Contractor) related to new water system construction activities. Three local observations, no formal excavation permit process, no local respiratory protection SOP, and no beryllium IHIR's documenting potential past or present exposures.
Sanitary Survey of Area 3 Water Distribution System	December 7, 2005	State of Nevada/ NDEP	Modifications to water system observed without Bureau of Safe Drinking Water Approved Plans

**NOTES:** NNSA/SSO = National Nuclear Security Administration, Sandia Site Office

TTR = Tonopah Test Range

ES&H = Environment, Safety, and Health

IHIR = Industrial Hygiene Investigative Report

SOP = Standard Operating Procedure

NDEP = Nevada Department of Environmental Protection

**TABLE 2-4. 2005 Summary of Permit Ownership at TTR**

Permit Type and Location	Permit Number	Issue Date	Expiration Date	Comments
<i>Air Quality Permits</i>				
Class II Air Quality Operation Permit	AP9611-0680.01	July 23, 2001	July 23, 2006	1- 3' x 5' Screening Plant 1- 7' x 7' Portable Screen <b>Non-Permit Equipment List</b> Generators (53 emission units) Boilers (7 emission units) Maintenance Activities (5 emission units) Propane Storage Tanks (23 emission units) Surface Area Disturbance (> 5 acres)
<i>RCRA - Hazardous Waste</i>				
Hazardous Waste Generator	NV1890011991	January 7, 1993	Indefinite	State of Nevada
<i>Stormwater Permit (Construction)</i>				
Bill's Hill Laircm Project	CSW-5462	November 22, 2005	Indefinite	State of Nevada
<i>Production Well (Drinking Water)</i>				
Well 6 Production Well	NY-3014-12NC	September 2004	September 2005*	State of Nevada

**NOTES:** \* The State of Nevada Bureau of Health Protection Services renews the permit for Well 6 (NY-3014-12NC) annually.

TTR = Tonopah Test Range

RCRA = Resource Conservation and Recovery Act

## chapter three

# TTR ENVIRONMENTAL PROGRAMS INFORMATION



### In This Chapter ...

Environmental Restoration Project Activities  
Waste Management Programs  
Spill Prevention Control and Countermeasures Plan  
National Environmental Policy Act  
Environmental Monitoring Performed by Outside Agencies  
Summary of Release Reporting

### *Environmental Snapshot*

*TTR is committed to achieving significant reductions in the amount of chemical and hazardous wastes generated on-site. Waste minimization includes recycling and recovery of solvents, fuels and oil, and antifreeze.*

The Environmental Restoration (ER) Project, the Waste Management Program, and the National Environmental Policy Act (NEPA) Program are some of the programs and activities Sandia Corporation's Tonopah Test Range (TTR) utilizes to meet compliance with various state and federal regulations, Executive Orders (EOs), and U.S. Department of Energy (DOE) Orders. Terrestrial surveillance, drinking water, wastewater, and air quality programs are discussed in Chapter 4 of this report.

### **3.1 ER PROJECT ACTIVITIES**

The ER Project at TTR began in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. In late 1992 and early 1993, an agreement was reached between DOE Headquarters (HQ), the DOE/National Nuclear Security Administration (NNSA) Service Center and the DOE, Nevada Site Office (NSO) regarding the management of ER activities at TTR. The decision was made to designate the responsibility of all ER sites to DOE/NSO.

Since 1996, cleanup activities for sites located in the State of Nevada have been regulated by the Federal Facility Agreement and Consent Order (FFACO) (DoD/DOE/State of NV 1996). The FFACO was negotiated between DOE/NSO, the Nevada Division of Environmental Protection (NDEP), and the U.S. Department of Defense (DoD). The FFACO took effect on May 10, 1996 and accomplished the following:

- Established a framework for identifying Corrective Action Sites (CASs),
- Grouped CASs into Corrective Action Units (CAUs),
- Prioritized CAUs, and
- Implemented corrective action activities.

The FFACO is also discussed in Section 2.3. CAUs located at TTR are addressed by two ER Division Projects:

**(1) Industrial Sites Project** – Sites historically used to support nuclear testing and Sandia Corporation's activities. Industrial Sites include historic septic systems, landfills, sewage lagoons, depleted uranium sites, and ordnance testing sites.

**(2) Soil Sites Project** – Areas where historical nuclear testing has resulted in surface and/or shallow subsurface soil contamination. Soil sites include large area soil contamination from plutonium dispersal testing.

ER site contamination includes radiological (e.g., depleted uranium [DU] and plutonium) and non-radiological constituents (e.g., ordnance, solvents, pesticides, septic sludges, and heavy metals).

#### **CAS Identification**

The initial identification, description, and listing of CASs at TTR were derived from the Preliminary Assessment (PA) and the Federal Facility Preliminary Assessment Review (E&E 1989). In 1993, the potential TTR CASs identified in the PA were subdivided into four "Soil Sites CAUs" and 43 "Industrial Sites CAUs." Twelve additional potential CASs not included in the PA were also identified. These CASs were identified through:

- ER sites inventory process,
- Ordnance removal activities,
- Geophysical surveys,
- Former worker interviews,
- Archive reviews,
- Site visits, and
- Aerial radiological and multispectral surveys (1993 to 1996).

The remediation activities at the Clean Slate and Double Tracks sites (Project Roller Coaster) are discussed in Chapter 1. These sites are listed under Soil Sites CAUs/CASs in Table 3-1 as CAU-411, -412, -413, and -414.

Table 3-1 summarizes the existing Industrial and Soil Sites CAUs and CASs at TTR. The ER activities planned for these CASs range from "no activities currently planned" to "NDEP-approved closure." The list of CAS and general information presented in Table 3-1 is contained in Appendices II, III, and IV of the FFACO (DoD/DOE/State of NV 1996).

#### **2005 ER Activities**

ER activities in 2005 were focused on closure planning for CAU 484 and CAU 496, and remediation/closure fieldwork for CAU 489. Planning activities for the investigation and closure of CAU 408 also began in 2005. Field activities at TTR generated 54 kg (120 lb) of non-Resource Conservation and Recovery Act (RCRA) waste consisting of non-impacted personal

**TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs 2005 Status**

<b>Industrial Sites CAUs/CASs</b>		
<b>CAS Number</b>	<b>CAS Description</b>	<b>General Location</b>
<b>CAU-400 - Closed</b>		
<i>Bomblet Pit and Five Points Landfill, TTR</i>		
TA-19-001-05PT	Ordnance Disposal Pit	Five Points Intersection
TA-55-001-TAB2	Ordnance Disposal Pit	Bunker 2 Road
<b>CAU-401 - Closed</b>		
<i>Area 3 Gas Station UST Site, TTR</i>		
03-02-003-0357	UST, Gas	First Gas Station, Area 3
<b>CAU-402 - Closed</b>		
<i>Area 3 Bldg. 0353 UST Site, TTR</i>		
03-02-001-0353	UST, Diesel	Bldg. 0353
<b>CAU-403 - Closed</b>		
<i>Area 3 Second Gas Station UST, TTR</i>		
03-02-004-0360	USTs	Second Gas Station
<b>CAU-404 - Closed</b>		
<i>Roller Coaster Lagoons and Trench, TTR</i>		
TA-03-001-TARC	Roller Coaster Lagoons	NW of Antelope Lake
TA-21-001-TARC	Roller Coaster North Disposal Trench	NW of Antelope Lake
<b>CAU-405 - Closed</b>		
<i>Area 3 Septic Systems, TTR</i>		
03-05-002-SW03	Septic Waste System	Area 3
03-05-002-SW04	Septic Waste System	Area 3
03-05-002-SW07	Septic Waste System	Area 3
<b>CAU-406 - Closed</b>		
<i>Area 3 Bldg. 03-74 and Bldg. 03-58 UDPs, TTR</i>		
03-51-002-0374	Heavy Duty Shop UDP, Sumps	Bldg. 0374
03-51-003-0358	UPS Building UDP	UPS Building, Area 3
<b>CAU-407 - Closed</b>		
<i>Roller Coaster Rad Safe Area, TTR</i>		
TA-23-001-TARC	Roller Coaster Rad Safe Area	Northwest of Antelope Lake
<b>CAU-408 - Planning Phase</b>		
<i>Bomblet Target Area, TTR</i>		
TA-55-002-TAB2	Bomblet Target Areas	Antelope Lake
<b>CAU-409 - Closed</b>		
<i>Other Waste Sites, TTR</i>		
RG-24-001-RGCR	Battery Dump Site	Cactus Repeater
TA-53-001-TAB2	Septic Sludge Disposal Pit	Bunker 2
TA-53-002-TAB2	Septic Sludge Disposal Pit	Bunker 2
<b>CAU-410 - Closed</b>		
<i>Area 9 Underground Vault and Disposal Trench, TTR</i>		
09-21-001-09MG	Former Bunker or Underground Vault	East of Area 9 Magazines
09-21-001-TA09	Disposal Trenches	Area 9
TA-19-002-TAB2	Debris Mound	Bunker 2
TA-21-003-TANL	Disposal Trench	NEDS Lake
TA-21-002-TAAL	Disposal Trench	South Antelope Lake

Refer to notes at end of table.

**TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs 2005 Status (continued)**

<b>Industrial Sites CAUs/CASs</b>		
<b>CAS Number</b>	<b>CAS Description</b>	<b>General Location</b>
<b>CAU-423 – Closed</b>		
Area 3 UDP, Bldg. 0360, TTR		
03-02-002-0308	UDP	Bldg. 0360
03-02-002-0308	UDP	Bldg. 0360
<b>CAU-424 - Closed</b>		
Area 3 Landfill Complex, TTR		
03-08-001-A301	Landfill Cell A3-1	Area 3 Landfill Complex
03-08-002-A302	Landfill Cell A3-2	Area 3 Landfill Complex
03-08-002-A303	Landfill Cell A3-3	Area 3 Landfill Complex
03-08-002-A304	Landfill Cell A3-4	Area 3 Landfill Complex
03-08-002-A305	Landfill Cell A3-5	Area 3 Landfill Complex
03-08-002-A306	Landfill Cell A3-6	Area 3 Landfill Complex
03-08-002-A307	Landfill Cell A3-7	Area 3 Landfill Complex
03-08-002-A308	Landfill Cell A3-8	Area 3 Landfill Complex
<b>CAU-425 – Closed</b>		
Area 9 Main Lake Construction Debris Disposal Area, TTR		
09-08-001-TA09	Construction Debris Disposal Area	Area 9/Main Lake
<b>CAU-426 - Closed</b>		
Cactus Spring Waste Trenches, TTR		
RG-08-001-RGCS	Waste Trenches	Cactus Spring Ranch
<b>CAU-427 - Closed</b>		
Area 3 Septic Waste Systems 2 and 6, TTR		
03-05-002-SW02	Septic Waste System No. 2	Area 3
03-05-002-SW06	Septic Waste System No. 6	Area 3
<b>CAU-428 - Closed</b>		
Area 3 Septic Waste Systems 1 and 5, TTR		
03-05-002-SW01	Septic Waste System No. 1	Area 3
03-05-002-SW05	Septic Waste System No. 5	Area 3
<b>CAU-429 - Closed</b>		
Area 3 Bldg. 03-55 and Area 9 Bldg. 09-52 UDPs, TTR		
03-51-001-0355	Photo Shop UDPs, Drains	Photo Shop Area 3
09-51-001-0952	Mobile Photographic Lab UDPs	Area 9
<b>CAU-430 - Closed</b>		
DU Artillery Round #1, TTR		
TA-55-003-0960	DU Artillery Round	South of Area 9
<b>CAU-453 - Closed</b>		
Area 9 UXO Landfill, TTR		
09-55-001-0952	Area 9 Landfill	Area 9
<b>CAU-461 - Closed</b>		
Test Area JTA Sites, TTR		
TA-52-002-TAML	DU Impact Site	Main Lake
TA-52-003-0960	DU Artillery Round #2	South of Area 9
TTR-001	1987 W-79 JTA	Unknown – South of Area 9
<b>CAU-484 – Investigation Phase</b>		
Antelope and NEDS Lakes Waste Sites, TTR		
TA-52-001-TANL	NEDS Detonation Area	NEDS Lake
TA-52-004-TAAL	Metal Particle Dispersion Test	Antelope Lake
TA-52-005-TAAL	JTA DU Sites	Antelope Lake
TA-54-001-TANL	Rocket Propellant Burn Area	NEDS Lake
RG-52-007-TAML	Davis Gun Site – Mellan	Test Range
TA-52-006-TAPL	DU Surface Debris	Colimbo Detonation Area, NEDS Lake

Refer to notes at end of table.

**TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs 2005 Status (concluded)**

<b>Industrial Sites CAUs/CASs</b>		
<b>CAS Number</b>	<b>CAS Description</b>	<b>General Location</b>
<b>CAU-485 - Closed</b>		
Cactus Spring Ranch Pu and DU Site, TTR		
TA-39-001-TAGR	Cactus Spring Ranch, Soil Contamination	West of Target Areas
<b>CAU-486 - Closed</b>		
Double Tracks Rad Safe Area, Nellis Range 71 North		
71-23-001-71DT	Double Tracks Rad Safe Area	Nellis Range 71 North
<b>CAU-487 - Closed</b>		
Thunderwell Site, TTR		
RG-26-001-RGRV	Thunderwell Site	Thunderwell Site
<b>CAU-489 - Remediation Phase</b>		
WWII UXO Sites, TTR		
RG-55-001-RGMN	WWII Ordnance Site	Mellan Airstrip
RG-55-002-RGHS	WWII Ordnance Site	H-Site Road
RG-55-003-RG36	WWII Ordnance Site	Gate 36E
<b>CAU-490 - Closed</b>		
Station 44 Burn Area, TTR		
RG-56-001-RGBA	Fire Training Area	Station 44
03-56-001-03BA	Fire Training Area	Area 3
03-58-001-03FN	Sandia Service Yard	Area 3
09-54-001-09L2	Solid Propellant Burn Site	Area 9
<b>CAU-495 - Closed</b>		
Unconfirmed JTA Sites, TTR		
TA-55-006-09SE	Buried Artillery Round	Test Area
TA-55-007-09SE	Buried Artillery Round	Test Area
<b>CAU-496 - Closed</b>		
Buried Rocket Site - Antelope Lake, TTR		
TA-55-008-TAAL	Buried Rocket	Antelope Lake
<b>CAU-499 - Closed</b>		
Hydrocarbon Spill Site, TTR		
RG-25-001-RD24	Hydrocarbon Spill Site	Radar 24 Site
<b>Soil Sites CAUs/CASs:</b>		
<b>CAU-411 - Closed</b>		
Double Tracks Plutonium Dispersion, Nellis		
NAFR-23-01	Pu-contaminated Soil	Double Tracks
<b>CAU-412 - Closed</b>		
Clean Slate 1 Plutonium Dispersion, TTR		
TA-23-01CS	Pu-Contaminated Soil	Clean Slate 1
<b>CAU-413 - Remediation Phase</b>		
Clean Slate 2 Plutonium Dispersion, TTR		
TA-23-02CS	Pu-Contaminated Soil	Clean Slate 2
<b>CAU-414 - Not Started</b>		
Clean Slate 3 Plutonium Dispersion, TTR		
TA-23-03CS	Pu-Contaminated Soil	Clean Slate 3

**SOURCE:** DoD/DOE/State of NV 1996 and ongoing updates

**NOTE:** DOE = U.S. Department of Energy  
 CAU = Corrective Action Unit  
 CAS = Corrective Action Site  
 DU = depleted uranium  
 ER = Environmental Restoration  
 NEDS = Non-Explosive Destruction Site  
 WWII = World War II  
 Pu = Plutonium

NNSA = National Nuclear Security Administration  
 NSO = Nevada Site Office  
 UDP = underground discharge points  
 UST = underground storage tank  
 UXO = unexploded ordnance  
 TTR = Tonopah Test Range  
 JTA = Joint Test Assembly

protective equipment (PPE) (paper, plastic, Tyvec, gloves, etc.). The non-RCRA waste was transported to the Nevada Test Site (NTS) for disposal. One package containing 9 kg (20 lb) of PPE generated from field activities is being managed as low-level waste pending characterization. Characterization and disposal of the 9 kg (20 lb) of PPE will be completed in 2006. No RCRA or mixed waste (MW) was generated during ER activities and/or disposed in 2005. Closure activities for CAU 489 generated 68,492 kg (151,000 lb) of scrap metal that was staged on-site pending approval of disposal at the NTS. Westinghouse Government Service participates in environmental cleanup and restoration activities.

### **3.2 WASTE MANAGEMENT PROGRAMS**

All waste generated by Sandia Corporation activities at TTR is managed by Westinghouse Government Service under the Waste Management Program. (Sandia Corporation does not handle waste generated by ER activities.) Waste categories include radioactive waste, RCRA-hazardous waste, other chemical waste, and non-hazardous solid waste. Waste minimization and recycling efforts are integrated into Waste Management Program activities. Waste generated and handled by Sandia Corporation at TTR in 2005 was as follows:

<i>Waste Type</i>	<i>Weight</i>
RCRA hazardous waste	1,998 kg (4,395 lb)
Non-RCRA-regulated	2,061 kg (4,535 lb)
Recycled Waste	5,852 kg (12,875 lb)
Radioactive waste	0 kg

Sandia Corporation shipped all regulated waste to off-site permitted treatment, storage, and disposal (TSD) facilities.

Table 3-2 shows a detailed breakdown of the RCRA waste categories and quantities. Table 3-3 lists regulated non-RCRA waste categories and quantities. Table 3-4 lists waste categories transported off-site for recycling or alternative fuel use. A *Hazardous Waste Biennial Report* is prepared by SNL/NM and submitted to the U.S. Environmental Protection Agency (EPA) through DOE/NNSA/NSO (SNL 2004a).

### **Waste Minimization Program**

TTR is committed to achieving significant reductions in the amount of chemical and hazardous wastes generated on-site. Waste minimization includes recycling and recovery of the following materials:

- Solvents,
- Fuels and oil,
- Antifreeze (on-site recycling unit),
- Lead acid batteries,
- Freon (on-site recovery unit),
- Fluorescent and sodium bulbs, and
- Mercury-containing equipment.

Recyclable waste and used oil was sent for recycling or disposed of through the waste disposal contractor.

### **Radioactive Waste Management**

There were no shipments of radioactive waste in 2005.

### **3.3 SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN**

The *SPCC Plan for SNL Tonopah Test Range* (SNL 2004) pertains to oil storage equipment and secondary containments subject to 40 CFR 112, "Oil Pollution Prevention" and 40 CFR 110, "Discharge of Oil."

There are 11 aboveground storage tanks (ASTs), two bulk storage areas (BSA), and one transformer storage area that are covered by the SPCC Plan at TTR.

### **3.4 NEPA PROGRAM**

#### **NEPA Activities at TTR**

At TTR, NEPA compliance is coordinated between Sandia Corporation at TTR, Sandia Corporation at Sandia National Laboratories, New Mexico (SNL/NM), and DOE/NNSA, Sandia Site Office (SSO). Additionally, under the direction of Sandia Corporation, compliance is supported by the Water Resources Center at the Desert Research Institute (DRI) through the University of Nevada System. DRI prepares archaeological and biological surveys and reports. Final reports are submitted to Sandia Corporation for transmittal to DOE/NNSA/SSO for review and decision-making and consultation with state and federal agencies.



**TABLE 3-2.** Sandia Corporation TTR RCRA-Regulated Hazardous Waste Shipped Off-site in 2005

Waste Description	Waste Codes	Generated (lb)
Waste Toxic Solid, Organic, NOS	D035, F002, F003, F005	25
Waste (Lithium Battery)	D001, D003	25
Waste Aerosols	D001	120
Waste Water Reactive Solid, Self Heating NOS	D001, D003, D008	235
Waste Paint Related Material	D001	90
Waste Flammable Liquids	D001	550
Waste Flammable Liquids, NOS	D001, U220	225
Waste Petroleum Distillates	D001, D008, D018, F005	190
Waste Batteries, Wet Filled with Alkali	D002, D006	40
Hazardous Waste Solid, NOS	D008	70
Hazardous Waste Solid, NOS	D009, U151	70
Mercury Contained in Manufactured Articles, Hazardous Waste Solid, NOS	D009	40
Waste Diesel Fuel	D001	1,720
Hazardous Waste Solid, NOS	D035, F005	30
Waste Corrosive Liquid, NOS	D002	25
Hazardous Waste, Solid, NOS	D006, D007	150
Hazardous Waste, Solid, NOS	D008, D009	55
Hazardous Waste, Liquid, NOS	D007, D011	280
Hazardous Waste, Liquid, NOS	D006, D007, D011	455
<b>TOTAL</b>		<b>4,395</b>

**NOTES:** NOS = not otherwise specified      RCRA = Resource Conservation and Recovery Act  
TTR = Tonopah Test Range                      lb = pounds

**TABLE 3-3.** Non-RCRA-Regulated Hazardous or Toxic Waste Shipped Off-site in 2005

Waste Description	Waste Codes	Shipped	Generated (lb)
Non-Reg Solid Waste	NCR		4,265
Non-Reg Liquid Waste	NCR		100
Regulated Medical Waste	NCR		152
Polychlorinated Biphenyl's (PCB) Ballasts	TSCA		18
<b>TOTAL</b>			<b>4,535</b>
D&D Asbestos Waste	TSCA	10 yd <sup>3</sup>	10 yd <sup>3</sup>
Apex Solid Waste Landfill (Tires/Metal)	NCR	63 yd <sup>3</sup>	63 yd <sup>3</sup>
<b>Environmental Restoration (ER)</b>			
Hydrocarbon impacted soil & debris		0	0
IDW		300	300
LLW (soil, debris, and PPE)		0	0
Inert UXO debris		0	283,500
<b>TOTAL</b>			<b>283,800</b>

**NOTES:** NCR = no code required                      TSCA = Toxic Substances Control Act  
RCRA = Resource Conservation and Recovery Act      LLW = low level waste  
IDW = Investigation-Derived Waste                      UXO = unexploded ordnance  
D&D = decontamination and demolition              PPE = personal protective equipment  
yd<sup>3</sup> = cubic yard    lb = pounds

**TABLE 3-4.** Recycled Regulated Hazardous or Toxic Waste Shipped Off-site in 2005

Recycled Material or Energy Recovered Material	Generated (lb)	
Batteries Wet, Filled with Acid	1,035	
Brass	11,290	
Batteries Dry Containing Potassium Hydroxide Solid	15	
Fluorescent Lights	490	
Circuit Boards for Recycle	45	
<b>TOTAL</b>		<b>12,875</b>

**NOTES:** lb = pounds

The Final Environmental Impact Statement (EIS) for the NTS and Off-Site Locations in the State of Nevada, which includes the TTR site, was completed in 1996; the DOE Record of Decision (ROD) was filed on December 9, 1996 (DOE 1996).

### **2005 NEPA Documentation**

A total of nine NEPA reviews were processed during 2005. One NEPA review was completed by SNL/NM. Seven NEPA checklists were submitted to SSO for review and were found to be categorically excluded. One NEPA checklist is pending a decision with the Nellis Air Force Base.

### **3.5 ENVIRONMENTAL MONITORING PERFORMED BY OUTSIDE AGENCIES**

In addition to Sandia Corporation, other agencies perform environmental monitoring activities at TTR, as described below.

#### **EPA**

The EPA Environmental Monitoring Systems Laboratory in Las Vegas, NV, monitored background radiation in the area of TTR as part of its Off-site Radiation Monitoring Reports Program (EPA 1999), which is now being done by DRI.

#### **DRI, University of Nevada System**

The DRI trains and provides monitoring station managers (generally they are local science teachers) to run the EPA air monitoring equipment set up at locations within the local community including the towns of Tonopah and Goldfield. The EPA laboratory in Las Vegas, Nevada provides the equipment and performs the analysis and reporting.

DRI also provides external quality assurance (QA) on field measurements taken by the EPA at these community-monitoring stations. DRI monitors selected locations concurrently using a portable monitoring station (PMS) and thermoluminescent dosimeters (TLDs). DRI's *Community Radiation Monitoring Program Annual Report* now appears as part of the NTS Annual Site Environmental Report (ASER) (DOE 2005a).

DRI also performs other monitoring—primarily hydrological—for the DOE, as requested. This may include evaluating environmental impacts due to construction projects at TTR.

#### **Westinghouse Government Service**

As part of its TTR support activities, Westinghouse Government Service personnel perform environmental monitoring activities for DOE and/or Sandia Corporation when needed as follows:

- Drinking water and wastewater sampling;
- National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart H (radionuclides) air quality monitoring;
- Soil sampling and site characterization of spill sites;
- Waste sampling and characterization; and
- ER support activities.

### **3.6 SUMMARY OF RELEASE REPORTING**

The following four release reporting documents must be submitted to external regulatory agencies if releases exceed applicable threshold quantities (TQ):

- *NESHAP Annual Report for CY 2005, SNL/NV* (SNL 2006), requires that an annual report be submitted from each DOE/NNSA site where facility sources contribute a public dose of over 0.1 mrem/yr. The NESHAP report must be submitted to the EPA by June 30th each year, following the reporting year. The report includes the calculated effective dose equivalent (EDE) in mrem/yr for the maximally exposed individual (MEI).
- *State of Nevada Reports* – The State of Nevada requires copies of each hazardous waste manifest that accompanies each waste shipment.

- *State of Nevada Extremely Hazardous Material Reporting Requirements* – This is not currently required since Sandia Corporation does not use any extremely hazardous materials during its routine operations.
- *Toxic Chemical Release Reporting Community Right-to-Know: Calendar Year 2005* (SNL 2006d) submitted for lead released at the TTR firing range.



Workers inspecting the main distribution valves under the elevated water storage tower as part of the Water Distribution System Replacement Project.

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chapter four

# TTR ENVIRONMENTAL MONITORING



## In This Chapter ...

Terrestrial Surveillance  
Water Monitoring  
Radiological Air Monitoring  
Non-radiological Air Emissions

## *Environmental Snapshot*

*One of the goals of the Terrestrial Surveillance Program is to identify and quantify new or existing environmental quality problems and their potential impacts, if any.*

## **4.1 TERRESTRIAL SURVEILLANCE**

Terrestrial surveillance is conducted at the Tonopah Test Range (TTR) to detect the possible migration of contaminants to off-site locations and to determine the potential impact of Sandia Corporation's operations on human health or the environment.

### **4.1.1 Program Objectives**

The objectives of the Terrestrial Surveillance Program can be summarized by the following excerpts of the requirements given in U.S. Department of Energy (DOE) Order 450.1, *Environmental Protection Program* (DOE 2005):

- Collect and analyze samples to characterize environmental conditions and define increasing or decreasing trends;
- Establish background levels of pollutants to define baseline conditions (off-site sampling);
- Provide continuing assessment of pollution abatement programs;
- Identify and quantify new or existing environmental quality problems and their potential impacts, if any; and
- Verify compliance with applicable environmental laws and regulations and commitments made in National Environmental Policy Act (NEPA) documents, such as Environmental Impact Statements (EISs), as well as other official documents.

### **4.1.2 Regulatory Standards and Comparisons**

The Terrestrial Surveillance Program is designed and conducted in accordance with the requirements of DOE Order 450.1, *Environmental Protection Program* (DOE 2005). Concentration limits for radionuclides and metals in terrestrial media are not well defined; however, the terrestrial surveillance coordinator does compare the results from on-site and perimeter locations to off-site results to determine the impact, if any, of Sandia Corporation's operations on the environment. In addition, sample results for metal in surface soils are compared to U.S. surface soil average concentrations, published in *Trace Elements in Soils and Plants* (Kabata-Pendias 2000), or local/regional surface soil average

concentrations, published in *Elements in North American Soils* (Dragun and Chekiri 2005).

A summary report of metals-in-soil at TTR has been prepared and will serve as another point of reference (SNL 2006c).

### **4.1.3 Statistical Analyses**

Samples are generally collected from fixed locations to effectively make statistical comparisons with results from previous years. Statistical analyses are performed to determine if a specific result or group of on-site or perimeter results, differs from off-site values, and to identify trends at a specific sampling location. Since multiple data points are necessary to provide an accurate view of a system, the Terrestrial Surveillance Program does not rely on the results from any single year's sampling event to characterize on-site environmental conditions. Results from a single sampling point may vary from year to year, due to slight changes in sampling locations, differences in climatic conditions, and laboratory variations or errors. Therefore, as the amount of data increases, the accuracy of the characterization increases.

The results of the statistical analyses allow for prioritization of sample locations for possible follow-up action. The prioritization process is a decision-making tool to assist in determining the appropriate level of concern for each sample result. The Statistical Analysis Prioritization Method (Shyr, Herrera, and Haaker 1998) is based on two "yes or no" questions resulting in a matrix of four priority levels (Table 4-1). In addition, a qualitative, visual inspection of a graphical presentation of the data is conducted to compare sampling results to regional/local and site-specific concentrations. This step is performed to ensure that anomalous data that would otherwise pass statistical scrutiny is flagged for further investigation.

To date, there have been no terrestrial sample results that have indicated a significant level of concern (Priority-1) that would trigger actions at locations that are not already being addressed by the Environmental Restoration (ER) Project.

In past years, the period of time covered by the statistical analysis was from 1994 to present. In 2001, the analysis was limited to a five-year period (this year beginning in 2000). The reason for the

**TABLE 4-1. Decision Matrix for Determining Priority Action Levels**

Priority	Are results higher than off-site?*	Is there an increasing trend ?	Priority for further investigation
1	Yes	Yes	Immediate attention needed. Specific investigation planned and/or notifications made to responsible parties.
2	Yes	No	Some concern based on the level of contaminant present. Further investigation and/or notifications as necessary.
3	No	Yes	A minor concern since contaminants present are not higher than off-site averages. Further investigation and/or notifications as necessary.
4	No	No	No concern. No investigation required.

NOTES: Based on Statistical Analysis Prioritization Methodology (Shyr, Herrera, and Haaker 1998).

\*While some sites may appear higher than off-site, there may not be a statistically significant difference.

change was that SNL/NM changed analytical laboratories in 2000, with lower (better) detection capabilities for many of the metals and radiological analyses. As a result, a large number of false decreasing trends were noted for many of the parameters when the whole data set was analyzed. Until now, by limiting the analysis to a five-year period, the number of apparent decreasing trends was reduced. Trend analyses now includes all data from 2000 onwards.

#### 4.1.4 Sampling Locations

Terrestrial surveillance began at TTR in 1992. In addition to routine sampling, a large-scale baseline sampling was performed in 1994 in areas where Sandia Corporation had a long-term or continued presence.

Routine terrestrial surveillance is conducted at on-site, perimeter, and off-site locations that remain essentially the same from year to year. The sampling locations, number of samples, and analyses performed are prioritized based on the following criteria:

- **On-site locations** are near areas of known contamination, potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate, such as in the vicinity of ER sites. A list of on-site sampling locations is shown in Table 4-2. Appendix A contains maps of the sampling locations.
- **Off-site locations** are selected to provide a measurement of environmental conditions unaffected by Sandia Corporation's activities

at TTR. Data collected from off-site locations serve as a reference point to compare data collected at perimeter and on-site locations. Multiple years of sampling data are compiled to determine statistical averages for off-site concentrations. Off-site locations are chosen both in remote, natural settings as well as in areas near local population centers and along highways. Table 4-3 contains a list of the off-site sample locations. The off-site locations sampled are shown in Figure A-1 of Appendix A.

- **Perimeter locations** are selected to establish if contaminants are migrating either onto or off Sandia Corporation property at TTR. A list of perimeter sampling locations is shown in Table 4-4. A map of the perimeter locations is shown in Figure A-2 of Appendix A. All perimeter locations are in areas to which Sandia Corporation does not control access within TTR.

#### 4.1.5 Radiological Parameters and Results

Soil is the only terrestrial medium sampled at TTR. There are no bodies of water, other than the playa lakes (dry lake beds with only occasional standing water), and vegetation is scarce. Soil samples are collected to ascertain the presence of air-deposited pollutants or contaminants that have been transported and deposited as a result of surface water runoff. Samples are collected from the top two inches of soil using a hand trowel. The 2005 analytical results are found in Appendix A of this report and are summarized in this section. The detailed statistical analyses are documented in the *Tonopah Test Range Data Analysis in Support of the Annual Site Environmental Report, 2005* (SNL

**TABLE 4-2. On-Site Terrestrial Surveillance Locations at TTR**

On-Site Location	Location Number	Sample Location	Soil Sampling	Replicate*	TLD
South Plume	S-48	N/S Mellan Airstrip – Antelope Tuff	√	√	
	S-49	N/S Mellan Airstrip – SW of S-48	√		
	S-50	N/S Mellan Airstrip – sign post	√		
	S-51	N/S Mellan Airstrip – NE of S-50	√	√	
	S-52	NE of NW/SE Mellan Airstrip	√		
Range Operations Center	S-40	Waste Water Monitoring Station	√		
	S-41	“Danger Powerline Crossing” Sign	√		
	S-42	Main Road/Edward’s Freeway	√		
	S-43	SW Corner of Sandia Corporation, TTR Operations Center	√		
	S-44	NE Corner of Sandia Corporation, TTR Operations Center	√		
	S-45	Storage Shelters, 03-38/03-39	√		
	S-46	Sand Building	√		
	S-47	Generator Storage Area	√		
Various On-Site Locations	S-01	Antelope Lake Area Fence, Cultural Area Sign	√		√
	S-02	N/S Mellan Airstrip (TLD at South fence post)	√		√
	S-03	TLD at Clean Slate 2	√	√	√
	S-04	TLD at Clean Slate 3	√		√
	S-09	Roller Coaster Decon	√	√	√
	S-10	Brownes Road/Denton Freeway	√		√
	S-13	Area 3 between Bldg. 100 and Caution Sign			√
	S-14	Area 3 CP SW side on fence			√
	S-15	Moody Ave. by cattle guard and entrance to airport and chow hall			√
	S-16	Area 9 by Bldg. 09-08 and LPG storage			√
	S-17	Hard Target area by Bldg. 23-16			√
	S-38	Mellan Hill – Metal Scrap Pile	√		
	S-39	Mellan Hill – North	√		
	S-53	Main Road/Lake Road SE	√		

NOTES: TLD = Thermoluminescent Dosimeter

TTR = Tonopah Test Range

N/S = North/South (runway runs North/South)

\*I□

of sampling and analysis.

**TABLE 4-3. Off-Site Terrestrial Surveillance Locations at TTR**

On-Site Location	Location Number	Sample Location	Soil Sampling	Replicate*	TLD
Off-Site	C-18	Tonopah Old Court House			
	C-19	Mining Museum, North Goldfield			√
	C-20	State Road 6 Rest Area	√		
	C-21	State Road 6/95 Rest Area	√		√
	C-22	Rocket	√		√
	C-23	Alkali/Silver Peak Turnoff	√		
	C-24	Cattle Guard	√		
	C-25	Tonopah Ranger Station	√		
	C-26	Gabbs Pole Line Road	√		
	C-27	State Roads 6/376 Junction	√		
	C-28	Stone Cabin/Willow Creek	√		
	C-29	State Roads 6/375 Junction	√	√	
	C-30	State Road 375 Ranch Cattle Gate	√		
	C-31	Golden Arrow/Silver Bow	√		
	C-32	Five miles south of Rocket	√		
C-33	Nine miles south of Rocket	√			

NOTES: TLD = Thermoluminescent Dosimeter

TTR = Tonopah Test Range

\*In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.



**TABLE 4-4.** Perimeter Terrestrial Surveillance Locations at TTR

On-Site Location	Location Number	Sample Location	Soil Sampling	Replicate*	TLD
Perimeter	P-05	O&M Complex - Site 4 Entrance Gate			√
	P-06	Cedar Pass Road Guard Station	√		√
	P-07	On-Base Housing - SW			√
	P-08	On-Base Housing (Main guard gate/power pole CP17)	√		√
	P-11	Cactus Springs (TLD south of P-35)	√	√	√
	P-12	TLD at "US Gov't Property" Sign	√		√
	P-34	O&M Complex (Owan Drive post)	√		
	P-35	Cactus Springs (north fence post)	√		
	P-36	On-Base Housing (NE fence line)	√		
	P-37	On-Base Housing (guard station)	√		

NOTES: TLD = Thermoluminescent Dosimeter

TTR = Tonopah Test Range

O&M = Operations & Maintenance

\*In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.

2006a). Radiological parameters include gamma-emitting radionuclides, plutonium and uranium.

- **Gamma-emitting radionuclides** – Gamma spectroscopy is used to detect the emission of gamma radiation from radioactive materials. Radionuclide identification is possible by measuring the spectrum of gamma energies associated with a sample, since each radionuclide has a unique and consistent series of gamma emissions. Cesium-137 (Cs-137) is an example of a long-lived gamma emitter that is prevalent in the environment (as fallout from historical nuclear weapons testing). Other gamma-emitters of interest at TTR are Americium-241 (Am-241) and depleted uranium (DU) from past explosives testing.
- **Plutonium** – Due to past explosive testing, plutonium is present in some limited areas of TTR. One of the indicators of the presence of weapons-grade plutonium is the radionuclide Am-241. Isotopic plutonium analysis is sometimes performed on any sample for which gamma spectroscopy identified Am-241 in concentrations greater than its minimum detectable activity (MDA).
- **Uranium** – Uranium occurs naturally in soils and may also be present as a pollutant in the environment due to past testing conducted at TTR. Total uranium ( $U_{tot}$ ) analysis is used to measure all uranium isotopes present in a sample. A high  $U_{tot}$  measurement may trigger an isotope-specific analysis to determine the possible source of uranium (i.e., natural, man-made, enriched, or depleted).

- **External gamma radiation exposure rates** - Thermoluminescent Dosimeters (TLDs) are used to measure ambient gamma exposure rates. Several natural gamma radiation sources exist, including cosmic radiation and radioactive materials that exist in geologic materials at TTR. The TLD network was established to determine the regional gamma exposure rate due to natural sources and to determine the impact, if any, of Sandia Corporation's operations on these levels. The dosimeters are placed on aluminum poles at a height of approximately one meter, and are exchanged and measured quarterly (January, April, July, and October) at 20 on-site, perimeter and off-site locations.

#### **Radiological Results**

The results of the statistical analysis showed no on-site or perimeter location that was both higher than off-site and with an increasing trend (Priority-1). Overall summary statistics for all radiological results are presented in Table 4-5. The following radiological analytes showed three locations as Priority-2 (higher than off-site): Am-241, Cs-137,  $U_{tot}$ . The Priority-2 locations along with the associated summary statistics are listed in Table 4-6. The following radiological analytes showed three locations as Priority-3 (increasing trend): Cs-137 and  $U_{tot}$ . While this increasing trend is "statistically significant," it is not operationally significant (does not pose a safety and health threat to human health or the environment). Table 4-7 lists the analytes and their associated summary statistics. It should be noted that plutonium-238 (Pu-238), Pu-239/240, U-235, and U-238 were considered as Priority-4

**TABLE 4-5.** Summary Statistics for Soil Locations (all units in pCi/g unless otherwise noted)

Analyte	Location Class	Sample Size	Average	Median	Std Dev	Minimum	Maximum
<b>Am-241</b>	On-site	105	0.128	0.009	0.494	-0.231	3.580
	Perimeter	40	-0.005	-0.002	0.048	-0.189	0.055
	Off-site	70	-0.003	0.005	0.048	-0.202	0.065
<b>Cs-137</b>	On-site	105	0.265	0.236	0.182	0.000	0.767
	Perimeter	40	0.217	0.159	0.158	0.012	0.573
	Off-site	70	0.222	0.185	0.147	0.000	0.639
<b>Pu-238</b>	On-site	26	0.014	0.006	0.020	-0.010	0.082
	Perimeter	8	0.007	0.004	0.009	0.002	0.028
	Off-site	14	0.006	0.005	0.007	-0.002	0.024
<b>Pu-239/240</b>	On-site	26	0.445	0.105	1.068	0.001	4.920
	Perimeter	8	0.016	0.012	0.014	0.001	0.043
	Off-site	14	0.012	0.011	0.010	-0.001	0.032
<b>U-235</b>	On-site	105	0.099	0.092	0.059	-0.043	0.259
	Perimeter	40	0.087	0.074	0.056	0.013	0.252
	Off-site	70	0.093	0.082	0.060	-0.005	0.293
<b>U-238</b>	On-site	105	1.370	1.360	0.490	0.470	2.610
	Perimeter	40	1.290	1.280	0.590	0.180	2.650
	Off-site	70	1.420	1.350	0.590	0.410	2.960
<b>Total Uranium (µg/g)</b>	On-site	105	0.744	0.735	0.145	0.509	1.150
	Perimeter	40	0.739	0.708	0.198	0.483	1.490
	Off-site	70	0.771	0.736	0.204	0.463	1.550

**NOTES:** Historical summary of all data for all locations and time (pooled)  
 pCi/g = picocurie per gram                      µg/g = microgram per gram

(not higher than off-site or no increasing trend).

The respective radiological analytes are discussed in the sections below listing the locations showing either Priority-2 or Priority-3.

**Am-241**

One on-site location (S-09) continues to be identified as Priority-2 (higher than off-site). S-09 is located near the Roller Coaster Decon site. The maximum result for this location was recorded in 2002 and is 3.56 pCi/g. No other on-site locations were identified as Priority-2. No perimeter location was identified as Priority-2 or Priority-3 (increasing trend).

**Cs-137**

One on-site location (S-50) continues to be identified as Priority-2 (higher than off-site). S-50 is located near the N/S Mellan Airstrip. The maximum value for Cs-137 was observed in 2003 at 0.767 pCi/g.

One perimeter location (P-06) was identified as Priority-3 (increasing trend) for Cs-137. P-06 is located at the Cedar Pass Road Guard Station. The maximum value for P-06 was 0.221 pCi/g.

**U<sub>tot</sub>**

There was one perimeter location (P-35) that was identified as Priority-2 (higher than off-site). The maximum value observed at this location was 1.49

µg/g. P-35 is located at Cactus Springs northeast north fence post. There were one on-site location (S-10) and one perimeter location (P-37) that were identified as Priority-3 (increasing trend). S-10 is located near the Brownes Road and Denton Freeway. P-37 is located at the guard station near on-base housing. The maximum value from these two locations was noted to be 0.923 µg/g and was observed at S-10 during the 2005 sampling period.

**TLD Results**

Sampling for 2005 was conducted from January 2005 through January 2006. TLDs were missing (not recovered) at several locations during 2005; when a TLD location has a missing quarter the data is not included in the summary statistics. Summary statistics for the past five years are shown in Table 4-8.

On-site and perimeter locations were statistically different from off-site locations; off-site locations are statistically lower than either on-site or perimeter locations. There also appears to be a statistical difference between years, with 2005 having the highest recorded results. There is a grouping between 2004 and 2005, which is statistically greater than the grouping between 2003, 2002, and 2001. Figure 4-1 graphically portrays the TLD results from 2001 through 2005. TLD results and TLD measurements by quarter and location type for 2005 are shown in Tables A-7 and A-8 of Appendix A, respectively.

**TABLE 4-6.** Summary Statistics for Soil Locations Noted as Priority-2 (all units in pCi/g unless otherwise noted)

Analyte	Location	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Am-241	S-09	5	1.676	1.150	1.346	0.532	3.560
Cs-137	S-50	5	0.500	0.552	0.213	0.200	0.767
Total Uranium (µg/g)	P-35	5	1.171	1.110	0.227	0.936	1.490

NOTES: pCi/g = picocurie per gram      µg/g = microgram per gram

**TABLE 4-7.** Summary Statistics for Soil Locations Noted as Priority-3 (all units in pCi/g unless otherwise noted)

Analyte	Location	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Cs-137	P-06	5	0.162	0.147	0.036	0.131	0.221
Total Uranium (µg/g)	S-10	5	0.817	0.799	0.067	0.745	0.923
	P-37	5	0.725	0.737	0.065	0.619	0.796

NOTES: pCi/g = picocurie per gram      µg/g = microgram per gram

**TABLE 4-8.** Summary Statistics for TLDs by Location Class (all units in m/rem unless otherwise noted)

Location Class	Sample Size	Average	Median	Std Dev	Minimum	Maximum
On-site	31	162.7	160.1	18.6	132.6	228.8
Perimeter	19	153.2	155.6	10.8	134.5	172.7
Off-site	9	140.3	138.2	15.6	120.0	163.2

NOTES: m/rem = millirem

#### 4.1.6 Non-Radiological Parameters and Results

In 2005, soils were also analyzed for non-radiological constituents, as is done periodically (SNL 2006a). The results showed no anomalies that required further investigation under the decision-making process described in Section 4.1.3. All results were categorized as Priority 4. This data is shown in Appendix A. In addition, all historical non-radiological soil analyses were analyzed and reported in a summary report (SNL 2006c). This report will serve as a baseline reference for non-radiological constituents in TTR soils.

## 4.2 WATER MONITORING

Results for potable water, wastewater effluent sampling, and the issue of storm water monitoring are discussed in this section.

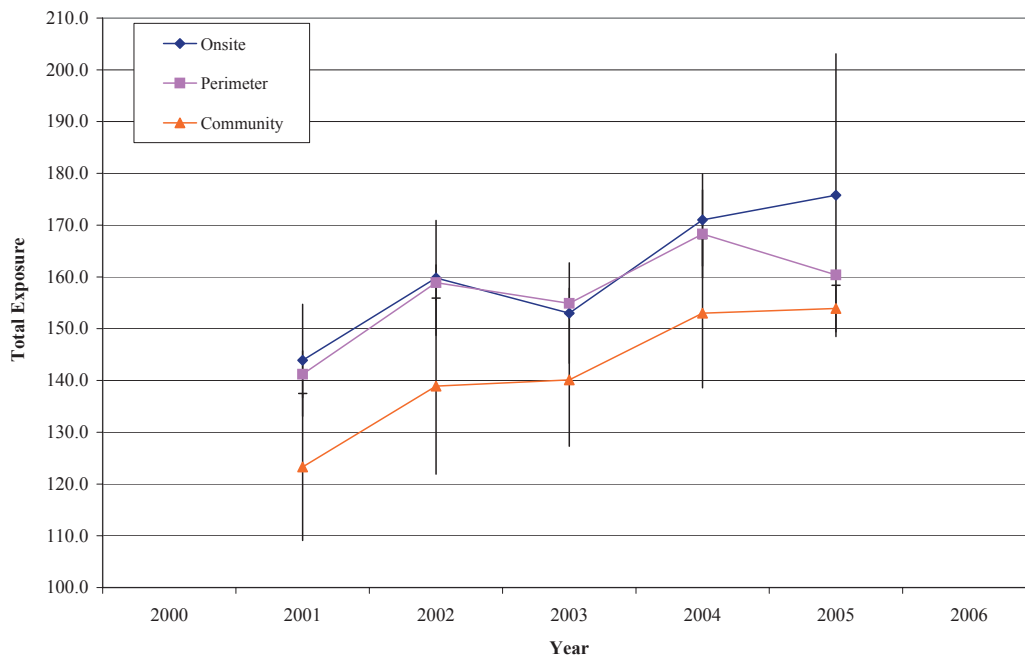
The *Water Conservation Plan for the Tonopah Test Range* complies with State Water Resources Division regulations requiring a water conservation plan for permitted water systems and major water users in Nevada (DOE 1992).

#### 4.2.1 Production Well Monitoring

There are three active wells used by Sandia Corporation at TTR. Production Well 6, Well 7, and the Roller Coaster Well. Production Well 6 and the Roller Coaster Well are the most active. Production Well 6, which supplies drinking water to the Sandia Corporation Main Compound in Area 3, is the only well that has been sampled for contaminants. Outlying areas use bottled water. The other wells are not used for potable purposes (construction and dust suppression) and there is no regulatory sampling requirement.

All sampling is conducted in accordance with requirements set by the state (State of Nevada 1997). Analytes are sampled at different intervals, as shown in Table 4-9.

Sampled parameters included, but were not limited to, total coliforms, nitrates, nitrites, volatile organic compounds (VOCs), Synthetic Organic Compounds (SOCs), Total Trihalomethanes/Haloacetic Acids, and arsenic.



**FIGURE 4-1.** Tonopah Test Range TLD Exposure (2001-2005)

The State of Nevada conducted a Sanitary Inspection of the “old” permitted water system for Area 3 in December 2005. Sandia Corporation remained in compliance with all Well 6 permit requirements in 2005.

Di (2-Ethylhexyl) Phthalate (DEHP) was detected in one sample (well below the MCL) and triggered quarterly monitoring for the contaminant until not detected in two consecutive quarterly samples. DEHP is the most commonly used of a group of related chemicals called phthalates or phthalic acid esters. The greatest use of DEHP is as a plasticizer for polyvinylchloride (PVC) and other polymers including rubber, cellulose and styrene. A number of packaging materials and tubings used in the production of foods and beverages are PVC contaminated with phthalic acid esters, primarily DEHP.

In 2005, the majority of the work was completed on upgrading the TTR Area III Water System (The TTR Water and Fire Protection Project). Well 6 was refurbished, a new elevated storage tank was erected, all distribution lines were replaced, a pH adjustment system was installed, new hypochlorinators were installed, and an arsenic removal system was installed. During the upgrade, TTR used Air Force or bottled water for domestic purposes. The system is currently awaiting State of Nevada inspection and approval and is expected to come on-line in early 2006. Due to the arsenic treatment and pH adjustment enhancements, operator certification

requirements were increased from Distribution Grade 1 (D-1) to Treatment Grade 2 (T-2). TTR currently has two T-2 operators in training and one T-1 operator in training.

#### 4.2.2 Sewage System and Septic Tank Monitoring

Sewage from Sandia Corporation’s facilities in the Main Compound at Area 3 goes to the U.S. Air Force (USAF) facultative sewage lagoon. Either SNL/NM or Westinghouse Government Service takes annual wastewater samples from Area 3 at the point wastewater leaves Sandia Corporation property and enters the USAF system.

The USAF holds the National Pollutant Discharge Elimination System (NPDES) permit for its wastewater discharges. The USAF takes quarterly samples from the headwater end of the lagoon. In the past, Sandia Corporation provided quarterly sampling results to the USAF for inclusion into their USAF Discharge Monitoring Report (DMR); however, the NPDES permit was modified in 1997 and no longer stipulates the requirement of quarterly data from Sandia Corporation. Therefore, Sandia Corporation now only provides annual sample results to the USAF.

Forty eight hour composite wastewater samples are collected on an annual basis and have the following parameters analyzed:

- Total coliforms;
- Total cyanide (Sandia Corporation does not use cyanide-containing compounds at TTR);
- pH (potential of hydrogen [acidity]) and non-filtered residue;
- Phenolics (Sandia Corporation does not use phenol-containing compounds at TTR);
- Chemical oxygen demand (COD);
- VOCs;
- Semi-Volatile Organic Compounds (SVOCs);
- Metals (cadmium, chromium, copper, nickel, silver, zinc, lead, selenium, and mercury);
- Total recoverable petroleum hydrocarbons (TRPH);
- Oil and grease; and
- Tritium, gamma spectroscopy, gross alpha, and gross beta.

All analytical results for wastewater sampled at Area 3 were within regulatory limits in 2005.

### ***Septic Tank Systems***

A new septic tank and leach field were constructed in late 2005 in Area 9. Septic tank systems are sampled, as needed. There are now seven septic systems located on-site, which are owned by DOE/ NNSA at TTR. These seven active septic tanks are used in remote locations and are maintained by the TTR facilities group. The sewage from these locations flows into septic tanks and associated drain fields. None of these systems required maintenance, sampling, or pumping in 2005. All other remaining septic systems have been closed or are undergoing closure and are being addressed by the ER Project.

### ***4.2.3 Storm Water Monitoring***

Currently, Sandia Corporation has no requirement to perform storm water monitoring at TTR. All storm water issues and monitoring are managed by the USAF.

## ***4.3 RADIOLOGICAL AIR MONITORING***

Air quality compliance at the TTR is met by adherence to specific permit conditions and compliance with local, state, and federal air regulations. Ambient air quality monitoring is not currently required at TTR. Ambient air monitoring was last conducted in 1996 to ascertain the level of radiological constituents in the air as discussed below.

**TABLE 4-9.** Production Well Monitoring at TTR

<b>Analyte</b>	<b>Sampling Frequency</b>
Total Coliform	Monthly
Nitrate, Secondary (13) Drinking Water Standards	2003
Dioxin, Nitrate, Total Trihalomethanes/Haloacetic Acids (5)	2004
Arsenic, IOC's Phase II, IOC's Phase V, Nitrate, Nitrite Nitrate and Nitrite (Total), SOC's Phase II, SOC's Phase V Total Trihalomethanes/Haloacetic Acids (5), VOC's Phase I and II, VOC's Phase V,	2005
Asbestos, Lead/Copper, Nitrate, Secondary (13) Drinking Water Standards Total Trihalomethanes/Haloacetic Acids (5)	2006
Dioxin, Nitrate	2007
Arsenic, IOC's Phase II, IOC's Phase V, Nitrate, Nitrite, Nitrate and Nitrite (Total) SOC's Phase II, SOC's Phase V, VOC's Phase I and II, VOC's Phase V	2008
Lead/Copper, Nitrate, Secondary (13) Drinking Water Standards	2009
Dioxin, Nitrate	2010

**NOTES:** IOC = inorganic compounds  
VOC = volatile organic compounds  
SOC = synthetic organic compounds

**TABLE 4-10.** Calculated Dose Assessment Results for On-site Receptor

Dose to Receptor	Location	1997 Measured Dose*	NESHAP Standard	Natural Background
On-site Receptor (EDE to the MEI)	Airport TTR Area	0.024 mrem/yr (0.00024 mSv/yr)	10 mrem/yr (0.1 mSv/yr)	250 mrem/yr <sup>1</sup>

NOTES: \*Dose calculated from continuous monitoring February 1996 to February 1997.

EDE = effective dose equivalent

MEI = maximally exposed individual

mrem/yr = millirem per year

mSv/yr = millisievert per year

TTR = Tonopah Test Range

<sup>1</sup> Natural background is estimated at 250 mrem/yr nationwide.

Operations by Sandia Corporation at TTR do not involve activities that release radioactive emissions from either point sources (stacks and vents) or diffuse sources such as outdoor testing. However, diffuse radiological emissions are produced from the re-suspension of americium and plutonium present at the Clean Slate ER sites. Other ER sites with minor radiological contamination, such as DU, do not produce significant air emission sources from re-suspension.

#### ***National Emission Standards for Hazardous Air Pollutants (NESHAP)***

NESHAP, 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities," has set a maximum of 10 mrem/yr for all combined air emission pathway sources from any DOE/NNSA facility. Although the dose calculated from the Clean Slate sites is many times less than this standard, there was a question of whether the site would require continuous radiological air monitoring.

The 1995 NESHAP report for TTR reported a calculated effective dose equivalent (EDE) to the maximally exposed individual (MEI) of 1.1 mrem/yr as a result of diffuse emissions from the Clean Slate sites (SNL 1996). Because the EPA requires continuous air monitoring for any radionuclide source that contributes a dose in excess of 0.1 mrem/yr to the MEI, Sandia Corporation instituted continuous air monitoring at the site for one year, from February 22, 1996 to February 25, 1997. The monitoring site was chosen at the TTR Airport, the location of the highest calculated dose for a member of the public. This site selection is discussed in the 1996 NESHAP report (SNL 1997). The dose assessment result from the continuous monitoring was 0.024 mrem/yr. This was about four times less than the 0.1 mrem/yr threshold cutoff for which

continuous monitoring would be required by the EPA. The average air concentration in curies per cubic meter (Ci/m<sup>3</sup>) were measured as follows:

Am-241	4.1 x 10 <sup>-18</sup> Ci/m <sup>3</sup>
Pu-238	1.6 x 10 <sup>-18</sup> Ci/m <sup>3</sup>
Pu-239/240	9.5 x 10 <sup>-19</sup> Ci/m <sup>3</sup>

Although an annual calculated dose assessment is not required for the site, Sandia Corporation continues to produce an annual NESHAP report for TTR (SNL 2006). The results from the 1996 to 1997 monitoring will continue to be used for as long as there is no change in the status of the Clean Slate sites. Table 4-10 summarizes these dose assessment results. Future TTR activities are not expected to change; however, if new sources or modifications to the existing sources are anticipated, they will be evaluated for NESHAP applicability.

#### ***4.4 NON-RADIOLOGICAL AIR EMISSIONS***

The TTR Class II Air Quality Operating Permit Renewal in 2002 exempted most emission sources used at TTR with the exception of the screening plant and portable screen. In 2005, the total emissions reported to the State of Nevada were 0.001 ton per year from the portable screen. The screening plant was not used.



Tonopah Test Range

# chapter five

## 2005 ANNUAL SITE ENVIRONMENTAL REPORT FOR THE KAUAI TEST FACILITY

### In This Chapter ...

Facilities and Operations  
2005 Rocket Launches  
Demographics  
Compliance Summary  
Environmental Program Activities  
Environmental Surveillance & Monitoring Activities

### *Environmental Snapshot*

*There were no reportable occurrences at the Kauai Test Facility in 2005.*

The Kauai Test Facility (KTF) is a government-owned/contractor-operated laboratory. Sandia Corporation, a wholly-owned subsidiary of Lockheed Martin Corporation, manages and operates KTF for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA). KTF is operated as a rocket preparation, launching, and tracking facility for DOE/NNSA, as well as in support of other U.S. military agencies. Sandia National Laboratories, Kauai Test Facility (SNL/KTF) refers to the facilities at KTF. The DOE/NNSA Sandia Site Office (SSO) in Albuquerque, New Mexico administers the contract and oversees contractor operations at the site. SNL/KTF exists as a facility within the boundaries of the U.S. Department of Defense (DoD) Pacific Missile Range Facility (PMRF). SNL/KTF is located on the island of Kauai at the north end of the PMRF, near Nohili Point (Figure 5-1). This Annual Site Environmental Report (ASER) summarizes data and the compliance status of the environmental protection and monitoring programs at SNL/KTF for calendar year (CY) 2005. This report was prepared in accordance with DOE Order 450.1, *Environmental Protection Program* (DOE 2005) and DOE Order 231.1A, *Environment, Safety, and Health Reporting* (DOE 2004a).

## 5.1 FACILITIES AND OPERATIONS

SNL/KTF has been an active rocket-launching facility since 1962. The KTF and Remote Range Interfaces Department, under Sandia Corporation, manages and conducts the rocket-launching activities at SNL/KTF. The site is primarily used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering re-entry vehicles, scientific studies of atmospheric and exoatmospheric phenomena, and Missile Defense Agency programs. Nuclear devices have never been launched from SNL/KTF.

The first facilities at KTF were constructed in the early 1960s to support the National Readiness Program. The most recent construction, completed in March 2005, extended the Missile Service Tower (MST) to support DOE and MDA. From 1992 to 2005, there have been 23 launches.

The KTF launcher field was originally designed to accommodate 40 launch pads, but only 15

pads were constructed. Of these, 11 have had their launchers removed. Beyond the implementation of portions of the original plan, two additional launch pads were constructed: Pad 41 at Kokole Point and Pad 42 (the MST launch pad). The launcher field site has a number of permanent facilities used to support rocket operations. In addition to rocket launch pad sites, SNL/KTF facilities include missile assembly areas, data acquisition and operations facilities, a maintenance shop, and a trailer compound for administration and technical support personnel. Other features at SNL/KTF include extensive radar tracking and worldwide radio communication access to other DoD facilities.

The administrative area of SNL/KTF, known as the Main Compound, is located within a fenced area near the North Nohili access road from PMRF. Inside the fenced compound, a number of trailers and vans are connected together with a network of concrete docks and covered walkways. The majority of these temporary facilities are used during operational periods to support the field staff at SNL/KTF. During non-operational periods, general maintenance continues and dehumidifiers remain in operation (to protect equipment). Additionally, there are a number of permanent buildings, most of which are in use year-round to support and maintain SNL/KTF facilities.

## 5.2 2005 ROCKET LAUNCHES

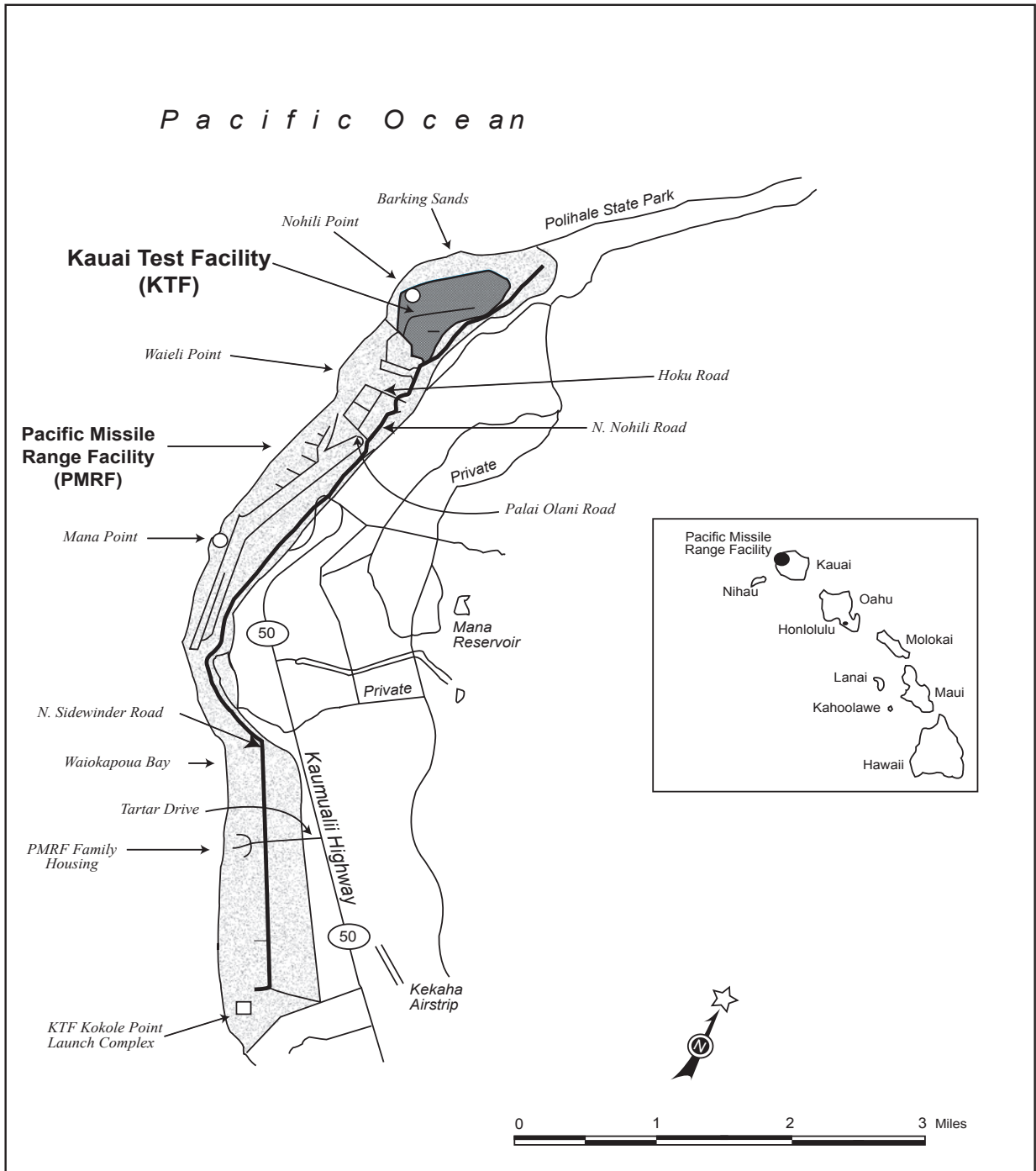
There were four rocket launches from SNL/KTF in 2005. The launches were covered by the KTF Environmental Assessment (EA), published in July 1992 (DOE 1992a) and the U.S. Department of Defense, Pacific Missile Range Facility Enhanced Capability Final (DoD 1998):

- Navy Theater Wide, FM-7 , February 24, 2005,
- Critical Measures Counter Measures CMCM-1 A, August 5, 2005,
- Critical Measures Counter Measures CMCM-1 B, August 16, 2005, and
- AEGIS BMD FTM04-2 (FM-8), November 17, 2005.



Rocket Launch at Kauai Test Facility





**FIGURE 5-1.** Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area (The Kauai Test Facility (KTF) is to the north, near Nohili Point)

**TABLE 5-1. Permits in Place at SNL/KTF**

Type	Permit Number	Date Issued	Expiration Date	Regulatory Agency
Non-covered Source Permit (NSP) (two stand-by diesel generators)	NSP 0429-01-N	April 30, 2004	April 29, 2009	State of Hawaii
Resource Conservation and Recovery Act (RCRA)	HI-0000-363309	Sept. 23, 1994	Not specified	EPA Region IX and Hawaii Dept. of Health
Underground Storage Tank (UST) (2,500)	Not applicable	Sept. 13, 1991	Indefinite	EPA Region IX and Hawaii Dept. of Health

**NOTE:** In 1999, there was a change in reporting fuel through put from annual reporting to biannual reporting to the State of Hawaii.

SNL/KTF = Sandia National Laboratories, Kauai Test Facility

EPA = U.S. Environmental Protection Agency

UST = Underground Storage Tank

### 5.3 DEMOGRAPHICS

There are 17 permanent on-site personnel at SNL/KTF. During operational periods when rocket launches occur, an additional 15 to 130 persons from the U.S. mainland are brought to SNL/KTF (DOE 1992a). The closest population center to SNL/KTF is the town of Kekaha (population 3,300), which is eight miles from the site.

### 5.4 COMPLIANCE SUMMARY

The list of regulations and statutes on page 5-5 provides an overview of compliance status for Sandia Corporation's operations at SNL/KTF in 2005. Table 5-1 lists the applicable permits in place at SNL/KTF.

#### ***Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)***

CERCLA, also known as "Superfund," addresses areas of past spills and releases. SNL/KTF has no current Environmental Restoration (ER) areas located on-site.

The U.S. Environmental Protection Agency (EPA) designated ongoing oversight of SNL/KTF to the Hawaii Department of Health Hazard Evaluation and Emergency Response Office. The EPA recommended continued reevaluation for environmental contamination due to the launching facility. Rocket exhaust continues to be the main source of metals and other non-reportable air emission releases.

#### ***Superfund Amendments and Reauthorization Act (SARA)***

SARA Title III requires chemical inventory information and threshold quantity reporting as directed by the Emergency Planning and Community Right-to-Know Act (EPCRA), Sections 311 and 312. All required information has been submitted to the State of Hawaii. There were no reportable releases at SNL/KTF under EPCRA or CERCLA in 2005. Table 5-2 lists SARA Title III reporting requirements.

#### ***Resource Conservation and Recovery Act (RCRA)***

In 1994, SNL/KTF reached "small quantity hazardous waste generator" status as defined by RCRA, and therefore, obtained an EPA Identification Number. However, the volume of waste generated in 2005 qualified SNL/KTF to maintain "conditionally exempt small quantity generator" status.

#### ***Federal Facility Compliance Act (FFCA)***

The FFCA addresses the disposition of mixed waste (MW) at federal facilities. No radioactive waste of any kind has been generated or stored at SNL/KTF and, therefore, this statute is not applicable to the site.

#### ***National Environmental Policy Act (NEPA)***

NEPA requires federal agencies and other organizations that perform federally-sponsored projects to consider environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these issues, and include this information in early project planning and decision-making. Additionally, if a proposed action is determined

## Major Environmental Regulations & Statutes Applicable to KTF

### Clean Air Act (CAA) and CAA Amendments (CAAA)

Provides standards to protect the nation's air quality [http://www.epa.gov/oar/oaq\\_caa.html](http://www.epa.gov/oar/oaq_caa.html)

### Clean Water Act (CWA)

Provides general water quality standards to protect the nation's water sources and byways  
<http://www.epa.gov/region5/water/cwa.htm>

### Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances <http://www.epa.gov/region5/defs/html/cercla.htm>

### Cultural resources acts

Includes various acts that protect archeological, historical, religious sites, and resources  
[http://water.usgs.gov/eap/env\\_guide/cultural.html](http://water.usgs.gov/eap/env_guide/cultural.html)

### Endangered Species Act (ESA)

Provides special protection status for federally-listed endangered or threatened species  
<http://www.epa.gov/region5/defs/html/esa.htm>

### Executive Orders (EOs)

Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and greening the government through leadership in environmental management  
[http://www.archives.gov/federal\\_register/executive\\_orders/disposition.html](http://www.archives.gov/federal_register/executive_orders/disposition.html)

### Federal Facility Compliance Act (FFCA)

Directs federal agencies regarding environmental compliance <http://tis.eh.doe.gov/oepa/laws/ffca.html>

### Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Controls the distribution and use of various pesticides <http://www.epa.gov/region5/defs/html/fifra.htm>

### Migratory Bird Treaty Act (MBTA) of 1918

Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests <http://tis.eh.doe.gov/oepa/laws/mbta.html>

### National Emission Standards for Hazardous Air Pollutants (NESHAP)

Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA  
<http://www.epa.gov/radiation/neshaps/>

### National Environmental Policy Act (NEPA)

Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making <http://tis.eh.doe.gov/NEPA/>

### Resource Conservation and Recovery Act (RCRA)

Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (USTs) <http://www.epa.gov/region5/defs/html/rcra.htm>

### Safe Drinking Water Act (SDWA)

Provides specific standards used for drinking water sources <http://www.epa.gov/safewater/sdwa/sdwa.html>

### Superfund Amendments and Reauthorization Act (SARA)

SARA, Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community  
<http://www.epa.gov/region5/defs/html/sara.htm>

### Toxic Substance Control Act (TSCA)

Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs) <http://www.epa.gov/compliance/civil/tsca/index.html>

**TABLE 5-2. 2005 SARA Title III (or EPCRA) Reporting Requirements Applicable to SNL/KTF**

Section	SARA Title III Section Title	Requires Reporting?		Description
		Yes	No	
302 - 303	Notification/ Plans	✓		Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/SSO, which distributes it to the required entities.
304	Emergency Notification		✓	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2005.
311-312	MSDSs/ Chemical Purchase Inventory Report	✓		There are two “Community Right-to-Know” reporting requirements: (a) SNL/KTF completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) SNL/KTF provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA’s alternative MSDS reporting, which is detailed in 40 CFR Part 370.21.
313	Toxic Chemical Release Forms		✓	Sandia Corporation is below the reporting threshold in 2005 for producing a TRI Report for SNL/KTF operations.

**NOTES:** RQ = reportable quantity  
 EHS = extremely hazardous substance  
 EPA = U.S. Environmental Protection Agency  
 SARA = Superfund Amendments and Reauthorization Act  
 EPCRA = Emergency Planning and Community Right-to-Know Act  
 MSDS = Material Safety Data Sheets (gives relevant chemical information)  
 CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act  
 DOE/NNSA/SSO = U.S. Department of Energy, National Nuclear Security Administration, Sandia Site Office

TRI = Toxic Release Inventory  
 SNL/KTF = Sandia National Laboratories, Kauai Test Facility

to have environmentally “significant” impacts, the agency must prepare an EA or an environmental impact statement (EIS) before making an irretrievable commitment of resources or funding. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to choose a course of action with the least environmental impacts. The DOE/NNSA/SSO coordinates NEPA compliance at SNL/KTF with Sandia National Laboratories, New Mexico (SNL/NM).

**Endangered Species Act (ESA)**

The ESA applies to both private individuals and federal agencies. Federal agencies must ensure that any action authorized, funded, or carried out by them will not jeopardize the continued existence of a threatened or endangered species, or result in adverse modifications of its habitat. The ESA is addressed under the NEPA Program and Ecology Program. If potentially significant impacts to sensitive species or habitats are found

as a result of the proposed action, an EA or an EIS must be prepared.

Table 5-3 lists all threatened and endangered state and federal listed species occurring on the island of Kauai.

**Cultural Resources Acts**

The three primary cultural resources acts applicable at SNL/KTF are as follows:

- National Historic Preservation Act (NHPA);
- Archaeological Resources Protection Act (ARPA); and
- American Indian Religious Freedom Act (AIRFA).

At SNL/KTF, cultural resources compliance is coordinated through the NEPA Program. Actions that could adversely affect cultural resources are initially analyzed in a NEPA Checklist.

**TABLE 5-3.** Threatened and Endangered Species Potentially Occurring on SNL/KTF

Common Name	Scientific Name	Federal Status	State Status
PLANTS			
Liliwai	<i>Acaena exigua</i>	Endangered	Endangered
No common name	<i>Achyranthes mutica</i>	Endangered	Endangered
Mahoe	<i>Alectryon macrococcus</i>	Endangered	Endangered
Kuawawaenohu	<i>Alsinidendron lychnoides</i>	Endangered	Endangered
No common name	<i>Alsinidendron viscosum</i>	Endangered	Endangered
No common name	<i>Bonamia menziesii</i>	Endangered	Endangered
Olulu	<i>Brighamia insignis</i>	Endangered	Endangered
Uhiuhi	<i>Caesalpinia kawaiense</i>	Endangered	Endangered
‘Awiwi	<i>Centaurium sebaeoides</i>	Endangered	Endangered
No common name	<i>Chamaesyce halemanui</i>	Endangered	Endangered
Pauoa	<i>Ctenitis squamigera</i>	Endangered	Endangered
Haha	<i>Cyanea asarifolia</i>	Endangered	Endangered
Haha	<i>Cyanea recta</i>	Threatened	Threatened
Haha	<i>Cyanea remyi</i>	Endangered	Endangered
Haha	<i>Cyanea undulata</i>	Endangered	Endangered
Pu’uka’a	<i>Cyperus trachysanthos</i>	Endangered	Endangered
Ha’iwale	<i>Cyrtandra limahuliensis</i>	Threatened	Threatened
Mapele	<i>Cyrtandra cyaneoides</i>	Endangered	Endangered
No common name	<i>Delissea rhytidosperma</i>	Endangered	Endangered
‘Oha	<i>Delissea rivularis</i>	Endangered	Endangered
Asplenium Leaved Diella	<i>Diellia erecta</i>	Endangered	Endangered
No common name	<i>Diellia pallida</i>	Endangered	Endangered
No common name	<i>Diplazium molokaiense</i>	Endangered	Endangered
Na’ena’e	<i>Dubautia pauciflora</i>	Endangered	Endangered
Na’ena’e	<i>Dubautia latifolia</i>	Endangered	Endangered
‘Akoko	<i>Euphorbia haeleeleana</i>	Endangered	Endangered
Heau	<i>Exocarpos luteolus</i>	Endangered	Endangered
Mehamehame	<i>Flueggea neowawraea</i>	Endangered	Endangered
No common name	<i>Gouania meyenii</i>	Endangered	Endangered
Honohono	<i>Haplostachys haplostachya</i>	Endangered	Endangered
‘Awiwi	<i>Hedyotis cookiana</i>	Endangered	Endangered
Na Pali Beach Hedyotis	<i>Hedyotis st.-johnii</i>	Endangered	Endangered
No common name	<i>Hesperomannia lydgatei</i>	Endangered	Endangered
Kauai Hau Kuahiwi	<i>Hibiscadelphus distans</i>	Endangered	Endangered
Hau Kuahiwi	<i>Hibiscadelphus woodii</i>	Endangered	Endangered
Hibiscus, Clay’s	<i>Hibiscus clayi</i>	Endangered	Endangered
Koki’o ke’oke’o	<i>Hibiscus waimeae ssp. hannerae</i>	Endangered	Endangered
Wawae’iole	<i>Huperzia mannii (Phlegmariurus mannii)</i>	Endangered	Endangered
Ischaemum, Hilo	<i>Ischaemum byrone</i>	Endangered	Endangered
Aupaka	<i>Isodendron laurifolium</i>	Endangered	Endangered
Aupaka	<i>Isodendron longifolium</i>	Threatened	Threatened
Koki’o	<i>Kokia kauaiensis</i>	Endangered	Endangered

**TABLE 5-3. Threatened and Endangered Species Potentially Occurring on SNL/KTF (continued)**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Federal Status</b>	<b>State Status</b>
Kamakahala	<i>Labordia lydgatei</i>	Endangered	Endangered
Kamakahala	<i>Labordia tinifolia</i> var. <i>wahiawaensis</i>	Endangered	Endangered
Nehe	<i>Lipochaeta fauriei</i>	Endangered	Endangered
Nehe	<i>Lipochaeta micrantha</i>	Endangered	Endangered
Nehe	<i>Lipochaeta waimeaensis</i>	Endangered	Endangered
Wawae'iole	<i>Lycopodium nutans</i> ( <i>Phlegmariurus nutans</i> )	Endangered	Endangered
No common name	<i>Lysimachia filifolia</i>	Endangered	Endangered
No common name	<i>Mariscus pennatiformis</i> ssp. <i>pennatiformis</i>	Endangered	Endangered
Alani	<i>Melicope haupuensis</i>	Endangered	Endangered
Alani	<i>Melicope knudsenii</i>	Endangered	Endangered
Alani	<i>Melicope pallida</i>	Endangered	Endangered
Alani	<i>Melicope quadrangularis</i>	Endangered	Endangered
No common name	<i>Munroidendron racemosum</i>	Endangered	Endangered
Kolea	<i>Myrsine linearifolia</i>	Threatened	Threatened
'Aiea	<i>Nothoestrum peltatum</i>	Endangered	Endangered
Lau 'ehu	<i>Panicum niihauense</i>	Endangered	Endangered
Makou	<i>Peucedanum sandwicense</i>	Threatened	Threatened
No common name	<i>Phyllostegia glabra</i> var. <i>lanaiensis</i>	Endangered	Endangered
No common name	<i>Phyllostegia knudsenii</i>	Endangered	Endangered
No common name	<i>Phyllostegia waimeae</i>	Endangered	Endangered
No common name	<i>Phyllostegia wawrana</i>	Endangered	Endangered
No common name	<i>Platanthera holochila</i>	Endangered	Endangered
Mann's Bluegrass	<i>Poa mannii</i>	Endangered	Endangered
Hawaiian Bluegrass	<i>Poa sandwicensis</i>	Endangered	Endangered
No common name	<i>Poa siphonoglossa</i>	Endangered	Endangered
Lo'ulu	<i>Pritchardia napaliensis</i>	Endangered	Endangered
Lo'ulu	<i>Pritchardia viscosa</i>	Endangered	Endangered
Kaulu	<i>Pteralyxia kauaiensis</i>	Endangered	Endangered
No common name	<i>Remya kauaiensis</i>	Endangered	Endangered
No common name	<i>Remya montgomeryi</i>	Endangered	Endangered
Dwarf Naupaka	<i>Scaevola coriacea</i>	Endangered	Endangered
Ma'oli'oli	<i>Schiedea apokremnos</i>	Endangered	Endangered
No common name	<i>Schiedea helleri</i>	Endangered	Endangered
No common name	<i>Schiedea kauaiensis</i>	Endangered	Endangered
No common name	<i>Schiedea membranacea</i>	Endangered	Endangered
No common name	<i>Schiedea nuttallii</i>	Endangered	Endangered
No common name	<i>Schiedea spergulina</i> var. <i>leiopoda</i>	Endangered	Endangered
No common name	<i>Schiedea spergulina</i> var. <i>spergulina</i>	Threatened	Threatened
Lauhilihi	<i>Schiedea stellarioides</i>	Endangered	Endangered
'Ohai	<i>Sesbania tomentosa</i>	Endangered	Endangered
No common name	<i>Silene lanceolata</i>	Endangered	Endangered
Popolo Ku Mai	<i>Solanum incompletum</i>	Endangered	Endangered

**TABLE 5-3.** Threatened and Endangered Species Potentially Occurring on SNL/KTF (concluded)

<b>Common Name</b>	<b>Scientific Name</b>	<b>Federal Status</b>	<b>State Status</b>
Popolo ‘aiakeakua	<i>Solanum sandwicense</i>	Endangered	Endangered
No common name	<i>Spermolepis hawaiiensis</i>	Endangered	Endangered
No common name	<i>Stenogyne campanulata</i>	Endangered	Endangered
No common name	<i>Viola helenae</i>	Endangered	Endangered
Nani wai’ale’ale	<i>Viola kauaensis var. wahiawaensis</i>	Endangered	Endangered
Iliau, Dwarf	<i>Wilkesia hobbdi</i>	Endangered	Endangered
No common name	<i>Xylosma crenatum</i>	Endangered	Endangered
A’e	<i>Zanthoxylum dipetalum</i>	Endangered	Endangered
A’e	<i>Zanthoxylum hawaiiense</i>	Endangered	Endangered
<b>ANIMALS</b>			
<b>Mammals</b>			
Hawaiian Hoary Bat	<i>Lasiurus cinereus semotus</i>	Endangered	Endangered
Hawaiian Monk Seal	<i>Monachus schauinslandi</i>	Endangered	Endangered
<b>Birds</b>			
Hawaiian Duck	<i>Anas wyvilliana</i>	Endangered	Endangered
Hawaiian Coot	<i>Fulica americana alai</i>	Endangered	Endangered
Hawaiian Gallinule	<i>Gallinula chloropus sandwicensis</i>	Endangered	Endangered
Kauai Nuku pu’u	<i>Hemignathus lucidus hanapepe</i>	Endangered	Endangered
Kauai ‘Akia loa	<i>Hemignathus procerus</i>	Endangered	Endangered
Black-necked Stilt	<i>Himantopus mexicanus knudseni</i>	Endangered	Endangered
Kauai ‘O’o	<i>Moho braccatus</i>	Endangered	Endangered
Large Kauai Thrush	<i>Myadestes myadestinus</i>	Endangered	Endangered
Small Kauai Solitaire	<i>Myadestes palmeri</i>	Endangered	Endangered
Hawaiian Goose	<i>Nesochen sandwicensis</i>	Endangered	Endangered
No common name	<i>Psittirostra psittacea</i>	Endangered	Endangered
Dark-rumped Petrel	<i>Pterodroma phaeopygia sandwichensis</i>	Endangered	Endangered
Newell’s Shearwater	<i>Puffinus auricularis newelli</i>	Threatened	Threatened
<b>Reptiles</b>			
Loggerhead Sea Turtle (incidental in Hawaii)	<i>Caretta caretta</i>	Threatened	Threatened
Green Sea Turtle	<i>Chelonia mydas</i>	Threatened	Threatened
Leatherback Sea Turtle (incidental in Hawaii)	<i>Dermochelys coriacea</i>	Endangered	Endangered
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Endangered	Endangered
<b>Snails</b>			
Newcomb’s Snail	<i>Erinna newcombi</i>	Threatened	Threatened
<b>Arachnids</b>			
Kauai Cave Wolf Spider	<i>Adelocosa anops</i>	Endangered	Endangered
<b>Insects</b>			
Blackburn’s Sphinx Moth	<i>Manduca blackburni</i>	Endangered	Endangered
Kauai Pomace Fly	<i>Drosophila musaphila</i>	Proposed Endangered	Proposed Endangered
<b>Crustaceans</b>			
Kauai Cave Amphipod	<i>Spelaeorchestia koloana</i>	Endangered	Endangered

### ***Migratory Bird Treaty Act (MBTA) of 1918***

The MBTA of 1918 implemented the 1916 Convention for the protection of migratory birds. The original statute implemented the agreement between the U.S. and Great Britain (for Canada) and later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and Russia. In addition to the special consideration afforded to species listed as threatened and endangered, most birds are protected under the MBTA of 1918, as amended. At SNL/KTF, the MBTA is coordinated with NEPA compliance reviews and the Ecology Program.

### ***Environmental Compliance Executive Orders (EOs)***

The primary EOs related to environmental compliance at SNL/KTF are as follows:

- EO 11990, *Protection of Wetlands*, as amended
- EO 11988, *Floodplain Management*, as amended
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended
- EO 13101, *Greening the Government Through Leadership in Environmental Management*
- EO 13148, *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition*
- EO 13149, *Greening the Government Through Federal Fleet and Transportation Efficiency*
- EO 13123, *Greening the Government Through Efficient Energy Management*

### ***Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990***

Ambient air quality is regulated by Hawaii Administrative Rules (HAR), Title 11, Chapter 59 under the jurisdiction of the Hawaii Department of Health, Clean Air Branch. Currently, there are no facilities at SNL/KTF that require federal air permits or compliance with the New Source Performance Standards (NSPS), "Prevention of Significant Deterioration (PSD)," or 40 CFR 61, "National Emission Standards for Hazardous Air

Pollutants" (NESHAP). Within the boundaries of PMRF, no federal air emission permits are held either by DOE for SNL/KTF, or by DoD for PMRF. However, the two electrical generators at SNL/KTF are permitted for operation by the State of Hawaii under a "Noncovered Source Permit (NSP)" (Hawaii Department of Health 2004).

As required by the State of Hawaii, the 2005 Annual Fee and Monitoring Report (air emissions) was submitted to the State of Hawaii on January 31, 2006. In 2005, the total fuel usage reported to the State of Hawaii was 18,556 gallons of diesel fuel. Sandia Corporation was in compliance with all air quality regulations in 2005.

Rocket launches are mobile sources and do not require any reporting of reportable quantity (RQ) releases.

### ***Clean Water Act (CWA)***

There were no compliance issues with respect to any state or federal water pollution regulations in 2005. There are three septic tanks on-site owned by SNL/KTF facilities. The two older septic tanks for the Launch Operations Building (LOB) and the Missile Assembly Building (MAB) do not require permits from the State of Hawaii. A new septic tank and leach field was installed by Aqua Engineers in January 2005.

A National Pollutant Discharge Elimination System (NPDES) permit is not required due to the lack of significant storm water runoff discharging into "Waters of the U.S.," as defined in 40 CFR 122. However, this is not to say that there is no runoff. The EPA has concern with storm water runoff washing off the launcher pads and discharging to the ocean. Some of the downstream pathways include habitat for several federally-designated endangered or threatened species. The EPA has therefore recommended periodic evaluations for environmental contamination.

***Oil Storage*** – There is one underground storage tank (UST) at SNL/KTF, which is owned by the DOE. There is also one 10,000-gallon above ground fuel tank inside the Main Compound. Sandia Corporation cooperates with the U.S. Navy's spill control guidelines contained in the Spill Prevention Control and Countermeasures (SPCC) Plan, Pacific Missile Range Facility (NFEC 2003).



### ***Safe Drinking Water Act (SDWA)***

The SDWA does not apply directly to Sandia Corporation activities at SNL/KTF because all drinking water is obtained through PMRF's facilities or is purchased from commercial suppliers.

### ***Toxic Substances Control Act (TSCA)***

TSCA regulates the distribution of polychlorinated biphenyls (PCBs) and asbestos. The transformers on the SNL/KTF site have been tested and are free of PCBs, and there are no asbestos issues at the site.

### ***Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)***

FIFRA controls the distribution and application of pesticides including herbicides, insecticides, and rodenticides. All pesticide use at SNL/KTF follows EPA requirements.

### ***Releases and Occurrences***

There were no reportable occurrences at SNL/KTF in 2005.

## **5.5 ENVIRONMENTAL PROGRAM ACTIVITIES**

This section describes three environmental programs: NEPA, the ER Project, and the Spill Prevention Program.

### ***NEPA Program Activities***

The DOE completed a comprehensive Site-Wide Environmental Assessment for SNL/KTF operations in 1992 (DOE 1992a), which resulted in a Finding of No Significant Impact (FONSI), issued on July 17, 1992. This EA provided NEPA documentation covering all rocket-launching activities at SNL/KTF; however, in late FY2005, the DOE/NNSA/SSO determined it was time to review and update the Site-Wide EA for KTF. This review and update is expected to begin in FY2006.

In the meantime, prior to Sandia Corporation initiating any new activities at the KTF, SNL/NM will prepare a NEPA Checklist for submittal to DOE/NNSA/SSO for a determination.

### ***ER Project Activities***

There are no ER sites at SNL/KTF. The three ER sites identified in 1995 were given a No KTF ASER

Further Action (NFA) determination by the EPA on September 30, 1996. This confirmed that SNL/KTF met all CERCLA requirements and no additional sampling or remediation would be necessary in the three areas. This, however, does not preclude that other environmental sampling activities will take place at SNL/KTF.

## **5.6 ENVIRONMENTAL SURVEILLANCE AND MONITORING ACTIVITIES**

### ***Wastewater Monitoring***

Sandia Corporation's activities at SNL/KTF produce only sanitary sewage, which is directed into eight wastewater systems—three septic tanks and five French drains with pumping systems located in the LOB parking lot, the paved drive west of the office complex, the paved lot west of the garage, the drive west of the shops, and the parking lot east of the office complex—in accordance with Hawaii Underground Injection Control regulations (HAR Title 11, Chapter 23). The septic systems are periodically pumped by licensed state-certified contractors and inspected by state officials. The limited quantity of sewage released does not impact any protected waters and, as noted earlier, there are no drinking water wells in the area of SNL/KTF. Currently, septic tanks do not require permitting or sampling. As a best management practice (BMP), Sandia Corporation periodically performs sampling. No contaminants were identified above the reporting limits from past sampling events.

### ***Air Emission Monitoring***

Based on effluent air monitoring results of the STARS Flight Test Unit 1 (FTU-1) in February 1993 and the CDX rocket launch in the summer of 1992 (SNL 1992), it was determined that rocket launches at SNL/KTF were not a significant source of air pollutants. Launches are infrequent and emissions recorded did not exceed federal and state standards. Because the STARS type rocket produces the greatest air emissions and remained within acceptable limits, it can be assumed that future launches of this type will also be within acceptable limits. Therefore, no further air emission monitoring is planned at this time. If a new rocket type is launched from SNL/KTF that differs in emission substance from the STARS rocket, or air emission requirements change, future monitoring may be considered.

### ***Meteorological Monitoring***

On-site meteorological instruments are used during test periods to characterize atmospheric transport, diffusion conditions, and stability classes. Due to the infrequency of launches, no formal meteorological monitoring plan is in place for SNL/KTF. Climatic information representative of SNL/KTF is obtained from the PMRF.

### ***Noise Monitoring***

In accordance with the Quiet Communities Act of 1978 (42 U.S.C. 4901 et seq.), noise monitoring was conducted in February 1993 during the STARS FTU-1 launch to confirm the determination made in the STARS EIS that noise produced from the largest launch would be below maximum acceptable levels (SNL 1993). Data collected in the nearest town of Kekaha indicated that levels were no louder than noise generated from passing vehicles on a nearby highway.

### ***Terrestrial Surveillance***

Terrestrial surveillance sampling of soil is conducted every five years. No sampling occurred in 2005.

chapter six

# TTR & KTF REFERENCES



## In This Chapter ...

References

Executive Orders

DOE Orders

Code of Federal Regulations

Act and Statutes

State of Hawaii Environmental Regulations

State of Nevada Environmental Regulations

- ASI 1990** Advanced Sciences, Inc., Archaeological Survey and Testing, *Department of Energy, Kauai Test Facility*. Prepared for Sandia National Laboratories by Advanced Sciences, Inc., San Diego, CA (1990).
- Brock 1990** Brock, Richard E., *A Survey of the Green Sea Turtle Population Fronting the Kauai Test Facility, Pacific Missile Range, Barking Sands, Kauai: An Analysis of Potential Impacts with Implementation of the Strategic Defense Initiative*. Prepared for IT Corporation by Environmental Assessment Co., Honolulu, HI (1990).
- Brookins 1992** Brookins, D., "Background Radiation in the Albuquerque, New Mexico, U.S.A., Area," in *Environmental Geology and Water Science*, Vol. 19, No. 1, pp. 11-15 (1992).
- DOC 2006** U.S. Department of Commerce, U.S. Census Bureau, website at <<http://www.census.gov/>> Washington, DC (2006).
- DoD 1998** U.S. Department of Defense, *Pacific Missile Range Facility Enhanced Capability Final Environmental Impact Statement (EIS)*. U.S. Department of Defense, Department of the Navy, Kauai, HI (December 1998).
- DoD/DOE/ State of NV 1996** U.S. Department of Defense, U.S. Department of Energy, and Nevada Department of Conservation and Natural Resources, *Federal Facility Agreement and Consent Order (FFACO)*. State of Nevada Department of Conservation and Natural Resources, Division of Environmental Protection and the U.S. DOE and the U.S. DoD in the Matter of Federal Facility Agreement and Consent Order (March 15, 1996). Available on the Web at: <http://ndep.nv.gov/boff/ffco.htm>.
- DOE 2005** DOE Order 450.1 (See DOE Orders Section)
- DOE 2005a** U.S. Department of Energy, *Nevada Test Site Environmental Report 2004*, DOE/NV 11718-1080 Prepared by Bechtel for the U.S. DOE/NNSA, Las Vegas NV (2005).
- DOE 2004** DOE Manual 231.1-1A (See DOE Orders Section)
- DOE 2004a** DOE Order 231.1A (See DOE Orders Section)
- DOE 2003** DOE Manual 231.1-2 (see DOE Orders Section)
- DOE 2002** DOE Order 470.2B (See DOE Orders Section)
- DOE 2001** DOE Order 451.1B (See DOE Orders Section)
- DOE 2001a** DOE Order 435.1 (See DOE Orders Section)
- DOE 1996** U.S. Department of Energy, *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*, DOE/EIS-0243. DOE, Nevada Operations Office, Las Vegas, NV (August 1996).
- DOE 1994** U.S. Department of Energy, *Memorandum of Agreement Between the Nevada Operations Office and the Albuquerque Operations Office*, DE-GM08-98NV13555, as amended (Appendix C, *Tonopah Test Range*, signed October 1997). U.S. Department of Energy, Albuquerque, NM and Las Vegas, NV (1994).
- DOE 1993** DOE Order 5400.5 (See DOE Orders Section)
- DOE 1993a** DOE/AL Order 5400.2A (See DOE Orders Section)
- DOE 1992** U.S. Department of Energy, *Water Conservation Plan for the Tonopah Test Range*, Range 4809. U.S. Department of Energy/Nevada Operations Office, Las Vegas, NV (1992).

- DOE 1992a** U.S. Department of Energy, *Kauai Test Facility Environmental Assessment*, DOE/EA-0492. U.S. Department of Energy, Albuquerque Operations Office (DOE/AL), Albuquerque, NM (1992).
- DOE 1990** DOE Secretary of Energy Notice SEN-22-90 (See DOE Orders Section)
- Dragun and Chekiri 2005** Dragun, J. and K. Chekiri, *Elements in North American Soils*. The Association for Environmental Health and Sciences, Amherst, MA (2005).
- DRI/DOE 2006** Desert Research Institute/U. S. Department of Energy, Community Environmental Monitoring Program (CEMP) website: <http://www.wrcc.dri.edu/cemp/> (2006).
- DRI 1997** Desert Research Institute (DRI), *Draft Analysis of Ambient Airborne Particulate Matter for Plutonium; Clean Slate 1 During Excavation and Truck Loading, Tonopah Test Range, May 1997 - June 1997*, DRI Document Number 6357-683-7562.1D1. Prepared by DRI for the U.S. Department of Energy/Nevada Field Office, Las Vegas, NV (November 14, 1997).
- DRI 1991** Desert Research Institute, *Special Nevada Report*, DOE/NV/10715-T1. Prepared by Science Applications International Corporation (SAIC) for the Department of the Air Force (September 23, 1991).
- Dunaway and White, 1974** Dunaway, P.B. and M.G. White, *The Dynamics of Plutonium in Desert Environments, Nevada Applied Ecology Group Progress Report*, NVO-142. U.S. Atomic Energy Commission, Nevada Operations Office, Las Vegas, NV (1974).
- E&E 1989** Ecology and Environment, Inc., *Federal Facility Preliminary Assessment Review*, EPA Region IX, F9-8903-021, NV3570090016. Ecology and Environment, Inc., San Francisco, CA (1989).
- EG&G 1995** Edgerton, Germeshausen & Grier Corporation, *Aerial Radiological Survey of the Tonopah Test Range Including Clean Slate 1, 2, 3, Roller Coaster, Decontamination Area, Cactus Springs Ranch Target Areas, Central Nevada*, EGG-11265-1145. EG&G Energy Measurements, Inc., Las Vegas, NV (1995).
- EG&G 1979** Edgerton, Germeshausen & Grier Corporation, *Status of Endangered and Threatened Plant Species on Tonopah Test Range - A Survey*, EGG-1183-2387. EG&G, Las Vegas, NV (1979).
- EPA 2006** U.S. Environmental Protection Agency, "National Priorities List (NPL) Sites in the United States," available on the Web at <http://www.epa.gov/superfund/sites/npl/npl.htm>. U.S. Environmental Protection Agency, Washington, DC (2006).
- EPA 1999** U.S. Environmental Protection Agency, *Off-site Environmental Monitoring Report: Radiation Monitoring Around United States Nuclear Test Areas, Calendar Year 1997*, EPA/402-R-98-013, U.S. Environmental Protection Agency, Las Vegas, NV (1999).
- ERDA 1975** U.S. Energy Research and Development Administration, *Environmental Assessment, Tonopah Test Range*, EIA/MA/76-2. U.S. Energy Research and Development Administration (ERDA), Washington, DC (1975).
- Essington and Fowler 1976** Essington, E. H., and E. B. Fowler, "Distribution of Transuranic Nuclides in Soils," a review in *Transuranics in Natural Environments*, Report NVO-178. U.S. Energy Research and Development Administration, Las Vegas, NV (1976).
- Funk 1985** Funk, Evangeline J., *Flora, Fauna, and Water Resources Report of the Pacific Missile Range Facility, Hawaiian Area, Kauai, HI*. Prepared for the U.S. Navy by Botanical Consultants, Honolulu, HI (1985).

- Gilbert et al. 1975** Gilbert, R. O., et al., “Statistical Analysis of <sup>239-240</sup>Pu and <sup>241</sup>Am Contamination of Soil and Vegetation on NAEG Study Sites,” in *The Radioecology of Plutonium and Other Transuranics in Desert Environments*, Report NVO-153. U.S. Energy Research and Development Administration, Las Vegas, NV (1975).
- Gore 1993** Gore, A., *From Red Tape to Results: Creating a Government that Works Better and Costs Less* (Report of the National Performance Review). U.S. Government Printing Office, Washington, DC (1993).
- Hawaii Dept. of Health, (DOH) 2004** Hawaii Department of Health, “State of Hawaii Noncovered Source Permit No. 0429-01-N,” Expiration Date 04/29/2009. State of Hawaii DOH. Honolulu, HI (April 30, 2004).
- IT 1996** IT Corporation, *Sampling and Analysis Plan for Clean Slate 1*. IT Corporation, Albuquerque, NM (September 1996).
- IT 1993** IT Corporation, *Analytical Results for Tonopah Test Range, Transformer Oil Samples, Collected July 16-18, 1993*. IT Corporation, Albuquerque, NM (September 1993).
- Kabata-Pendias 2000** Kabata-Pendias, *Trace Elements in Soils and Plants*, 3rd. Ed. CRC Press, Inc., Boca Raton, FL (2000).
- Leavitt 1980** Leavitt, V., *Soil Profiles of Mounds on Plutonium-Contaminated Areas of the Nevada Test Range Complex*. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Las Vegas, NV (1980).
- Leavitt 1976** Leavitt, V., “Soil Surveys of Five Plutonium-Contaminated Areas on the Test Range Complex in Nevada,” in *Nevada Applied Ecology Group Procedures Handbook for Environmental Transuranics*, Report NVO-166, Volume 1. National Environmental Research Center, Las Vegas, NV (1976).
- McKague, H.L., et al. 1989** McKague, H.L., P. Orkild, and S. Mattson, *The Geology of the Nevada Test Site and Surrounding Area*, Field Trip Guidebook T186. American Geophysical Union, Washington D.C. (1989).
- Miller, Deola, Herrera, Oldewage 2006** Miller, Mark L., Deola, Regina A., Herrera, Heidi M., Oldewage, Han D. “Chemical Analyses of Soil Samples Collected from the Tonopah Test Range, NV , 1994 – 2005”, SAND2006-2071. Sandia National Laboratories, Albuquerque, NM (April 2006).
- NFEC 2003** Sandia National Laboratories, *Spill Prevention Control and Countermeasures (SPCC) Plan, Pacific Missile Range Facility, Kauai, Hawaii*. Prepared for Sandia National Laboratories by the Naval Facilities Engineer Command (NFEC), Environmental Division, Pearl Harbor, HI (2003).
- Romney et al. 1975** Romney, E. M., et al., “<sup>239-240</sup>Pu and <sup>241</sup>Am Contamination of Vegetation in Aged Plutonium Fallout Areas,” in *The Radioecology of Plutonium and Other Transuranics in Desert Environments*, Report NVO-153. U.S. Energy Research and Development Administration, Las Vegas, NV (1975).
- Schaeffer 1970** Schaeffer, J. R., *Climatology of Tonopah Test Range, Nevada 1961-1969*, SC-TM-70-0215. Sandia National Laboratories, Albuquerque, NM (1970).
- Shyr, Herrera, Haaker 1998** Shyr, L, H. Herrera, R. Haaker, *The Role of Data Analysis in Sampling Design of Environmental Monitoring*, SAND98-0612. Sandia National Laboratories, Albuquerque, NM (March 1998).

- Sinnock 1982** Sinnock, S., *Geology of the Nevada Test Site and Nearby Areas - Southern Nevada*, SAND82-2207. Sandia National Laboratories, Albuquerque, NM (1982).
- SNL 2006** Sandia National Laboratories, *NESHAP Annual Report for CY 2005, Sandia National Laboratories, Nevada*. Sandia National Laboratories, Albuquerque, NM (2006).
- SNL 2006a** Sandia National Laboratories, *Tonopah Test Range Data Analysis in Support of the Annual Site Environmental Report, 2005*. Sandia National Laboratories, Albuquerque, NM (March 2006).
- SNL 2006b** Sandia National Laboratories, “Noncovered Source Permit No. 0429-01-N: 2005 Annual Fee and Monitoring Report” (for Kauai Test Facility). Sandia National Laboratories, Albuquerque, NM. (2006).
- SNL 2006c** Sandia National Laboratories, *Chemical Analyses of Soil Samples Collected from the Sandia National Laboratories, Tonopah Test Range Environs, 1994-2005*. SAND2006-2071, Sandia National Laboratories, Albuquerque, NM (May 2006).
- SNL 2006d** Sandia National Laboratories, *Toxic Chemical Release Reporting Community Right-to-Know: Calendar Year 2005*. Sandia National Laboratories, Albuquerque, NM (June 2006).
- SNL 2004** Sandia National Laboratories, *Spill Prevention Control and Countermeasures (SPCC) Plan for SNL Tonopah Test Range, Plan 90-12, Rev. 5*. Sandia National Laboratories, Albuquerque, NM (August 2004).
- SNL 2004a** Sandia National Laboratories, *2003 Hazardous Waste Biennial Report for Sandia National Laboratories/New Mexico and Sandia National Laboratories/Tonopah Test Range*, Sandia National Laboratories, Albuquerque, NM (March 2004).
- SNL 1997** Sandia National Laboratories, (1) *NESHAP Annual Report for CY 1996* (EPA Summary) and (2) *Radiological Dose Calculations and Supplemental Dose Assessment Data for NESHAP Compliance for Sandia National Laboratories, Nevada, CY 1996*. Sandia National Laboratories, Albuquerque, NM (1997).
- SNL 1996** Sandia National Laboratories, (1) *NESHAP Annual Report for CY 1995* (EPA Summary) and (2) *Radiological Dose Calculations and Supplemental Dose Assessment Data for NESHAP Compliance for Sandia National Laboratories, Nevada, CY 1995*. Sandia National Laboratories, Albuquerque, NM (1996).
- SNL 1995** Sandia National Laboratories, *Site Inspection Report for the Kauai Test Facility*. Sandia National Laboratories, Albuquerque, NM (April 1995).
- SNL 1993** Sandia National Laboratories, “SNL Acoustic Monitoring Plan of the STARS Flight Test Unit 1.” Memo to Linda Ninh from B.E. Swanson. Sandia National Laboratories, Albuquerque, NM (1993).
- SNL 1992** Sandia National Laboratories, “CDX Rocket Motor Effluent Monitoring,” Memo from W.E. Stocum (7712) to R.G. Hay (2723). Sandia National Laboratories, Albuquerque, NM (1992).
- State of Nevada 1997** State of Nevada, *State of Nevada Bureau of Health Protection Services Vulnerability Assessment Contamination Monitoring Waiver*. State of Nevada, (Sampling protocols for water quality, expiration date 2010) (October 21, 1997).
- Tamura 1977** Tamura, T., “Plutonium Distribution in a Desert Pavement - Desert Mound Soil System in Area 11,” in *Environmental Plutonium on the Nevada Test Site and Environs*, Report NVO-171. U.S. Energy Research and Development Administration, Las Vegas, NV (1977).
- Tamura 1976** Tamura, T., “Plutonium Association in Soils,” in *Transuranics in Natural Environments*, Report NVO-178. U.S. Energy Research and Development Administration, Las Vegas, NV (1976).

- Tamura 1975** Tamura, T., "Characterization of Plutonium in Surface Soils from Area 13 of the Nevada Test Site," in *The Radioecology of Plutonium and Other Transuranics in Desert Environments*, Report NVO-153. U.S. Energy Research and Development Administration, Las Vegas, NV (1975).
- USAF/DOE/  
NNSA 2002** U.S. Air Force/DOE/NNSA, *Department of the Air Force Permit to the National Nuclear Security Administration to use Property Located on the Nevada Test and Training Range, Nevada*. U.S. Air Force/DOE/NNSA, Tonopah, Nevada (2002).
- USAF 1999** U.S. Air Force, *Renewal of the Nellis Air Force Range Land Withdrawal: Department of the Air Force Legislative Environmental Impact Statement*. U.S. Air Force, Nellis Air Force Range, Nevada (March 1999).

### **EXECUTIVE ORDERS**

- EO 11990** *Protection of Wetlands*, as amended (May 24, 1977).
- EO 11988** *Floodplain Management*, as amended (May 24, 1977).
- EO 12898** *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended (February 11, 1994).
- EO 13101** *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition* (September 14, 1998).
- EO 13123** *Greening the Government Through Efficient Energy Management* (June 3, 1999).
- EO 13148** *Greening the Government Through Leadership in Environmental Management* (April 21, 2000).
- EO 13149** *Greening the Government Through Federal Fleet and Transportation Efficiency* (April 21, 2000).

### **DOE ORDERS**

- DOE 2005** U.S. Department of Energy, *Environmental Protection Program*, DOE Order 450.1, Changes 1 and 2. U.S. Department of Energy, Washington, DC (December 7, 2005).
- DOE 2004** U.S. Department of Energy, *Environment, Safety, and Health Reporting Manual*, DOE Manual 231.1-1A, Change 1. U.S. Department of Energy, Washington, DC (September 9, 2004).
- DOE 2004a** U.S. Department of Energy, *Environment, Safety, and Health Reporting*, DOE Order 231.1-1A. U.S. Department of Energy, Washington, DC (June 3, 2004).
- DOE 2003** U.S. Department of Energy, *Occurrence Reporting and Processing of Operations Information*, DOE Manual 231.1-2. U.S. Department of Energy, Washington, DC (August 18, 2003).
- DOE 2002** U.S. Department of Energy, *Independent Oversight and Performance Assurance Program*, DOE Order 470.2B. U.S. Department of Energy, Washington, DC (October 31, 2002).
- DOE 2001** U.S. Department of Energy, *National Environmental Policy Act Compliance Program*, DOE Order 451.1B. Change 1. U.S. Department of Energy, Washington, DC (September 28, 2001).
- DOE 2001a** U.S. Department of Energy, *Radioactive Waste Management*, DOE Order 435.1, Change 1. U.S. Department of Energy, Washington, DC (August 28, 2001).
- DOE 1993** U.S. Department of Energy, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5. U.S. Department of Energy, Washington, DC (January 7, 1993).
- DOE 1993a** U.S. Department of Energy, *Environmental Compliance Issue Coordination*, DOE/AL 5400.2A. U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM (July 13, 1993).



**DOE 1990** U.S. Department of Energy, “DOE Policy on Signatures of RCRA Permit Applications,” SEN-22-90. U.S. Department of Energy, Washington, DC (5/8/1990).

### **CODE OF FEDERAL REGULATIONS**

- 10 CFR 830** “Nuclear Safety Management”
- 10 CFR 835** “Occupational Radiation Protection”
- 10 CFR 1021** “National Environmental Policy Act Implementing Procedures”
- 40 CFR 61** “National Emission Standards for Hazardous Air Pollutants (NESHAP)”
- 40 CFR 110** “Discharge of Oil”
- 40 CFR 112** “Oil Pollution Prevention”
- 40 CFR 122** “EPA Administered Permit Programs: The National Pollutant Discharge Elimination System”
- 40 CFR 141.26** “Monitoring Frequency and Compliance Requirements for Radionuclides in Community Water Systems”
- 40 CFR 270** “EPA Administered Permit Programs: The Hazardous Waste Permit Program”
- 40 CFR 280** “Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks”
- 40 CFR 355** “Emergency Planning and Notification”
- 40 CFR 370** “Hazardous Chemical Reporting: Community Right-to-Know”

### **ACTS & STATUTES**

- American Indian Religious Freedom Act (AIRFA) of 1978 (42 U.S.C. §1996)
- Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. § 470aa)
- Atomic Energy Act (AEA) of 1954 (42 U.S.C. §2011 et seq.)
- Clean Air Act (CAA) and CAA Amendments (CAAA) of 1990 (42 U.S.C. §7401)
- Clean Water Act (CWA) of 1977 (The Federal Water Pollution Control Act) (33 U.S.C. §1251)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. §9601) (Amended by SARA)
- Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 U.S.C. § 11001 et seq.) (Also known as SARA Title III)
- Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.)
- Federal Facility Compliance Act (FFCA) of 1992 (42 U.S.C. § 6961)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. § 136)
- Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. § 703 et seq.)
- National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. §4321)
- National Historic Preservation Act of 1966, as amended (16 U.S.C. §470 et seq.)
- Pollution Prevention Act of 1990 (42 U.S.C. §13101 et seq.)
- Quiet Communities Act of 1978 (42 U.S.C. §4901 et seq.)
- Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C. § 6901 et seq.)
- Safe Drinking Water Act (SDWA) (42 U.S.C. §300f)
- Superfund Amendments and Reauthorization Act (SARA) of 1986 (see CERCLA)
- Toxic Substances Control Act (TSCA) of 1976 (15 U.S.C. §2601 et seq)

**STATE OF HAWAII**  
**ENVIRONMENTAL REGULATIONS**

Hawaii Administrative Rules (HAR), Title 11, Chapter 23, "Underground Injection Control"  
Hawaii Administrative Rules (HAR), Title 11, Chapter 59, "Ambient Air Quality Standards"

**STATE OF NEVADA**  
**ENVIRONMENTAL REGULATIONS**

Nevada regulatory information can be found at the Nevada State Legislature website:  
<http://www.leg.state.nv.us/>

A listing of the Nevada Administration Code (NAC) can be found at:  
<http://www.leg.state.nv.us/NAC/CHAPTERS.html>

**TABLE 6-1.** State of Nevada Administrative Code (NAC) Applicable to the TTR

Chapter 444, Sanitation	Applicable Sources or Activities
NAC 444.570 to 444.7499, "Solid Waste Disposal"	<ul style="list-style-type: none"> <li>• Disposal of construction debris</li> <li>• Disposal of routine non-hazardous solid wastes</li> <li>• Disposal of septic sludge</li> </ul>
NAC 444A.005 to 444A.500, "Programs for Recycling"	<ul style="list-style-type: none"> <li>• Recyclable materials including waste tires</li> </ul>
Chapter 445A, Water Controls	
NAC 445A.070 to 445A.348, "Water Pollution Control"	<ul style="list-style-type: none"> <li>• Septic tanks</li> <li>• Surface water runoff</li> </ul>
NAC 445A.450 to 445A. 6731, "Public Water Systems"	<ul style="list-style-type: none"> <li>• Production well sampling</li> </ul>
Chapter 445B, Air Controls	
NAC 445B.001 to 445B.3497, "Air Pollution"	<ul style="list-style-type: none"> <li>• Open burning</li> <li>• Hazardous air pollutants from stacks and vents</li> <li>• Disturbance of soils during construction (particulate matter)</li> </ul>
NAC 445B.700 to 445B.845, "Emissions From Engines"	<ul style="list-style-type: none"> <li>• Generators</li> <li>• Mobile sources</li> </ul>
Chapter 504, Wildlife Management and Propagation*	
NAC 504.110 to 504.340, "Wildlife Management Areas"	<ul style="list-style-type: none"> <li>• Road construction</li> </ul>
NAC 504.510 to 504.550, "Alteration of Stream System or Watershed"	<ul style="list-style-type: none"> <li>• Construction activities</li> </ul>
NAC 504.800 to 504.865, "Preservation of Wild Horses"***	<ul style="list-style-type: none"> <li>• General activities on the range in wild horse areas</li> </ul>
Chapter 534, Underground Water and Wells	
NAC 534.010 to 534.450, "Underground Water and Wells"	<ul style="list-style-type: none"> <li>• Drilling, operation, and abandonment of wells</li> </ul>

**NOTES:** TTR = Tonopah Test Range

\*This regulation provides protection to endangered, threatened, and sensitive species.

\*\*Two wild horse units encompass areas within the Nellis Air Force Range:

"Unit 252: That portion of Nye County ..... and those portions of the Nellis Air Force Range as authorized by the United States Department of Defense."

"Unit 253: That portion of Nye County ... including those portions of the Nellis Air Force Range as authorized by the United States Department of Defense and the Nevada Test Site as authorized by the United States Department of Energy." (NAC 504.21, "General Designation of Management Areas and Units")

# APPENDIX A

## TERRESTRIAL SURVEILLANCE RESULTS AND SAMPLING LOCATION MAPS FOR TTR



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# CONTENTS

## FIGURES

A-1	Off-site Soil Sampling Locations .....	A-5
A-2	Perimeter Soil Sampling Locations .....	A-9
A-3	Soil Sampling Locations in the South Plume Area (On-site).....	A-13
A-4	Soil Sampling Locations in the Range Operations Center and Compound (On-site).....	A-17
A-5	Various On-site Soil Sampling Locations.....	A-21
A-6	Various Soil Sampling Locations at Mellan Hill Area .....	A-22
A-7	Soil Sampling Locations Near the Hard Target/Depleted Uranium Area .....	A-23

## TABLES

A-1	Radiological Results for Off-site Soil Sampling Locations at TTR, 2005 .....	A-1
A-2	Radiological Results for Perimeter Soil Sampling Locations at TTR, 2005.....	A-7
A-3	Radiological Results for South Plume Area On-site Soil Sampling Locations at TTR, 2005 .....	A-11
A-4	Radiological Results for Range Operations Center On-site Soil Sampling Locations at TTR, 2005 .....	A-15
A-5	Radiological Results for Various On-site Soil Sampling Locations at TTR, 2005 .....	A-19
A-6	Radiological Replicate Sampling for Soil Sampling Locations, 2005 .....	A-25
A-7	TLD Measurements by Quarter and Location Class for Calendar Year 2005.....	A-27
A-8	Summary TLD Results for Calendar Year 2005.....	A-29
A-9	Non-radiological Results for Off-Site Soil Sampling Locations, 2005.....	A-31
A-10	Non-radiological Results for Perimeter Soil Sampling Locations, 2005 .....	A-39
A-11	Non-radiological Results for On-Site Soil Sampling Locations, 2005 .....	A-45
A-12	Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 .....	A-57
A-13	Various Reference Values for Metals-in-Soil .....	A-69

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**TABLE A-1.** Radiological Results for Off-site Soil Sampling Locations at TTR, 2005

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
C-20	Americium-241	pCi/g	0.0082 $\pm$ 0.0672	0.0602	0.122	U
	Cesium-137	pCi/g	0.205 $\pm$ 0.0338	0.0128	0.0263	
	Potassium-40	pCi/g	30.3 $\pm$ 0.827	0.11	0.233	
	Uranium-235	pCi/g	0.0214 $\pm$ 0.0782	0.0732	0.149	U
	Uranium-238	pCi/g	0.989 $\pm$ 0.802	0.478	0.971	
	Uranium	mg/kg	0.748	0.00992	0.0397	
C-21	Americium-241	pCi/g	-0.0178 $\pm$ 0.0213	0.0197	0.04	U
	Cesium-137	pCi/g	0.121 $\pm$ 0.0367	0.0143	0.0295	
	Potassium-40	pCi/g	27.4 $\pm$ 1.78	0.112	0.24	
	Uranium-235	pCi/g	0.103 $\pm$ 0.095	0.0694	0.141	U
	Uranium-238	pCi/g	0.822 $\pm$ 0.413	0.197	0.399	
	Uranium	mg/kg	0.769	0.01	0.04	
C-22	Americium-241	pCi/g	-0.0109 $\pm$ 0.163	0.103	0.209	U
	Cesium-137	pCi/g	0.0508 $\pm$ 0.0256	0.0149	0.0307	
	Potassium-40	pCi/g	30.1 $\pm$ 2.1	0.117	0.248	
	Uranium-235	pCi/g	0.0699 $\pm$ 0.111	0.096	0.195	U
	Uranium-238	pCi/g	0.754 $\pm$ 1.25	0.819	1.66	U
	Uranium	mg/kg	0.659	0.00988	0.0395	
C-23	Americium-241	pCi/g	0.0103 $\pm$ 0.0527	0.0497	0.101	U
	Cesium-137	pCi/g	0.0735 $\pm$ 0.0205	0.0119	0.0243	
	Potassium-40	pCi/g	25.1 $\pm$ 1.71	0.0792	0.169	
	Uranium-235	pCi/g	0.157 $\pm$ 0.12	0.0658	0.133	
	Uranium-238	pCi/g	0.725 $\pm$ 0.588	0.4	0.811	U
	Uranium	mg/kg	0.654	0.00994	0.0398	
C-24	Americium-241	pCi/g	-0.0712 $\pm$ 0.0987	0.0799	0.163	U
	Cesium-137	pCi/g	0.12 $\pm$ 0.0249	0.0126	0.026	
	Potassium-40	pCi/g	28.2 $\pm$ 2.07	0.114	0.241	
	Uranium-235	pCi/g	0.156 $\pm$ 0.129	0.0767	0.156	U
	Uranium-238	pCi/g	1.02 $\pm$ 1.21	0.622	1.26	U
	Uranium	mg/kg	1.55	0.0098	0.0392	
C-25	Americium-241	pCi/g	0.00625 $\pm$ 0.0284	0.0264	0.0534	U
	Cesium-137	pCi/g	0.159 $\pm$ 0.0345	0.0182	0.0372	
	Potassium-40	pCi/g	30.1 $\pm$ 1.95	0.14	0.293	
	Uranium-235	pCi/g	0.0418 $\pm$ 0.146	0.0903	0.183	U
	Uranium-238	pCi/g	1.38 $\pm$ 0.572	0.252	0.509	
	Uranium	mg/kg	1.17	0.00996	0.0398	

See notes at end of table.

**TABLE A-1.** Radiological Results for Off-site Soil Sampling Locations at TTR, 2005 (continued)

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
C-26	Americium-241	pCi/g	0.0341 $\pm$ 0.0599	0.0592	0.12	U
	Cesium-137	pCi/g	0.573 $\pm$ 0.0551	0.0141	0.0291	
	Potassium-40	pCi/g	28.4 $\pm$ 1.92	0.11	0.233	
	Uranium-235	pCi/g	0.0984 $\pm$ 0.105	0.0793	0.161	U
	Uranium-238	pCi/g	1.39 $\pm$ 0.762	0.47	0.953	
	Uranium	mg/kg	0.955	0.00986	0.0394	
C-27	Americium-241	pCi/g	0.00512 $\pm$ 0.0822	0.0694	0.141	U
	Cesium-137	pCi/g	0.53 $\pm$ 0.0488	0.0152	0.0315	
	Potassium-40	pCi/g	26.9 $\pm$ 1.9	0.102	0.222	
	Uranium-235	pCi/g	0.0381 $\pm$ 0.0985	0.089	0.181	U
	Uranium-238	pCi/g	1.17 $\pm$ 0.946	0.573	1.17	
	Uranium	mg/kg	0.872	0.00992	0.0397	
C-28	Americium-241	pCi/g	-0.0881 $\pm$ 0.0932	0.0769	0.156	U
	Cesium-137	pCi/g	0.153 $\pm$ 0.0242	0.0122	0.0252	
	Potassium-40	pCi/g	31.2 $\pm$ 2.19	0.118	0.248	
	Uranium-235	pCi/g	0.0516 $\pm$ 0.129	0.0741	0.151	U
	Uranium-238	pCi/g	0.411 $\pm$ 1.03	0.611	1.24	U
	Uranium	mg/kg	0.81	0.00984	0.0394	
C-29	Americium-241	pCi/g	0.0348 $\pm$ 0.0607	0.0589	0.119	U
	Cesium-137	pCi/g	0.105 $\pm$ 0.0223	0.0118	0.0244	
	Potassium-40	pCi/g	18.6 $\pm$ 1.31	0.109	0.23	
	Uranium-235	pCi/g	0.0869 $\pm$ 0.106	0.0801	0.162	U
	Uranium-238	pCi/g	1.37 $\pm$ 0.813	0.471	0.955	
	Uranium	mg/kg	1.1	0.00994	0.0398	
C-30	Americium-241	pCi/g	-0.202 $\pm$ 0.0966	0.0773	0.157	U
	Cesium-137	pCi/g	0.158 $\pm$ 0.0239	0.0119	0.0244	
	Potassium-40	pCi/g	30.1 $\pm$ 2.04	0.0812	0.171	
	Uranium-235	pCi/g	0.00446 $\pm$ 0.0978	0.0727	0.147	U
	Uranium-238	pCi/g	0.956 $\pm$ 0.883	0.569	1.15	U
	Uranium	mg/kg	0.762	0.00992	0.0397	
C-31	Americium-241	pCi/g	0.0291 $\pm$ 0.0333	0.0251	0.0506	U
	Cesium-137	pCi/g	0.204 $\pm$ 0.0345	0.0163	0.0333	
	Potassium-40	pCi/g	31.6 $\pm$ 2	0.13	0.271	
	Uranium-235	pCi/g	0.123 $\pm$ 0.13	0.0831	0.168	U
	Uranium-238	pCi/g	1.05 $\pm$ 0.533	0.23	0.465	
	Uranium	mg/kg	0.889	0.00984	0.0394	

See notes at end of table.



**TABLE A-1. Radiological Results for Off-site Soil Sampling Locations at TTR, 2005 (concluded)**

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
C-32	Americium-241	pCi/g	-0.0397 $\pm$ 0.0625	0.0537	0.109	U
	Cesium-137	pCi/g	0.135 $\pm$ 0.0292	0.014	0.0288	
	Potassium-40	pCi/g	30 $\pm$ 2.02	0.112	0.237	
	Uranium-235	pCi/g	0.137 $\pm$ 0.0952	0.0708	0.144	U
	Uranium-238	pCi/g	1.23 $\pm$ 0.824	0.44	0.893	
	Uranium	mg/kg	0.689	0.00994	0.0398	
C-33	Americium-241	pCi/g	-0.0203 $\pm$ 0.0691	0.0618	0.126	U
	Cesium-137	pCi/g	0.139 $\pm$ 0.0296	0.0147	0.0304	
	Potassium-40	pCi/g	28.1 $\pm$ 1.83	0.118	0.25	
	Uranium-235	pCi/g	0.0844 $\pm$ 0.127	0.0784	0.159	U
	Uranium-238	pCi/g	1.15 $\pm$ 0.83	0.509	1.03	
	Uranium	mg/kg	0.677	0.0098	0.0392	

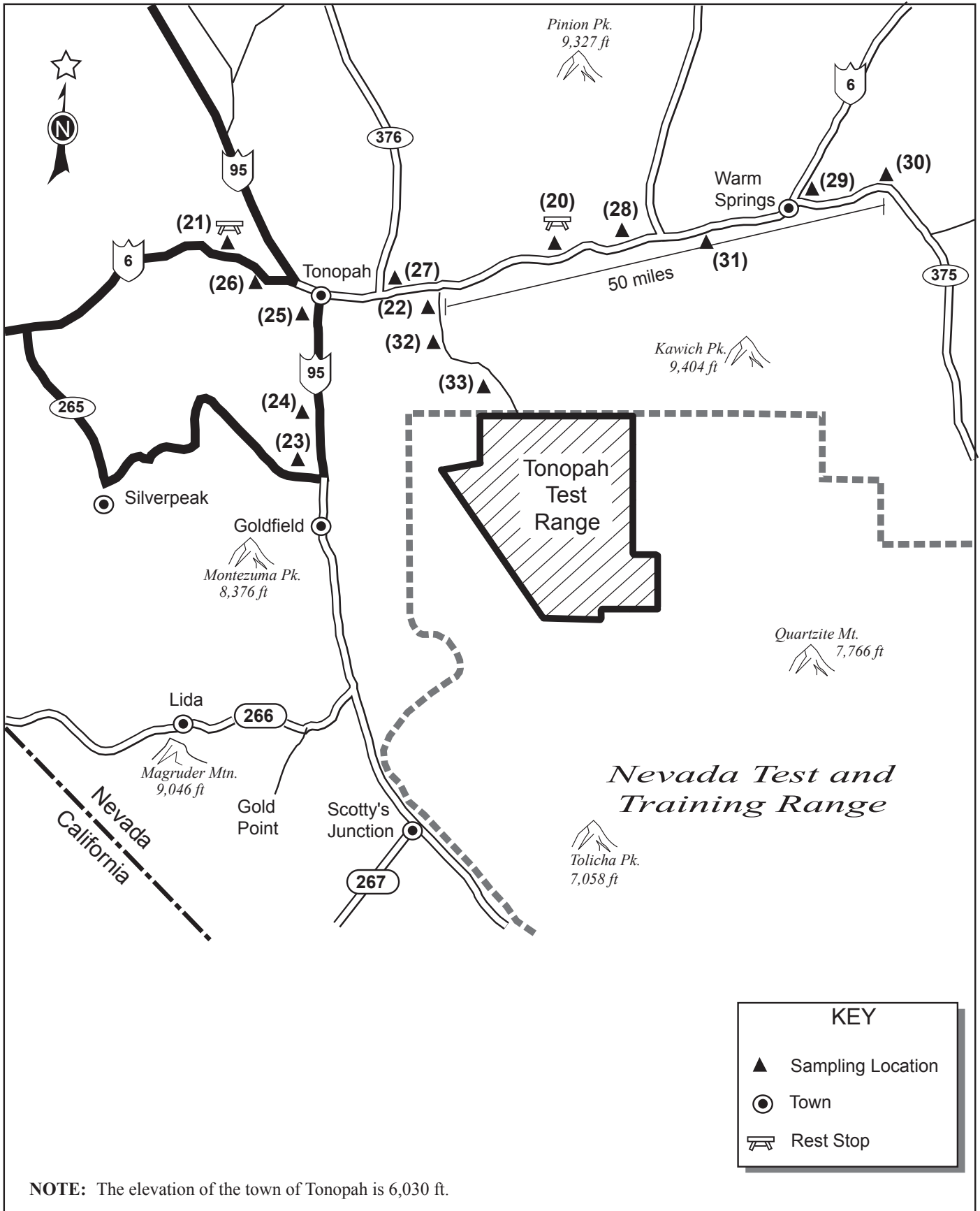
**NOTES:** pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

TTR = Tonopah Test Range

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

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**FIGURE A-1.** Off-site Soil Sampling Locations

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**TABLE A-2.** Radiological Results for Perimeter Soil Sampling Locations at TTR, 2005

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
P-06	Americium-241	pCi/g	0.0293 $\pm$ 0.0811	0.0798	0.162	U
	Cesium-137	pCi/g	0.147 $\pm$ 0.0364	0.0118	0.0243	
	Potassium-40	pCi/g	30.2 $\pm$ 2.1	0.0951	0.202	
	Uranium-235	pCi/g	0.0732 $\pm$ 0.0832	0.0773	0.157	U
	Uranium-238	pCi/g	1.69 $\pm$ 1.3	0.6	1.22	
	Uranium	mg/kg	0.637	0.00986	0.0394	
P-08	Americium-241	pCi/g	0.0278 $\pm$ 0.0602	0.0569	0.115	U
	Cesium-137	pCi/g	0.107 $\pm$ 0.0231	0.0118	0.0244	
	Potassium-40	pCi/g	29.8 $\pm$ 2.04	0.0989	0.211	
	Uranium-235	pCi/g	0.0131 $\pm$ 0.0797	0.0713	0.145	U
	Uranium-238	pCi/g	0.575 $\pm$ 0.806	0.464	0.941	U
	Uranium	mg/kg	0.717	0.0098	0.0392	
P-11	Americium-241	pCi/g	0.0548 $\pm$ 0.0601	0.0559	0.113	U
	Cesium-137	pCi/g	0.529 $\pm$ 0.0485	0.012	0.0246	
	Potassium-40	pCi/g	28.9 $\pm$ 1.79	0.0797	0.169	
	Uranium-235	pCi/g	0.0547 $\pm$ 0.0908	0.067	0.136	U
	Uranium-238	pCi/g	1.22 $\pm$ 0.736	0.457	0.924	
	Uranium	mg/kg	0.708	0.00996	0.0398	
P-12	Americium-241	pCi/g	0.0475 $\pm$ 0.067	0.0469	0.0947	U
	Cesium-137	pCi/g	0.289 $\pm$ 0.0352	0.0108	0.0221	
	Potassium-40	pCi/g	31.5 $\pm$ 2.04	0.096	0.2	
	Uranium-235	pCi/g	0.0819 $\pm$ 0.0867	0.064	0.129	U
	Uranium-238	pCi/g	1.08 $\pm$ 0.721	0.392	0.792	
	Uranium	mg/kg	0.718	0.0098	0.0392	
P-34	Americium-241	pCi/g	-0.189 $\pm$ 0.136	0.112	0.227	U
	Cesium-137	pCi/g	0.307 $\pm$ 0.0408	0.0178	0.0365	
	Potassium-40	pCi/g	31.4 $\pm$ 2.2	0.113	0.241	
	Uranium-235	pCi/g	0.0369 $\pm$ 0.105	0.102	0.207	U
	Uranium-238	pCi/g	0.179 $\pm$ 1.09	0.881	1.78	U
	Uranium	mg/kg	0.801	0.01	0.04	
P-35	Americium-241	pCi/g	-0.00189 $\pm$ 0.0809	0.0685	0.139	U
	Cesium-137	pCi/g	0.159 $\pm$ 0.0227	0.0103	0.0211	
	Potassium-40	pCi/g	28.2 $\pm$ 2.01	0.0903	0.189	
	Uranium-235	pCi/g	0.104 $\pm$ 0.105	0.0657	0.133	U
	Uranium-238	pCi/g	0.628 $\pm$ 0.824	0.506	1.03	U
	Uranium	mg/kg	1.31	0.01	0.04	

See notes at end of table.

**TABLE A-2.** Radiological Results for Perimeter Soil Sampling Locations at TTR, 2005 (concluded)

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
P-36	Americium-241	pCi/g	0.0214 $\pm$ 0.0713	0.0637	0.129	U
	Cesium-137	pCi/g	0.13 $\pm$ 0.0178	0.00793	0.0162	
	Potassium-40	pCi/g	30.3 $\pm$ 0.563	0.0742	0.154	
	Uranium-235	pCi/g	0.111 $\pm$ 0.0791	0.0526	0.106	
	Uranium-238	pCi/g	1.42 $\pm$ 0.816	0.459	0.928	
	Uranium	mg/kg	0.848	0.0099	0.0396	
P-37	Americium-241	pCi/g	-0.00315 $\pm$ 0.0323	0.0303	0.061	U
	Cesium-137	pCi/g	0.0958 $\pm$ 0.0199	0.0177	0.036	X
	Potassium-40	pCi/g	28.5 $\pm$ 1.88	0.105	0.22	
	Uranium-235	pCi/g	0.0617 $\pm$ 0.11	0.0707	0.143	U
	Uranium-238	pCi/g	0.617 $\pm$ 0.484	0.279	0.562	
	Uranium	mg/kg	0.796	0.00984	0.0394	

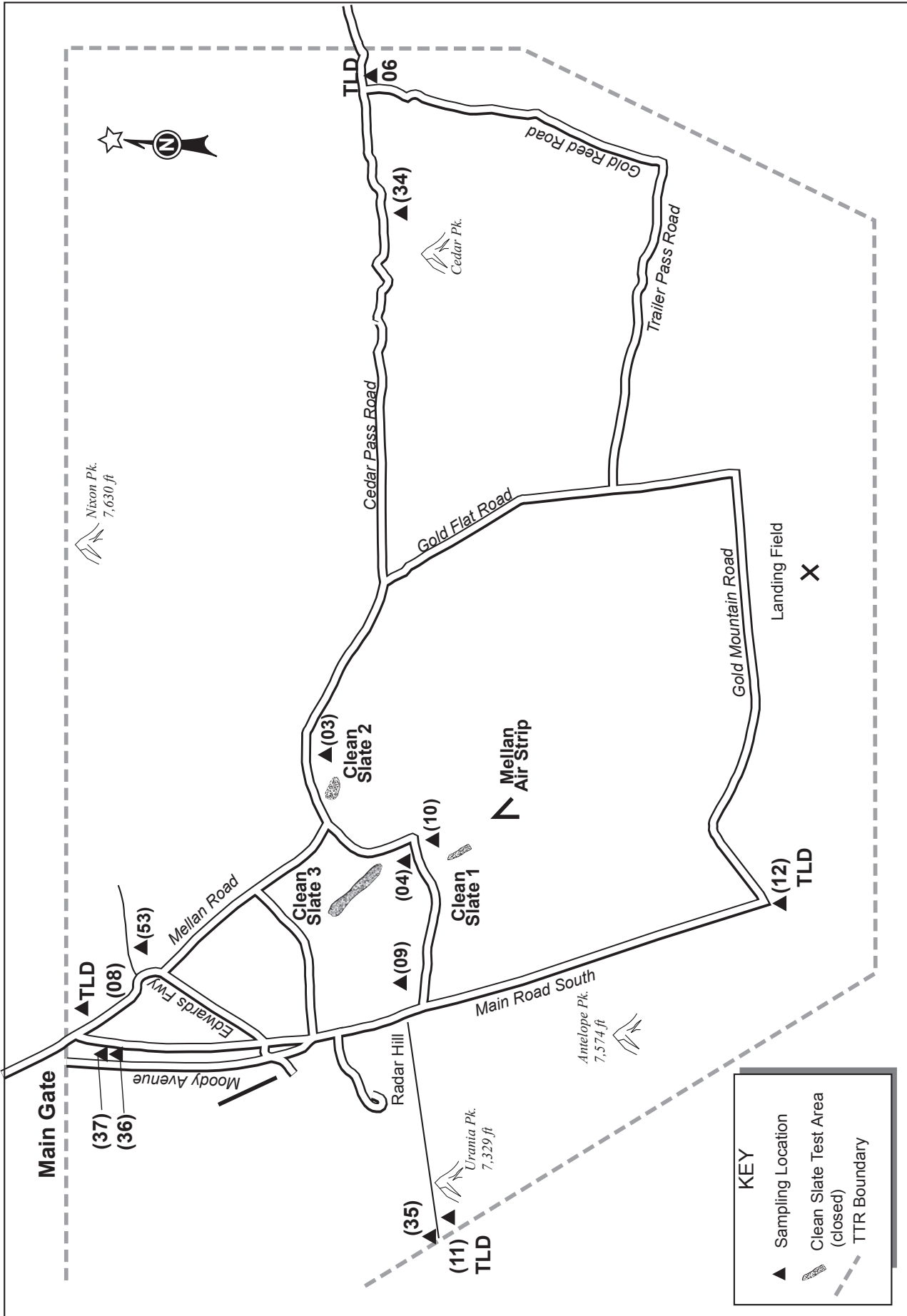
**NOTES:** pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

TTR = Tonopah Test Range

X = Presumptive evidence that analyte is not present.

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.



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FIGURE A-2. Perimeter Soil Sampling Locations

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**TABLE A-3.** Radiological Results for South Plume Area On-site Soil Sampling Locations at TTR, 2005

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
S-48	Americium-241	pCi/g	0.000699 $\pm$ 0.0995	0.083	0.169	U
	Cesium-137	pCi/g	0.387 $\pm$ 0.0424	0.0146	0.03	
	Potassium-40	pCi/g	31.8 $\pm$ 2.31	0.11	0.233	
	Uranium-235	pCi/g	0.0142 $\pm$ 0.0842	0.0793	0.161	U
	Uranium-238	pCi/g	0.883 $\pm$ 1.02	0.607	1.23	U
	Uranium	mg/kg	0.665 $\pm$	0.00988	0.0395	
S-49	Americium-241	pCi/g	0.304 $\pm$ 0.121	0.0599	0.122	
	Cesium-137	pCi/g	0.416 $\pm$ 0.061	0.0153	0.0315	
	Potassium-40	pCi/g	34.3 $\pm$ 2.17	0.11	0.235	
	Uranium-235	pCi/g	0.0241 $\pm$ 0.118	0.0964	0.196	U
	Uranium-238	pCi/g	1.18 $\pm$ 0.878	0.493	1	
	Uranium	mg/kg	0.771 $\pm$	0.00992	0.0397	
S-50	Americium-241	pCi/g	-0.014 $\pm$ 0.0345	0.0321	0.0647	U
	Cesium-137	pCi/g	0.2 $\pm$ 0.0378	0.0146	0.0298	
	Potassium-40	pCi/g	30.2 $\pm$ 1.99	0.109	0.229	
	Uranium-235	pCi/g	0.105 $\pm$ 0.108	0.0756	0.153	U
	Uranium-238	pCi/g	0.634 $\pm$ 0.546	0.286	0.578	
	Uranium	mg/kg	0.694 $\pm$	0.00996	0.0398	
S-51	Americium-241	pCi/g	2.11 $\pm$ 0.215	0.0585	0.118	
	Cesium-137	pCi/g	0.344 $\pm$ 0.0378	0.0115	0.0235	
	Potassium-40	pCi/g	30.2 $\pm$ 2.01	0.087	0.183	
	Uranium-235	pCi/g	0.0713 $\pm$ 0.103	0.0663	0.134	U
	Uranium-238	pCi/g	0.796 $\pm$ 0.553	0.444	0.897	U
	Uranium	mg/kg	1.01 $\pm$	0.00996	0.0398	
S-52	Americium-241	pCi/g	-0.129 $\pm$ 0.0994	0.0817	0.165	U
	Cesium-137	pCi/g	0.232 $\pm$ 0.0299	0.0114	0.0233	
	Potassium-40	pCi/g	32.3 $\pm$ 2.17	0.0878	0.183	
	Uranium-235	pCi/g	0.00399 $\pm$ 0.101	0.0715	0.144	U
	Uranium-238	pCi/g	0.997 $\pm$ 0.849	0.59	1.19	U
	Uranium	mg/kg	0.792 $\pm$	0.00996	0.0398	

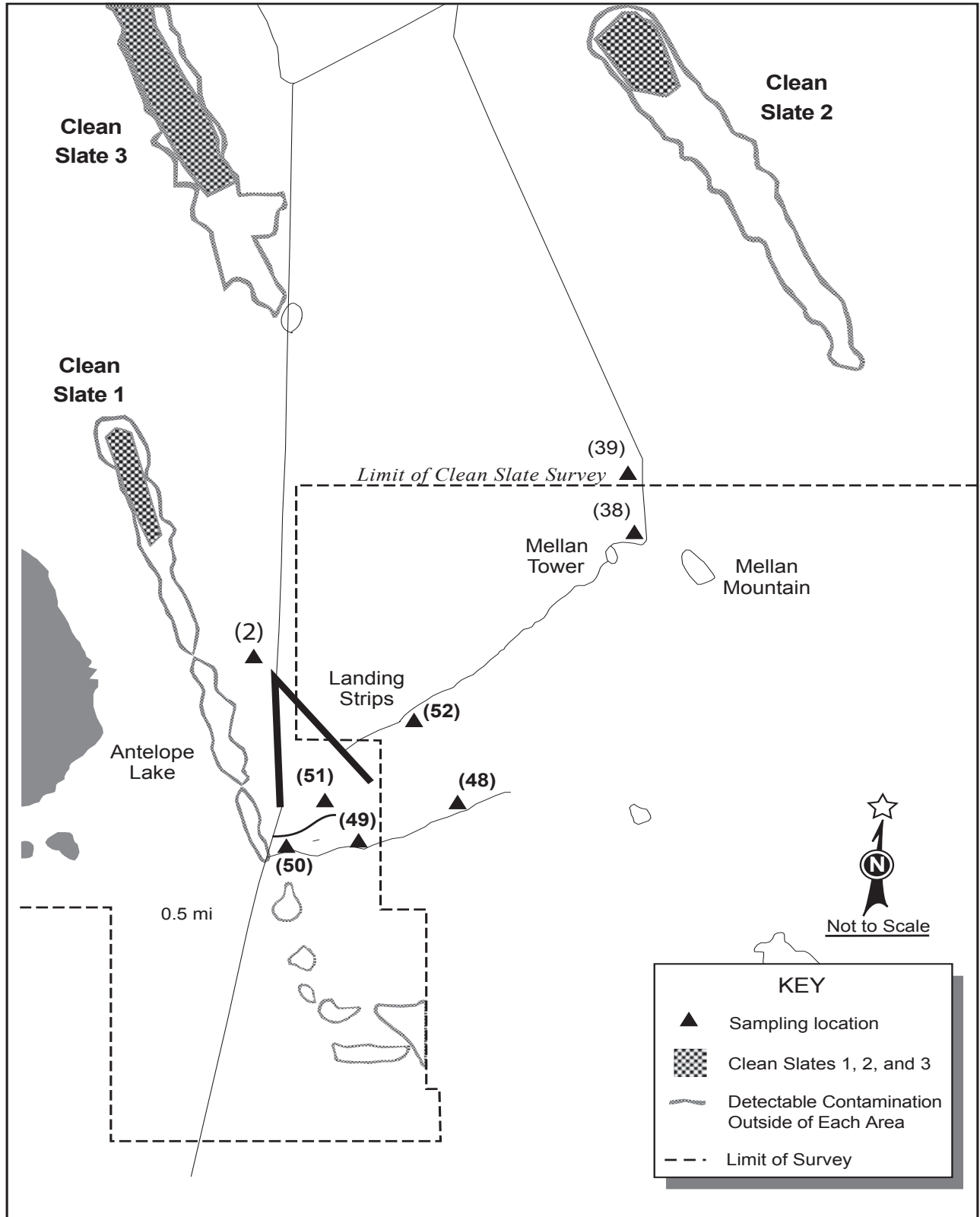
**NOTES:** pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

TTR = Tonopah Test Range

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

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**FIGURE A-3.** Soil Sampling Locations in the South Plume Area (On-site)

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**TABLE A-4.** Radiological Results for Range Operations Center On-Site Soil Sampling Locations at TTR, 2005

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
S-40	Americium-241	pCi/g	-0.231 $\pm$ 0.0999	0.0774	0.156	U
	Cesium-137	pCi/g	0.0142 $\pm$ 0.0183	0.0114	0.0232	U
	Potassium-40	pCi/g	32.3 $\pm$ 2.17	0.0851	0.178	
	Uranium-235	pCi/g	0.023 $\pm$ 0.0914	0.0704	0.142	U
	Uranium-238	pCi/g	0.767 $\pm$ 0.825	0.572	1.15	U
	Uranium	mg/kg	0.988	0.0098	0.0392	
S-41	Americium-241	pCi/g	-0.0177 $\pm$ 0.0279	0.0276	0.0556	U
	Cesium-137	pCi/g	0.036 $\pm$ 0.0123	0.00676	0.0138	
	Potassium-40	pCi/g	32.8 $\pm$ 1.93	0.0544	0.112	
	Uranium-235	pCi/g	0.0302 $\pm$ 0.0671	0.0465	0.0938	U
	Uranium-238	pCi/g	1.18 $\pm$ 0.503	0.236	0.475	
	Uranium	mg/kg	0.681	0.0098	0.0392	
S-42	Americium-241	pCi/g	-0.00153 $\pm$ 0.0192	0.0179	0.0363	U
	Cesium-137	pCi/g	0.286 $\pm$ 0.0355	0.0123	0.0253	
	Potassium-40	pCi/g	30 $\pm$ 1.87	0.0976	0.206	
	Uranium-235	pCi/g	0.0626 $\pm$ 0.0963	0.0615	0.125	U
	Uranium-238	pCi/g	1.36 $\pm$ 0.448	0.175	0.354	
	Uranium	mg/kg	0.739	0.00986	0.0394	
S-43	Americium-241	pCi/g	0.0292 $\pm$ 0.0612	0.0442	0.0891	U
	Cesium-137	pCi/g	0.0153 $\pm$ 0.0113	0.00941	0.0192	U
	Potassium-40	pCi/g	31 $\pm$ 2	0.0779	0.162	
	Uranium-235	pCi/g	0.0748 $\pm$ 0.0896	0.0574	0.116	U
	Uranium-238	pCi/g	1.42 $\pm$ 0.715	0.344	0.694	
	Uranium	mg/kg	0.986	0.00984	0.0394	
S-44	Americium-241	pCi/g	-0.00522 $\pm$ 0.0464	0.0416	0.084	U
	Cesium-137	pCi/g	0.068 $\pm$ 0.0138	0.00842	0.0172	
	Potassium-40	pCi/g	30.4 $\pm$ 0.557	0.0691	0.144	
	Uranium-235	pCi/g	0.0514 $\pm$ 0.0796	0.0522	0.106	U
	Uranium-238	pCi/g	1.19 $\pm$ 0.573	0.327	0.66	
	Uranium	mg/kg	0.898	0.00988	0.0395	
S-45	Americium-241	pCi/g	-0.00337 $\pm$ 0.0824	0.0563	0.114	U
	Cesium-137	pCi/g	0.0304 $\pm$ 0.0146	0.00856	0.0175	
	Potassium-40	pCi/g	32.1 $\pm$ 2.16	0.0755	0.157	
	Uranium-235	pCi/g	0.0192 $\pm$ 0.0719	0.0537	0.108	U
	Uranium-238	pCi/g	1.32 $\pm$ 0.896	0.447	0.902	
	Uranium	mg/kg	0.858	0.00996	0.0398	

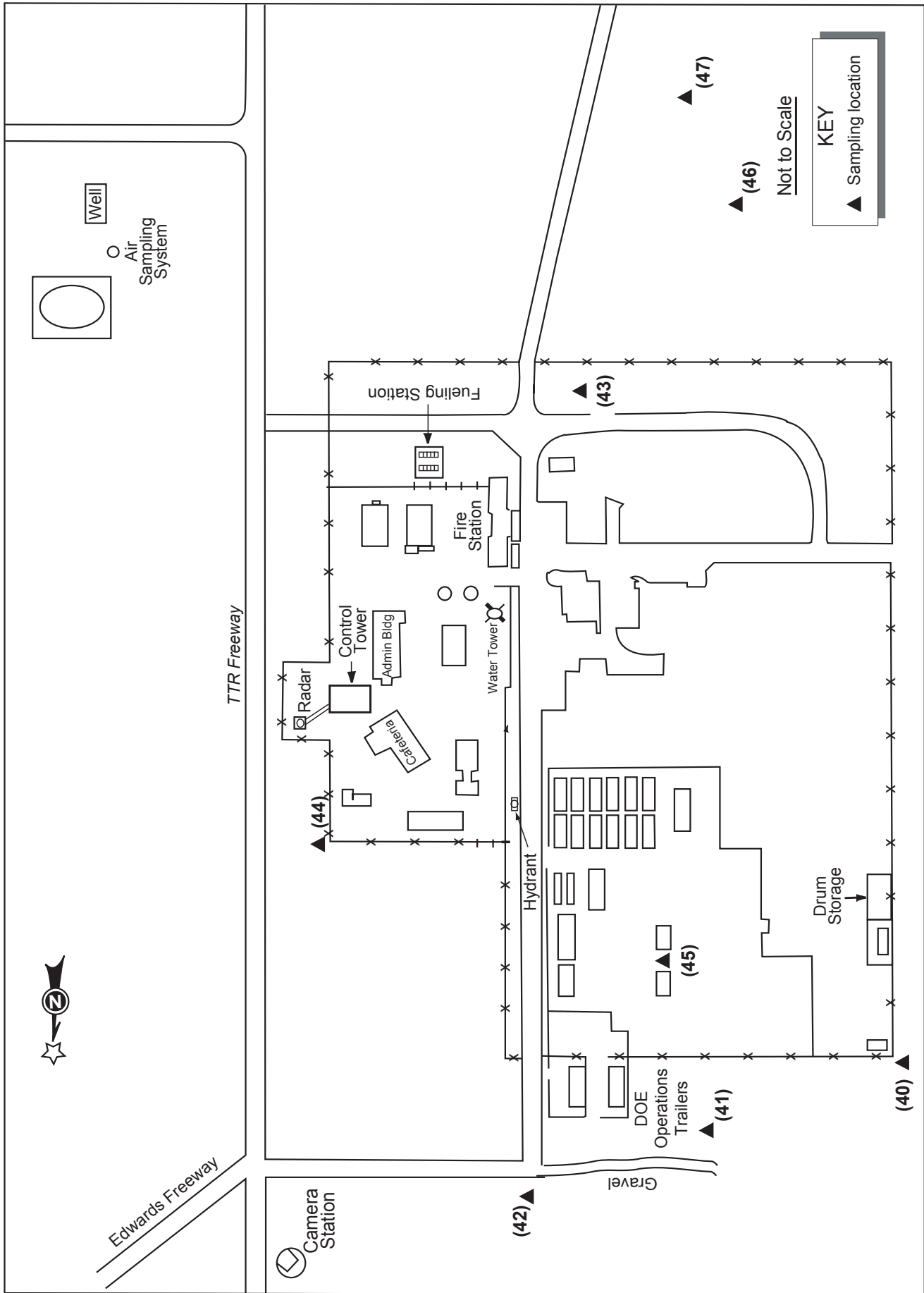
See notes at end of table.

**TABLE A-4.** Radiological Results for Range Operations Center On-Site Soil Sampling Locations at TTR, 2005 (concluded)

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
S-46	Americium-241	pCi/g	-0.211 $\pm$ 0.0686	0.0524	0.106	U
	Cesium-137	pCi/g	0.0197 $\pm$ 0.0168	0.0117	0.0239	U
	Potassium-40	pCi/g	35.6 $\pm$ 2.59	0.099	0.204	
	Uranium-235	pCi/g	0.0805 $\pm$ 0.0971	0.0646	0.13	U
	Uranium-238	pCi/g	1.66 $\pm$ 0.748	0.412	0.83	
	Uranium	mg/kg	1.15	0.0098	0.0392	
S-47	Americium-241	pCi/g	0.00709 $\pm$ 0.021	0.02	0.0403	U
	Cesium-137	pCi/g	0.115 $\pm$ 0.0289	0.0131	0.0267	
	Potassium-40	pCi/g	32.9 $\pm$ 2.03	0.106	0.219	
	Uranium-235	pCi/g	0.0829 $\pm$ 0.106	0.0688	0.139	U
	Uranium-238	pCi/g	0.963 $\pm$ 0.435	0.193	0.388	
	Uranium	mg/kg	0.604	0.00994	0.0398	

**NOTES:** pCi/g = picocurie per gram  
 mg/kg = milligrams per kilogram  
 TTR = Tonopah Test Range

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.



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**FIGURE A-4.** Soil Sampling Locations in the Range Operations Center and Compound (on-site)

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**TABLE A-5.** Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2005

Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
S-02	Americium-241	pCi/g	-0.0027 $\pm$ 0.0553	0.0516	0.104	U
	Cesium-137	pCi/g	0.199 $\pm$ 0.0263	0.0118	0.0242	
	Potassium-40	pCi/g	30.9 $\pm$ 2.06	0.0822	0.173	
	Uranium-235	pCi/g	0.0133 $\pm$ 0.0836	0.0664	0.134	U
	Uranium-238	pCi/g	1.45 $\pm$ 0.773	0.419	0.846	
	Uranium	mg/kg	0.919	0.00992	0.0397	
S-03	Americium-241	pCi/g	0.116 $\pm$ 0.116	0.0679	0.137	U
	Cesium-137	pCi/g	0.303 $\pm$ 0.0246	0.00902	0.0184	
	Potassium-40	pCi/g	29.9 $\pm$ 0.547	0.0685	0.143	
	Uranium-235	pCi/g	0.106 $\pm$ 0.0734	0.0548	0.111	U
	Uranium-238	pCi/g	0.928 $\pm$ 0.932	0.501	1.01	U
	Uranium	mg/kg	0.806	0.00992	0.0397	
S-04	Americium-241	pCi/g	0.0779 $\pm$ 0.0795	0.06	0.122	U
	Cesium-137	pCi/g	0.263 $\pm$ 0.029	0.0133	0.0274	
	Potassium-40	pCi/g	32.6 $\pm$ 0.809	0.104	0.221	
	Uranium-235	pCi/g	0.106 $\pm$ 0.0998	0.0778	0.158	U
	Uranium-238	pCi/g	1.18 $\pm$ 0.826	0.498	1.01	
	Uranium	mg/kg	0.916	0.01	0.04	
S-09	Americium-241	pCi/g	1.15 $\pm$ 0.17	0.0616	0.125	
	Cesium-137	pCi/g	0.0911 $\pm$ 0.0245	0.0144	0.0296	
	Potassium-40	pCi/g	26.6 $\pm$ 1.79	0.105	0.222	
	Uranium-235	pCi/g	0.089 $\pm$ 0.0883	0.08	0.162	U
	Uranium-238	pCi/g	0.872 $\pm$ 0.667	0.484	0.981	U
	Uranium	mg/kg	0.668	0.0098	0.0392	
S-10	Americium-241	pCi/g	-0.0728 $\pm$ 0.0813	0.0739	0.149	U
	Cesium-137	pCi/g	0.139 $\pm$ 0.0296	0.0157	0.0322	
	Potassium-40	pCi/g	35.3 $\pm$ 2.65	0.135	0.282	
	Uranium-235	pCi/g	0.204 $\pm$ 0.153	0.0926	0.187	
	Uranium-238	pCi/g	1.64 $\pm$ 0.955	0.578	1.17	
	Uranium	mg/kg	0.923	0.00984	0.0394	
S-38	Americium-241	pCi/g	-0.162 $\pm$ 0.0815	0.0655	0.132	U
	Cesium-137	pCi/g	0.351 $\pm$ 0.0501	0.0128	0.0262	
	Potassium-40	pCi/g	36.5 $\pm$ 2.7	0.121	0.251	
	Uranium-235	pCi/g	0.00626 $\pm$ 0.0863	0.0794	0.16	U
	Uranium-238	pCi/g	1.1 $\pm$ 0.732	0.512	1.03	
	Uranium	mg/kg	0.584	0.00992	0.0397	

See notes at end of table.

**TABLE A-5. Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2005 (concluded)**

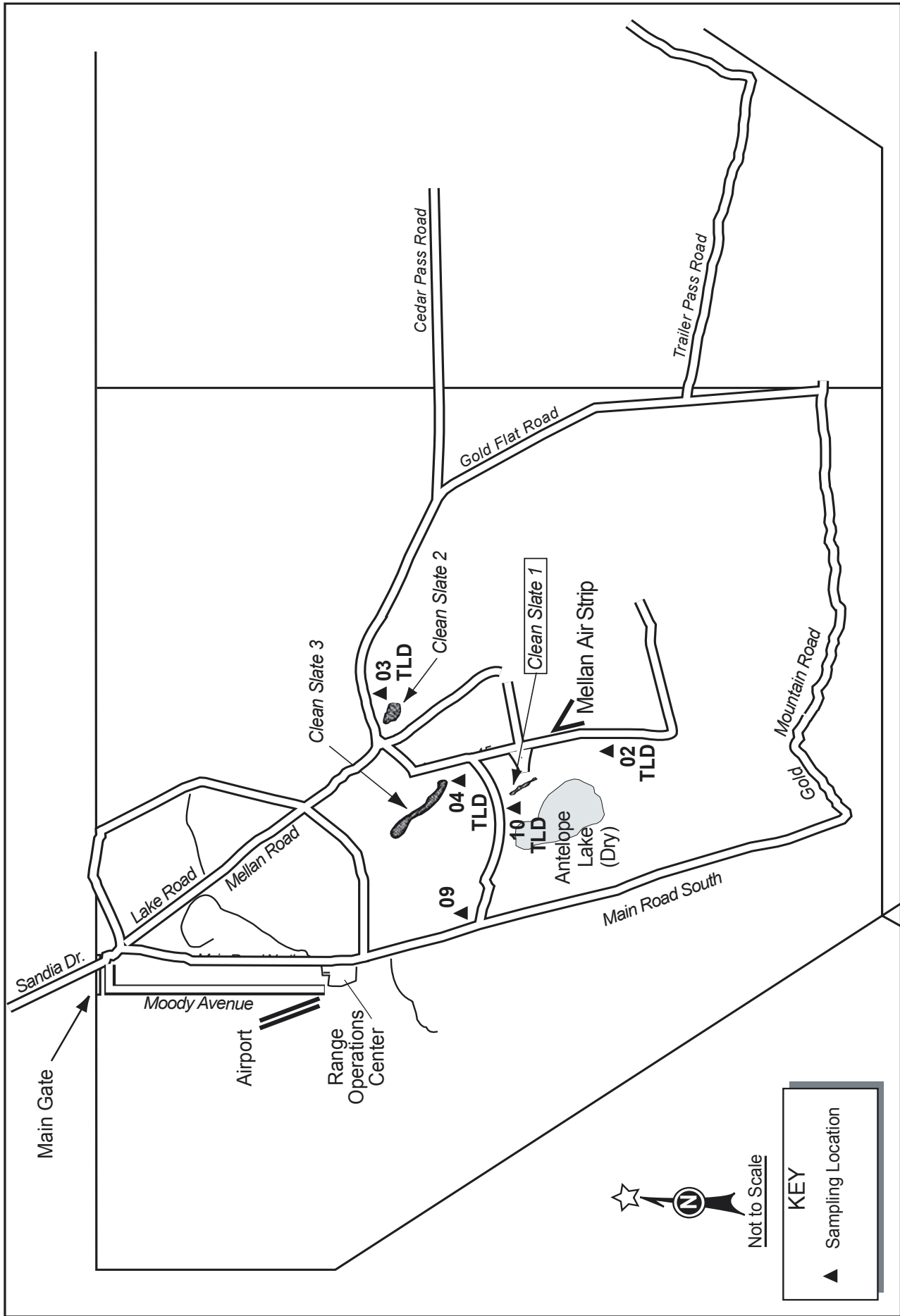
Location	Analyte	Units	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier
S-39	Americium-241	pCi/g	0.0443 $\pm$ 0.0416	0.0314	0.0633	U
	Cesium-137	pCi/g	0.3 $\pm$ 0.0424	0.0138	0.0281	
	Potassium-40	pCi/g	29.3 $\pm$ 1.91	0.0994	0.208	
	Uranium-235	pCi/g	0.0433 $\pm$ 0.0812	0.0744	0.15	U
	Uranium-238	pCi/g	0.775 $\pm$ 0.495	0.299	0.602	
	Uranium	mg/kg	1.04	0.00998	0.0399	
S-53	Americium-241	pCi/g	-0.0338 $\pm$ 0.117	0.0838	0.17	U
	Cesium-137	pCi/g	0.219 $\pm$ 0.0334	0.014	0.0288	
	Potassium-40	pCi/g	32.8 $\pm$ 2.39	0.107	0.228	
	Uranium-235	pCi/g	0.0641 $\pm$ 0.109	0.0836	0.17	U
	Uranium-238	pCi/g	1.7 $\pm$ 1.63	0.648	1.32	
	Uranium	mg/kg	0.614	0.00986	0.0394	

**NOTES:** pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

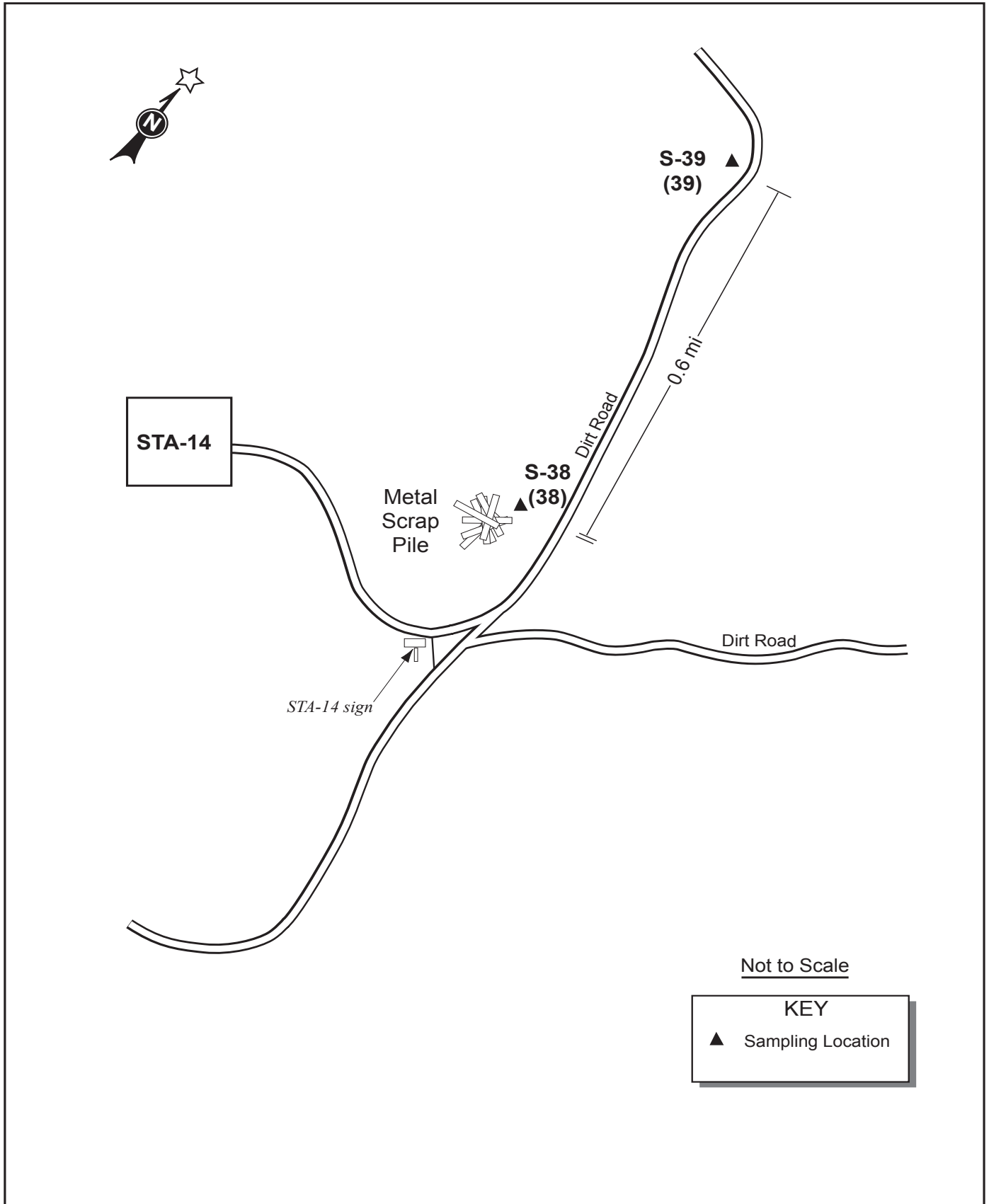
TTR = Tonopah Test Range

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.



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FIGURE A-5. Various On-site Soil Sampling Locations



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FIGURE A-6. Various Soil Sampling Locations at Mellan Hill Area

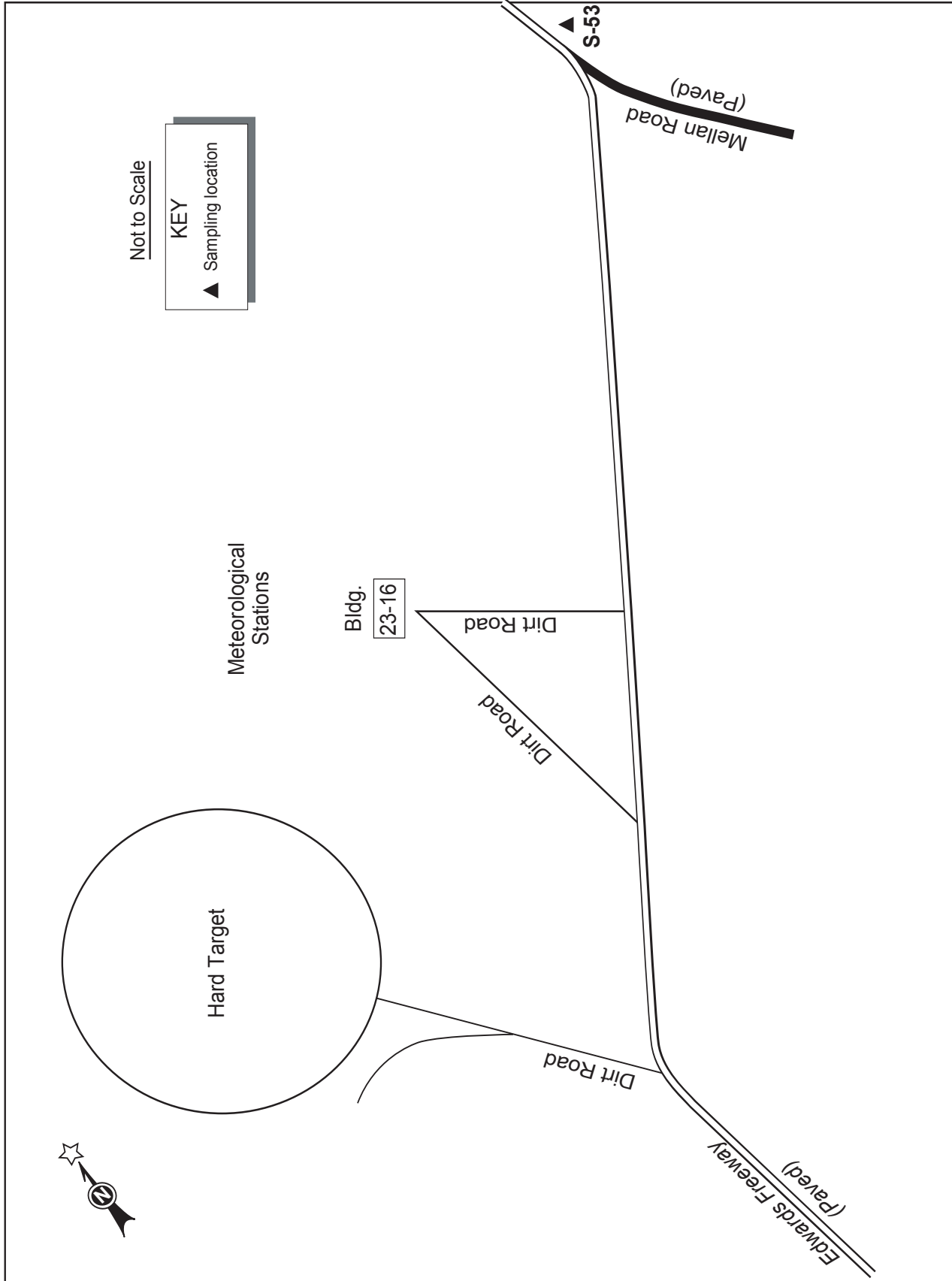


FIGURE A-7. Soil Sampling Location Near the Hard Target /Depleted Uranium Area

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**TABLE A-6. Radiological Replicate Sampling for Soil Sampling Locations, 2005**

Location	Analyte	Units	Sample ID	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier	Avg	Std Dev	Min	Max	CV%
C-29	Americium-241	pCi/g	681103-001	0.0348 $\pm$ 0.0607	0.0589	0.119	U					
			681103-002	-0.0709 $\pm$ 0.0788	0.0739	0.15	U					
			681103-003	0.0329 $\pm$ 0.0637	0.0588	0.119	U					
	Cesium-137	pCi/g	681103-001	0.105 $\pm$ 0.0223	0.0118	0.0244		0.11	0.07	0.04	0.19	0.67 %
			681103-002	0.0416 $\pm$ 0.0245	0.0147	0.0303						
			681103-003	0.191 $\pm$ 0.0221	0.0114	0.0236						
	Potassium-40	pCi/g	681103-001	18.6 $\pm$ 1.31	0.109	0.23		18.83	1.76	17.20	20.70	0.09 %
			681103-002	20.7 $\pm$ 1.63	0.137	0.288						
			681103-003	17.2 $\pm$ 1.16	0.0998	0.211						
Uranium	mg/kg	681103-001	1.1	0.00994	0.0398		1.06	0.04	1.03	1.10	0.03 %	
		681103-002	1.06	0.00986	0.0394							
		681103-003	1.03	0.0098	0.0392							
P-11	Americium-241	pCi/g	681127-001	0.0548 $\pm$ 0.0601	0.0559	0.113	U					
			681127-002	0.0511 $\pm$ 0.0639	0.0485	0.098	U					
			681127-003	-0.0217 $\pm$ 0.0559	0.055	0.111	U					
	Cesium-137	pCi/g	681127-001	0.529 $\pm$ 0.0485	0.012	0.0246		0.39	0.18	0.19	0.53	0.45 %
			681127-002	0.462 $\pm$ 0.0426	0.0113	0.0232						
			681127-003	0.191 $\pm$ 0.0242	0.00899	0.0183						
Potassium-40	pCi/g	681127-001	28.9 $\pm$ 1.79	0.0797	0.169		30.20	1.13	28.90	30.90	0.04 %	
		681127-002	30.8 $\pm$ 2.01	0.084	0.176							
		681127-003	30.9 $\pm$ 2.08	0.0678	0.141							
Uranium	mg/kg	681127-001	0.708	0.00996	0.0398		0.86	0.32	0.65	1.23	0.37 %	
		681127-002	1.23	0.00988	0.0395							
		681127-003	0.647	0.00982	0.0393							
S-03	Americium-241	pCi/g	681114-001	0.116 $\pm$ 0.116	0.0679	0.137	U					
			681114-002	-0.0265 $\pm$ 0.0723	0.0641	0.129	U					
			681114-003	-0.0433 $\pm$ 0.111	0.0991	0.201	U					
	Cesium-137	pCi/g	681114-001	0.303 $\pm$ 0.0246	0.00902	0.0184		0.29	0.02	0.27	0.30	0.07 %
			681114-002	0.293 $\pm$ 0.0281	0.00946	0.0193						
			681114-003	0.266 $\pm$ 0.0278	0.0143	0.0294						
Potassium-40	pCi/g	681114-001	29.9 $\pm$ 0.547	0.0685	0.143		29.83	0.12	29.70	29.90	0 %	
		681114-002	29.7 $\pm$ 2.01	0.0757	0.158							
		681114-003	29.9 $\pm$ 0.789	0.103	0.217							
Uranium	mg/kg	681114-001	0.806	0.00992	0.0397		0.74	0.06	0.68	0.81	0.08 %	
		681114-002	0.682	0.00982	0.0393							
		681114-003	0.734	0.0098	0.0392							

See notes at end of table.

**TABLE A-6. Radiological Replicate Sampling for Soil Sampling Locations, 2005 (concluded)**

Location	Analyte	Units	Sample ID	Activity ( $\pm 2 \sigma$ )	Decision Level	Detection Limit	Lab Qualifier	Avg	Std Dev	Min	Max	CV%	
S-09	Americium-241	pCi/g	068111-001	1.15 $\pm$ 0.17	0.0616	0.125		1.13	0.48	0.64	1.60	0.43 %	
			068111-002	1.6 $\pm$ 0.264	0.0949	0.193							
			068111-003	0.636 $\pm$ 0.138	0.0675	0.137							
	Cesium-137	pCi/g	068111-001	0.0911 $\pm$ 0.0245	0.0144	0.0296		0.10	0.01	0.09	0.11	0.11 %	
			068111-002	0.0908 $\pm$ 0.0259	0.014	0.0291							
			068111-003	0.109 $\pm$ 0.0255	0.0132	0.0273							
	Potassium-40	pCi/g	068111-001	26.6 $\pm$ 1.79	0.105	0.222		26.57	0.25	26.30	26.80	0.01 %	
			068111-002	26.8 $\pm$ 2.02	0.125	0.267							
			068111-003	26.3 $\pm$ 1.72	0.104	0.222							
Uranium	mg/kg	068111-001	0.668	0.0098	0.0392		0.69	0.05	0.65	0.74	0.07 %		
		068111-002	0.739	0.00988	0.0395								
		068111-003	0.651	0.00996	0.0398								
S-48	Americium-241	pCi/g	068120-001	0.000699 $\pm$ 0.0995	0.083	0.169	U	-0.05	0.10	-0.17	0.03		
			068120-002	0.0256 $\pm$ 0.0365	0.0221	0.0449	U						
			068120-003	-0.167 $\pm$ 0.082	0.0652	0.132	U						
	Cesium-137	pCi/g	068120-001	0.387 $\pm$ 0.0424	0.0146	0.03		0.37	0.08	0.29	0.45	0.22 %	
			068120-002	0.287 $\pm$ 0.042	0.0153	0.0316							
			068120-003	0.45 $\pm$ 0.05	0.0138	0.0283							
	Potassium-40	pCi/g	068120-001	31.8 $\pm$ 2.31	0.11	0.233		31.90	1.45	30.50	33.40	0.05 %	
			068120-002	30.5 $\pm$ 1.97	0.133	0.282							
			068120-003	33.4 $\pm$ 2.47	0.124	0.258							
Uranium	mg/kg	068120-001	0.665	0.00988	0.0395		0.67	0.01	0.66	0.69	0.02 %		
		068120-002	0.664	0.00992	0.0397								
		068120-003	0.685	0.0099	0.0396								

**NOTES:** pCi/g = picocurie per gram

mg/kg = milligram per kilogram

Std Dev = Standard deviation

CV = Coefficient of variation, not calculated for U values.

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.

Avg = Average

Min = Minimum

Max = Maximum



**TABLE A-7. TLD Measurements by Quarter and Location Class for Calendar Year 2005**

Location Class	Location Number	1 <sup>st</sup> Quarter (78 Days)		2 <sup>nd</sup> Quarter (90 Days)		3 <sup>rd</sup> Quarter (91 Days)		4 <sup>th</sup> Quarter (85 Days)		Exposure Rate	
		Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	uR per hour	Error
On-Site	S-01	47.7	4.7	47.3	0.9	39.3	0.5	45.9	1.9	21.8	0.6
	S-02	40.9	1.0	41.8	0.8	37.4	1.4	40.4	2.1	19.4	0.3
	S-03	41.1	2.1	46.3	5.3	38.1	0.6	42.8	2.9	20.4	0.8
	S-04	42.5	4.3	41.8	1.0	66.9	6.4	77.6	17.5	27.7	2.3
	S-09	36.7	0.9	39.9	0.9	35.0	1.7	35.2	1.5	17.8	0.3
	S-10	40.5	1.2	41.0	0.7	41.9	4.2	40.6	3.6	20.0	0.7
	S-13	40.9	0.8	40.7	1.0	36.7	1.1	38.3	1.1	19.0	0.2
	S-14	37.0	0.4	38.3	1.0	35.2	0.5	36.8	4.3	17.5	0.5
	S-15	41.1	0.5	41.3	1.1	38.4	0.5	41.0	0.9	19.6	0.2
	S-16	40.1	0.4	43.4	3.7	37.2	0.6	39.8	1.2	19.4	0.5
Perimeter	S-17	39.8	0.7	40.0	1.7	36.8	0.5	37.9	1.6	18.7	0.3
	P-05	39.7	2.6	43.7	1.2	37.5	0.7	39.5	0.5	19.4	0.4
	P-06	40.0	2.5	42.4	1.4	37.6	2.1	38.9	3.5	19.3	0.6
	P-07	*	*	*	*	34.3	0.9	36.8	2.1	16.8	0.5
	P-08	37.0	0.6	38	1.5	35.4	1.3	35.7	0.4	17.7	0.3
	P-11	40.6	2.9	40.7	0.8	44.9	0.9	*	*	20.3	0.5
Off-Site	P-12	42.3	0.5	41.8	1.2	40.4	0.5	40	1.2	19.9	0.2
	C-19	30.4	0.4	36.0	1.6	29.9	0.6	30.6	0.4	15.4	0.2
	C-21	36.8	1.3	42.7	0.7	38.2	0.5	39.4	2.7	19.0	0.4
	C-22	36.8	1.1	40.2	1.4	35.3	0.6	38.4	0.4	18.3	0.2

**NOTES:** mR = Milliroentgen ( $10^{-3}$  roentgen);  $\mu$ R = microroentgen ( $10^{-6}$  roentgen)

\* TLD lost, stolen, not exchanged, or data invalid and not used in calculation of average exposure rate

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**TABLE A-8.** Summary TLD Results for Calendar Year 2005

<b>Location Class</b>	<b>Number of Locations</b>	<b>Mean Exposure Rate (uR/hour)</b>	<b>Median Exposure Rate (uR/hour)</b>	<b>Std Dev.</b>	<b>Minimum</b>	<b>Maximum</b>
<b>On-Site</b>	11	20.2	19.5	3.8	16.0	38.0
<b>Perimeter</b>	6	16.7	19.0	1.9	15.7	22.6
<b>Off-Site</b>	3	17.6	18.1	2.0	13.7	19.8

NOTES: uR = microroentgen ( $10^{-6}$  roentgen)

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**TABLE A-9.** Non-radiological Results for Off-Site Soil Sampling Locations, 2005

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-20	Aluminum	mg/kg	7870	6.71	19.7	
	Antimony	mg/kg	0.394	0.394	0.986	U
	Arsenic	mg/kg	3.49	0.592	1.48	
	Barium	mg/kg	122	0.0986	0.493	
	Beryllium	mg/kg	0.0986	0.0986	0.493	U
	Cadmium	mg/kg	0.203	0.0986	0.493	J
	Calcium	mg/kg	2150	3.55	9.86	
	Chromium	mg/kg	4.9	0.0986	0.493	B
	Cobalt	mg/kg	2.61	0.197	0.493	
	Copper	mg/kg	5.09	0.296	0.986	
	Iron	mg/kg	9280	1.78	9.86	
	Lead	mg/kg	9.41	0.247	0.986	
	Magnesium	mg/kg	2030	8.38	29.6	
	Manganese	mg/kg	341	0.197	0.986	
	Mercury	mg/kg	0.00743	0.00244	0.00974	J
	Nickel	mg/kg	3.18	0.0986	0.493	B
	Potassium	mg/kg	2290	4.93	14.8	
	Selenium	mg/kg	0.592	0.592	1.48	U
	Silver	mg/kg	0.0986	0.0986	0.493	U
	Sodium	mg/kg	245	4.44	14.8	
Thallium	mg/kg	0.493	0.493	1.97	U	
Vanadium	mg/kg	21.2	0.0986	0.493		
Zinc	mg/kg	28.8	0.197	0.986		
C-21	Aluminum	mg/kg	5230	6.79	20	
	Antimony	mg/kg	1.03	0.399	0.998	
	Arsenic	mg/kg	8.27	0.599	1.5	
	Barium	mg/kg	77.6	0.0998	0.499	
	Beryllium	mg/kg	0.0998	0.0998	0.499	U
	Cadmium	mg/kg	0.142	0.0998	0.499	J
	Calcium	mg/kg	4130	3.59	9.98	B
	Chromium	mg/kg	4.31	0.0998	0.499	
	Cobalt	mg/kg	1.73	0.2	0.499	
	Copper	mg/kg	6.78	0.299	0.998	
	Iron	mg/kg	7300	1.8	9.98	
	Lead	mg/kg	8.79	0.25	0.998	
	Magnesium	mg/kg	2710	8.48	29.9	
	Manganese	mg/kg	183	0.2	0.998	
	Mercury	mg/kg	0.0109	0.00232	0.00929	B
	Nickel	mg/kg	3.08	0.0998	0.499	B
	Potassium	mg/kg	1980	4.99	15	
	Selenium	mg/kg	0.599	0.599	1.5	U
	Silver	mg/kg	0.586	0.0998	0.499	B
	Sodium	mg/kg	210	4.49	15	
Thallium	mg/kg	0.499	0.499	2	U	
Vanadium	mg/kg	15	0.0998	0.499		
Zinc	mg/kg	27.6	0.2	0.998		

See notes at end of table.

**TABLE A-9.** Non-radiological Results for Off-Site Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-22	Aluminum	mg/kg	10700	6.71	19.7	
	Antimony	mg/kg	1.07	0.394	0.986	
	Arsenic	mg/kg	7.3	0.592	1.48	
	Barium	mg/kg	157	0.0986	0.493	
	Beryllium	mg/kg	0.0986	0.0986	0.493	U
	Cadmium	mg/kg	0.281	0.0986	0.493	J
	Calcium	mg/kg	7190	3.55	9.86	
	Chromium	mg/kg	5.82	0.0986	0.493	B
	Cobalt	mg/kg	3.63	0.197	0.493	
	Copper	mg/kg	8.77	0.296	0.986	
	Iron	mg/kg	10900	1.78	9.86	
	Lead	mg/kg	13.1	0.247	0.986	
	Magnesium	mg/kg	4050	8.38	29.6	
	Manganese	mg/kg	492	0.197	0.986	
	Mercury	mg/kg	0.0108	0.00243	0.00972	
	Nickel	mg/kg	5.49	0.0986	0.493	B
	Potassium	mg/kg	4270	4.93	14.8	
	Selenium	mg/kg	0.592	0.592	1.48	U
	Silver	mg/kg	0.0986	0.0986	0.493	U
	Sodium	mg/kg	543	4.44	14.8	
Thallium	mg/kg	0.572	0.493	1.97	J	
Vanadium	mg/kg	17.5	0.0986	0.493		
Zinc	mg/kg	42.3	0.197	0.986		
C-23	Aluminum	mg/kg	10000	6.67	19.6	
	Antimony	mg/kg	1.96	0.392	0.98	
	Arsenic	mg/kg	10.6	0.588	1.47	
	Barium	mg/kg	178	0.098	0.49	
	Beryllium	mg/kg	0.098	0.098	0.49	U
	Cadmium	mg/kg	0.389	0.098	0.49	J
	Calcium	mg/kg	13400	3.53	9.8	B
	Chromium	mg/kg	6.71	0.098	0.49	
	Cobalt	mg/kg	4.76	0.196	0.49	
	Copper	mg/kg	12.5	0.294	0.98	
	Iron	mg/kg	13600	1.76	9.8	
	Lead	mg/kg	26.4	0.245	0.98	
	Magnesium	mg/kg	3920	8.33	29.4	
	Manganese	mg/kg	680	0.196	0.98	
	Mercury	mg/kg	0.0136	0.00235	0.00939	B
	Nickel	mg/kg	6.29	0.098	0.49	B
	Potassium	mg/kg	3020	4.9	14.7	
	Selenium	mg/kg	2.94	2.94	7.35	U
	Silver	mg/kg	0.098	0.098	0.49	BU
	Sodium	mg/kg	381	4.41	14.7	
Thallium	mg/kg	1.51	0.49	1.96	J	
Vanadium	mg/kg	27.5	0.098	0.49		
Zinc	mg/kg	48.5	0.196	0.98		

See notes at end of table.

**TABLE A-9.** Non-radiological Results for Off-Site Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-24	Aluminum	mg/kg	13400	6.77	19.9	
	Antimony	mg/kg	1.59	0.398	0.996	
	Arsenic	mg/kg	25.1	0.598	1.49	
	Barium	mg/kg	281	0.0996	0.498	
	Beryllium	mg/kg	0.358	0.0996	0.498	J
	Cadmium	mg/kg	0.294	0.0996	0.498	J
	Calcium	mg/kg	21900	3.59	9.96	B
	Chromium	mg/kg	6.95	0.0996	0.498	
	Cobalt	mg/kg	5.69	0.199	0.498	
	Copper	mg/kg	13.6	0.299	0.996	
	Iron	mg/kg	12100	1.79	9.96	
	Lead	mg/kg	44.4	0.249	0.996	
	Magnesium	mg/kg	4650	8.47	29.9	
	Manganese	mg/kg	925	0.199	0.996	
	Mercury	mg/kg	0.0221	0.0024	0.0096	B
	Nickel	mg/kg	6.48	0.0996	0.498	B
	Potassium	mg/kg	4010	4.98	14.9	
	Selenium	mg/kg	0.598	0.598	1.49	U
	Silver	mg/kg	0.267	0.0996	0.498	BJ
	Sodium	mg/kg	380	4.48	14.9	
Thallium	mg/kg	1.67	0.498	1.99	J	
Vanadium	mg/kg	26.6	0.0996	0.498		
Zinc	mg/kg	40	0.199	0.996		
C-25	Aluminum	mg/kg	15000	6.73	19.8	
	Antimony	mg/kg	1.14	0.396	0.99	
	Arsenic	mg/kg	10.5	0.594	1.49	
	Barium	mg/kg	144	0.099	0.495	
	Beryllium	mg/kg	0.099	0.099	0.495	U
	Cadmium	mg/kg	0.354	0.099	0.495	J
	Calcium	mg/kg	21100	3.56	9.9	B
	Chromium	mg/kg	8.59	0.099	0.495	
	Cobalt	mg/kg	4.2	0.198	0.495	
	Copper	mg/kg	11.4	0.297	0.99	
	Iron	mg/kg	14800	1.78	9.9	
	Lead	mg/kg	15.8	0.248	0.99	
	Magnesium	mg/kg	5970	8.42	29.7	
	Manganese	mg/kg	449	0.198	0.99	
	Mercury	mg/kg	0.0191	0.00244	0.00977	B
	Nickel	mg/kg	6.63	0.099	0.495	B
	Potassium	mg/kg	3870	4.95	14.9	
	Selenium	mg/kg	2.97	2.97	7.43	U
	Silver	mg/kg	0.099	0.099	0.495	BU
	Sodium	mg/kg	2790	4.46	14.9	
Thallium	mg/kg	1.36	0.495	1.98	J	
Vanadium	mg/kg	29.9	0.099	0.495		
Zinc	mg/kg	50.5	0.198	0.99		

See notes at end of table.

**TABLE A-9. Non-radiological Results for Off-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-26	Aluminum	mg/kg	9830	6.79	20	
	Antimony	mg/kg	1.23	0.399	0.998	
	Arsenic	mg/kg	8.75	0.599	1.5	
	Barium	mg/kg	159	0.0998	0.499	
	Beryllium	mg/kg	0.0998	0.0998	0.499	U
	Cadmium	mg/kg	0.371	0.0998	0.499	J
	Calcium	mg/kg	19600	3.59	9.98	B
	Chromium	mg/kg	7.03	0.0998	0.499	
	Cobalt	mg/kg	3.49	0.2	0.499	
	Copper	mg/kg	13.2	0.299	0.998	
	Iron	mg/kg	11700	1.8	9.98	
	Lead	mg/kg	12.6	0.25	0.998	
	Magnesium	mg/kg	4850	8.48	29.9	
	Manganese	mg/kg	504	0.2	0.998	
	Mercury	mg/kg	0.0168	0.00232	0.00929	B
	Nickel	mg/kg	5.68	0.0998	0.499	B
	Potassium	mg/kg	3230	4.99	15	
	Selenium	mg/kg	0.599	0.599	1.5	U
	Silver	mg/kg	0.208	0.0998	0.499	BJ
	Sodium	mg/kg	409	4.49	15	
Thallium	mg/kg	1.45	0.499	2	J	
Vanadium	mg/kg	23.9	0.0998	0.499		
Zinc	mg/kg	37.3	0.2	0.998		
C-27	Aluminum	mg/kg	12800	6.73	19.8	
	Antimony	mg/kg	0.513	0.396	0.99	J
	Arsenic	mg/kg	11.9	0.594	1.49	
	Barium	mg/kg	162	0.099	0.495	
	Beryllium	mg/kg	0.495	0.495	2.48	U
	Cadmium	mg/kg	0.221	0.099	0.495	J
	Calcium	mg/kg	4200	3.56	9.9	B
	Chromium	mg/kg	9.92	0.099	0.495	
	Cobalt	mg/kg	4.8	0.198	0.495	
	Copper	mg/kg	11.9	0.297	0.99	
	Iron	mg/kg	15100	1.78	9.9	
	Lead	mg/kg	13	0.248	0.99	
	Magnesium	mg/kg	4450	8.42	29.7	
	Manganese	mg/kg	425	0.198	0.99	
	Mercury	mg/kg	0.0112	0.0024	0.0096	B
	Nickel	mg/kg	7.38	0.099	0.495	B
	Potassium	mg/kg	4140	4.95	14.9	
	Selenium	mg/kg	0.594	0.594	1.49	U
	Silver	mg/kg	0.099	0.099	0.495	BU
	Sodium	mg/kg	1150	4.46	14.9	
Thallium	mg/kg	0.838	0.495	1.98	J	
Vanadium	mg/kg	35.5	0.099	0.495		
Zinc	mg/kg	38.8	0.198	0.99		

See notes at end of table.



**TABLE A-9.** Non-radiological Results for Off-Site Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-28	Aluminum	mg/kg	9060	6.76	19.9	
	Antimony	mg/kg	0.398	0.398	0.994	U
	Arsenic	mg/kg	3.85	0.596	1.49	
	Barium	mg/kg	118	0.0994	0.497	
	Beryllium	mg/kg	0.0994	0.0994	0.497	U
	Cadmium	mg/kg	0.122	0.0994	0.497	J
	Calcium	mg/kg	2400	3.58	9.94	
	Chromium	mg/kg	6.24	0.0994	0.497	B
	Cobalt	mg/kg	2.79	0.199	0.497	
	Copper	mg/kg	7.48	0.298	0.994	
	Iron	mg/kg	10100	1.79	9.94	
	Lead	mg/kg	18.1	0.249	0.994	
	Magnesium	mg/kg	2610	8.45	29.8	
	Manganese	mg/kg	256	0.199	0.994	
	Mercury	mg/kg	0.00989	0.00243	0.00971	
	Nickel	mg/kg	4.26	0.0994	0.497	B
	Potassium	mg/kg	2910	4.97	14.9	
	Selenium	mg/kg	0.596	0.596	1.49	U
	Silver	mg/kg	0.168	0.0994	0.497	J
	Sodium	mg/kg	252	4.47	14.9	
Thallium	mg/kg	0.497	0.497	1.99	U	
Vanadium	mg/kg	19.3	0.0994	0.497		
Zinc	mg/kg	30.2	0.199	0.994		
C-29	Aluminum	mg/kg	10900	6.71	19.7	
	Antimony	mg/kg	2.65	0.398	0.996	
	Arsenic	mg/kg	19.1	0.596	1.49	
	Barium	mg/kg	328	0.0986	0.493	
	Beryllium	mg/kg	0.369	0.0994	0.497	J
	Cadmium	mg/kg	0.927	0.0996	0.498	
	Calcium	mg/kg	26600	3.55	9.86	B
	Chromium	mg/kg	9.68	0.0996	0.498	B
	Cobalt	mg/kg	4.44	0.199	0.497	
	Copper	mg/kg	17.9	0.296	0.986	
	Iron	mg/kg	12300	1.79	9.96	
	Lead	mg/kg	15.7	0.249	0.994	
	Magnesium	mg/kg	9260	8.47	29.9	
	Manganese	mg/kg	369	0.199	0.996	
	Mercury	mg/kg	0.0283	0.00244	0.00974	B
	Nickel	mg/kg	21.7	0.0994	0.497	B
	Potassium	mg/kg	4000	4.93	14.8	
	Selenium	mg/kg	0.598	0.598	1.49	U
	Silver	mg/kg	0.111	0.0994	0.497	J
	Sodium	mg/kg	223	4.47	14.9	
Thallium	mg/kg	1.37	0.498	1.99	J	
Vanadium	mg/kg	47.6	0.0986	0.493		
Zinc	mg/kg	89.4	0.199	0.994		

See notes at end of table.

**TABLE A-9. Non-radiological Results for Off-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-30	Aluminum	mg/kg	10500	6.72	19.8	
	Antimony	mg/kg	0.909	0.395	0.988	J
	Arsenic	mg/kg	7.25	0.593	1.48	
	Barium	mg/kg	134	0.0988	0.494	
	Beryllium	mg/kg	0.0988	0.0988	0.494	U
	Cadmium	mg/kg	0.267	0.0988	0.494	J
	Calcium	mg/kg	17900	3.56	9.88	B
	Chromium	mg/kg	6.02	0.0988	0.494	
	Cobalt	mg/kg	3.43	0.198	0.494	
	Copper	mg/kg	6.21	0.296	0.988	
	Iron	mg/kg	11500	1.78	9.88	
	Lead	mg/kg	8.27	0.247	0.988	
	Magnesium	mg/kg	4250	8.4	29.6	
	Manganese	mg/kg	323	0.198	0.988	
	Mercury	mg/kg	0.00477	0.00235	0.00939	BJ
	Nickel	mg/kg	4.69	0.0988	0.494	B
	Potassium	mg/kg	5470	4.94	14.8	
	Selenium	mg/kg	0.593	0.593	1.48	U
	Silver	mg/kg	0.0988	0.0988	0.494	BU
	Sodium	mg/kg	1630	4.45	14.8	
Thallium	mg/kg	0.845	0.494	1.98	J	
Vanadium	mg/kg	27.9	0.0988	0.494		
Zinc	mg/kg	28.6	0.198	0.988		
C-31	Aluminum	mg/kg	9400	6.72	19.8	
	Antimony	mg/kg	1.08	0.395	0.988	
	Arsenic	mg/kg	5.24	0.593	1.48	
	Barium	mg/kg	146	0.0988	0.494	
	Beryllium	mg/kg	0.0988	0.0988	0.494	U
	Cadmium	mg/kg	0.233	0.0988	0.494	J
	Calcium	mg/kg	5060	3.56	9.88	
	Chromium	mg/kg	4.58	0.0988	0.494	B
	Cobalt	mg/kg	2.64	0.198	0.494	
	Copper	mg/kg	6.29	0.296	0.988	
	Iron	mg/kg	8640	1.78	9.88	
	Lead	mg/kg	9.53	0.247	0.988	
	Magnesium	mg/kg	2980	8.4	29.6	
	Manganese	mg/kg	455	0.198	0.988	
	Mercury	mg/kg	0.0101	0.00248	0.00992	
	Nickel	mg/kg	3.86	0.0988	0.494	B
	Potassium	mg/kg	4200	4.94	14.8	
	Selenium	mg/kg	0.593	0.593	1.48	U
	Silver	mg/kg	0.123	0.0988	0.494	J
	Sodium	mg/kg	618	4.45	14.8	
Thallium	mg/kg	0.883	0.494	1.98	J	
Vanadium	mg/kg	13.3	0.0988	0.494		
Zinc	mg/kg	26.9	0.198	0.988		

See notes at end of table.

**TABLE A-9.** Non-radiological Results for Off-Site Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-32	Aluminum	mg/kg	8550	6.75	19.8	
	Antimony	mg/kg	0.512	0.397	0.992	J
	Arsenic	mg/kg	3.79	0.595	1.49	
	Barium	mg/kg	97.8	0.0992	0.496	
	Beryllium	mg/kg	0.0992	0.0992	0.496	U
	Cadmium	mg/kg	0.0992	0.0992	0.496	U
	Calcium	mg/kg	2220	3.57	9.92	
	Chromium	mg/kg	4.8	0.0992	0.496	B
	Cobalt	mg/kg	1.8	0.198	0.496	
	Copper	mg/kg	4.92	0.298	0.992	
	Iron	mg/kg	8420	1.79	9.92	
	Lead	mg/kg	6.46	0.248	0.992	
	Magnesium	mg/kg	2430	8.43	29.8	
	Manganese	mg/kg	167	0.198	0.992	
	Mercury	mg/kg	0.00534	0.00246	0.00985	J
	Nickel	mg/kg	3.07	0.0992	0.496	B
	Potassium	mg/kg	3430	4.96	14.9	
	Selenium	mg/kg	0.595	0.595	1.49	U
	Silver	mg/kg	0.0992	0.0992	0.496	U
	C-33	Sodium	mg/kg	186	4.46	14.9
Thallium		mg/kg	0.496	0.496	1.98	U
Vanadium		mg/kg	16.5	0.0992	0.496	
Zinc		mg/kg	23	0.198	0.992	
Aluminum		mg/kg	7490	6.8	20	
Antimony		mg/kg	0.4	0.4	1	U
Arsenic		mg/kg	3.26	0.6	1.5	
Barium		mg/kg	110	0.1	0.5	
Beryllium		mg/kg	0.1	0.1	0.5	U
Cadmium		mg/kg	0.1	0.1	0.5	U
Calcium		mg/kg	2160	3.6	10	
Chromium		mg/kg	4.1	0.1	0.5	B
Cobalt		mg/kg	1.65	0.2	0.5	
Copper		mg/kg	4.33	0.3	1	
Iron		mg/kg	7320	1.8	10	
Lead		mg/kg	6.04	0.25	1	
Magnesium		mg/kg	2080	8.5	30	
Manganese	mg/kg	167	0.2	1		
Mercury	mg/kg	0.00511	0.00244	0.00976	J	
Nickel	mg/kg	2.73	0.1	0.5	B	
Potassium	mg/kg	2970	5	15		
Selenium	mg/kg	0.6	0.6	1.5	U	
Silver	mg/kg	0.1	0.1	0.5	U	

See notes at end of table.

**TABLE A-9. Non-radiological Results for Off-Site Soil Sampling Locations, 2005 (concluded)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-33 (cont.)	Sodium	mg/kg	179	4.5	15	
	Thallium	mg/kg	0.5	0.5	2	U
	Vanadium	mg/kg	13.7	0.1	0.5	
	Zinc	mg/kg	20.4	0.2	1	

**NOTES:** mg/kg = milligrams per kilogram

B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

**TABLE A-10.** Non-radiological Results for Perimeter Soil Sampling Locations, 2005

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
P-06	Aluminum	mg/kg	8830	6.79	20	
	Antimony	mg/kg	0.45	0.399	0.998	J
	Arsenic	mg/kg	4.61	0.599	1.5	
	Barium	mg/kg	103	0.0998	0.499	
	Beryllium	mg/kg	0.0998	0.0998	0.499	U
	Cadmium	mg/kg	0.249	0.0998	0.499	J
	Calcium	mg/kg	2990	3.59	9.98	B
	Chromium	mg/kg	5.67	0.0998	0.499	
	Cobalt	mg/kg	2.87	0.2	0.499	
	Copper	mg/kg	6.37	0.299	0.998	
	Iron	mg/kg	8360	1.8	9.98	
	Lead	mg/kg	11.2	0.25	0.998	
	Magnesium	mg/kg	2730	8.48	29.9	
	Manganese	mg/kg	361	0.2	0.998	
	Mercury	mg/kg	0.0102	0.00245	0.0098	B
	Nickel	mg/kg	4.83	0.0998	0.499	B
	Potassium	mg/kg	3190	4.99	15	
	Selenium	mg/kg	0.599	0.599	1.5	U
	Silver	mg/kg	0.0998	0.0998	0.499	BU
	Sodium	mg/kg	146	4.49	15	
Thallium	mg/kg	0.499	0.499	2	U	
Vanadium	mg/kg	13.7	0.0998	0.499		
Zinc	mg/kg	39.7	0.2	0.998		
P-08	Aluminum	mg/kg	5410	6.75	19.8	
	Antimony	mg/kg	0.397	0.397	0.992	U
	Arsenic	mg/kg	2.65	0.595	1.49	
	Barium	mg/kg	76	0.0992	0.496	
	Beryllium	mg/kg	0.0992	0.0992	0.496	U
	Cadmium	mg/kg	0.122	0.0992	0.496	J
	Calcium	mg/kg	1640	3.57	9.92	
	Chromium	mg/kg	2.88	0.0992	0.496	B
	Cobalt	mg/kg	1.48	0.198	0.496	
	Copper	mg/kg	3.54	0.298	0.992	
	Iron	mg/kg	5990	1.79	9.92	
	Lead	mg/kg	4.58	0.248	0.992	
	Magnesium	mg/kg	1580	8.43	29.8	
	Manganese	mg/kg	160	0.198	0.992	
	Mercury	mg/kg	0.0043	0.00234	0.00938	J
	Nickel	mg/kg	2.14	0.0992	0.496	B
	Potassium	mg/kg	1980	4.96	14.9	
	Selenium	mg/kg	0.595	0.595	1.49	U
	Silver	mg/kg	0.0992	0.0992	0.496	U
	Sodium	mg/kg	148	4.46	14.9	
Thallium	mg/kg	0.496	0.496	1.98	U	
Vanadium	mg/kg	10.4	0.0992	0.496		
Zinc	mg/kg	23.4	0.198	0.992		

See notes at end of table.

**TABLE A-10.** Non-radiological Results for Perimeter Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
P-11	Aluminum	mg/kg	7390	6.72	19.8	
	Antimony	mg/kg	0.395	0.395	0.988	U
	Arsenic	mg/kg	12.4	0.593	1.48	
	Barium	mg/kg	200	0.0988	0.494	
	Beryllium	mg/kg	0.684	0.098	0.49	
	Cadmium	mg/kg	0.188	0.098	0.49	J
	Calcium	mg/kg	1760	3.53	9.8	
	Chromium	mg/kg	3.01	0.098	0.49	B
	Cobalt	mg/kg	3.49	0.196	0.49	
	Copper	mg/kg	6.29	0.296	0.988	
	Iron	mg/kg	10500	1.76	9.8	
	Lead	mg/kg	14.2	0.245	0.98	
	Magnesium	mg/kg	1530	8.33	29.4	
	Manganese	mg/kg	473	0.196	0.98	
	Mercury	mg/kg	0.0131	0.00249	0.00995	
	Nickel	mg/kg	2.77	0.098	0.49	B
	Potassium	mg/kg	2440	4.9	14.7	
	Selenium	mg/kg	0.588	0.588	1.47	U
	Silver	mg/kg	0.115	0.098	0.49	J
	P-12	Sodium	mg/kg	122	4.41	14.7
Thallium		mg/kg	0.49	0.49	1.96	U
Vanadium		mg/kg	11.3	0.098	0.49	
Zinc		mg/kg	34.1	0.196	0.98	B
Aluminum		mg/kg	11300	6.67	19.6	
Antimony		mg/kg	0.392	0.392	0.98	U
Arsenic		mg/kg	11.3	0.588	1.47	
Barium		mg/kg	153	0.098	0.49	
Beryllium		mg/kg	0.85	0.098	0.49	
Cadmium		mg/kg	0.336	0.098	0.49	J
Calcium		mg/kg	7320	3.53	9.8	
Chromium		mg/kg	7.25	0.098	0.49	B
Cobalt		mg/kg	3.79	0.196	0.49	
Copper		mg/kg	8.03	0.294	0.98	
Iron		mg/kg	12400	1.76	9.8	
Lead		mg/kg	14.9	0.245	0.98	
Magnesium		mg/kg	4340	8.33	29.4	
Manganese		mg/kg	552	0.196	0.98	
Mercury		mg/kg	0.0121	0.00231	0.00924	
Nickel		mg/kg	5.76	0.098	0.49	B
Potassium	mg/kg	4130	4.9	14.7		
Selenium	mg/kg	0.588	0.588	1.47	U	
Silver	mg/kg	0.13	0.098	0.49	J	
Sodium	mg/kg	378	4.41	14.7	B	
Thallium	mg/kg	0.49	0.49	1.96	U	
Vanadium	mg/kg	20.8	0.098	0.49		
Zinc	mg/kg	41.5	0.196	0.98	B	

See notes at end of table.

**TABLE A-10. Non-radiological Results for Perimeter Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
P-34	Aluminum	mg/kg	8940	6.68	19.6	
	Antimony	mg/kg	0.457	0.393	0.982	J
	Arsenic	mg/kg	4.34	0.589	1.47	
	Barium	mg/kg	102	0.0982	0.491	
	Beryllium	mg/kg	0.0982	0.0982	0.491	U
	Cadmium	mg/kg	0.164	0.0982	0.491	J
	Calcium	mg/kg	2190	3.54	9.82	B
	Chromium	mg/kg	5.49	0.0982	0.491	
	Cobalt	mg/kg	2.56	0.196	0.491	
	Copper	mg/kg	5.86	0.295	0.982	
	Iron	mg/kg	8690	1.77	9.82	
	Lead	mg/kg	9.45	0.246	0.982	
	Magnesium	mg/kg	2800	8.35	29.5	
	Manganese	mg/kg	334	0.196	0.982	
	Mercury	mg/kg	0.0112	0.00246	0.00984	B
	Nickel	mg/kg	4.17	0.0982	0.491	B
	Potassium	mg/kg	2960	4.91	14.7	
	Selenium	mg/kg	0.589	0.589	1.47	U
	Silver	mg/kg	0.0982	0.0982	0.491	BU
	Sodium	mg/kg	162	4.42	14.7	
Thallium	mg/kg	0.491	0.491	1.96	U	
Vanadium	mg/kg	14.9	0.0982	0.491		
Zinc	mg/kg	27.6	0.196	0.982		
P-35	Aluminum	mg/kg	11800	6.8	20	
	Antimony	mg/L	0.004	0.004	0.01	U
	Arsenic	mg/L	0.006	0.006	0.015	U
	Barium	mg/kg	121	0.1	0.5	
	Beryllium	mg/L	0.001	0.001	0.005	U
	Cadmium	mg/L	0.001	0.001	0.005	U
	Calcium	mg/L	0.0999	0.036	0.1	J
	Chromium	mg/L	0.001	0.001	0.005	U
	Cobalt	mg/kg	6.3	0.2	0.5	
	Copper	mg/L	0.003	0.003	0.01	U
	Iron	mg/L	0.018	0.018	0.1	U
	Lead	mg/kg	17.6	0.25	1	
	Magnesium	mg/L	0.085	0.085	0.3	U
	Manganese	mg/L	0.002	0.002	0.01	U
	Mercury	mg/kg	0.0171	0.0025	0.01	
	Nickel	mg/L	0.001	0.001	0.005	U
	Potassium	mg/L	0.05	0.05	0.15	U
	Selenium	mg/kg	0.6	0.6	1.5	U
	Silver	mg/kg	0.1	0.1	0.5	U
	Sodium	mg/kg	384	4.5	15	B
Thallium	mg/L	0.005	0.005	0.02	U	
Vanadium	mg/kg	41.3	0.1	0.5		
Zinc	mg/kg	69.2	0.2	1	B	

See notes at end of table.

**TABLE A-10.** Non-radiological Results for Perimeter Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
P-36	Aluminum	mg/kg	7030	6.72	19.8	
	Antimony	mg/kg	0.444	0.395	0.988	J
	Arsenic	mg/kg	3.26	0.593	1.48	
	Barium	mg/kg	89.1	0.0988	0.494	
	Beryllium	mg/kg	0.0988	0.0988	0.494	U
	Cadmium	mg/kg	0.0988	0.0988	0.494	U
	Calcium	mg/kg	1710	3.56	9.88	
	Chromium	mg/kg	3.93	0.0988	0.494	B
	Cobalt	mg/kg	1.75	0.198	0.494	
	Copper	mg/kg	4.88	0.296	0.988	
	Iron	mg/kg	6830	1.78	9.88	
	Lead	mg/kg	4.58	0.247	0.988	
	Magnesium	mg/kg	2140	8.4	29.6	
	Manganese	mg/kg	165	0.198	0.988	
	Mercury	mg/kg	0.005	0.00245	0.00979	J
	Nickel	mg/kg	3.13	0.0988	0.494	B
	Potassium	mg/kg	2820	4.94	14.8	
	Selenium	mg/kg	0.593	0.593	1.48	U
	Silver	mg/kg	0.0988	0.0988	0.494	U
	Sodium	mg/kg	141	4.45	14.8	
	Thallium	mg/kg	0.494	0.494	1.98	U
Vanadium	mg/kg	12	0.0988	0.494		
Zinc	mg/kg	20.5	0.198	0.988		
P-37	Aluminum	mg/kg	8090	6.68	19.6	
	Antimony	mg/kg	0.753	0.393	0.982	J
	Arsenic	mg/kg	3.76	0.589	1.47	
	Barium	mg/kg	90.7	0.0982	0.491	
	Beryllium	mg/kg	0.0982	0.0982	0.491	U
	Cadmium	mg/kg	0.11	0.0982	0.491	J
	Calcium	mg/kg	4090	3.54	9.82	
	Chromium	mg/kg	4.31	0.0982	0.491	B
	Cobalt	mg/kg	1.88	0.196	0.491	
	Copper	mg/kg	5.48	0.295	0.982	
	Iron	mg/kg	7890	1.77	9.82	
	Lead	mg/kg	4.96	0.246	0.982	
	Magnesium	mg/kg	2590	8.35	29.5	
	Manganese	mg/kg	170	0.196	0.982	
	Mercury	mg/kg	0.00581	0.0025	0.00998	J
	Nickel	mg/kg	3.4	0.0982	0.491	B
	Potassium	mg/kg	2750	4.91	14.7	
Selenium	mg/kg	0.589	0.589	1.47	U	
Silver	mg/kg	0.109	0.0982	0.491	J	

See notes at end of table.



**TABLE A-10.** Non-radiological Results for Perimeter Soil Sampling Locations, 2005 (concluded)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
P-37 (cont.)	Sodium	mg/kg	178	4.42	14.7	
	Thallium	mg/kg	0.491	0.491	1.96	U
	Vanadium	mg/kg	14.3	0.0982	0.491	
	Zinc	mg/kg	24	0.196	0.982	

**NOTES:** mg/kg = milligrams per kilogram

B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

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**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-02	Aluminum	mg/kg	11100	6.67	19.6	
	Antimony	mg/kg	0.539	0.392	0.98	J
	Arsenic	mg/kg	4.47	0.588	1.47	
	Barium	mg/kg	93	0.098	0.49	
	Beryllium	mg/kg	0.791	0.098	0.49	
	Cadmium	mg/kg	0.164	0.098	0.49	J
	Calcium	mg/kg	2520	3.53	9.8	
	Chromium	mg/kg	5.93	0.098	0.49	B
	Cobalt	mg/kg	2.64	0.196	0.49	
	Copper	mg/kg	5.53	0.294	0.98	
	Iron	mg/kg	9150	1.76	9.8	
	Lead	mg/kg	9.61	0.245	0.98	
	Magnesium	mg/kg	3170	8.33	29.4	
	Manganese	mg/kg	288	0.196	0.98	
	Mercury	mg/kg	0.00785	0.00244	0.00976	J
	Nickel	mg/kg	5.39	0.098	0.49	B
	Potassium	mg/kg	3770	4.9	14.7	
	Selenium	mg/kg	0.588	0.588	1.47	U
	Silver	mg/kg	0.098	0.098	0.49	U
	Sodium	mg/kg	203	4.41	14.7	B
Thallium	mg/kg	0.49	0.49	1.96	U	
Vanadium	mg/kg	14.5	0.098	0.49		
Zinc	mg/kg	28.5	0.196	0.98	B	
S-03	Aluminum	mg/kg	8360	6.68	19.6	
	Antimony	mg/kg	0.393	0.393	0.982	U
	Arsenic	mg/kg	4.82	0.599	1.5	
	Barium	mg/kg	96.3	0.0998	0.499	
	Beryllium	mg/kg	0.1	0.1	0.5	U
	Cadmium	mg/kg	0.142	0.0982	0.491	J
	Calcium	mg/kg	2250	3.54	9.82	B
	Chromium	mg/kg	4.92	0.0998	0.499	
	Cobalt	mg/kg	2.63	0.2	0.499	
	Copper	mg/kg	5.63	0.295	0.982	
	Iron	mg/kg	8710	1.77	9.82	
	Lead	mg/kg	8.54	0.246	0.982	
	Magnesium	mg/kg	2520	8.35	29.5	
	Manganese	mg/kg	342	0.196	0.982	
	Mercury	mg/kg	0.0107	0.00243	0.00971	B
	Nickel	mg/kg	3.75	0.0998	0.499	B
	Potassium	mg/kg	2530	4.99	15	
	Selenium	mg/kg	0.589	0.589	1.47	U
	Silver	mg/kg	0.0982	0.0982	0.491	BU
	Sodium	mg/kg	176	4.49	15	
Thallium	mg/kg	0.5	0.5	2	U	
Vanadium	mg/kg	16.6	0.1	0.5		
Zinc	mg/kg	26.5	0.2	0.998		

See notes at end of table.

**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-04	Aluminum	mg/kg	8750	6.79	20	
	Antimony	mg/kg	0.74	0.399	0.998	J
	Arsenic	mg/kg	5.17	0.599	1.5	
	Barium	mg/kg	106	0.0998	0.499	
	Beryllium	mg/kg	0.0998	0.0998	0.499	U
	Cadmium	mg/kg	0.275	0.0998	0.499	J
	Calcium	mg/kg	3020	3.59	9.98	B
	Chromium	mg/kg	5.24	0.0998	0.499	
	Cobalt	mg/kg	2.67	0.2	0.499	
	Copper	mg/kg	6.37	0.299	0.998	
	Iron	mg/kg	8870	1.8	9.98	
	Lead	mg/kg	8.67	0.25	0.998	
	Magnesium	mg/kg	3030	8.48	29.9	
	Manganese	mg/kg	405	0.2	0.998	
	Mercury	mg/kg	0.0104	0.00236	0.00945	B
	Nickel	mg/kg	4.28	0.0998	0.499	B
	Potassium	mg/kg	3130	4.99	15	
	Selenium	mg/kg	0.599	0.599	1.5	U
	Silver	mg/kg	0.0998	0.0998	0.499	BU
	Sodium	mg/kg	193	4.49	15	
Thallium	mg/kg	0.499	0.499	2	U	
Vanadium	mg/kg	15.4	0.0998	0.499		
Zinc	mg/kg	29.1	0.2	0.998		
S-09	Aluminum	mg/kg	11200	6.69	19.7	
	Antimony	mg/kg	0.794	0.394	0.984	J
	Arsenic	mg/kg	7.99	0.593	1.48	
	Barium	mg/kg	147	0.098	0.49	
	Beryllium	mg/kg	0.139	0.0984	0.492	J
	Cadmium	mg/kg	0.314	0.0984	0.492	J
	Calcium	mg/kg	6160	3.56	9.88	B
	Chromium	mg/kg	8.2	0.0988	0.494	
	Cobalt	mg/kg	5.87	0.198	0.494	
	Copper	mg/kg	9.34	0.296	0.988	
	Iron	mg/kg	16900	1.76	9.8	
	Lead	mg/kg	12.4	0.246	0.984	
	Magnesium	mg/kg	5450	8.33	29.4	
	Manganese	mg/kg	429	0.196	0.98	
	Mercury	mg/kg	0.0147	0.00247	0.00988	B
	Nickel	mg/kg	6.06	0.0984	0.492	B
	Potassium	mg/kg	3740	4.92	14.8	
	Selenium	mg/kg	0.588	0.588	1.47	U
	Silver	mg/kg	0.0984	0.0984	0.492	BU
	Sodium	mg/kg	206	4.45	14.8	
Thallium	mg/kg	0.49	0.49	1.96	U	
Vanadium	mg/kg	26.9	0.0988	0.494		
Zinc	mg/kg	43.6	0.196	0.98		

See notes at end of table.

**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-10	Aluminum	mg/kg	9500	6.77	19.9	
	Antimony	mg/L	0.004	0.004	0.01	U
	Arsenic	mg/L	0.006	0.006	0.015	U
	Barium	mg/L	0.001	0.001	0.005	U
	Beryllium	mg/L	0.001	0.001	0.005	U
	Cadmium	mg/L	0.001	0.001	0.005	U
	Calcium	mg/kg	4450	3.59	9.96	B
	Chromium	mg/L	0.001	0.001	0.005	U
	Cobalt	mg/L	0.001	0.001	0.005	U
	Copper	mg/L	0.003	0.003	0.01	U
	Iron	mg/kg	9390	1.79	9.96	
	Lead	mg/kg	8	0.249	0.996	
	Magnesium	mg/L	0.085	0.085	0.3	U
	Manganese	mg/L	0.002	0.002	0.01	U
	Mercury	mg/L	0.00005	0.00005	0.0002	U
	Nickel	mg/L	0.001	0.001	0.005	U
	Potassium	mg/L	0.0824	0.05	0.15	J
	Selenium	mg/kg	0.598	0.598	1.49	U
	Silver	mg/kg	0.0996	0.0996	0.498	BU
	Sodium	mg/kg	307	4.48	14.9	
Thallium	mg/L	0.005	0.005	0.02	U	
Vanadium	mg/L	0.001	0.001	0.005	U	
Zinc	mg/L	0.00455	0.002	0.01	J	
S-38	Aluminum	mg/kg	9600	6.73	19.8	
	Antimony	mg/kg	0.52	0.396	0.99	J
	Arsenic	mg/kg	6.29	0.594	1.49	
	Barium	mg/kg	92.7	0.099	0.495	
	Beryllium	mg/kg	0.099	0.099	0.495	U
	Cadmium	mg/kg	0.213	0.099	0.495	J
	Calcium	mg/kg	3070	3.56	9.9	B
	Chromium	mg/kg	6.61	0.099	0.495	
	Cobalt	mg/kg	2.71	0.198	0.495	
	Copper	mg/kg	6.72	0.297	0.99	
	Iron	mg/kg	10900	1.78	9.9	
	Lead	mg/kg	10.4	0.248	0.99	
	Magnesium	mg/kg	3360	8.42	29.7	
	Manganese	mg/kg	292	0.198	0.99	
	Mercury	mg/kg	0.0114	0.00242	0.00966	B
	Nickel	mg/kg	4.85	0.099	0.495	B
	Potassium	mg/kg	3950	4.95	14.9	
	Selenium	mg/kg	0.594	0.594	1.49	U
	Silver	mg/kg	0.099	0.099	0.495	BU
	Sodium	mg/kg	192	4.46	14.9	
Thallium	mg/kg	0.495	0.495	1.98	U	
Vanadium	mg/kg	19.7	0.099	0.495		
Zinc	mg/kg	36.3	0.198	0.99		

See notes at end of table.

**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-39	Aluminum	mg/kg	11300	6.76	19.9	
	Antimony	mg/kg	0.426	0.398	0.994	J
	Arsenic	mg/kg	7.92	0.596	1.49	
	Barium	mg/kg	142	0.0994	0.497	
	Beryllium	mg/kg	0.0994	0.0994	0.497	U
	Cadmium	mg/kg	0.292	0.0994	0.497	J
	Calcium	mg/kg	4320	3.58	9.94	B
	Chromium	mg/kg	7.75	0.0994	0.497	
	Cobalt	mg/kg	3.84	0.199	0.497	
	Copper	mg/kg	9.42	0.298	0.994	
	Iron	mg/kg	12600	1.79	9.94	
	Lead	mg/kg	11.4	0.249	0.994	
	Magnesium	mg/kg	4330	8.45	29.8	
	Manganese	mg/kg	570	0.199	0.994	
	Mercury	mg/kg	0.00884	0.00234	0.00938	BJ
	Nickel	mg/kg	6.49	0.0994	0.497	B
	Potassium	mg/kg	3880	4.97	14.9	
	Selenium	mg/kg	0.596	0.596	1.49	U
	Silver	mg/kg	0.0994	0.0994	0.497	BU
	Sodium	mg/kg	474	4.47	14.9	
Thallium	mg/kg	0.725	0.497	1.99	J	
Vanadium	mg/kg	23.3	0.0994	0.497		
Zinc	mg/kg	38.3	0.199	0.994		
S-40	Aluminum	mg/kg	10400	6.76	19.9	
	Antimony	mg/kg	1.02	0.398	0.994	
	Arsenic	mg/kg	5.99	0.596	1.49	
	Barium	mg/kg	139	0.0994	0.497	
	Beryllium	mg/kg	0.0994	0.0994	0.497	U
	Cadmium	mg/kg	0.315	0.0994	0.497	J
	Calcium	mg/kg	7640	3.58	9.94	
	Chromium	mg/kg	6.38	0.0994	0.497	B
	Cobalt	mg/kg	4	0.199	0.497	
	Copper	mg/kg	8.51	0.298	0.994	
	Iron	mg/kg	11500	1.79	9.94	
	Lead	mg/kg	11.2	0.249	0.994	
	Magnesium	mg/kg	3610	8.45	29.8	
	Manganese	mg/kg	354	0.199	0.994	
	Mercury	mg/kg	0.00918	0.0024	0.00962	J
	Nickel	mg/kg	5.73	0.0994	0.497	B
	Potassium	mg/kg	3860	4.97	14.9	
	Selenium	mg/kg	0.596	0.596	1.49	U
	Silver	mg/kg	0.0994	0.0994	0.497	U
	Sodium	mg/kg	383	4.47	14.9	
Thallium	mg/kg	0.784	0.497	1.99	J	
Vanadium	mg/kg	23.7	0.0994	0.497		
Zinc	mg/kg	43.3	0.199	0.994		

See notes at end of table.

**TABLE A-11.** Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-41	Aluminum	mg/kg	9500	6.67	19.6	
	Antimony	mg/kg	1.29	0.392	0.98	
	Arsenic	mg/kg	6.67	0.588	1.47	
	Barium	mg/kg	110	0.098	0.49	
	Beryllium	mg/kg	0.098	0.098	0.49	U
	Cadmium	mg/kg	0.335	0.098	0.49	J
	Calcium	mg/kg	7240	3.53	9.8	
	Chromium	mg/kg	6.06	0.098	0.49	B
	Cobalt	mg/kg	3.67	0.196	0.49	
	Copper	mg/kg	8.99	0.294	0.98	
	Iron	mg/kg	10900	1.76	9.8	
	Lead	mg/kg	30.3	0.245	0.98	
	Magnesium	mg/kg	3320	8.33	29.4	
	Manganese	mg/kg	324	0.196	0.98	
	Mercury	mg/kg	0.00715	0.00232	0.00929	J
	Nickel	mg/kg	5.37	0.098	0.49	B
	Potassium	mg/kg	3800	4.9	14.7	
	Selenium	mg/kg	2.94	2.94	7.35	U
	Silver	mg/kg	0.098	0.098	0.49	U
	Sodium	mg/kg	343	4.41	14.7	
Thallium	mg/kg	0.852	0.49	1.96	J	
Vanadium	mg/kg	25.4	0.098	0.49		
Zinc	mg/kg	35.4	0.196	0.98		
S-42	Aluminum	mg/kg	10600	6.67	19.6	
	Antimony	mg/kg	1.06	0.392	0.98	
	Arsenic	mg/kg	6.91	0.588	1.47	
	Barium	mg/kg	138	0.098	0.49	
	Beryllium	mg/kg	0.098	0.098	0.49	U
	Cadmium	mg/kg	0.265	0.098	0.49	J
	Calcium	mg/kg	9670	3.53	9.8	
	Chromium	mg/kg	6.21	0.098	0.49	B
	Cobalt	mg/kg	3.68	0.196	0.49	
	Copper	mg/kg	7.79	0.294	0.98	
	Iron	mg/kg	11400	1.76	9.8	
	Lead	mg/kg	8.66	0.245	0.98	
	Magnesium	mg/kg	3900	8.33	29.4	
	Manganese	mg/kg	316	0.196	0.98	
	Mercury	mg/kg	0.0111	0.00248	0.00993	
	Nickel	mg/kg	5.28	0.098	0.49	B
	Potassium	mg/kg	3550	4.9	14.7	
	Selenium	mg/kg	0.588	0.588	1.47	U
	Silver	mg/kg	0.138	0.098	0.49	J
	Sodium	mg/kg	452	4.41	14.7	
Thallium	mg/kg	1.24	0.49	1.96	J	
Vanadium	mg/kg	25.3	0.098	0.49		
Zinc	mg/kg	30.1	0.196	0.98		

See notes at end of table.

**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-43	Aluminum	mg/kg	10400	6.72	19.8	
	Antimony	mg/kg	1.25	0.395	0.988	
	Arsenic	mg/kg	11.1	0.593	1.48	
	Barium	mg/kg	129	0.0988	0.494	
	Beryllium	mg/kg	0.0988	0.0988	0.494	U
	Cadmium	mg/kg	0.463	0.0988	0.494	J
	Calcium	mg/kg	18000	3.56	9.88	
	Chromium	mg/kg	5.65	0.0988	0.494	B
	Cobalt	mg/kg	3.15	0.198	0.494	
	Copper	mg/kg	8.88	0.296	0.988	
	Iron	mg/kg	11600	1.78	9.88	
	Lead	mg/kg	12.4	0.247	0.988	
	Magnesium	mg/kg	3160	8.4	29.6	
	Manganese	mg/kg	268	0.198	0.988	
	Mercury	mg/kg	0.00654	0.00233	0.00933	J
	Nickel	mg/kg	4.4	0.0988	0.494	B
	Potassium	mg/kg	3160	4.94	14.8	
	Selenium	mg/kg	2.96	2.96	7.41	U
	Silver	mg/kg	0.0988	0.0988	0.494	U
	Sodium	mg/kg	556	4.45	14.8	
Thallium	mg/kg	1.14	0.494	1.98	J	
Vanadium	mg/kg	29.7	0.0988	0.494		
Zinc	mg/kg	204	0.198	0.988		
S-44	Aluminum	mg/kg	11500	6.67	19.6	
	Antimony	mg/kg	1.09	0.392	0.98	
	Arsenic	mg/kg	9.7	0.588	1.47	
	Barium	mg/kg	137	0.098	0.49	
	Beryllium	mg/kg	0.098	0.098	0.49	U
	Cadmium	mg/kg	0.383	0.098	0.49	J
	Calcium	mg/kg	11300	3.53	9.8	
	Chromium	mg/kg	6.44	0.098	0.49	B
	Cobalt	mg/kg	3.73	0.196	0.49	
	Copper	mg/kg	8.06	0.294	0.98	
	Iron	mg/kg	12400	1.76	9.8	
	Lead	mg/kg	12.2	0.245	0.98	
	Magnesium	mg/kg	3570	8.33	29.4	
	Manganese	mg/kg	291	0.196	0.98	
	Mercury	mg/kg	0.008	0.0024	0.00962	J
	Nickel	mg/kg	5.26	0.098	0.49	B
	Potassium	mg/kg	3500	4.9	14.7	
	Selenium	mg/kg	2.94	2.94	7.35	U
	Silver	mg/kg	0.098	0.098	0.49	U
	Sodium	mg/kg	422	4.41	14.7	
Thallium	mg/kg	0.84	0.49	1.96	J	
Vanadium	mg/kg	29.5	0.098	0.49		
Zinc	mg/kg	143	0.196	0.98		

See notes at end of table.



**TABLE A-11.** Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-45	Aluminum	mg/kg	11400	6.72	19.8	
	Antimony	mg/kg	1.22	0.395	0.988	
	Arsenic	mg/kg	6.62	0.593	1.48	
	Barium	mg/kg	144	0.0988	0.494	
	Beryllium	mg/kg	0.494	0.494	2.47	U
	Cadmium	mg/kg	1.11	0.0988	0.494	
	Calcium	mg/kg	7610	3.56	9.88	
	Chromium	mg/kg	45.6	0.0988	0.494	B
	Cobalt	mg/kg	7.93	0.198	0.494	
	Copper	mg/kg	11.6	0.296	0.988	
	Iron	mg/kg	14400	1.78	9.88	
	Lead	mg/kg	14.3	0.247	0.988	
	Magnesium	mg/kg	9220	8.4	29.6	
	Manganese	mg/kg	352	0.198	0.988	
	Mercury	mg/kg	0.00611	0.00243	0.00972	J
	Nickel	mg/kg	18.6	0.0988	0.494	B
	Potassium	mg/kg	5000	4.94	14.8	
	Selenium	mg/kg	0.593	0.593	1.48	U
	Silver	mg/kg	0.0988	0.0988	0.494	U
	Sodium	mg/kg	1040	4.45	14.8	
Thallium	mg/kg	0.494	0.494	1.98	U	
Vanadium	mg/kg	29.5	0.0988	0.494		
Zinc	mg/kg	274	0.198	0.988		
S-46	Aluminum	mg/kg	9130	6.75	19.8	
	Antimony	mg/kg	1.12	0.397	0.992	
	Arsenic	mg/kg	7.99	0.595	1.49	
	Barium	mg/kg	164	0.0992	0.496	
	Beryllium	mg/kg	0.0992	0.0992	0.496	U
	Cadmium	mg/kg	0.401	0.0992	0.496	J
	Calcium	mg/kg	12600	3.57	9.92	
	Chromium	mg/kg	7.62	0.0992	0.496	B
	Cobalt	mg/kg	3.52	0.198	0.496	
	Copper	mg/kg	9.32	0.298	0.992	
	Iron	mg/kg	11400	1.79	9.92	
	Lead	mg/kg	14.3	0.248	0.992	
	Magnesium	mg/kg	3400	8.43	29.8	
	Manganese	mg/kg	411	0.198	0.992	
	Mercury	mg/kg	0.00683	0.00232	0.00929	J
	Nickel	mg/kg	6.27	0.0992	0.496	B
	Potassium	mg/kg	3510	4.96	14.9	
	Selenium	mg/kg	2.98	2.98	7.44	U
	Silver	mg/kg	0.0992	0.0992	0.496	U
	Sodium	mg/kg	390	4.46	14.9	
Thallium	mg/kg	0.903	0.496	1.98	J	
Vanadium	mg/kg	23.2	0.0992	0.496		
Zinc	mg/kg	78.7	0.198	0.992		

See notes at end of table.

**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-47	Aluminum	mg/kg	8740	6.67	19.6	
	Antimony	mg/kg	0.675	0.392	0.98	J
	Arsenic	mg/kg	5.31	0.588	1.47	
	Barium	mg/kg	115	0.098	0.49	
	Beryllium	mg/kg	0.098	0.098	0.49	U
	Cadmium	mg/kg	0.269	0.098	0.49	J
	Calcium	mg/kg	5770	3.53	9.8	
	Chromium	mg/kg	5.96	0.098	0.49	B
	Cobalt	mg/kg	3.22	0.196	0.49	
	Copper	mg/kg	7.67	0.294	0.98	
	Iron	mg/kg	10600	1.76	9.8	
	Lead	mg/kg	11.8	0.245	0.98	
	Magnesium	mg/kg	3210	8.33	29.4	
	Manganese	mg/kg	334	0.196	0.98	
	Mercury	mg/kg	0.0076	0.00237	0.00949	J
	Nickel	mg/kg	4.75	0.098	0.49	B
	Potassium	mg/kg	4060	4.9	14.7	
	Selenium	mg/kg	0.588	0.588	1.47	U
	Silver	mg/kg	0.18	0.098	0.49	J
	Sodium	mg/kg	473	4.41	14.7	
Thallium	mg/kg	0.75	0.49	1.96	J	
Vanadium	mg/kg	21.5	0.098	0.49		
Zinc	mg/kg	37.9	0.196	0.98		
S-48	Aluminum	mg/kg	14500	6.75	19.8	
	Antimony	mg/kg	0.398	0.398	0.996	U
	Arsenic	mg/kg	4.53	0.592	1.48	
	Barium	mg/kg	194	0.0986	0.493	
	Beryllium	mg/kg	0.921	0.0996	0.498	
	Cadmium	mg/kg	0.296	0.0986	0.493	J
	Calcium	mg/kg	6050	3.57	9.92	
	Chromium	mg/kg	7.92	0.0996	0.498	B
	Cobalt	mg/kg	4	0.197	0.493	
	Copper	mg/kg	9.16	0.296	0.986	
	Iron	mg/kg	13200	1.78	9.86	
	Lead	mg/kg	11.6	0.248	0.992	
	Magnesium	mg/kg	5040	8.43	29.8	
	Manganese	mg/kg	392	0.199	0.996	
	Mercury	mg/kg	0.0136	0.00247	0.00988	
	Nickel	mg/kg	6.99	0.0992	0.496	B
	Potassium	mg/kg	5860	4.96	14.9	
	Selenium	mg/kg	0.598	0.598	1.49	U
	Silver	mg/kg	0.105	0.0992	0.496	J
	Sodium	mg/kg	594	4.46	14.9	B
Thallium	mg/kg	0.496	0.496	1.98	U	
Vanadium	mg/kg	23.3	0.0986	0.493		
Zinc	mg/kg	37.5	0.197	0.986	B	

See notes at end of table.

**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-49	Aluminum	mg/kg	11600	6.73	19.8	
	Antimony	mg/kg	0.396	0.396	0.99	U
	Arsenic	mg/kg	3.77	0.594	1.49	
	Barium	mg/kg	256	0.099	0.495	
	Beryllium	mg/kg	0.76	0.099	0.495	
	Cadmium	mg/kg	0.324	0.099	0.495	J
	Calcium	mg/kg	5820	3.56	9.9	
	Chromium	mg/kg	6.18	0.099	0.495	B
	Cobalt	mg/kg	3.59	0.198	0.495	
	Copper	mg/kg	7.39	0.297	0.99	
	Iron	mg/kg	10000	1.78	9.9	
	Lead	mg/kg	11.8	0.248	0.99	
	Magnesium	mg/kg	4380	8.42	29.7	
	Manganese	mg/kg	592	0.198	0.99	
	Mercury	mg/kg	0.0111	0.00235	0.00939	
	Nickel	mg/kg	5.48	0.099	0.495	B
	Potassium	mg/kg	6030	4.95	14.9	
	Selenium	mg/kg	0.594	0.594	1.49	U
	Silver	mg/kg	0.099	0.099	0.495	U
	Sodium	mg/kg	553	4.46	14.9	B
Thallium	mg/kg	0.495	0.495	1.98	U	
Vanadium	mg/kg	16.9	0.099	0.495		
Zinc	mg/kg	33.2	0.198	0.99	B	
S-50	Aluminum	mg/kg	14600	6.77	19.9	
	Antimony	mg/kg	0.398	0.398	0.996	U
	Arsenic	mg/kg	3.95	0.598	1.49	
	Barium	mg/kg	190	0.0996	0.498	
	Beryllium	mg/kg	0.94	0.0996	0.498	
	Cadmium	mg/kg	0.282	0.0996	0.498	J
	Calcium	mg/kg	6800	3.59	9.96	
	Chromium	mg/kg	8.52	0.0996	0.498	B
	Cobalt	mg/kg	3.78	0.199	0.498	
	Copper	mg/kg	9.33	0.299	0.996	
	Iron	mg/kg	12600	1.79	9.96	
	Lead	mg/kg	11	0.249	0.996	
	Magnesium	mg/kg	4860	8.47	29.9	
	Manganese	mg/kg	400	0.199	0.996	
	Mercury	mg/kg	0.0111	0.00242	0.00966	
	Nickel	mg/kg	6.67	0.0996	0.498	B
	Potassium	mg/kg	6720	4.98	14.9	
	Selenium	mg/kg	0.598	0.598	1.49	U
	Silver	mg/kg	0.0996	0.0996	0.498	U
	Sodium	mg/kg	718	4.48	14.9	B
Thallium	mg/kg	0.498	0.498	1.99	U	
Vanadium	mg/kg	21.2	0.0996	0.498		
Zinc	mg/kg	39	0.199	0.996	B	

See notes at end of table.

**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-51	Aluminum	mg/kg	13200	6.8	20	
	Antimony	mg/kg	0.4	0.4	1	U
	Arsenic	mg/kg	4.6	0.6	1.5	
	Barium	mg/kg	160	0.1	0.5	
	Beryllium	mg/kg	0.885	0.1	0.5	
	Cadmium	mg/kg	0.279	0.1	0.5	J
	Calcium	mg/kg	4920	3.6	10	
	Chromium	mg/kg	8.22	0.1	0.5	B
	Cobalt	mg/kg	4.14	0.2	0.5	
	Copper	mg/kg	8.81	0.3	1	
	Iron	mg/kg	11800	1.8	10	
	Lead	mg/kg	13.8	0.25	1	
	Magnesium	mg/kg	4650	8.5	30	
	Manganese	mg/kg	549	0.2	1	
	Mercury	mg/kg	0.0128	0.00249	0.00997	
	Nickel	mg/kg	6.88	0.1	0.5	B
	Potassium	mg/kg	5760	5	15	
	Selenium	mg/kg	0.6	0.6	1.5	U
	Silver	mg/kg	0.1	0.1	0.5	U
	Sodium	mg/kg	578	4.5	15	B
Thallium	mg/kg	0.5	0.5	2	U	
Vanadium	mg/kg	19.8	0.1	0.5		
Zinc	mg/kg	35.1	0.2	1	B	
S-52	Aluminum	mg/kg	7500	6.67	19.6	
	Antimony	mg/kg	0.392	0.392	0.98	U
	Arsenic	mg/kg	3.96	0.588	1.47	
	Barium	mg/kg	92.7	0.098	0.49	
	Beryllium	mg/kg	0.508	0.098	0.49	
	Cadmium	mg/kg	0.137	0.098	0.49	J
	Calcium	mg/kg	2130	3.53	9.8	
	Chromium	mg/kg	4.22	0.098	0.49	B
	Cobalt	mg/kg	2.24	0.196	0.49	
	Copper	mg/kg	4.32	0.294	0.98	
	Iron	mg/kg	6960	1.76	9.8	
	Lead	mg/kg	8.12	0.245	0.98	
	Magnesium	mg/kg	2280	8.33	29.4	
	Manganese	mg/kg	338	0.196	0.98	
	Mercury	mg/kg	0.00858	0.00235	0.00942	J
	Nickel	mg/kg	3.41	0.098	0.49	B
	Potassium	mg/kg	2750	4.9	14.7	
	Selenium	mg/kg	0.588	0.588	1.47	U
	Silver	mg/kg	0.098	0.098	0.49	U
	Sodium	mg/kg	186	4.41	14.7	B
Thallium	mg/kg	0.49	0.49	1.96	U	
Vanadium	mg/kg	11.7	0.098	0.49		
Zinc	mg/kg	22	0.196	0.98	B	

See notes at end of table.

**TABLE A-11. Non-radiological Results for On-Site Soil Sampling Locations, 2005 (concluded)**

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-53	Aluminum	mg/kg	6820	6.77	19.9	
	Antimony	mg/kg	1.22	0.398	0.996	
	Arsenic	mg/kg	5.84	0.598	1.49	
	Barium	mg/kg	158	0.0996	0.498	
	Beryllium	mg/kg	0.0996	0.0996	0.498	U
	Cadmium	mg/kg	0.212	0.0996	0.498	J
	Calcium	mg/L	0.036	0.036	0.1	U
	Chromium	mg/kg	3.95	0.0996	0.498	B
	Cobalt	mg/kg	1.88	0.199	0.498	
	Copper	mg/L	0.003	0.003	0.01	U
	Iron	mg/kg	7260	1.79	9.96	
	Lead	mg/kg	5.86	0.249	0.996	
	Magnesium	mg/L	0.085	0.085	0.3	U
	Manganese	mg/L	0.002	0.002	0.01	U
	Mercury	mg/kg	0.00491	0.00234	0.00935	J
	Nickel	mg/kg	2.96	0.0996	0.498	B
	Potassium	mg/kg	2880	4.98	14.9	
	Selenium	mg/L	0.006	0.006	0.015	U
	Silver	mg/L	0.001	0.001	0.005	U
	Sodium	mg/kg	311	4.48	14.9	
Thallium	mg/L	0.005	0.005	0.02	U	
Vanadium	mg/L	0.001	0.001	0.005	U	
Zinc	mg/L	0.00359	0.002	0.01	J	

**NOTES:** mg/kg = milligrams per kilogram

B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

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**TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005**

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%
Off-Site C-29	Aluminum	mg/kg	068103-001	10800	6.77	19.9		10500	10900	10733.33	208.17	0.02
	Aluminum	mg/kg	068103-002	10500	6.76	19.9						
	Aluminum	mg/kg	068103-003	10900	6.71	19.7						
	Antimony	mg/kg	068103-001	2.65	0.398	0.996		2.65	3.02	2.85	0.19	0.07
	Antimony	mg/kg	068103-002	3.02	0.398	0.994						
	Antimony	mg/kg	068103-003	2.87	0.394	0.986						
	Arsenic	mg/kg	068103-001	20.4	0.598	1.49		19.1	21.3	20.27	1.11	0.05
	Arsenic	mg/kg	068103-002	19.1	0.596	1.49						
	Arsenic	mg/kg	068103-003	21.3	0.592	1.48						
	Barium	mg/kg	068103-001	350	0.0996	0.498		312	350	330	19.08	0.06
	Barium	mg/kg	068103-002	312	0.0994	0.497						
	Barium	mg/kg	068103-003	328	0.0986	0.493						
	Beryllium	mg/kg	068103-001	0.284	0.0996	0.498	J	0.28	0.37	0.33	0.04	
	Beryllium	mg/kg	068103-002	0.369	0.0994	0.497	J					
	Beryllium	mg/kg	068103-003	0.326	0.0986	0.493	J					
	Cadmium	mg/kg	068103-001	0.927	0.0996	0.498		0.85	1.01	0.93	0.08	0.09
	Cadmium	mg/kg	068103-002	0.852	0.0994	0.497						
	Cadmium	mg/kg	068103-003	1.01	0.0986	0.493						
	Calcium	mg/kg	068103-001	27000	3.59	9.96		26600	27100	26900	264.58	
	Calcium	mg/kg	068103-002	27100	3.58	9.94						
	Calcium	mg/kg	068103-003	26600	3.55	9.86	B					
	Chromium	mg/kg	068103-001	9.68	0.0996	0.498	B	8.82	9.68	9.39	0.5	
	Chromium	mg/kg	068103-002	8.82	0.0994	0.497	B					
	Chromium	mg/kg	068103-003	9.68	0.0986	0.493						
	Cobalt	mg/kg	068103-001	3.98	0.199	0.498		3.98	4.44	4.2	0.23	0.05
	Cobalt	mg/kg	068103-002	4.44	0.199	0.497						
	Cobalt	mg/kg	068103-003	4.19	0.197	0.493						
	Copper	mg/kg	068103-001	17.3	0.299	0.996		17.3	17.9	17.67	0.32	0.02
	Copper	mg/kg	068103-002	17.8	0.298	0.994						
	Copper	mg/kg	068103-003	17.9	0.296	0.986						
Iron	mg/kg	068103-001	12300	1.79	9.96		12300	12800	12500	264.58	0.02	
Iron	mg/kg	068103-002	12800	1.79	9.94							
Iron	mg/kg	068103-003	12400	1.78	9.86							

See notes at end of table.

TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%
C-29 (cont.)	Lead	mg/kg	068103-001	27.6	0.249	0.996		15.7	29.3	24.2	7.41	0.31
	Lead	mg/kg	068103-002	15.7	0.249	0.994						
	Lead	mg/kg	068103-003	29.3	0.247	0.986						
	Magnesium	mg/kg	068103-001	9260	8.47	29.9		9260	9850	9606.67	308.27	0.03
	Magnesium	mg/kg	068103-002	9710	8.45	29.8						
	Magnesium	mg/kg	068103-003	9850	8.38	29.6						
	Manganese	mg/kg	068103-001	369	0.199	0.996		310	380	353	37.64	0.11
	Manganese	mg/kg	068103-002	310	0.199	0.994						
	Manganese	mg/kg	068103-003	380	0.197	0.986						
	Mercury	mg/kg	068103-001	0.056	0.00231	0.00924		0.02	0.06	0.03	0.02	
	Mercury	mg/kg	068103-002	0.0181	0.00237	0.00948						
	Mercury	mg/kg	068103-003	0.0283	0.00244	0.00974	B					
	Nickel	mg/kg	068103-001	18.2	0.0996	0.498	B	18.2	21.7	20	1.75	
	Nickel	mg/kg	068103-002	21.7	0.0994	0.497	B					
	Nickel	mg/kg	068103-003	20.1	0.0986	0.493	B					
	Potassium	mg/kg	068103-001	4170	4.98	14.9		3870	4170	4013.33	150.44	0.04
	Potassium	mg/kg	068103-002	3870	4.97	14.9						
	Potassium	mg/kg	068103-003	4000	4.93	14.8						
	Selenium	mg/kg	068103-001	0.598	0.598	1.49	U	0.59	0.72	0.64	0.07	
	Selenium	mg/kg	068103-002	0.718	0.596	1.49	J					
	Selenium	mg/kg	068103-003	0.592	0.592	1.48	U					
	Silver	mg/kg	068103-001	0.0996	0.0996	0.498	U	0.1	0.11	0.1	0.01	
	Silver	mg/kg	068103-002	0.111	0.0994	0.497	J					
Silver	mg/kg	068103-003	0.0986	0.0986	0.493	BU						
Sodium	mg/kg	068103-001	402	4.48	14.9		223	402	287.67	99.3	0.35	
Sodium	mg/kg	068103-002	223	4.47	14.9							
Sodium	mg/kg	068103-003	238	4.44	14.8							
Thallium	mg/kg	068103-001	1.37	0.498	1.99	J	1.19	1.37	1.26	0.09		
Thallium	mg/kg	068103-002	1.19	0.497	1.99	J						
Thallium	mg/kg	068103-003	1.23	0.493	1.97	J						
Vanadium	mg/kg	068103-001	47.2	0.0996	0.498		40.8	47.6	45.2	3.82	0.08	
Vanadium	mg/kg	068103-002	40.8	0.0994	0.497							
Vanadium	mg/kg	068103-003	47.6	0.0986	0.493							
Zinc	mg/kg	068103-001	96.5	0.199	0.996		89.4	99.7	95.2	5.27	0.06	
Zinc	mg/kg	068103-002	89.4	0.199	0.994							
Zinc	mg/kg	068103-003	99.7	0.197	0.986							

See notes at end of table.



**TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%	
<b>Perimeter</b>													
P-11	Aluminum	mg/kg	068127-001	5870	6.67	19.6		5610	7390	6290	961.46	0.15	
	Aluminum	mg/kg	068127-002	7390	6.72	19.8							
	Aluminum	mg/kg	068127-003	5610	6.67	19.6							
	Antimony	mg/kg	068127-001	0.392	0.392	0.98	U	0.39	0.41	0.4	0.01		
	Antimony	mg/kg	068127-002	0.395	0.395	0.988	U						
	Antimony	mg/kg	068127-003	0.412	0.392	0.98	J						
	Arsenic	mg/kg	068127-001	7.82	0.588	1.47		7.82	12.4	10.17	2.29	0.23	
	Arsenic	mg/kg	068127-002	12.4	0.593	1.48							
	Arsenic	mg/kg	068127-003	10.3	0.588	1.47							
	Barium	mg/kg	068127-001	139	0.098	0.49		139	200	163	32.51	0.2	
	Barium	mg/kg	068127-002	200	0.0988	0.494							
	Barium	mg/kg	068127-003	150	0.098	0.49							
	Beryllium	mg/kg	068127-001	0.684	0.098	0.49		0.68	1	0.82	0.16	0.2	
	Beryllium	mg/kg	068127-002	1	0.0988	0.494							
	Beryllium	mg/kg	068127-003	0.78	0.098	0.49							
	Cadmium	mg/kg	068127-001	0.134	0.098	0.49	J	0.13	0.27	0.2	0.07		
	Cadmium	mg/kg	068127-002	0.269	0.0988	0.494	J						
	Cadmium	mg/kg	068127-003	0.188	0.098	0.49	J						
	Calcium	mg/kg	068127-001	1820	3.53	9.8		1760	2060	1880	158.75	0.08	
	Calcium	mg/kg	068127-002	2060	3.56	9.88							
	Calcium	mg/kg	068127-003	1760	3.53	9.8							
	Chromium	mg/kg	068127-001	3.01	0.098	0.49	B	3.01	5.64	3.91	1.5		
	Chromium	mg/kg	068127-002	5.64	0.0988	0.494	B						
	Chromium	mg/kg	068127-003	3.07	0.098	0.49	B						
	Cobalt	mg/kg	068127-001	3.43	0.196	0.49		3.43	4.78	3.9	0.76	0.2	
	Cobalt	mg/kg	068127-002	4.78	0.198	0.494							
	Cobalt	mg/kg	068127-003	3.49	0.196	0.49							
Copper	mg/kg	068127-001	5.96	0.294	0.98		5.96	6.46	6.24	0.25	0.04		
Copper	mg/kg	068127-002	6.29	0.296	0.988								
Copper	mg/kg	068127-003	6.46	0.294	0.98								
Iron	mg/kg	068127-001	10500	1.76	9.8		10500	15000	12733.33	2250.19	0.18		
Iron	mg/kg	068127-002	15000	1.78	9.88								
Iron	mg/kg	068127-003	12700	1.76	9.8								
Lead	mg/kg	068127-001	14.2	0.245	0.98		14.2	28.2	19.37	7.69	0.4		
Lead	mg/kg	068127-002	28.2	0.247	0.988								
Lead	mg/kg	068127-003	15.7	0.245	0.98								

See notes at end of table.

**TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%	
<b>Off-Site</b>													
P-11 (cont.)	Magnesium	mg/kg	068127-001	1610	8.33	29.4		1530	2160	1766.67	342.98	0.19	
	Magnesium	mg/kg	068127-002	2160	8.4	29.6							
	Magnesium	mg/kg	068127-003	1530	8.33	29.4							
	Manganese	mg/kg	068127-001	437	0.196	0.98		437	651	520.33	114.58	0.22	
	Manganese	mg/kg	068127-002	651	0.198	0.988							
	Manganese	mg/kg	068127-003	473	0.196	0.98							
	Mercury	mg/kg	068127-001	0.0183	0.00242	0.00968		0.01	0.02	0.01	0	0	0.25
	Mercury	mg/kg	068127-002	0.0131	0.00249	0.00995							
	Mercury	mg/kg	068127-003	0.0115	0.00246	0.00985							
	Nickel	mg/kg	068127-001	2.69	0.098	0.49	B	2.69	3.58	3.01	0.49	0.49	
	Nickel	mg/kg	068127-002	3.58	0.0988	0.494	B						
	Nickel	mg/kg	068127-003	2.77	0.098	0.49	B						
	Potassium	mg/kg	068127-001	2460	4.9	14.7		2440	3000	2633.33	317.7	317.7	0.12
	Potassium	mg/kg	068127-002	3000	4.94	14.8							
	Potassium	mg/kg	068127-003	2440	4.9	14.7							
	Selenium	mg/kg	068127-001	0.588	0.588	1.47	U	0.59	0.68	0.62	0.05	0.05	
	Selenium	mg/kg	068127-002	0.593	0.593	1.48	U						
	Selenium	mg/kg	068127-003	0.675	0.588	1.47	J						
	Silver	mg/kg	068127-001	0.098	0.098	0.49	U	0.1	0.12	0.1	0.01	0.01	
	Silver	mg/kg	068127-002	0.0988	0.0988	0.494	U						
	Silver	mg/kg	068127-003	0.115	0.098	0.49	J						
	Sodium	mg/kg	068127-001	117	4.41	14.7	B	117	163	134	25.24	25.24	
	Sodium	mg/kg	068127-002	163	4.45	14.8	B						
Sodium	mg/kg	068127-003	122	4.41	14.7	B							
Thallium	mg/kg	068127-001	0.49	0.49	1.96	U	0.49	0.49	0.49	0	0		
Thallium	mg/kg	068127-002	0.494	0.494	1.98	U							
Thallium	mg/kg	068127-003	0.49	0.49	1.96	U							
Vanadium	mg/kg	068127-001	11.3	0.098	0.49		11.3	15.9	13.1	2.46	2.46	0.19	
Vanadium	mg/kg	068127-002	15.9	0.0988	0.494								
Vanadium	mg/kg	068127-003	12.1	0.098	0.49								
Zinc	mg/kg	068127-001	34.1	0.196	0.98	B	34.1	46	41.8	6.68	6.68		
Zinc	mg/kg	068127-002	46	0.198	0.988	B							
Zinc	mg/kg	068127-003	45.3	0.196	0.98	B							

See notes at end of table.

**TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%
<b>Various On-Site</b>												
S-03	Aluminum	mg/kg	068114-001	8360	6.68	19.6		8130	8900	8463.33	395.26	0.05
	Aluminum	mg/kg	068114-002	8130	6.79	20						
	Aluminum	mg/kg	068114-003	8900	6.8	20						
	Antimony	mg/kg	068114-001	0.393	0.393	0.982	U	0.39	0.6	0.51	0.11	
	Antimony	mg/kg	068114-002	0.6	0.399	0.998	J					
	Antimony	mg/kg	068114-003	0.55	0.4	1	J					
	Arsenic	mg/kg	068114-001	6.06	0.589	1.47		4.82	6.06	5.39	0.63	0.12
	Arsenic	mg/kg	068114-002	4.82	0.599	1.5						
	Arsenic	mg/kg	068114-003	5.29	0.6	1.5						
	Barium	mg/kg	068114-001	101	0.0982	0.491		96.3	101	98.6	2.35	0.02
	Barium	mg/kg	068114-002	96.3	0.0998	0.499						
	Barium	mg/kg	068114-003	98.5	0.1	0.5						
	Beryllium	mg/kg	068114-001	0.0982	0.0982	0.491	U	0.1	0.1	0.1	0	
	Beryllium	mg/kg	068114-002	0.0998	0.0998	0.499	U					
	Beryllium	mg/kg	068114-003	0.1	0.1	0.5	U					
	Cadmium	mg/kg	068114-001	0.142	0.0982	0.491	J	0.13	0.17	0.15	0.02	
	Cadmium	mg/kg	068114-002	0.134	0.0998	0.499	J					
	Cadmium	mg/kg	068114-003	0.174	0.1	0.5	J					
	Calcium	mg/kg	068114-001	2250	3.54	9.82	B	2070	2250	2156.67	90.18	
	Calcium	mg/kg	068114-002	2070	3.59	9.98	B					
	Calcium	mg/kg	068114-003	2150	3.6	10	B					
	Chromium	mg/kg	068114-001	4.93	0.0982	0.491		4.92	5.43	5.09	0.29	0.06
	Chromium	mg/kg	068114-002	4.92	0.0998	0.499						
	Chromium	mg/kg	068114-003	5.43	0.1	0.5						
	Cobalt	mg/kg	068114-001	2.71	0.196	0.491		2.63	2.82	2.72	0.1	0.04
	Cobalt	mg/kg	068114-002	2.63	0.2	0.499						
	Cobalt	mg/kg	068114-003	2.82	0.2	0.5						
Copper	mg/kg	068114-001	5.63	0.295	0.982		5.63	6.29	5.9	0.35	0.06	
Copper	mg/kg	068114-002	5.77	0.299	0.998							
Copper	mg/kg	068114-003	6.29	0.3	1							
Iron	mg/kg	068114-001	8710	1.77	9.82		8630	9070	8803.33	234.38	0.03	
Iron	mg/kg	068114-002	8630	1.8	9.98							
Iron	mg/kg	068114-003	9070	1.8	10							
Lead	mg/kg	068114-001	8.54	0.246	0.982		8.54	9.28	8.96	0.38	0.04	
Lead	mg/kg	068114-002	9.05	0.25	0.998							
Lead	mg/kg	068114-003	9.28	0.25	1							

See notes at end of table.

TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%
S-03 (cont.)	Magnesium	mg/kg	068114-001	2520	8.35	29.5		2380	2670	2523.33	145.03	0.06
	Magnesium	mg/kg	068114-002	2380	8.48	29.9						
	Magnesium	mg/kg	068114-003	2670	8.5	30						
	Manganese	mg/kg	068114-001	342	0.196	0.982		338	354	344.67	8.33	0.02
	Manganese	mg/kg	068114-002	338	0.2	0.998						
	Manganese	mg/kg	068114-003	354	0.2	1						
	Mercury	mg/kg	068114-001	0.0107	0.00243	0.00971	B	0.01	0.01	0.01	0	
	Mercury	mg/kg	068114-002	0.0102	0.00235	0.00942	B					
	Mercury	mg/kg	068114-003	0.00911	0.00231	0.00926	BJ					
	Nickel	mg/kg	068114-001	3.77	0.0982	0.491	B	3.75	4.21	3.91	0.26	
	Nickel	mg/kg	068114-002	3.75	0.0998	0.499	B					
	Nickel	mg/kg	068114-003	4.21	0.1	0.5	B					
	Potassium	mg/kg	068114-001	2660	4.91	14.7		2530	2770	2653.33	120.14	0.05
	Potassium	mg/kg	068114-002	2530	4.99	15						
	Potassium	mg/kg	068114-003	2770	5	15						
	Selenium	mg/kg	068114-001	0.589	0.589	1.47	U	0.59	0.6	0.6	0.01	
	Selenium	mg/kg	068114-002	0.599	0.599	1.5	U					
	Selenium	mg/kg	068114-003	0.6	0.6	1.5	U					
	Silver	mg/kg	068114-001	0.0982	0.0982	0.491	BU	0.1	0.1	0.1	0	
	Silver	mg/kg	068114-002	0.0998	0.0998	0.499	BU					
	Silver	mg/kg	068114-003	0.1	0.1	0.5	BU					
	Sodium	mg/kg	068114-001	179	4.42	14.7		174	179	176.33	2.52	0.01
	Sodium	mg/kg	068114-002	176	4.49	15						
	Sodium	mg/kg	068114-003	174	4.5	15						
	Thallium	mg/kg	068114-001	0.491	0.491	1.96	U	0.49	0.5	0.5	0	
	Thallium	mg/kg	068114-002	0.499	0.499	2	U					
	Thallium	mg/kg	068114-003	0.5	0.5	2	U					
	Vanadium	mg/kg	068114-001	15.2	0.0982	0.491		15.2	16.6	15.9	0.7	0.04
Vanadium	mg/kg	068114-002	15.9	0.0998	0.499							
Vanadium	mg/kg	068114-003	16.6	0.1	0.5							
Zinc	mg/kg	068114-001	25.7	0.196	0.982		25.7	27.4	26.53	0.85	0.03	
Zinc	mg/kg	068114-002	26.5	0.2	0.998							
Zinc	mg/kg	068114-003	27.4	0.2	1							

See notes at end of table.

TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%
S-09 Off-Site	Aluminum	mg/kg	068111-001	14000	6.67	19.6		11200	14000	12566.67	1401.19	0.11
	Aluminum	mg/kg	068111-002	11200	6.69	19.7						
	Aluminum	mg/kg	068111-003	12500	6.72	19.8						
	Antimony	mg/kg	068111-001	0.414	0.392	0.98	J	0.41	0.85	0.69	0.24	
	Antimony	mg/kg	068111-002	0.794	0.394	0.984	J					
	Antimony	mg/kg	068111-003	0.849	0.395	0.988	J					
	Arsenic	mg/kg	068111-001	6.95	0.588	1.47		6.95	7.99	7.58	0.55	0.07
	Arsenic	mg/kg	068111-002	7.8	0.591	1.48						
	Arsenic	mg/kg	068111-003	7.99	0.593	1.48						
	Barium	mg/kg	068111-001	147	0.098	0.49		138	147	141	5.2	0.04
	Barium	mg/kg	068111-002	138	0.0984	0.492						
	Barium	mg/kg	068111-003	138	0.0988	0.494						
	Beryllium	mg/kg	068111-001	0.102	0.098	0.49	J	0.1	0.14	0.11	0.02	
	Beryllium	mg/kg	068111-002	0.139	0.0984	0.492	J					
	Beryllium	mg/kg	068111-003	0.0988	0.0988	0.494	U					
	Cadmium	mg/kg	068111-001	0.232	0.098	0.49	J	0.18	0.31	0.24	0.07	
	Cadmium	mg/kg	068111-002	0.314	0.0984	0.492	J					
	Cadmium	mg/kg	068111-003	0.183	0.0988	0.494	J					
	Calcium	mg/kg	068111-001	6060	3.53	9.8	B	6060	8260	6826.67	1242.31	
	Calcium	mg/kg	068111-002	8260	3.54	9.84	B					
	Calcium	mg/kg	068111-003	6160	3.56	9.88	B					
	Chromium	mg/kg	068111-001	9.18	0.098	0.49		8.07	9.18	8.48	0.61	0.07
	Chromium	mg/kg	068111-002	8.07	0.0984	0.492						
	Chromium	mg/kg	068111-003	8.2	0.0988	0.494						
	Cobalt	mg/kg	068111-001	6.26	0.196	0.49		5.87	6.26	6.04	0.2	0.03
	Cobalt	mg/kg	068111-002	5.99	0.197	0.492						
	Cobalt	mg/kg	068111-003	5.87	0.198	0.494						
	Copper	mg/kg	068111-001	10.4	0.294	0.98		9.34	10.4	9.69	0.61	0.06
Copper	mg/kg	068111-002	9.34	0.295	0.984							
Copper	mg/kg	068111-003	9.34	0.296	0.988							
Iron	mg/kg	068111-001	16900	1.76	9.8		16100	16900	16466.67	404.15	0.02	
Iron	mg/kg	068111-002	16100	1.77	9.84							
Iron	mg/kg	068111-003	16400	1.78	9.88							
Lead	mg/kg	068111-001	12.8	0.245	0.98		12.4	12.9	12.7	0.26	0.02	
Lead	mg/kg	068111-002	12.4	0.246	0.984							
Lead	mg/kg	068111-003	12.9	0.247	0.988							

See notes at end of table.

**TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%		
S-09 (cont.)	Off-Site	Magnesium	mg/kg	068111-001	5450	8.33	29.4		4620	5043.33	415.25	0.08		
		Magnesium	mg/kg	068111-002	4620	8.37	29.5							
		Magnesium	mg/kg	068111-003	5060	8.4	29.6							
		Manganese	mg/kg	068111-001	429	0.196	0.98		394	429	414.67	18.34	0.04	
		Manganese	mg/kg	068111-002	394	0.197	0.984							
		Manganese	mg/kg	068111-003	421	0.198	0.988							
		Mercury	mg/kg	068111-001	0.0147	0.00247	0.00988	B	0.01	0.01	0.01	0		
		Mercury	mg/kg	068111-002	0.0141	0.00231	0.00924	B						
		Mercury	mg/kg	068111-003	0.0128	0.00233	0.0093	B						
		Nickel	mg/kg	068111-001	7	0.098	0.49	B	6.06	7	6.65	0.52		
		Nickel	mg/kg	068111-002	6.06	0.0984	0.492	B						
		Nickel	mg/kg	068111-003	6.9	0.0988	0.494	B						
		Potassium	mg/kg	068111-001	4720	4.9	14.7		3740	4720	4133.33	517.82	0.13	
		Potassium	mg/kg	068111-002	3740	4.92	14.8							
		Potassium	mg/kg	068111-003	3940	4.94	14.8							
		Selenium	mg/kg	068111-001	0.588	0.588	1.47	U	0.59	2.95	1.38	1.36		
		Selenium	mg/kg	068111-002	2.95	2.95	7.38	U						
		Selenium	mg/kg	068111-003	0.593	0.593	1.48	U						
		Silver	mg/kg	068111-001	0.098	0.098	0.49	BU	0.1	0.1	0.1	0		
		Silver	mg/kg	068111-002	0.0984	0.0984	0.492	BU						
		Silver	mg/kg	068111-003	0.0988	0.0988	0.494	BU						
		Sodium	mg/kg	068111-001	236	4.41	14.7		206	236	220.33	15.04	0.07	
		Sodium	mg/kg	068111-002	219	4.43	14.8							
		Sodium	mg/kg	068111-003	206	4.45	14.8							
		Thallium	mg/kg	068111-001	0.49	0.49	1.96	U	0.49	0.78	0.63	0.15		
		Thallium	mg/kg	068111-002	0.608	0.492	1.97	J						
		Thallium	mg/kg	068111-003	0.783	0.494	1.98	J						
		Vanadium	mg/kg	068111-001	28.5	0.098	0.49		26.2	28.5	27.2	1.18	0.04	
		Vanadium	mg/kg	068111-002	26.2	0.0984	0.492							
		Vanadium	mg/kg	068111-003	26.9	0.0988	0.494							
		Zinc	mg/kg	068111-001	43.6	0.196	0.98		39	43.6	41.9	2.52	0.06	
		Zinc	mg/kg	068111-002	39	0.197	0.984							
		Zinc	mg/kg	068111-003	43.1	0.198	0.988							

See notes at end of table.

**TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%
<b>South Plume Area</b>												
S-48	Aluminum	mg/kg	068120-001	15000	6.77	19.9		14500	15000	14833.33	288.68	0.02
	Aluminum	mg/kg	068120-002	15000	6.71	19.7						
	Aluminum	mg/kg	068120-003	14500	6.75	19.8						
	Antimony	mg/kg	068120-001	0.398	0.398	0.996	U	0.39	0.4	0.4	0	
	Antimony	mg/kg	068120-002	0.394	0.394	0.986	U					
	Antimony	mg/kg	068120-003	0.397	0.397	0.992	U					
	Arsenic	mg/kg	068120-001	4.26	0.598	1.49		4.12	4.53	4.3	0.21	0.05
	Arsenic	mg/kg	068120-002	4.53	0.592	1.48						
	Arsenic	mg/kg	068120-003	4.12	0.595	1.49						
	Barium	mg/kg	068120-001	299	0.0996	0.498		194	299	235.33	55.95	0.24
	Barium	mg/kg	068120-002	194	0.0986	0.493						
	Barium	mg/kg	068120-003	213	0.0992	0.496						
	Beryllium	mg/kg	068120-001	0.921	0.0996	0.498		0.92	0.97	0.94	0.03	0.03
	Beryllium	mg/kg	068120-002	0.97	0.0986	0.493						
	Beryllium	mg/kg	068120-003	0.93	0.0992	0.496						
	Cadmium	mg/kg	068120-001	0.314	0.0996	0.498	J	0.3	0.32	0.31	0.01	
	Cadmium	mg/kg	068120-002	0.296	0.0986	0.493	J					
	Cadmium	mg/kg	068120-003	0.324	0.0992	0.496	J					
	Calcium	mg/kg	068120-001	9030	3.59	9.96		5430	9030	6836.67	1924.61	0.28
	Calcium	mg/kg	068120-002	5430	3.55	9.86						
	Calcium	mg/kg	068120-003	6050	3.57	9.92						
	Chromium	mg/kg	068120-001	7.92	0.0996	0.498	B	7.92	9.11	8.65	0.64	
	Chromium	mg/kg	068120-002	8.91	0.0986	0.493	B					
	Chromium	mg/kg	068120-003	9.11	0.0992	0.496	B					
	Cobalt	mg/kg	068120-001	3.58	0.199	0.498		3.58	4	3.85	0.24	0.06
	Cobalt	mg/kg	068120-002	4	0.197	0.493						
	Cobalt	mg/kg	068120-003	3.98	0.198	0.496						
	Copper	mg/kg	068120-001	8.56	0.299	0.996		8.56	9.16	8.92	0.32	0.04
Copper	mg/kg	068120-002	9.16	0.296	0.986							
Copper	mg/kg	068120-003	9.05	0.298	0.992							
Iron	mg/kg	068120-001	12100	1.79	9.96		12100	13800	13033.33	862.17	0.07	
Iron	mg/kg	068120-002	13200	1.78	9.86							
Iron	mg/kg	068120-003	13800	1.79	9.92							
Lead	mg/kg	068120-001	10.5	0.249	0.996		10.5	11.7	11.27	0.67	0.06	
Lead	mg/kg	068120-002	11.7	0.247	0.986							
Lead	mg/kg	068120-003	11.6	0.248	0.992							

See notes at end of table.

**TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (continued)**

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%	
S-48 (cont.)	Magnesium	mg/kg	068120-001	4830	8.47	29.9		4830	5070	4980	130.77	0.03	
	Magnesium	mg/kg	068120-002	5070	8.38	29.6							
	Magnesium	mg/kg	068120-003	5040	8.43	29.8							
	Manganese	mg/kg	068120-001	392	0.199	0.996		392	438	416.33	23.12	0.06	
	Manganese	mg/kg	068120-002	419	0.197	0.986							
	Manganese	mg/kg	068120-003	438	0.198	0.992							
	Mercury	mg/kg	068120-001	0.0136	0.00247	0.00988		0.01	0.02	0.01	0	0	0.11
	Mercury	mg/kg	068120-002	0.0164	0.0024	0.00958							
	Mercury	mg/kg	068120-003	0.0137	0.00243	0.00972							
	Nickel	mg/kg	068120-001	6.18	0.0996	0.498	B	6.18	6.99	6.69	0.45		
	Nickel	mg/kg	068120-002	6.91	0.0986	0.493	B						
	Nickel	mg/kg	068120-003	6.99	0.0992	0.496	B						
	Potassium	mg/kg	068120-001	7550	4.98	14.9		5860	7550	6486.67	925.76		0.14
	Potassium	mg/kg	068120-002	6050	4.93	14.8							
	Potassium	mg/kg	068120-003	5860	4.96	14.9							
	Selenium	mg/kg	068120-001	0.598	0.598	1.49	U	0.59	0.6	0.6	0		
	Selenium	mg/kg	068120-002	0.592	0.592	1.48	U						
	Selenium	mg/kg	068120-003	0.595	0.595	1.49	U						
	Silver	mg/kg	068120-001	0.0996	0.0996	0.498	U	0.1	0.13	0.11	0.01		
	Silver	mg/kg	068120-002	0.127	0.0986	0.493	J						
Silver	mg/kg	068120-003	0.105	0.0992	0.496	J							
Sodium	mg/kg	068120-001	612	4.48	14.9	B	488	612	564.67	67			
Sodium	mg/kg	068120-002	488	4.44	14.8	B							
Sodium	mg/kg	068120-003	594	4.46	14.9	B							

See notes at end of table.



**TABLE A-12. Non-radiological Replicate Sampling for Soil Sampling Locations, 2005 (concluded)**

Location	Analyte	Units	Sample ID	Result	Decision Level	Detection Limit	Lab Qualifier	Min	Max	Avg	Std Dev	CV%
Off-Site S-48 (Cont.)	Thallium	mg/kg	068120-001	0.498	0.498	1.99	U	0.49	0.5	0.5	0	
	Thallium	mg/kg	068120-002	0.493	0.493	1.97	U					
	Thallium	mg/kg	068120-003	0.496	0.496	1.98	U					
	Vanadium	mg/kg	068120-001	22.2	0.0996	0.498		22.2	26.4	23.97	2.18	0.09
	Vanadium	mg/kg	068120-002	23.3	0.0986	0.493						
	Vanadium	mg/kg	068120-003	26.4	0.0992	0.496						
	Zinc	mg/kg	068120-001	36	0.199	0.996	B	36	41.2	38.23	2.68	
	Zinc	mg/kg	068120-002	37.5	0.197	0.986	B					
	Zinc	mg/kg	068120-003	41.2	0.198	0.992	B					

**NOTES:** pCi/g = picocurie per gram

ug/g = microgram per gram

mg/kg = milligrams per kilogram

B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.

U = The analyte was analyzed for, but not detected, below this concentration.

For organic and inorganic analytes the result is less than the effective Decision Level.

For radiochemical analytes the result is less than the decision level.

X = presumptive evidence that analyte is not present.

Std Dev = Standard Deviation

CV = Coefficient of variation, not calculated for B, J, or U values

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**TABLE A-13.** Various Reference Values for Metals-in-Soil

Analyte	NV Soil Concentrations		EPA Region 9 PRGs (Soil Screening Levels)		US Soil Concentrations	
	Lower Limit	Upper Limit	Residential	Industrial	Lower Limit	Upper Limit
Aluminum	5,000	100,000	76,000	100,000	4,500	100,000
Antimony	< 1.0	1.0	31	410	0.25	0.6
Arsenic	2.9	24	0.39	1.6	1	93
Barium	150	3,000	5,400	67,000	20	1,500
Beryllium	ND	5.0	150	1,400	0.04	2.54
Cadmium	ND	11	37	450	0.41	0.57
Calcium	600	320,000	n/a	n/a	n/a	n/a
Chromium	7.0	150	210	450	7	1,500
Cobalt	ND	20	900	1,900	3	50
Copper	7	150	3,100	41,000	3	300
Iron	1000	100,000	23,000	100,000	5,000	50,000
Lead	< 10	700	400	800	10	70
Magnesium	300	100,000	n/a	n/a	n/a	n/a
Manganese	30	5,000	1,800	19,000	20	3,000
Mercury	0.01	0.82	6	62	0.02	1.5
Molybdenum	ND	7.0	390	5,100	0.8	3.3
Nickel	5	50	1,600	20,000	5	150
Potassium	1,900	63,000	n/a	n/a	n/a	n/a
Selenium	< 0.1	1.1	390	5,100	0.1	4
Silica (Silicon)	150,000	440,000	n/a	n/a	24,000	368,000
Silver	0.5	5	390	5,100	0.2	3.2
Sodium	500	100,000	n/a	n/a	n/a	n/a
Strontium	100	1500	47,000	100,000	7	1,000
Thallium	n/a	n/a	5.2	67	0.02	2.8
Titanium	700	5,000	100,000	100,000	20	1,000
Vanadium	30	150	78	1,000	0.7	98
Zinc	10	2,100	23,000	100,000	13	300

NOTES: ND = not detectable  
n/a = not available

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# GLOSSARY



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## *A*

**Aeroballistics** – The study of the interaction of projectiles or high-speed vehicles with the atmosphere.

**Aerodynamics** – The science that deals with the motion of air and other gaseous fluids and with the forces acting on bodies when they move through such fluids or when such fluids move against or around the bodies.

**Am-241** – An alpha-ray emitter used as a radiation source in research.

**Ambient Air** – Any unconfined portion of the atmosphere: open air, surrounding air.

**Americium** – A chemical element, symbol Am, atomic number 95; the mass number of the isotope with the longest half-life is 243.

**Asbestos** – A mineral fiber that can pollute air or water and cause cancer or asbestosis when inhaled. Uses for asbestos-containing material include, but are not limited to, electrical and heat insulation, paint filler, reinforcing agents in rubber and plastics (e.g., tile mastic), and cement reinforcement.

## *B*

**Benchmarking** – 1. A point of reference from which measurements may be made 2. Something that serves as a standard by which others may be measured or judged 3. A standardized problem or test that serves as a basis for evaluation or comparison

**Best Management Practice** – The preferred methods and practices for managing operations.

## *C*

**Cesium** – A radioactive isotope of cesium used in radiation therapy.

**Chemical Oxygen Demand** – A measure of the oxygen required to oxidize all compounds, both organic and inorganic, in water.

**Coliform Organism** – Microorganisms found in the intestinal tract of humans and animals. Their presence in

water indicates fecal pollution and potentially adverse contamination by pathogens.

## *D*

**Decontamination** – Removal of harmful substances such as noxious chemicals, harmful bacteria or other organisms, or radioactive material from exposed individuals, rooms and furnishings in buildings, or the exterior environment.

**Demolition** – The act or process of wrecking or destroying, especially destruction by explosives.

**Depleted Uranium** – Uranium having a smaller percentage of uranium-235 than the 0.7% found in natural uranium.

**Diurnal** – 1. Relating to or occurring in a 24-hour period; daily. 2. Occurring or active during the daytime rather than at night: diurnal animals.

**Dose Assessment** – The process of determining radiological dose and uncertainty included in the dose estimate through the use of exposure scenarios, bioassay results, monitoring data, source term information, and pathway analysis.

**Dose Equivalent** – The product of the absorbed dose from ionizing radiation and such factors as account for biological differences due to the type of radiation and its distribution in the body in the body.

## *E*

**Ecology** – The relationship of living things to one another and their environment, or the study of such relationships.

**Environment, Safety and Health (ES&H)** – A program designed to protect and preserve the environment, and to ensure the safety and health of its employees, contractors, visitors, and the public.

**Environmental Assessment** – An environmental analysis prepared pursuant to the National Environmental Policy Act (NEPA) to determine whether a federal action would significantly affect the environment and thus require a more detailed environmental impact statement.

**Environmental Impact Statement** – A document required of federal agencies by the National Environmental Policy Act for major projects or legislative proposals significantly affecting the environment. A tool for decision making, it describes the positive and negative effects of the undertaking and cites alternative actions.

**Environmental Management** – A program designed to maintain compliance with EPA, state, local and DOE requirements.

**Environmental Management System** – A continuing cycle of planning, evaluating, implementing, and improving processes and actions undertaken to achieve environmental goals.

**Environmental Medium** – A major environmental category that surrounds or contacts humans, animals, plants, and other organisms (e.g. surface water, ground water, soil or air) and through which chemicals or pollutants move.

**Environmental Restoration** – A project chartered with the assessment and, if necessary, the remediation of inactive waste sites.

**Ephemeral Stream** – A stream channel which carries water only during and immediately after periods of rainfall or snowmelt.

## *F*

**Fauna** – 1. Animals, especially the animals of a particular region or period, considered as a group. 2. A catalog of the animals of a specific region or period.

**French Drain** – An underground passage for water, consisting of loose stones covered with earth.

## *G*

**Gamma-ray Spectrum** – The set of wavelengths or energies of gamma rays emitted by a given source.

**Gamma Spectroscopy** – A technique used to detect the emission of gamma radiation from radioactive materials.

**Geology** – The scientific study of the origin, history, and structure of the earth.

**Gross Alpha/Beta Particle Activity** – The total radioactivity due to alpha or beta particle emissions as inferred from measurements on a dry sample.

**Groundwater** – The supply of fresh water found beneath the Earth's surface, usually in aquifers, which supply wells and springs. Because ground water is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants or leaking underground storage tanks.

## *H*

**Herbicides** – A chemical pesticide designed to control or destroy plants, weeds, or grasses.

**Horst and Graben Topography** – A system of mountains and down-dropped fault valleys formed through regional extension.

**Hydrology** – The science dealing with the properties, distribution, and circulation of water.

## *I*

**Insecticides** – A pesticide compound specifically used to kill or prevent the growth of insects.

**Integrated Safety Management System** – Systematically integrates safety into management and work practices at all levels so that missions are accomplished while protecting the worker, the public, and the environment

## *M*

**Maximally Exposed Individual (MEI)** – The location of a member of the public which receives or has the potential to receive the maximum radiological dose from air emissions of a National Emissions Standards for Hazardous Air Pollutants (NESHAP) radionuclide source.

**Mixed Waste** – Radioactive waste that contains both source material, special nuclear material, or by-product material subject to the Atomic Energy Act of 1954, as



amended; and a hazardous component subject to the Resource Conservation and Recovery Act (RCRA), as amended.

## *N*

**NESHAP** – Emissions standards set by EPA for an air pollutant not covered by NAAQS that may cause an increase in fatalities or in serious, irreversible, or incapacitating illness. Primary standards are designed to protect human health, secondary standards to protect public welfare (e.g. building facades, visibility, crops, and domestic animals).

**National Environmental Policy Act (NEPA)** – The basic national charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy.

**Nitrates** – A compound containing nitrogen that can exist in the atmosphere or as a dissolved gas in water and which can have harmful effects on humans and animals. Nitrates in water can cause severe illness in infants and domestic animals. A plant nutrient and inorganic fertilizer, nitrate is found in septic systems, animal feed lots, agricultural fertilizers, manure, industrial waste waters, sanitary landfills, and garbage dumps.

**Nitrites** – 1. An intermediate in the process of nitrification. 2. Nitrous oxide salts used in food preservation.

## *P*

**Phenols** – Organic compounds that are byproducts of petroleum refining, tanning, and textile, dye, and resin manufacturing. Low concentrations cause taste and odor problems in water; higher concentrations can kill aquatic life and humans.

**Plutonium** – A radioactive metallic element chemically similar to uranium.

**Polychlorinated biphenyls** – PCB” and “PCBs” are chemical terms limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances that contains such substance. Because of their persistence, toxicity, and ecological damage via water pollution, their manufacture was discontinued in the U.S. in 1976.

**Potable Water** – Water free from impurities present in quantities sufficient to cause disease or harmful physiological effects.

## *R*

**Radioactive Waste** – Any waste that emits energy as rays, waves, streams or energetic particles. Radioactive materials are often mixed with hazardous waste, from nuclear reactors, research institutions, or hospitals.

**Radionuclide** – Radioactive particle, man-made (anthropogenic) or natural, with a distinct atomic weight number. Can have a long life as soil or water pollutant.

**Reportable Quantity** – Quantity of material or product compound or contaminant which when released to the environment is reportable to a regulatory agency.

**Rodenticides** – A chemical or agent used to destroy rats or other rodent pests, or to prevent them from damaging food, crops, etc.

## *S*

**Semi-volatile organic compounds** – Organic compounds that volatilize slowly at standard temperature (20 degrees C and 1 atm pressure).

**Solid Waste** – Any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities.

**Storm Water** – Water runoff from rainfall or snowmelt, including that discharged to the sanitary sewer system.

## *T*

**Thermoluminescent Dosimeters** – A device that monitors both the whole body and skin radiation dose to which a person has been exposed during the course of work. These same devices can also be used to measure environmental exposure rates.

**Total Recovered Petroleum Hydrocarbon** – A method for measuring petroleum hydrocarbons in samples of soil or water.

**Transuranic waste (TRU)** – Radioactive waste containing alpha-emitting radionuclides having an atomic number greater than 92, and a half-life greater than 20 years, in concentrations greater than 100 nCi/g.

**Trihalomethanes** – A chemical compound containing three halogen atoms substituted for the three hydrogen atoms normally present in a methane molecule. It can occur in chlorinated water as a result of reaction between organic materials in the water and chlorine added as a disinfectant.

**Tritium** – A rare radioactive hydrogen isotope with atomic mass 3 and half-life 12.5 years, prepared artificially for use as a tracer and as a constituent of hydrogen bombs.

## U

**Underground Storage Tanks** – A single tank or a combination of tanks, including underground pipes connected thereto, which are used to contain an accumulation of regulated substances, such as petroleum products, mineral oil, and chemicals, and the volume of which, including the volume of underground pipes connected thereto, is 10% or more beneath the surface of the ground.

**Uranium** – A heavy silvery-white metallic element, radioactive and toxic, easily oxidized, and having 14

known isotopes of which U 238 is the most abundant in nature. The element occurs in several minerals, including uraninite and carnotite, from which it is extracted and processed for use in research, nuclear fuels, and nuclear weapons.

## V

**Volatile Organic Compounds (VOC)** – Any organic compound that participates in atmospheric photochemical reactions except those designated by EPA as having negligible photochemical reactivity.

## W

**Waste Management** – The processes involved in dealing with the waste of humans and organisms, including minimization, handling, processing, storage, recycling, transport, and final disposal.

**Wastewater Effluent** – Wastewater--treated or untreated--that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

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