

Calendar Year 2002
*Annual Site Environmental Report for
Tonopah Test Range, Nevada and
Kauai Test Facility, Hawaii*



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Annual Site
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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 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, oversees TTR and KTF's operations. Sandia Corporation 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) 2002. 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 5400.1, *General Environmental Protection Program (DOE 1990)* and DOE Order 231.1, *Environment, Safety, and Health Reporting (DOE 1996)*.

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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.

If you are interested in reading chapter highlights, a one-page summary is provided at the beginning of each chapter for TTR (chapter summaries are not provided for KTF because document is one chapter in length).

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

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ACRONYMS AND ABBREVIATIONS

A	AEC	U.S. Atomic Energy Commission
	AIRFA	American Indian Religious Freedom Act
	AQC	Air Quality Compliance
	ARPA	Archaeological Resources Protection Act
	ASER	Annual Site Environmental Report
	AST	aboveground storage tank
B	BLM	U.S. Bureau of Land Management
	BMDO	Ballistic Missile Defense Organization
	BMP	Best Management Practice
	BSA	Bulk Storage Areas
C	CAA	Clean Air Act
	CAAA	Clean Air Act Amendments
	CAS	Corrective Action Site
	CAU	Corrective Action Unit
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFR	Code of Federal Regulations
	COD	chemical oxygen demand
	CWA	Clean Water Act
	CY	calendar year
D	DMR	Discharge Monitoring Report
	DoD	U.S. Department of Defense
	DOE	U.S. Department of Energy
	DRI	Desert Research Institute, Water Resource Center, University of Nevada System
	DU	depleted uranium
	E	EA
EDE		effective dose equivalent
EHS		extremely hazardous substance
EIS		Environmental Impact Statement
EM		Environmental Management (Department)
EO		Executive Order
EPA		U.S. Environmental Protection Agency
EPCRA		Emergency Planning and Community Right-to-Know Act
ER		Environmental Restoration
ES&H		Environment, Safety, and Health
ESA		Endangered Species Act
F	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
	FTU-1	Flight Test Unit 1
H	HAR	Hawaii Administrative Rules
	HQ	headquarters
I	ICP-20	Inductively Coupled Plasma-20 (stable metals)
	ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectrum

J	JASSM	Joint Air to Surface Stand-off Missile System
K	KTF	Kauai Test Facility
L	LDR	Land Disposal Restriction
	LLW	low-level waste
M	MBTA	Migratory Bird Treaty Act
	MDA	minimum detectable activity
	MOA	Memorandum of Agreement
	MEI	maximally exposed individual
	MSDS	Material Safety Data Sheet
	MW	mixed waste
N	NAEG	Nevada Applied Ecology Group
	NAFB	Nellis Air Force Base (Range Complex)
	NEDS	Non Explosive Destruction Site
	NDEP	Nevada Department of Environmental Protection
	NEPA	National Environmental Policy Act
	NESHAP	National Emission Standards for Hazardous Air Pollutants
	NFA	No Further Action
	NHPA	National Historic Preservation Act
	NNSA	National Nuclear Security Administration
	NOS	not otherwise specified
	NPDES	National Pollutant Discharge Elimination System
	NPL	National Priorities List
	N/R	Not required
	NSP	Non-covered Source Permit
	NSPS	New Source Performance Standard
	NSO	Nevada Site Office
	NTS	Nevada Test Site
	NTTR	Nevada Test and Training Range
	NV	Nevada
O	O&M	Operations and Maintenance
P	PA	Preliminary Assessment
	PCB	polychlorinated biphenyl
	PMRF	Pacific Missile Range Facility
	PMS	portable monitoring station
	PPE	personal protective equipment
	PSD	Prevention of Significant Deterioration
Q	QA	quality assurance
R	RBIFF	Reentry Body Impact Fuze Flight
	R&D	research and development
	RCRA	Resource Conservation and Recovery Act
	ROD	Record of Decision
	RQ	Reportable Quantity
	RY	reporting year
S	SARA	Superfund Amendments and Reauthorization Act
	SDI	Strategic Defense Initiative
	SDWA	Safe Drinking Water Act
	SNL/KTF	Kauai Test Facility
	SNL/NM	Sandia National Laboratories, New Mexico
	SPCC	Spill Prevention, Control, and Countermeasures
	SSO	Sandia Site Office

	STARS	Strategic Targeting System
	SVOC	semi-volatile organic compound
T	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
U	UDP	underground discharge point
	USAF	U.S. Air Force
	USFS	U.S. Forest Service
	USGS	U.S. Geological Survey
	UST	underground storage tank
	UXO	unexploded ordnance
V	VOC	volatile organic compound

Units of Measure

°C	Celsius degree	m	meter
cm	centimeter	m ²	square meter
°F	Fahrenheit degree	m ³	cube meter
ft	feet	mg	milligram
g	gram	mi	mile
in.	inch	ppm	parts per million
km	kilometer	yr	year
kg	kilogram		

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 ²	microgram per square meter
uR/hr	microroentgen per hour		

Chemical Abbreviations

Am-241	americium-241	Cs-137	cesium-137
Pu-238	plutonium-238	Pu-239	plutonium-239
Pu-240	plutonium-240	U _{tot}	uranium, total

Approximate Conversion Factors for Selected SI (Metric) Units

Multiply Si (metric) unit	by	To obtain U.S. customary unit
Celsius (°C)	$^{\circ}\text{F} = 9/5 \text{ }^{\circ}\text{C} + 32$	Fahrenheit (°F)
centimeter (cm)	0.39	inch (in.)
cubic meter (m ³)	35	cubic feet (ft ³)
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 ²)	0.39	square mile (mi ²)

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TTR & KTF Executive Summary

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The U.S. Department of Energy (DOE) oversees Sandia Corporation's Tonopah Test Range (TTR) and Kauai Test Facility (KTF) operations through the DOE, National Nuclear Security Administration (NNSA), Sandia Site Office (SSO), in Albuquerque, New Mexico. This report was prepared in accordance with, and as required, by DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990) and DOE Order 231.1, *Environment, Safety, and Health Reporting* (DOE 1996). This report summarizes data from environmental protection and monitoring programs at TTR and KTF for calendar year (CY) 2002. 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.

TTR

Sandia Corporation conducts operations at TTR in support of the DOE/NNSA's Weapons Ordnance Program. Sandia Corporation's activities involve research and development (R&D) 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,
- Terrestrial surveillance,
- Water quality monitoring,
- Air quality compliance (AQC),
- Environmental Restoration (ER), and
- National Environmental Policy Act (NEPA).

Waste Management

Waste generated at TTR in 2002 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 (TSD) 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 at TTR include areas contaminated from past rocket firings and target tests, abandoned septic systems, solvent contaminated soils at previous underground storage tank (UST) areas, and disposal areas for ordnance, septic sludge, and depleted uranium (DU).

In 2002, there were 8 kg (18 lb) of low-level waste (LLW) generated by the ER Project. ER cleanup activities generated a total of 5 kg (11 lb) of RCRA regulated hazardous waste. Another 4,004,647 kg (8,828,735 lb) of non-RCRA regulated waste was generated by the cleanup of sites with hydrocarbon-impacted soils and miscellaneous debris.

Terrestrial Surveillance

Soil samples were collected from 14 off-site, eight perimeter, and 21 on-site locations in 2002. 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. Thermoluminescent dosimeter (TLD) results (a measure of ambient gamma radiation) showed no distinguishable statistical difference between on-site and off-site locations in 2002. Non-radiological soil analyses were not performed in 2002 (analyses are scheduled for 2003).

Water Quality

Wastewater monitoring results confirmed that all permit conditions set by the State of Nevada were met in 2002.

Water quality samples are routinely taken from Production Well 6, which supplies potable water for Sandia Corporation's Main Compound at TTR. Water Quality sample results showed that all permit conditions were met in 2002.

Air Quality

Radiological air emissions are regulated by National Emission Standards for Hazardous Air Pollutants (NESHAP). 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. Continuous monitoring was conducted from February 22, 1996 to February 25, 1997 at the TTR airport, the area determined to be the site of the maximally exposed individual (MEI) (SNL 1997). The calculated dose was 0.024 millirem/year (mrem/yr), which is approximately 400 times less than the 10 mrem/yr standard set by the U.S. EPA. 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 2002, the total emissions reported to the State of Nevada were 0.001 ton/yr from the screening plant.

NEPA Activities

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 (DRI), a branch of the University of Nevada System. A total of five NEPA Checklists were submitted to DOE/NNSA/SSO for proposed actions in 2002.

KTF

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 (DoD) Pacific Missile Range Facility (PMRF). SNL/KTF, located on the island of Kauai at the north end of the PMRF near Nohili Point, has been an active rocket-launching facility since 1962. There were three rockets launched from SNL/KTF in 2002.

Environmental Programs

The following environmental programs are in place at KTF:

- NEPA,
- Water quality monitoring, and
- Terrestrial surveillance.

NEPA Activities

At KTF, NEPA compliance is coordinated between Sandia Corporation and DOE/NNSA/SSO. In 2002, SNL/NM NEPA completed one NEPA compliance review for proposed actions at SNL/KTF.

Water Quality

Septic tanks do not require permitting or sampling, but as a best management practice (BMP), septic tanks were sampled in September 2002. No contaminants were identified above the reporting limits.

Terrestrial Surveillance Ine Nmunng, he is

Chapter 1

TTR Introduction

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Chapter Summary

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. Westinghouse Government Service, TTR's operations and maintenance contractor, performs most environmental program functions.

This Annual Site Environmental Report (ASER), which is published to inform the public about environmental conditions at TTR, describes environmental protection programs and summarizes the compliance status with major environmental laws and regulations during Calendar Year (CY) 2002.

TTR is located within the boundaries of the Nevada Test and Training Range (NTTR) withdrawal. The principal DOE activities performed at TTR are 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.



- *TTR's annual rainfall is 4 inches on the desert floor and 12 inches in the mountains.*
- *The NTTR land withdrawal generally provides a positive effect on local plant and animal life species since it is relatively undisturbed by human activity.*

In 1963, Project Roller Coaster included a series of four nuclear weapons destruction tests, which left plutonium dispersal in the surrounding soils. The DOE/NNSA, Nevada Site Office (NSO) is responsible for the remediation of environmental restoration (ER) and related (legacy) activities, while SSO and Sandia Corporation are responsible for the environmental compliance of ongoing operations.



Missile Launch from Tonopah Test Range

Sandia Corporation's TTR is located on approximately 280 square miles (128,000 acres) within the boundaries of the NTTR withdrawal and is used to support DOE/NNSA and U.S. Air Force (USAF) activities and missions. TTR is operated by Sandia Corporation, a subsidiary of Lockheed Martin Corporation, which is administered by the DOE/NNSA/SSO in Albuquerque, New Mexico. As the operations and maintenance contractor for TTR, Westinghouse Government Service performs most environmental program functions, 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 ASER is prepared in accordance with the following DOE Orders that pertain to environmental protection and management:

- DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990);
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993);
- DOE Order 231.1, *Environment, Safety, and Health Reporting, Change 2* (DOE 1996);
- DOE M 231.1-1, *Environment, Safety, and Health Reporting Manual*, as amended by DOE Order 470.2A (DOE 2000);
- DOE Order 435.1, *Radioactive Waste Management* (DOE 2001a); and
- DOE/AL Order 5400.2A, *Environmental Compliance Issue Coordination* (DOE 1993a).

On January 15, 2003, DOE Order 450.1 was issued, which will supersede and cancel DOE Order 5400.1 when incorporated into the Sandia management and operating contract. Incorporation of DOE Order 450.1 into the contract is pending. This ASER summarizes data from environmental protection and monitoring programs at TTR for CY02. The environmental programs summarized include waste management, air, water, terrestrial monitoring and surveillance, the ER Project, and the National Environmental Policy Act (NEPA). DOE Order 5400.1 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.

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 (mi) 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 ft at the valley floor to 7,482 ft at Cactus Peak. The elevation within the town of Tonopah is 6,030 ft.

TTR Site Selection

TTR was selected as a bombing 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 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. The area was withdrawn in 1956 and TTR became operational in 1957 to operate and 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

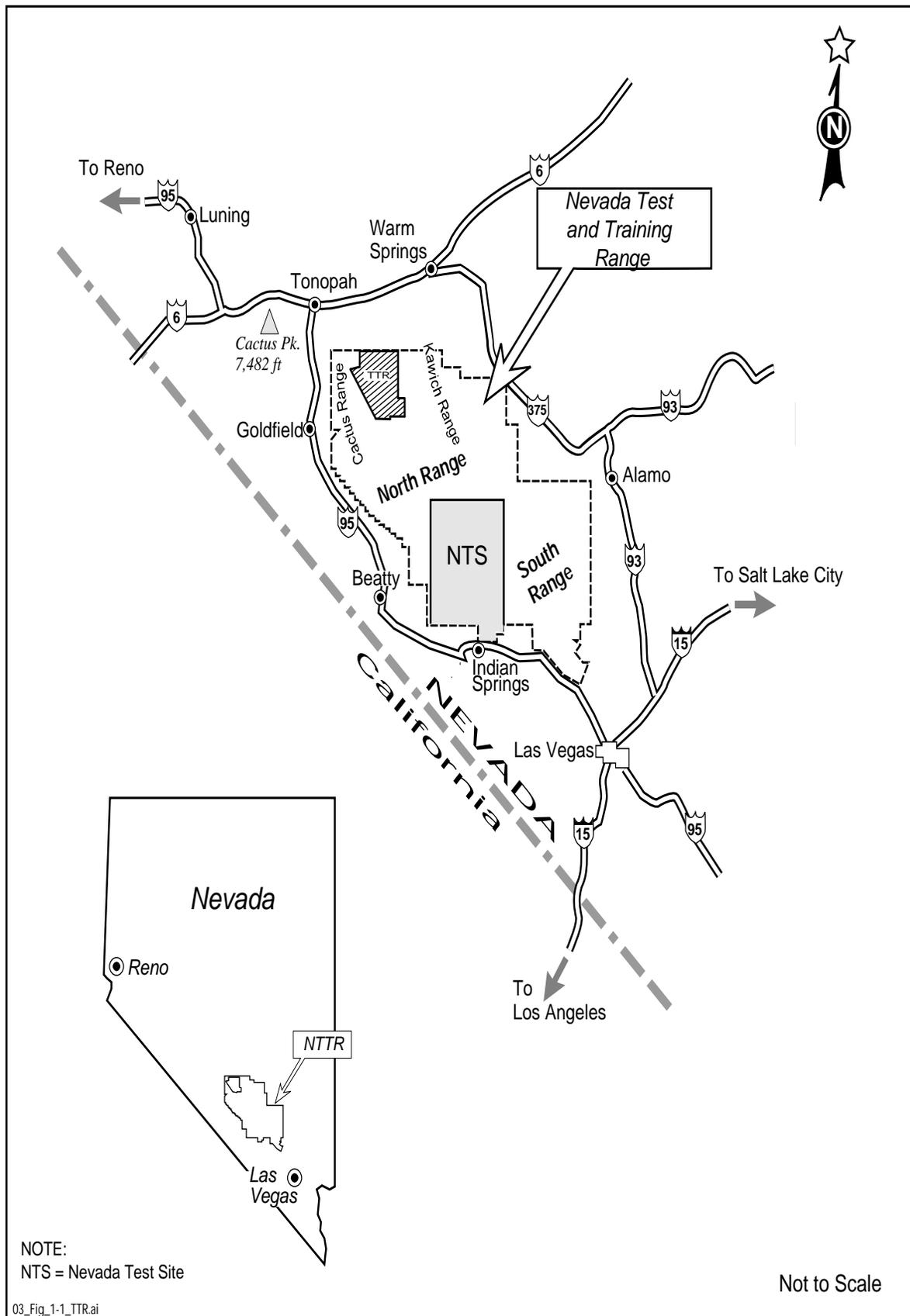


FIGURE 1-1. Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada.

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; 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/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 Sandia Corporation's TTR and Sandia National Laboratories, NM (SNL/NM) employees and contractors with oversight from DOE/SSO. In April 2002, a lease agreement 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 200 square miles (128,000 acres). The previous footprint was 336,665 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 mi west of the site boundary. The town of Tonopah (population 4,400) is approximately 30 mi northwest of the site (DOC 2003). Las Vegas, Nevada is 140 mi from TTR. The total population within an 50-mi 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 ft at the site. Groundwater is encountered at the Antelope Mine well in the Cactus Range at 21 ft and at the EH2 well near the TTR Airport at 454 ft. The depth to groundwater at the Area 9 well located at the north end of the site is approximately 131 ft. South of the Area 9 well, groundwater is encountered at 361 to 394 ft in Area 3. The static water level at the main water supply well (Well 6) is approximately 350 ft.

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 1978).

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 1978, DRI 1991). Salt desert shrub is characteristic of poorly drained soils and is common along dry lakebeds. Specific plants in this group include shadescale (a type of salt bush) (*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*), 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 effect 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 1978, DRI 1991). Common birds include various raptor species.

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. For example, recreational off-road vehicles can cause significant impacts to desert flora and fauna and it can take years for fragile desert ecosystems to recover from disturbances.

1.4 CLEAN SLATE AND DOUBLE TRACKS 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 picocurie 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 $1,000 \mu\text{g}/\text{m}^2$ of plutonium. The soil survey was conducted on 61-m 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 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

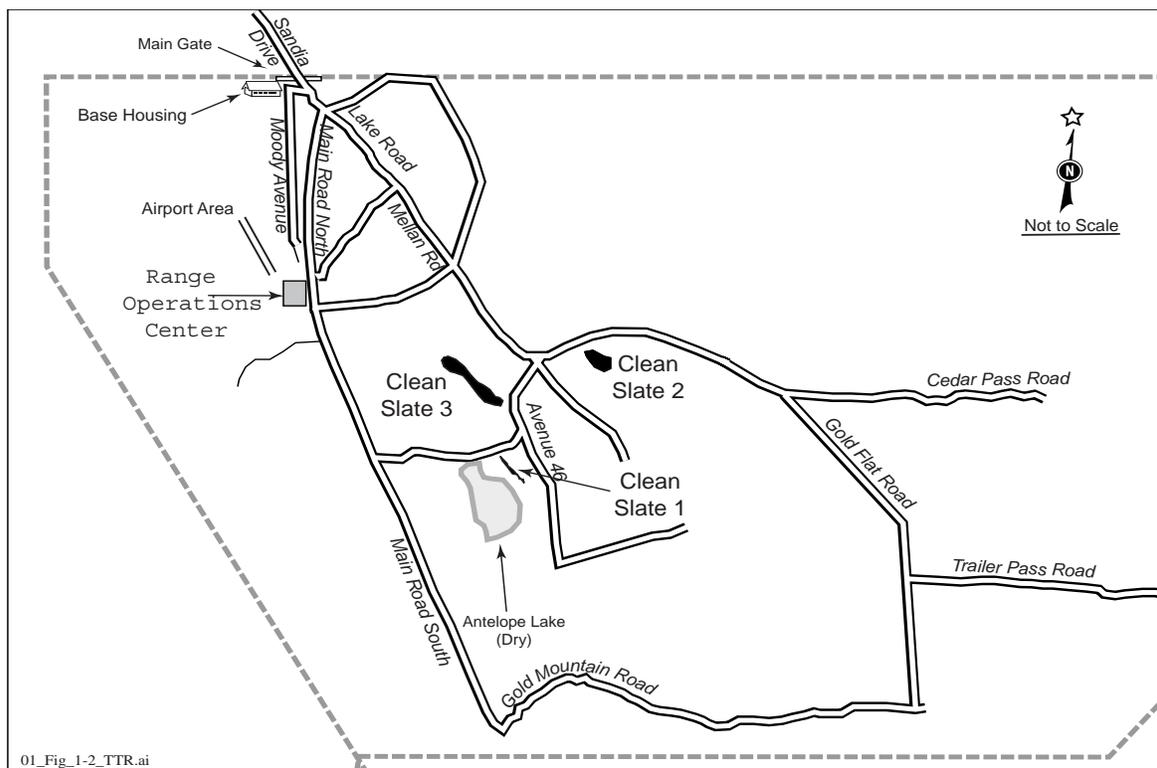


FIGURE 1-2. Location of Facilities Operated by SNL/NSO at TTR

TABLE 1-1. Project Roller Coaster Test Information

Test Name	Date of Test	Location	Status
Clean Slate 1	May 25, 1963	TTR	Closed
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)	Closed

NOTE: TTR = Tonopah Test Range

NTTR = Nevada Test and Training Range

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

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 m² (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. Although these data have been validated, they have only as of yet been presented to DOE/NSO in the form of a draft report (DRI 1997). A final report is pending. Bechtel Nevada has two air monitoring stations available for use at TTR. DOE/NSO suspended air monitoring in April 2000 and will not resume until active remediation efforts at the Clean Slate sites begin again. Clean Slates 1, 2, 3, and Double Tracks and a number of other sites at the Nevada Test Site are Corrective Action Units (CAUs) in the Soils Project, which has been suspended because of cleanup level issues.

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TTR Compliance Summary

In this Chapter ...

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<i>2002 Audits</i>	2-6
<i>2002 Issues and Actions for TTR</i>	2-6
<i>Environmental Permits</i>	2-8
<i>Occurrence Reporting</i>	2-8

Chapter Summary

Sandia Corporation is responsible for Environment, Safety, and Health (ES&H) compliance activities performed at Tonopah Test Range (TTR). A variety of programs at TTR work together to strive for 100 percent compliance with federal, state, and locally mandated regulations. TTR must adhere to strict reporting and permitting requirements.

External and internal audits were conducted in 2002 to identify issues that may have arisen from operations at TTR. There were no reportable environmental occurrences at TTR in 2002.

In 2002, Sandia Corporation and Westinghouse Government Service cooperated to ensure that TTR was in compliance with all permitting requirements.

Environmental Snapshot



- *There were no reportable environmental occurrences or permit violations at TTR in 2002.*
- *In 2002, Sandia Corporation submitted five National Environmental Policy Act (NEPA) Checklists to the U.S. Department of Energy (DOE) for proposed projects at TTR.*

There are many species of plants, animals, and insects that are protected under the Endangered Species Act (ESA) in Nye County, Nevada (thereby potentially occurring at TTR).



Sunset at Unit Lake

This chapter discusses Sandia Corporation's responsibility and the status of ES&H compliance with federal environmental statutes, regulations, Executive Orders (EOs), and DOE Orders applicable to TTR. Environmental audit summaries, occurrence reporting, and environmental permit status for 2002 are presented in this chapter.

Sandia Corporation and the DOE, National Nuclear Security Administration (NNSA) strive to meet 100 percent compliance with environmental laws, regulations, and other requirements established by federal and state agencies. The State of Nevada administers most environmental regulations applicable to TTR. Specific state regulations listed in [Chapter 6](#) include regulations governing solid and hazardous waste management, wildlife, wastewater effluent, and radiation control. Radionuclide air emission regulations are administered directly by the U.S. Environmental Protection Agency (EPA).

Sandia Corporation at TTR works in close cooperation with Sandia Corporation at Sandia National Laboratories, New Mexico (SNL/NM) to carry out environmental program activities and is responsible for environmental compliance at TTR. Westinghouse Government Service contracts to Sandia Corporation and performs or assists with most environmental program activities, such as air monitoring, water sampling, and waste characterization. Major federal laws applicable to environmental compliance at TTR are presented on [page 2-3](#) (see shaded box).

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.

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 2003](#)). 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 and SARA in 2002. [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 1,406 lbs per year of non-recovered lead. This information will be reported in the [Reporting Year \(RY\) 2002 TRI Report](#).

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 270 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 (O&M) 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. There are no USTs requiring registration at TTR. 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.

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

Clean Water Act (CWA)

Provides general water quality standards to protect the nation's water sources and byways
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
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

Endangered Species Act (ESA)

Provides special protection status for federally-listed endangered or threatened species
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
www.whitehouse.gov/news/orders

Federal Facility Compliance Act (FFCA)

Directs federal agencies regarding environmental compliance
http://tis.eh.doe.gov/oeпа/law_sum/ffca.htm

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Controls the distribution and use of various pesticides 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/oeпа/law_sum/mbta.html

National Emission Standards for Hazardous Air Pollutants (NESHAP)

Specifies standards for radionuclide air emissions and other hazardous air releases
www.epa.gov/radiation/neshaps/

National Environmental Policy Act (NEPA)

Ensures that federal agencies review all proposed activities and include environmental consideration 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) www.epa.gov/region5/defs/html/rcra.htm

Safe Drinking Water Act (SDWA)

Provides specific standards used for drinking water sources 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
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) www.epa.gov/compliance/civil/federal/tsca.html

TABLE 2-1. 2002 SARA Title III (or EPCRA) Reporting Requirements Applicable to TTR

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 2002.
311-312	MSDSs/ Chemical Purchase Inventory Report	!		There are two "Community Right-to-Know" reporting requirements: (a) TTR 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	!		EPCRA, Section 313, requires that facilities that use toxic chemicals listed in SARA Title III over a threshold value must submit a TRI report. For RY 2002, a report was submitted for lead.

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

RQ = reportable quantity

TRI = Toxic Release Inventory

SSO = Sandia Site Office

NNSA = National Nuclear Security Administration

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

EHS = extremely hazardous substance

DOE = U.S. Department of Energy

EPA = U.S. Environmental Protection Agency

RY = reporting year

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 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 generators and other combustion sources, 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 2002.

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 CY 2002* and [Chapter 4](#) of this report discuss these monitoring results ([SNL 2003](#)).

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) administer 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 2002 with respect to wastewater discharges.

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. Currently, Sandia Corporation does not conduct any activities at TTR that require storm water permitting or monitoring.

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. Sandia Corporation remained in compliance with all Well 6 permit requirements in 2002.

2.1.8 Toxic Substances Control Act (TSCA)

Compliance with the 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.

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 2002.

2.1.10 National Environmental Policy Act (NEPA)

NEPA requires federal agencies and private entities that perform federally-sponsored projects to include environmental aspects in early project planning and decision-making. A major intent of the law is to ensure that federal agencies are aware of the potential environmental impacts associated with their operations and are able to make informed decisions based on this information. An important component of the NEPA process is that it mandates that the agency’s decision process be open for public review. 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 an irretrievable commitment of resources or funding occurs. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to select the proposed action alternative with the least environmental impacts.

Activities at TTR conducted by Sandia Corporation are included in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE 1996a). Sandia Corporation provides technical guidance for all NEPA issues at TTR. Sandia Corporation’s NEPA Program is under the direction of the DOE/NNSA/SSO.

2002 NEPA Documentation

During 2002, Sandia Corporation submitted five NEPA Checklists to DOE/NNSA/SSO for proposed projects at TTR that were determined to be within the Nevada Test Site (NTS) EIS envelope.

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. 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, as amended, was established between the conventions of Canada, Japan, Russia, Mexico, and the United States. 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 Sandia Corporation's TTR, the MBTA is coordinated with NEPA compliance reviews.

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)

DOE/NNSA/SSO is responsible for determining the level of applicability of cultural resources requirements. In 2002, Sandia Corporation's operations did not impact any known cultural resources sites at TTR.

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 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.

2.2 2002 AUDITS

Table 2-3 lists audits conducted in 2002, including an assessment made by Sandia Corporation.

2.3 2002 ISSUES AND ACTIONS FOR TTR

Ongoing self-assessments of Sandia Corporation's compliance status continue to identify compliance issues. Resolution of these issues is coordinated with regulatory agencies to ensure that they are adequately addressed.

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

Common Name	Scientific Name	Federal Status	State of Nevada Status
PLANTS			
Sodaville milkvetch	<i>Astragalus lentiginosus var. sesquimetralis</i>	--	State Protected
Halfring milkvetch	<i>Astragalus mohavensis var hemigyris</i>	--	State Protected
Milkvetch	<i>Astragalus phoenix</i>	Threatened	State Protected
Spring-loving centaury	<i>Centaureum namophilum</i>	Threatened	State Protected
Ash Meadows sunray	<i>Enceliopsis nudicaulis var. corrugata</i>	Threatened	State Protected
Sunnyside green gentian	<i>Frasera gypsicola</i>	--	State Protected
Ash Meadows gumplant	<i>Grindelia fraxinopratensis</i>	Threatened	State Protected
Ash Meadows ivesia	<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>Polycytenium williamsiae</i>	--	State Protected
Tonopah fishhook cactus	<i>Sclerocactus nyensis</i>	--	State Protected
Hermit cactus	<i>Sclerocactus polyancistrus</i>	--	State Protected
INSECTS			
Ash Meadows naucorid	<i>Ambrysus amargosus</i>	Threatened	
FISH			
White River desert sucker	<i>Catostomus clarki intermedius</i>	--	State Protected
Moorman White River springfish	<i>Crenichthys baileyi thermophilus</i>	--	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
Big Smoky Valley tui chub	<i>Gila bicolor ssp.</i>	--	State Protected
Hot Creek Valley tui chub	<i>Gila bicolor ssp.</i>	--	State Protected
Little Fish Lake Valley tui chub	<i>Gila bicolor ssp.</i>	--	State Protected
Railroad Valley tui chub	<i>Gila bicolor ssp.</i>	--	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
Nevada speckled dace	<i>Rhinichthys osculus nevadensis</i>	Endangered	State Protected
AMPHIBIANS			
Amargosa toad	<i>Bufo nelsoni</i>	--	State Protected
REPTILES			
Banded Gila monster	<i>Heloderma suspectum cinctum</i>	--	State Protected
Desert tortoise (Mojave Desert pop.)	<i>Gopherus agassizii</i>	Threatened	State Protected
MAMMALS			
Spotted bat	<i>Euderma maculatum</i>	--	State Protected
Pygmy rabbit	<i>Brachylagus idahoensis</i>	--	State Protected
BIRDS			
Northern goshawk	<i>Accipiter gentilis</i>	--	State Protected
Western burrowing owl	<i>Athene cucularia hypugaea</i>	--	State Protected
Ferruginous hawk	<i>Buteo regalis</i>	--	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>	--	State Protected
Western least bittern	<i>Ixobrychus exilis hesperis</i>	--	State Protected
Flammulated owl	<i>Otus flammeolus</i>	--	State Protected
Phainopepla	<i>Phainopepla nitens</i>	--	State Protected
White-faced Ibis	<i>Plegadis chihi</i>	--	State Protected
Yuma clapper rail	<i>Rallus longirostris yumanensis</i>	Endangered	State Protected

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 is listed

in the FFACO under Appendices II (inactive CAUs) and III (active CAUs) and are 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 generators. 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. Sandia Corporation and Westinghouse Government Service ensure that all permit conditions are met. [Table 2-4](#) lists all permits and registrations in effect in 2002. TTR was in full compliance with all permitting requirements for 2002.

2.5 OCCURRENCE REPORTING

There were no reportable environmental occurrences in 2002.

TABLE 2-3. Summary of Environmental Audits Performed at TTR in 2002

Audit Title	Date	Results Summary
State of Nevada, Water Quality Audit	July 2002	No violations
DOE/NNSA/SSO CPAP	Aug 2002	Assessments: Hazcom, Emergency Management, Explosives Safety, Packaging & Transportation, and Confined Space. 5 Findings, 5 Observations, 6 Noteworthy Practices
Hazmat Drill/ Eval (SNL/NM)	Dec 2002	Minor recommendations

NOTE: SNL/NM = Sandia National Laboratories, New Mexico
DOE/NNSA/SSO = U.S. Department of Energy, National Nuclear Security Administration, Sandia Site Office
CPAP = Contractor Performance Assessment Program

TABLE 2-4. Summary of Permit Ownership at TTR

Permit Type and Location	Permit Number	Issue Date	Expiration Date	Comments
Air Quality Permits				
Open Burn Variance (Fire Extinguisher Training)	New with each issue	Quarterly	Quarterly	State of Nevada
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 Screening Plant Generators (53 emission units) Boilers (7 emission units) Maintenance Activities (5 emission units) Propane Storage Tanks (23 emission units) Surface Area Disturbance (> 5 acres)
RCRA - Hazardous Waste				
Hazardous Waste Generator	NV1890011991	January 7, 1993	Indefinite	State of Nevada
Production Well (Drinking Water)				
Well 6 Production Well	NY-3014-12NC	September 2001	September 2002*	State of Nevada
Well 6 Production Well	NY-3014-12NC	September 2002	September 2003*	State of Nevada

NOTE: * 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

"Emission units" are sources such as generators and boilers.

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TTR Environmental Programs Information

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<i>Waste Management Programs</i>	3-6
<i>SPCC Plan</i>	3-6
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<i>Summary of Release Reporting</i>	3-8

Chapter Summary

The Environmental Restoration (ER) Project, the Waste Management Program, and the National Environmental Policy Act (NEPA) 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.

In 2002, Sandia Corporation progressed with many environmental initiatives. The ER Project generated 42,302 kg (93,260 lb) of non-Resource Conservation and Recovery Act (RCRA) waste and 822 kg (1,812 lb) of RCRA waste at cleanup sites throughout TTR.

TTR is dedicated to significantly reducing the amount of chemical and hazardous wastes generated on-site, which includes recycling and recovery of various materials, such as solvents, fuels, and oil.

Environmental Snapshot



- *The JASSM Flattop Bunker Clean-up Project decontaminated and sent 4,000 lbs of computer components to a recycler. An additional 40 yards of metal debris was decontaminated and sent to a recycler.*

TTR's Waste Management Program is managed by Westinghouse Government Service and handles the following waste categories: radioactive waste, RCRA-hazardous waste, other chemical waste, and non-hazardous solid waste.



Wild Horses at TTR

Environmental programs at Sandia Corporation's TTR are in place to meet compliance with state and federal regulations, EOs, and DOE Orders. Programs and activities discussed in this chapter include the ER Project, the Waste Management Program, NEPA compliance activities, and environmental monitoring by outside agencies. 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/SSO, 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** – Past sites used to support nuclear testing activities, and
- (2) **Soil Sites Project** – Areas where tests resulted in extensive surface and/or shallow subsurface contamination.

ER site contamination includes radiological (e.g., depleted uranium [DU] and plutonium) and non-radiological constituents (e.g., artillery, solvents, 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 CAS information presented in [Table 3-1](#) is contained in Appendices II, III, and IV of the FFACO ([DoD/DOE/State of NV 1996](#)).

2002 ER Activities

In 2002, cleanup at ER sites generated a total of 4,004,660 kg (8,828,764 lbs) of waste including 4,004,647 kg (8,828,735 lbs) of non-RCRA waste, 5 kg (11 lbs) of RCRA waste, and 8 kg (18 lbs) of low-level waste (LLW). A total of 1,611,663 kg (3,553,109 lbs) of ER waste, including 8 kg (18 lbs) of LLW waste, was shipped to the NTS for disposal. The RCRA waste included spent field-testing kits and associated debris. All RCRA-hazardous waste will be shipped off-site to permitted treatment, storage, and disposal (TSD) facilities in 2003. There were 2,393,534 kg (5,276,839 lbs) of construction debris and personal protective equipment (PPE) disposed of at the U.S. Air Force (USAF) sanitary landfill in 2002. In addition, 1,021 kg (2,251 lbs) of sanitary rinsate was disposed of in the TTR sanitary lagoons in 2002. Westinghouse Government Service participates in environmental cleanup and restoration activities.

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs Calendar Year (CY) 2002 Status

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-400 - Closed Bomblet Pit and Five Points Landfill, TTR		
TA-19-001-05PT	Ordnance Disposal Pit	Five Points Intersection
TA-55-001-TAB2	Ordnance Disposal Pit	Bunker 2 Road
CAU-401 - Closed Area 3 Gas Station UST Site, TTR		
03-02-003-0357	UST, Gas	First Gas Station, Area 3
CAU-402 - Closed Area 3 Bldg. 0353 UST Site, TTR		
03-02-001-0353	UST, Diesel	Bldg. 0353
CAU-403 - Closed Area 3 Second Gas Station UST, TTR		
03-02-004-0360	USTs	Second Gas Station
CAU-404 - Closed Roller Coaster Lagoons and Trench, TTR		
TA-03-001-TARC	Roller Coaster Lagoons	NW of Antelope Lake
TA-21-001-TARC	Roller Coaster North Disposal Trench	NW of Antelope Lake
CAU-405 - Closed Area 3 Septic Systems, TTR		
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
CAU-406 - Closed Area 3 Bldg. 03-74 and Bldg. 03-58 UDPs, TTR		
03-51-002-0374	Heavy Duty Shop UDP, Sumps	Bldg. 0374
03-51-003-0358	UPS Building UDP	UPS Building, Area 3
CAU-407 - Closed Roller Coaster Rad Safe Area, TTR		
TA-23-001-TARC	Roller Coaster Rad Safe Area	Northwest of Antelope Lake
CAU-408 - Not Started Bomblet Target Area, TTR		
TA-55-002-TAB2	Bomblet Target Areas	Antelope Lake
CAU-409 - Closed Other Waste Sites, TTR		
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
CAU-410 - Characterization Phase Area 9 Underground Vault and Disposal Trench, TTR		
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 CY 2002 Status (*continued*)

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-423 - Closed		
Area 3 UDP, Bldg. 0360, TTR		
03-02-002-0308	UDP	Bldg. 0360
03-02-002-0308	UDP	Bldg. 0360
CAU-424 - Closed		
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
CAU-425 - Remediation Phase		
Area 9 Main Lake Construction Debris Disposal Area, TTR		
09-08-001-TA09	Construction Debris Disposal Area	Area 9/Main Lake
CAU-426 - Closed		
Cactus Spring Waste Trenches, TTR		
RG-08-001-RGCS	Waste Trenches	Cactus Spring Ranch
CAU-427 - Closed		
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
CAU-428 - Closed		
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
CAU-429 - Closed		
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
CAU-430 - Closed		
DU Artillery Round #1, TTR		
TA-55-003-0960	DU Artillery Round	South of Area 9
CAU-453 - Closed		
Area 9 UXO Landfill, TTR		
09-55-001-0952	Area 9 Landfill	Area 9
CAU-461 - Closed		
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TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs CY 2002 (*concluded*)

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-485 - Closed		
Cactus Spring Ranch Pu and DU Site, TTR		
TA-39-001-TAGR	Cactus Spring Ranch, Soil Contamination	West of Target Areas
CAU-486 - Closed		
Double Tracks Rad Safe Area, Nellis Range 71 North		
71-23-001-71DT	Double Tracks Rad Safe Area	Nellis Range 71 North
CAU-487 - Closed		
Thunderwell Site, TTR		
RG-26-001-RGRV	Thunderwell Site	Thunderwell Site
CAU-489 - Not Started		
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
CAU-490 - Remediation Phase		
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
CAU-495 - Closed		
Unconfirmed JTA Sites, TTR		
TA-55-006-09SE	Buried Artillery Round	Test Area
TA-55-007-09SE	Buried Artillery Round	Test Area
CAU-496 - Not Started		
Buried Rocket Site – Antelope Lake, TTR		
TA-55-008-TAAL	Buried Rocket	Antelope Lake
CAU-499 - Closed		
Hydrocarbon Spill Site, TTR		
RG-25-001-RD24	Hydrocarbon Spill Site	Radar 24 Site
Soil Sites CAUs/CASs:		
CAU-411 - Closed		
Double Tracks Plutonium Dispersion, Nellis		
NAFR-23-01	Pu-contaminated Soil	Double Tracks
CAU-412 - Closed		
Clean Slate 1 Plutonium Dispersion, TTR		
TA-23-01CS	Pu-Contaminated Soil	Clean Slate 1
CAU-413 - Remediation Phase		
Clean Slate 2 Plutonium Dispersion, TTR		
TA-23-02CS	Pu-Contaminated Soil	Clean Slate 2
CAU-414 - Not Started		
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

NNSA = National Nuclear Security Administration

NSO = Nevada Site Office

UDP = underground discharge points

UST = underground storage tank

UXO = unexploded ordnance

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 2002 was as follows:

<u>Waste Type</u>	<u>Weight</u>
RCRA waste	1,808 kg (3,986 lbs)
Non-RCRA-regulated hazardous or toxic waste	47,901 kg (105,604 lbs)
Radioactive waste - exit signs for recycle (Tritium)	0 kg

Sandia Corporation shipped all regulated waste to off-site permitted 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 2002).

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 totaling 8,644 kg (19,057 lb), including 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 2002.

3.3 SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN

The *SPCC Plan for SNL Tonopah Test Range (SNL 1999)*, which was revised in 1999, 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 three aboveground storage tanks (ASTs), two Bulk Storage Areas (BSA), and one transformer storage area that are regulated with a capacity of greater than 660 gallons that are applicable to the SPCC Plan at TTR.

3.4 NEPA PROGRAM

NEPA Activities at TTR

At TTR, NEPA compliance is a coordinated process by 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.

The *Final Environmental Impact Statement (EIS) for the Nevada Test Site 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 1996a).

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

TABLE 3-2. Sandia Corporation TTR Generated RCRA-Regulated Hazardous Waste Shipped Off-site in 2002

Waste Description	Waste Codes	Generated (lbs)
WASTE MANAGEMENT		
Aerosol Cans	D001	190
NiCad Batteries	D006	25
Lead Chromate Paint Chips	D007, D008	181
Corrosive liquid, Acidic, inorganic	D002	75
Corrosive liquid, Basic, inorganic	D002	15
Hazardous Waste, Liquid	D011	90
Flammable liquids	D001, F003, F005	30
Flammable liquids	D001, D005	20
Solvent Contaminated Rags	F005, F002, F003	589
Diesel Fuel	D001, D018	383
Vapor bulbs (sodium)	D005	30
Gasoline	UN1203	180
TOTAL		1,808

NOTE: NOS = not otherwise specified

RCRA = Resource Conservation and Recovery Act

TABLE 3-3. Non-RCRA-Regulated Hazardous or Toxic Waste Shipped Off-site in 2002

Waste Description	Generated (lbs)
WASTE MANAGEMENT	
Used Batteries (Large alkaline)	404
Separator Pit Cleanout	1840
Crushed Oil Filters	352
Oil Metal Cuttings	506
Welding Rod	206
JASSM Debris Drums	39,737
RBIFF Debris Drums	4,324
Dry Cell Batteries	20
Aerosols (non-flammable)	10
Non-Regulated Solid Waste	228
Waste Non-regulated Liquid Waste	220
TOTAL	47,901

NOTE: JASSM = Joint Air to Surface Stand-off Missile System

RBIFF = Reentry Body Impact Fuze Flight

RCRA = Resource Conservation and Recovery Act

TABLE 3-4. Recycled Regulated Hazardous or Toxic Waste Shipped Off-site in 2002

Recycled Material or Energy Recovered Material	Generated (lbs)
WASTE MANAGEMENT	
Computer Components	4,000
Used Oil	4,524
Fluorescent Bulbs	60
Fluorescent Bulbs U-Tube	60
TOTAL	8,644
ENVIRONMENTAL RESTORATION (ER)	
ER waste	0
TOTAL	0

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 Nevada Test Site Annual Site Environmental Report (ASER) (DOE 2002).

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 2002, SNL/NV (SNL 2003)*, 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

JASSM Flattop Bunker Clean-up Project

In December 2001, a fully armed JASSM test missile successfully detonated in the Flattop bunker. The bunker itself was fully populated with surplus equipment racks and instrumentation for the purpose of determining the blast effects of the warhead. Large quantities of circuit boards, video display terminals, etc. were present in each room of the facility during the test. It was anticipated that this excess material would leave a toxic residue throughout the facility, hampering clean-up, which was required to prepare the facility for the next test. Initial sampling indicated lead and cadmium contamination throughout the facility. The Bunker clean-up process began in January 2002 and took eight weeks to complete. The pulverized material was collected in 62 55-gallon drums. This material passed the RCRA TCLP test for leachability and was disposed of as non-RCRA regulated material in a hazardous waste landfill. 4,000 lbs of computer components were decontaminated and sent to a recycler. An additional 40 yards of metal debris was decontaminated and sent to a recycler.

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 2002 (SNL 2003d)* submitted for lead released at the TTR firing range.

TTR Environmental Monitoring

In this Chapter ...

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<i>Radiological Air Monitoring</i>	4-9
<i>Non-radiological Air Emissions</i>	4-10

Chapter Summary

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.

Sandia Corporation monitors drinking water supplies at TTR to ensure that the State of Nevada drinking water regulations are met. Wastewater sampling is conducted annually to ensure that Sandia Corporation's releases to the sanitary sewer system meet the requirements of the National Pollution Discharge Elimination System (NPDES), maintained by the U.S. Air Force (USAF). Septic systems are sampled, as needed.

Environmental monitoring and surveillance is conducted under the direction of the Environmental Management (EM) Department at Sandia National Laboratories, New Mexico (SNL/NM). Westinghouse Government Service, the on-site contractor at TTR, performed or



Environmental Snapshot

- *In 2002, total non-radiological air emissions reported to the State of Nevada were 0.001 ton per year from the TTR screening plant.*

assisted in most environmental monitoring activities in 2002. These included production Well 6 sampling, wastewater sampling, ambient air monitoring, soil sampling at spill sites, managing the thermoluminescent dosimeter (TLD) network, and hazardous waste characterization.

TTR adheres to specific air quality compliance permit conditions and complies with local, state, and federal air regulations. Ambient air monitoring is currently not required at TTR, but was last conducted in 1996.



View From Antelope Peak

4.1 TERRESTRIAL SURVEILLANCE

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 5400.1, *General Environmental Protection Program* (DOE 1990):

- 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.
- 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 5400.1, *General Environmental Protection Program* (DOE 1990). Concentration limits for radionuclides and metals in terrestrial media are not well defined; however, the EM Department does compare the results from on-site and perimeter locations to community (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 and Pendias, 1992), or local/regional surface soil average concentrations, published in *Elements in North American Soils* (Dragun and Chiasson, 1991).

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 the EM Department to prioritize 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. The matrix is shown in Table 4-1.

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 calendar year (CY) 2002, the analysis was limited to a five-year period (this year beginning in 1997). The reason for the change was that SNL/NM changed analytical laboratories in CY 2000, with lower 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. By limiting the analysis to a five-year period, the number of apparent decreasing trends was reduced, and should be eliminated over the next couple of years.

Non-radiological soil analyses are scheduled to occur every other year (during even numbered years) subject to funding.

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.

NOTE: 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.

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.

Soil is the only medium sampled at the 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.

Routine terrestrial surveillance is conducted at on-site, perimeter, and off-site locations that remain essentially the same from year to year. Sample locations may be modified as necessary to reflect current operations or to supplement data from existing locations. For example, prior to 2000, locations T-20 and T-21 were used to monitor around an area contaminated with depleted uranium (DU). That site has been remediated and the sampling locations were disturbed. Location T-21 was deleted from the Terrestrial Surveillance Program and, due to remediation efforts, T-20 was moved a short distance from the original sampling location.

Although the sampling locations were unchanged in CY2002, the location numbering scheme was changed. This change was made to be consistent with the format used at SNL/NM, and to be consistent with the TLD location numbering format already in use at TTR. Tables 4-2 through 4-4 show both the old and new location numbers to

allow comparison with previous reports.

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, Figures A-3, A-4a, A-5a, A-5b, and A-5c contain maps of the sampling locations. A total of 21 locations were sampled on-site.
- **Community (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 14 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 eight perimeter locations is shown in Figure A-2 of Appendix A. All perimeter locations are in areas to

TABLE 4-2. On-site Terrestrial Surveillance Locations at TTR

Revised Location Number	Old Location Number	Old TLD Location Number	Sample Location	Sample Type	Replicate* Location
1		T-1	Antelope Lake Area Fence	T	
2	T-02	T-2	N/S Mellan Airstrip	S,T	--
3	T-03	T-3	Clean Slate 2	S,T	Yes
4	T-04	T-4	Clean Slate 3	S,T	--
9	D-01	T-9	Roller Coaster Decon	S,T	Yes
10	T-10	T-10	Brownes Road/Denton Freeway	S,T	--
13		T-13	Area 3 Near Bldg. 100	T	
14		T-14	Area 3 CP SW Fence	T	
15		T-15	Moody Ave	T	
16		T-16	Area 9, Bldg. 09-08	T	
17		T-17	Hard Target by Bldg. 23-16	T	
38	MH-03		Mellan Hill – Metal Scrap Pile	S	--
39	MH-04		Mellan Hill – North	S	--
40	OC-02		Waste Water Monitoring Station	S	--
41	OC-03		“Danger Powerline Crossing” Sign	S	--
42	OC-04		Main Road/Edward’s Freeway	S	--
43	OC-10		SW Corner of Sandia Corporation, TTR Operations Center	S	--
44	OC-13		NE Corner of Sandia Corporation, TTR Operations Center	S	--
45	OC-19		Storage Shelters, 03-38/03-39	S	--
46	OC-22		Sand Building	S	--
47	OC-23		Generator Storage Area	S	--
48	T-14		N/S Mellan Airstrip – Antelope Tuff	S	Yes
49	T-16		N/S Mellan Airstrip – SW of T-14	S	--
50	T-17		N/S Mellan Airstrip – sign post	S	--

TABLE 4-4. Perimeter Terrestrial Surveillance Locations at TTR

Revised Location Number	Old Location Number	Old TLD Location Number	Sample Location	Sample Type	Replicate* Location
5		T-5	O&M Complex, Site 4 Entrance Gate	T	
6	T-06	T-6	Cedar Pass Road Guard Station	S,T	--
7		T-7	On-base Housing SW	T	
8	T-08	T-8	On-Base Housing (Main guard gate CP17)	S,T	--
11	T-13	T-11	Cactus Springs	S,T	--
12	T-12	T-12	TLD at "US Gov't Property" Sign	S,T	--
34	OM-03		O&M Complex (Owan Drive post)	S	--
35	T-11		Cactus Springs (north fence post)	S	--
36	T-36		On-Base Housing (NE fence line)	S	--
37	T-37		On-Base Housing (guard station)	S	--

NOTE: S = Soil, T = Thermoluminescent Dosimeter (TLD)

O&M = Operations & Maintenance

-- = There is not a replicate location for this sample location

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

which Sandia Corporation does not control access within TTR.

4.1.5 Radiological Parameters and Results

The CY 2002 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, 2002* (SNL 2003b). 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 DU from past explosives testing.
- **Plutonium** – Due to past explosive testing, plutonium is present in some areas of TTR. One of the indicators of the presence of weapons-grade plutonium is the radionuclide Am-241. Isotopic plutonium analysis is normally 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** - 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 22 on-site, perimeter and off-site locations.

Radiological Results

The results of the statistical analysis showed no on-site or perimeter locations that were 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. One location was identified as Priority-2 (higher than off-site) for Am-241. The highest value observed for this location was 3.58 pCi/g in 2000. The Priority-2 location along with its associated summary statistics is listed in Table 4-6. There were no other Priority-2 locations noted and there were no on-site or

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
Am-241	On-site	87	0.138	0.011	0.549	-0.162	3.58
	Perimeter	32	-0.001	0.009	0.059	-0.145	0.175
	Off-site	56	-0.001	0.004	0.044	-0.152	0.103
Cs-137	On-site	105	0.309	0.316	0.257	-0.85	1.000
	Perimeter	40	0.210	0.163	0.168	-0.09	0.642
	Off-site	70	0.233	0.187	0.184	0.00	0.930
Pu-238	On-site	29	0.017	0.006	0.021	-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
Pu-239/240	On-site	29	0.780	0.122	1.48	0.001	6.3
	Perimeter	8	0.016	0.012	0.014	0.001	0.043

TABLE 4-6. Summary Statistics For Soil Locations Noted As Priority-2 For Am-241 (All Units In pCi/g)

Analyte	Location	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Am-241	S-09 (formerly D-01)	5	1.82	0.72	1.59	0.546	3.58

NOTE: pCi/g = picocurie per gram
Std Dev = Standard Deviation

perimeter locations identified as Priority 3 (increasing trend). As in years past, there were also several locations identified with a decreasing trend.

TLD Results

Sampling for 2002 was conducted from January 9, 2002 through January 14, 2003. Table 4-7 shows the exposure rate (units of microrentgen/hour) summary statistics by location type from 1998 to 2002. TLDs were unrecovered at several locations during CY02. In addition, several locations in 2002 had low results reported during Q3 and Q4. Several attempts were made to determine the cause of the low results (5.1 to 6.5 mr per quarter instead of the usual values of 30 to 40 mr) without success. These values are not included in calculating the summary statistics, but are presented in Appendix A, Table A-12.

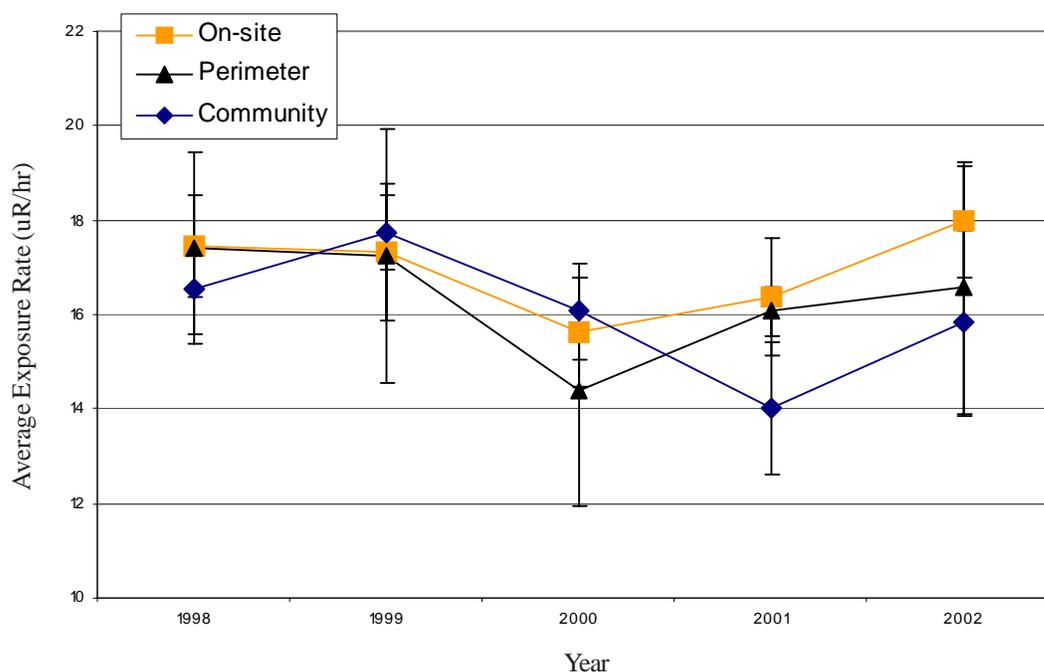


FIGURE 4-1. Tonopah Test Range TLD Exposure (1998-2002)

TABLE 4-7. Summary of TLD Exposure Rates for 1998 to 2002

Location Class	No. Of Obs	Units	Mean	Median	Std Dev	Minimum	Maximum
Off-Site	25	uR/hr	16.0	15.8	1.3	12.0	18.9
Perimeter	20	uR/hr	16.3	17.6	1.2	10.9	20.1
On-Site	65	uR/hr	16.9	17.0	0.9	13.7	21.3

NOTE: uR/hr = microroentgen per hour (10^{-6} roentgen per hour)

Std Dev = Standard Deviation

Obs = observations

TLD = Thermoluminescent dosimeter

4.1.6 Non-Radiological Parameters and Results

All soil samples are analyzed for the following 21 metals:

Aluminum (Al)	Antimony (Sb)
Arsenic (As)	Barium (Ba)
Beryllium (Be)	Cadmium (Cd)
Chromium (Cr)	Cobalt (Co)
Copper (Cu)	Iron (Fe)
Lead (Pb)	Magnesium (Mg)
Manganese (Mn)	Mercury (Hg)
Nickel (Ni)	Potassium (K)
Selenium (Se)	Silver (Ag)
Thallium (Tl)	Vanadium (V)
Zinc (Zn)	

All metals, except for mercury, are determined using the Inductively Coupled Plasma-Atomic Emission Spectrum (ICP-AES) method. Mercury is determined by the Cold Vapor Atomic Absorption method.

The CY02 analytical results are found in [Appendix A](#) and are summarized in this section. The detailed statistical analyses are documented in *2002 Data Analysis in Support of the Annual Site Environmental Report (SNL 2003b)*.

Non-radiological Results

No sampling location was noted to be Priority-1 (both higher than off-site and with an increasing trend). Several locations were identified as either Priority-2 or Priority-3 (higher than off-site or increasing trend). The Priority-2 and Priority-3 locations and parameters are listed in [Tables 4-8 through 4-9](#).

Sixteen of the 21 metals were listed as Priority-4: aluminum, antimony, arsenic, barium, beryllium, chromium, copper, iron, lead, mercury, nickel, potassium, selenium, silver, thallium, and vanadium.

Cadmium

One on-site location (S-45, formerly OC-19) was identified as Priority-2 (higher than off-site) for cadmium in surface soils. Concentration levels

observed at this location are higher than the US Surface Soil Concentration range of 0.41 to 0.57 mg/kg, but are within the range published for Nevada soils (not detectable to 11 mg/kg).

Cobalt

One perimeter location (P-35) was identified as Priority-2 (higher than off-site) for cobalt in surface soils. The concentration of cobalt at this location is well within the range of background identified for US surface soils (3 to 50 mg/kg) and for Nevada soils (not detectable to 20 mg/kg), and is expected to be naturally occurring.

Manganese

One perimeter location (P-35) was identified as Priority-2 (higher than off-site) for manganese in surface soils. The concentration of manganese at this location is well within the range of background identified for US surface soils (20 to 3000 mg/kg) and for Nevada soils (30 to 5,000 mg/kg), and is expected to be naturally occurring.

Zinc

One on-site location (S-44) was identified as Priority-2 (higher than off-site) and one on-site location (S-46) was identified as Priority-3 (increasing trend) for zinc in surface soils. The average concentration of zinc at both locations is well within the range of background identified for US surface soils (13 to 300 mg/kg) and for Nevada soils (25 to 128 mg/kg), and is expected to be naturally occurring.

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. Sampling at the two non-potable wells has not been required or requested by DOE/National Nuclear Security Administration (NNSA) or SNL/NM.

All sampling is conducted in accordance with requirements set by the state (State of Nevada 1997). Analytes are sampled at different intervals as follows:

Analyte	Sampling frequency
Total Coliform	monthly
Nitrates and nitrites	annually
Dioxins	last sampled in 1999
VOCs and SVOCs	last sampled in 2002
Copper and lead*	last sampled in 2002

NOTE: VOC = Volatile organic compounds
SVOC = Semi-volatile organic compounds

TABLE 4-8. Summary Statistics for All Locations (1998-2002) Identified as PRIORITY-2 for Metals During CY02 (all units in mg/kg)

Matrix	Analyte	Location Type	Location	Sample Size	Average	Std Dev	Min	Max
Soil	Cadmium	On-site	S-45	4	1.16	0.55	0.55	1.8
	Cobalt	Perimeter	P-35	4	5.99	1.93	3.49	8.16
	Manganese	Perimeter	P-35	4	701	213	422	917
	Zinc	On-site	S-44	4	111.6	29.3	70.5	135.0

TABLE 4-9. Summary Statistics for All Locations (1998-2002) Identified as PRIORITY-3 for Metals During CY02 (all units in mg/kg)

Matrix	Analyte	Location Type	Location	Sample Size	Average	Std Dev	Min	Max
Soil	Zinc	On-site	S-46	4	72.6	40.1	39	124

Sampled parameters included, but were not limited to, nitrates, nitrites, VOCs, lead, copper, and arsenic.

4.2.2 Sewage System and Septic Tank Monitoring

Sewage System

Sewage from Sandia Corporation's facilities in the Main Compound at Area 3 goes to the 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 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.

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

- 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;
- 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 2002.

Septic Tank Systems

Septic tank systems are sampled, as needed. There are six septic systems located on-site, which are owned by Sandia Corporation at TTR. These six 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 2002. 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.

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/m³) were measured as follows:

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

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

Dose to Receptor	Location
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25.04 -2091898 f187.44 400.8 80.16 -10.32 10.0 0 0 39B7/TT2151TT24 1 Tf0.29188

Chapter 5

2002 Annual Site Environmental Report for the Kauai Test Facility

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The Kauai Test Facility (KTF) is operated by Sandia Corporation as a rocket preparation, launching, and tracking facility for the U.S. Department of Energy (DOE), National Nuclear Security Administration (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 under Sandia Corporation's Management. The DOE/NNSA oversees operation of SNL/KTF through the Sandia Site Office (SSO), in Albuquerque, New Mexico. 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) 2002. This report was prepared in accordance with DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990) and DOE Order 231.1, *Environment, Safety, and Health Reporting* (DOE 1996).

5.1 FACILITIES AND OPERATIONS

SNL/KTF has been an active rocket-launching facility since 1962. The KTF and Range Interfaces Department under Sandia National Laboratories/New Mexico (SNL/NM) 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 Ballistic Missile Defense Organization (BMDO) programs. Nuclear devices have never been launched from SNL/KTF, nor have radiological materials been used at 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 1994, added four buildings to support DOE and Strategic Defense Initiative (SDI) launches. From 1992 to 2002, there have been 14 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 Strategic Targeting System (STARS) 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 2002 ROCKET LAUNCHES

There were three rockets launched from SNL/KTF in 2002. The launches were covered by the KTF Environmental Assessment (EA), published in July 1992 (DOE 1992a).

- Navy Theatre Wide (NTW) FM-2 FTR-3 January 25, 2002
- NTW FM-3 TTV-4 June 13, 2002
- NTW FM-4 TTV-6 November 21, 2002

This system uses a single stage M56 (Second stage of the Minute Man I System) rocket motor. The rocket was employed as a surrogate target in support of the Navy's Seabased Midcourse Defense Program.

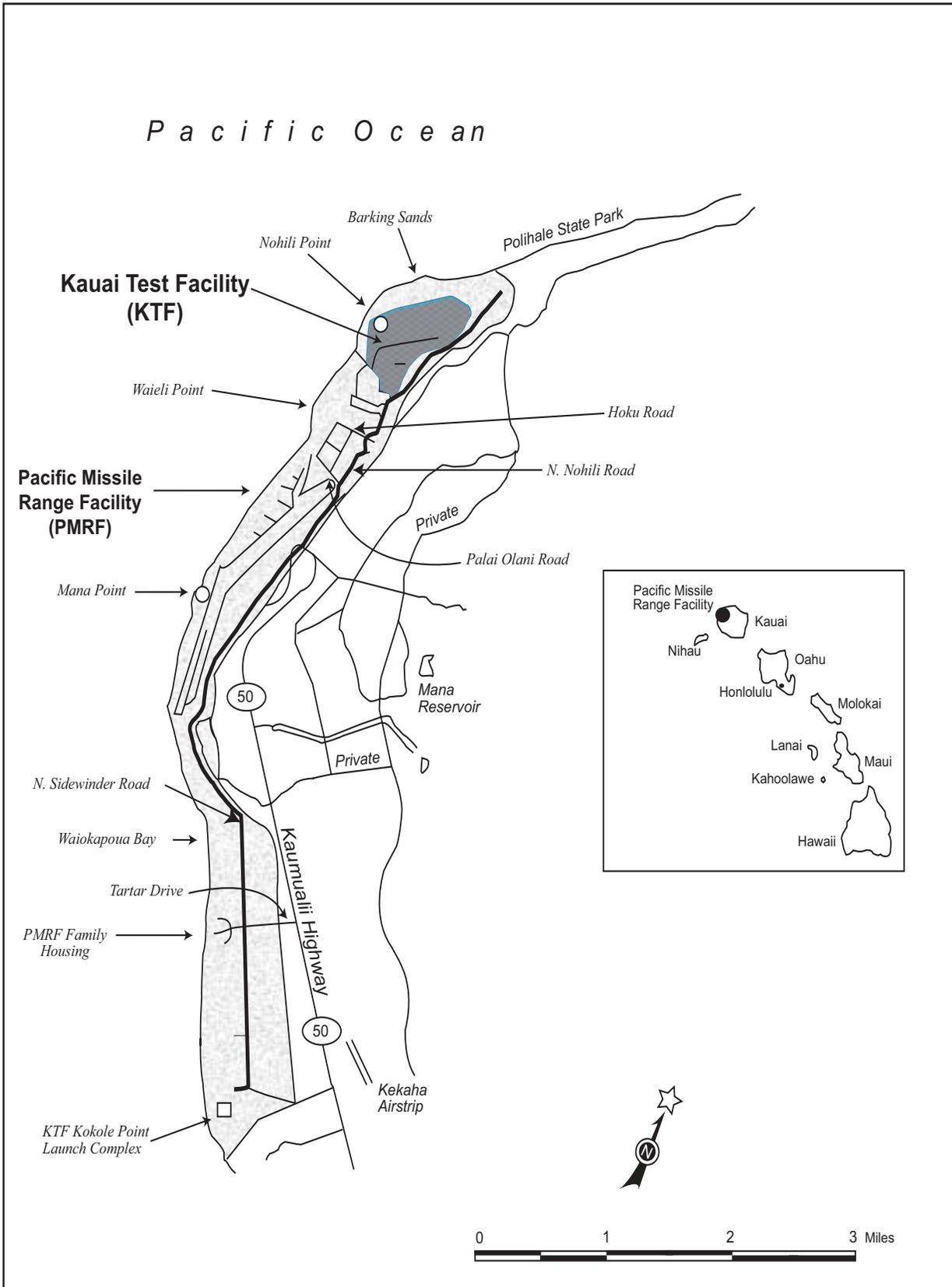


FIGURE 5-1. Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area (The Kauai Test Facility (KTF) is to the north, near Nohili Point)

TABLE 5.1. Permit Registrations 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	Sep 15, 1998	Sep 1, 2003	State of Hawaii
Resource Conservation and Recovery Act (RCRA)	HI-0000-363309	Sep 23, 1994	Not specified	EPA Region IX and Hawaii Dept. of Health
RCRA	HIP-0000-45104	Oct 20, 1998	One time only - Oct 28, 1998	EPA Region IX and Hawaii Dept. of Health
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

5.3 DEMOGRAPHICS

There are 13 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 statutes on page 5-4 provides an overview of compliance status for Sandia Corporation's operations at SNL/KTF in 2002. Table 5-1 lists the applicable permits in place at SNL/KTF.



Bird of Paradise

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 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 2002. Table 5-2 lists SARA Title III reporting requirements.

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

Clean Water Act (CWA)

Provides general water quality standards to protect the nation's water sources and byways
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
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

Endangered Species Act (ESA)

Provides special protection status for federally-listed endangered or threatened species
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
www.whitehouse.gov/news/orders

Federal Facility Compliance Act (FFCA)

Directs federal agencies regarding environmental compliance
http://tis.eh.doe.gov/oepa/law_sum/ffca.htm

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Controls the distribution and use of various pesticides 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/law_sum/mbta.html

National Emission Standards for Hazardous Air Pollutants (NESHAP)

Specifies standards for radionuclide air emissions and other hazardous air releases
www.epa.gov/radiation/neshaps/

National Environmental Policy Act (NEPA)

Ensures that federal agencies review all proposed activities and include environmental consideration 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) www.epa.gov/region5/defs/html/rcra.htm

Safe Drinking Water Act (SDWA)

Provides specific standards used for drinking water sources 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

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) www.epa.gov/compliance/civil/federal/tsca.html

TABLE 5-2. 2002 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 2002.
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 2002 for producing a TRI Report for SNL/KTF operations.

NOTE: MSDS = Material Safety Data Sheets (gives relevant chemical information)
 N/R = not required EHS = extremely hazardous substance
 RQ = reportable quantity SNL/KTF = Sandia National Laboratories, Kauai Test Facility
 DOE/NNSA/SSO = U.S. Department of Energy, National Nuclear Security Administration, Sandia Site Office
 CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
 MSDS = Material Safety Data Sheet

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 2002 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 private entities that perform federally-sponsored projects to include environmental aspects in early project planning and decision-making. A major intent of the law is to ensure that federal agencies are aware of the potential environmental impacts associated with their operations and are able to make informed decisions based on this information. An important component

of the NEPA process is that it mandates that the agency's decision process be open for public review. If a proposed action is determined to have environmentally "significant" impacts, the agency must prepare an EA or an environmental impact statement (EIS) before an irrevocable commitment of resources or funding occurs.

Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to select the proposed action alternative with the least environmental impacts. The DOE/NNSA/SSO coordinates NEPA compliance at SNL/KTF with SNL/NM.

Endangered Species Act (ESA)

ESA applies to both private individuals and federal agencies (Section 7 of ESA specifically applies to federal agencies). At SNL/KTF, ESA compliance is coordinated with NEPA compliance. The law ensures that any action authorized, funded, or carried out by a federal agency will not jeopardize the continued existence of a "threatened or endangered species," or result in adverse modifications to its habitat. [Table 5-3](#) lists all threatened and endangered

TABLE 5-3. Threatened and Endangered Species Potentially Occurring on 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
Pendant kihi fern	<i>Adenophorus periens</i>	Endangered	Endangered
Mahoe	<i>Alectryon macrococcus</i> var. <i>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
Uhiuhi	<i>Caesalpinia kavaiensis</i>	Endangered	Endangered
'Awiwi	<i>Centaurium sebaeoides</i>	Endangered	Endangered
'Akoko	<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
No common name	<i>Delissea rhytidosperma</i>	Endangered	Endangered
'Oha	<i>Delissea rivularis</i>	Endangered	Endangered
No common name	<i>Delissea undulata</i> ssp. <i>kauaiensis</i>	Endangered	Endangered
Asplenium leaved diella	<i>Diellia erecta</i>	Endangered	Endangered
No common name	<i>Diellia pallida</i> (proposed as <i>D. laciniata</i>)	Endangered	Endangered
No common name	<i>Diplazium molokaiense</i>	Endangered	Endangered
Kahalapehu	<i>Dubautia pauciflora</i>	Endangered	Endangered
'Akoko	<i>Euphorbia haeleleana</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
No common name	<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
Hau kuahiwi	<i>Hibiscadelphus distans</i>	Endangered	Endangered
Hau kuahiwi	<i>Hibiscadelphus woodii</i>	Endangered	Endangered
Ma'o hau hele	<i>Hibiscus brackenridgei</i> ssp. <i>mokuleianus</i>	Endangered	Endangered
Koki'o 'ula'ula; aloalo	<i>Hibiscus clayi</i>	Endangered	Endangered
Koki'o ke'oke'o	<i>Hibiscus waimeae</i> ssp. <i>hannerae</i>	Endangered	Endangered
Hilo ischaemum	<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 KTF (continued)

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> var. <i>exigua</i>	Endangered	Endangered
Nehe	<i>Lipochaeta micrantha</i> var. <i>micrantha</i>	Endangered	Endangered
Nehe	<i>Lipochaeta waimeensis</i>	Endangered	Endangered
No common name	<i>Lobelia niihauensis</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 haupeensis</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>Nothocestrum peltatum</i>	Endangered	Endangered
Lau 'ehu	<i>Panicum niihauense</i>	Endangered	Endangered
Makou	<i>Peucedanum sandwicense</i>	Threatened	Threatened
Wawae'iole	<i>Phlegmariurus mannii</i> (listed as <i>Huperzia mannii</i>)	Endangered	Endangered
Wawae'iole	<i>Phlegmariurus nutans</i> (listed as <i>Lycopodium nutans</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
Ale	<i>Plantago princeps</i> var. <i>anomala</i>	Endangered	Endangered
Ale	<i>Plantago princeps</i> var. <i>longibracteata</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
Loulu	<i>Pritchardia napaliensis</i>	Endangered	Endangered
Loulu	<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 KTF (concluded)

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	<i>Wilkesia hobdyi</i>	Endangered	Endangered
No common name	<i>Xylosma crenatum</i>	Endangered	Endangered
A'e	<i>Zanthoxylum hawaiiense</i>	Endangered	Endangered
ANIMALS			
Mammals			
Hawaiian hoary bat	<i>Lasiurus cinereus semotus</i>	Endangered	Endangered
Hawaiian monk seal	<i>Monachus schauinslandi</i>	Endangered	Endangered
Birds			
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</i>	Threatened	Threatened
Reptiles			
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
Olive ridley sea turtle (incidental in Hawaii)	<i>Lepidochelys olivacea</i>	Threatened	Threatened
Snails			
Newcomb's snail	<i>Erinna newcombi</i>	Threatened	Threatened
Arachnids			
Kauai cave wolf spider	<i>Adelocosa anops</i>	Endangered	Endangered
Insects			
Blackburn's sphinx moth	<i>Manduca blackburni</i>	Endangered	Endangered
Kauai pomace fly	<i>Drosophila musaphila</i>	Proposed Endangered	Proposed Endangered
Crustaceans			
Kauai cave amphipod	<i>Spelaeorchestia koloana</i>	Endangered	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.

Migratory Bird Treaty Act (MBTA) of 1918

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, construction sites are surveyed prior to digging or earth movement to avoid possible impacts to nesting birds.

Environmental Compliance Executive Orders (EOs)

The four 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 13148](#), *Greening the Government Through Leadership in Environmental 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 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 1998](#)), which expires in September 2003.

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

As required by the EPA, the 2002 Annual Fee and Monitoring Report (air emissions) was submitted to the State of Hawaii at the end of February 2002 ([SNL 2003a](#)). Sandia Corporation was in compliance with all air quality regulations in 2002.



Plumerias

Clean Water Act (CWA)

There were no compliance issues with respect to any state or federal water pollution regulations in 2002. There are three septic tanks on-site owned by SNL/KTF facilities, which currently do not require permits from the State of Hawaii.

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 were no issues or changes in status for this tank during 2002. There is also one 10,000-gallon aboveground 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 1997)*.

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 accidental releases or other environmental occurrences at SNL/KTF in 2002.

5.5 ENVIRONMENTAL PROGRAM ACTIVITIES

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

NEPA Program Activities

In accordance with NEPA, a comprehensive Site-wide EA was completed for SNL/KTF in 1992 (DOE 1992a), which resulted in a Finding of No Significant Impact (FONSI), issued on July 17, 1992. This EA is the current NEPA document covering all rocket-launching activities at SNL/KTF. Additionally, an EIS specific to the STARS Program is in place for rocket launches of this type (DoD 1998).

Prior to Sandia Corporation beginning any proposed action that may potentially affect sensitive species or habitats, a NEPA Checklist is submitted to DOE/NNSA/SSO for a determination. As it is applicable, DOE/NNSA/SSO must consult with the following agencies:

- U.S. Fish and Wildlife Service
- State of Hawaii Department of Land and Natural Resources

In 2002, SNL/NM NEPA staff completed one NEPA compliance review for proposed actions at SNL/KTF. This review referenced existing NEPA documentation for KTF.

ER Project Activities

There are no ER sites at SNL/KTF. This, however, does not preclude that other environmental sampling activities will take place at SNL/KTF.

Background – In 1995, a site inspection was performed at SNL/KTF to determine compliance with CERCLA requirements. Three ER sites were identified at that time. Based on the site inspection report (SNL 1995), the EPA informed the DOE/NNSA/SSO on September 30, 1996 that a No Further Action (NFA) determination had been made. This confirmed that SNL/KTF met all CERCLA requirements and no additional sampling or remediation would be necessary at the three areas.

5.6 ENVIRONMENTAL SURVEILLANCE AND MONITORING ACTIVITIES

Wastewater Monitoring

Sandia Corporation's activities at SNL/KTF produce only sanitary sewage, which is directed into five wastewater systems—three septic tanks and two French drains—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. In September 2002, the septic tanks were sampled and no contaminants were identified above the reporting limits.

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.



Night Launch of a STARS Rocket

5.7 TERRESTRIAL SURVEILLANCE

Sampling occurred at KTF during September 2002. A total of 28 terrestrial surveillance locations were sampled; 17 on-site locations and 11 community locations. Samples were analyzed for radiological and non-radiological analytes. Data collected during 2002 are listed in [Appendix B, Tables B-1 through B-5](#).

Statistical Analysis

KTF is not sampled on a yearly basis, but as funding permits (at least every five years). Therefore, there were only two years of data (1999 and 2002) for which to perform statistical analysis. No trending was performed since the statistical methodology used requires four sampling periods worth of data. A comparison between years was not performed since two different analytical laboratories were used and a comparison between the two years would primarily show analytical laboratory differences.

A comparison between on-site and community locations was performed to determine if any analyte showed differences between the two location types. (Note: there are no perimeter sampling locations at KTF. All locations are listed as either on-site or community.) The results of this statistical analysis are discussed below.

Sampling Locations

Terrestrial surveillance began at KTF in 1994. Sampling occurred in 1999 and then again in 2002. Although sample results were recorded in 1994, no information on detection limits or decision levels was kept and as a result this information is used for historical purposes. Data from 1994 is not used in any statistical analysis.

Routine terrestrial surveillance is conducted at on-site and off-site locations that remain essentially the same from sampling period to sampling period. Sample locations may be modified as necessary to reflect current operations or to supplement data from existing locations. To date, the only modification has been to modify the sampling location numbering format to be consistent with the one used at SNL/NM.

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. A list of on-site sampling locations is shown in [Table 5-4](#). [Appendix B, Figure B-1](#) contain a map of

TABLE 5-4. On-site Terrestrial Surveillance Locations at KTF

Revised Location Number	Location Number	Sample Location	Replicate* Location
Various On-Site Locations			
S-12	KTF-1	Near Wind Radar Road	--
S-13	KTF-2	SNL/KTF sign – DOE Trail Road	--
S-14	KTF-3	Building 638	--
S-15	KTF-4	Between Building 638 and 639	--
S-16	KTF-5	Building 639 East	--
S-17	KTF-6	Building 640 East	--
S-18	KTF-7	Building 640 West	--
S-19	KTF-8	Building 685 West	--

TABLE 5-5. Off-site Terrestrial Surveillance Locations at KTF

Revised Location Number	Old Location Number	Sample Location	Replicate* Location
C-01	BKTF-13	Rec Area I Beach Access sign – N. Nohili Road	--
C-02	BKTF-14	No Trespassing sign – West of Location C-01	--
C-03	BKTF-15	N. Nohili Road and Hoku Road	--
C-04	BKTF-16	Hoku Road W of Building 515	--
C-05	BKTF-17	Polihale State Park – Monkey Pod Tree	--
C-06	BKTF-18	Polihale State Park – Camping sign	--
C-07	BKTF-19	Polihale State Park – “Caution Road narrows” sign	Yes
C-08	BKTF-20	N. Nohili Road and Palai Olani Road	--
C-09	BKTF-23	Kokole Point Launch Area – Bldg H10	--
C-10	KTF-1	Kokole Point Launch Area – West	--
C-11	KTF-2	Kokole Point Launch Area – South	--

NOTE: KTF = Kauai Test Facility

-- = There is not a replicate location for this sample location

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

the sampling locations. A total of 17 locations were sampled on-site.

- **Community (Off-site) locations** are selected to provide a measurement of environmental conditions unaffected by Sandia Corporation’s activities at KTF. 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 5-5](#) contains a list of the off-site sample locations. The 11 off-site locations sampled are shown in [Figure B-2 of Appendix B](#).

Tritium

Tritium analysis was performed on all 28 samples, but in 23 of those samples, dead water had to be added to complete the analysis. All on-site locations had dead water on them. Only five community samples were analyzed using the traditional methods for tritium analysis, the other six community samples had dead water added in order to complete the analysis. Tritium results of pCi/g are broken out and shown separately in [Table B-5, Appendix B](#). It should be noted that the analytical laboratory used in 1999 had difficulty analyzing the samples for tritium. Due to the difficulties mentioned for tritium analysis, tritium results are being excluded from any analysis of KTF samples in the future.

Radiological Results

The results of the statistical analysis showed no difference between community and on-site locations. Overall summary statistics for all radiological results are presented in [Table 5-6](#).

Non-Radiological Parameters and Results

All soil samples are analyzed for the following 21 metals:

Aluminum (Al)	Antimony (Sb)
Arsenic (As)	Barium (Ba)
Beryllium (Be)	Cadmium (Cd)
Chromium (Cr)	Cobalt (Co)
Copper (Cu)	Iron (Fe)
Lead (Pb)	Magnesium (Mg)
Manganese (Mn)	Mercury (Hg)
Nickel (Ni)	Potassium (K)
Selenium (Se)	Silver (Ag)
Thallium (Tl)	Vanadium (V)
Zinc (Zn)	

All metals, except for mercury, are determined using the Inductively Coupled Plasma-Atomic Emission Spectrum (ICP-AES) method. Mercury is determined by the Cold Vapor Atomic Absorption method.

The CY02 analytical results are found in Appendix B of this report. The detailed statistical analyses are documented in *2002 Data Analysis in Support of the KTF Annual Site Environmental Report (SNL 2003c)*.

TABLE 5-6. Summary Statistics For Soil Locations (All Units In pCi/g Unless Otherwise Noted)

Analyte	Location Class	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Am-241*	On-site	17	0.0055	-.0002	0.016	-0.0163	0.0449
	Off-site	11	-0.0023	0	0.013	-0.0193	0.0179
Cs-137*	On-site	25	0.053	0.045	0.038	0.006	0.15
	Off-site	15	0.049	0.036	0.044	-0.007	0.12
H-3 (pCi/mL)	On-site	17	15.455	11.00	20.71	0.100	75.00
	Off-site	16	3.244	0.75	4.679	-0.171	15.00
H-3* (pCi/g)	On-site	17	0.0512	0	0.482	-0.735	1.11
	Off-site	6	0.7152	0.671	0.576	0.055	1.58
U-235*	On-site	30	0.037	0.027	0.067	-0.11	0.195
	Off-site	14	0.433	0.051	0.053	-0.06	0.160
U-238*	On-site	17	0.870	0.865	0.320	0.452	1.66
	Off-site	11	0.654	0.501	0.490	0.035	1.59
Total U (ug/g)	On-site	34	1.292	1.300	0.253	0.771	1.80
	Off-site	22	1.213	1.155	0.212	0.835	1.70

NOTE: *Indicates no or limited results recorded in 1999; analytical laboratory only reported if above the critical level
pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter
ug/g = microgram per gram
Std Dev = Standard Deviation

TABLE 5-7. Summary Statistics For Metals That Showed a Statistical Difference Between Community And On-Site Location Types. (All Units in mg/kg.)

Metal	Location Type	Sample Size	Mean	Median	Std Dev	Min	Max
Cobalt	On-site	34	16.95	15.25	9.52	2.70	34.6
	Community	22	11.39	9.24	9.53	1.45	31.0
Iron	On-site	34	16386	14150	7189	3500	28700
	Community	22	13066	11425	10624	2580	42000
Nickel	On-site	34	204.3	151.0	139.0	29.0	478
	Community	22	126.9	105.3	108.8	10.8	342

Non-radiological Results

Three metals (cobalt, iron, and nickel) showed a difference between samples collected on-site and those collected at community locations. In all three instances, the average on-site result was greater than that of the community samples. Table 5-7 lists the three metals and their respective summary statistics broken out by location type.

All results for cobalt are within the range of US Surface Soil Concentrations (3 to 50 mg/kg). All results for iron are also within the range of US Surface Soil Concentrations (5,000 to 50,000 mg/kg). Nickel concentrations at 11 on-site and four community locations, as well as the mean on-site concentration, exceeded the range for US Surface Soil Concentrations (<5 to 150 mg/kg). No published background values have been found for any of the metals that are specific for Hawaii or the island of Kauai. All values are below the EPA Region 9 Preliminary Remediation Goals for residential use (1,600 mg/kg) and do not indicate an immediate concern.

Chapter 6

TTR & KTF References

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- ASI 1990** *Archaeological Survey and Testing, Department of Energy, Kauai Test Facility.* Prepared for Sandia National Laboratories, by Advanced Sciences, Inc., San Diego, CA (1990).
- Brock** 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 2003** U.S. Department of Commerce, U.S. Census Bureau, website at <<http://www.census.gov/>> (2003).
- 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 2003** U.S. Department of Energy, *Environmental Protection Program*, DOE Order 450.1. U.S. Department of Energy, Washington, DC (January 15, 2003). (See DOE Orders Section.)
- DOE 2002** U.S. Department of Energy, *Nevada Test Site Annual Site Environmental Report for CY 2001*, DOE/NV 11718-747. Prepared by Bechtel for the U.S. DOE/NNSA. (Ch.5, "Radiological Environmental Programs") Las Vegas NV (2002).
- DOE 2002a** 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 2000** DOE Manual 231.1-1 (See DOE Orders Section.)
- DOE 1996** DOE Order 231.1 (See DOE Orders Section.)
- DOE 1996a** 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-GM08-98NV 13555, 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*, 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 Order 5400.1 (See DOE Orders Section).
- Dragun and Chiasson 1991** Dragun, J. and A. Chiasson, Elements in North American Soils. Hazardous Materials Control Resources Institute, Greenbelt, MD (1991).
- 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).
- DRI/DOE 2003** Desert Research Institute/ U. S. Department of Energy, Community Environmental Monitoring Program (CEMP) website: <http://www.wrcc.dri.edu/cemp/> (2003).
- 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 2003** 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, D.C. (2003).
- 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, D.C. (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 ²³⁹⁻²⁴⁰Pu and ²⁴¹Am 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, Al., *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, D.C. (1993).
- Hawaii Dept. of Health, (DOH) 1998** "State of Hawaii Noncovered Source Permit No. 0429-01-N," Expiration Date 09/01/2003. State of Hawaii DOH. Honolulu, HI (9/15/98).
- IT 1996** IT Corporation, *Sampling and Analysis Plan for Clean Slate 1*. IT Corporation (September 1996).
- IT 1994** IT Corporation, *Sandia National Laboratories/New Mexico Septic Tank Monitoring Report, Kauai Test Facility*. IT Corporation, prepared for Sandia National Laboratories, Albuquerque, NM (1994).
- 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 and Pendias, 1992** Kabata-Pendias and Pendias, 1992, *Trace Elements in Soils and Plants*, 2nd. Ed. CRC Press, Inc., Boca Raton, Florida (1992).
- 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).
- NFEC 1997** 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 (January 1997).
- Romney et al. 1975** Romney, E. M., et al., "²³⁹⁻²⁴⁰Pu and ²⁴¹Am 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 2003** Sandia National Laboratories, *NESHAP Annual Report for CY 2002, Sandia National Laboratories, Nevada*, internal doc # 75-1021-6. Sandia National Laboratories, Albuquerque, NM (June 2003).
- SNL 2003a** Sandia National Laboratories, “Noncovered Source Permit No. 0429-01-N: 2002 Annual Fee and Monitoring Report” (for Kauai Test Facility). Sandia National Laboratories, Albuquerque, NM. (February 18, 2003).
- SNL 2003b** Sandia National Laboratories, *Tonopah Test Range Data Analysis in Support of the Annual Site Environmental Report, 2002*. Sandia National Laboratories, Albuquerque, NM (July 2003).
- SNL 2003c** Sandia National Laboratories, *2002 Data Analysis in Support of the KTF Annual Site Environmental Report*. Sandia National Laboratories, Albuquerque, NM (July 2003).
- SNL 2003d** Sandia National Laboratories, *Toxic Chemical Release Reporting Community Right-to-Know: Calendar Year 2002*. Sandia National Laboratories, Albuquerque, NM (June 2003).
- SNL 2002** Sandia National Laboratories, *2001 Hazardous Waste Biennial Report for Sandia National Laboratories/New Mexico and Sandia National Laboratories/Tonopah Test Range*, Sandia National Laboratories, Albuquerque, New Mexico (March 2002).
- SNL 1999** Sandia National Laboratories, *Spill Prevention Control and Countermeasures (SPCC) Plan for SNL Tonopah Test Range*, Plan 90-12, Rev. 4. Sandia National Laboratories, Albuquerque, NM (October 1999).
- 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** “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 1978

United States Air Force, *Final Environmental Impact Statement, Proposed Public Land Withdrawal, Nellis Air Force Bombing Range: Nye, Clark, and Lincoln Counties, Nevada*. Department of the Air Force, Washington, DC (1978).

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 Efficiency 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 2003 U.S. Department of Energy, Environmental Protection Program, DOE Order 450.1, U.S. Department of Energy, Washington, D.C. (January 15, 2003).

DOE 2002a U.S. Department of Energy, *Independent Oversight and Performance Assurance Program*, DOE Order 470.2B. U.S. Department of Energy, Washington, D.C. (October 31, 2002).

DOE 2001 U.S. Department of Energy, *National Environmental Policy Act Compliance Program*, DOE Order 451.1B. 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 2000 U.S. Department of Energy, *Environment, Safety, and Health Reporting Manual*, DOE Manual 231.1-1, Change 2. U.S. Department of Energy, Washington, D.C. (January 28, 2000).

DOE 1996 U.S. Department of Energy, *Environment, Safety, and Health Reporting*, DOE Order 231.1, Change 2. U.S. Department of Energy, Washington, DC (November 7, 1996).

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, *General Environmental Protection Program*, DOE Order 5400.1, Change 1. DOE, Washington, DC (June 29, 1990).

CODE OF FEDERAL REGULATIONS

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"

CODE OF FEDERAL REGULATIONS (continued)

- 40 CFR 141.26** “Monitoring Frequency for Radioactivity 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 (16 U.S.C. §470).
- 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

40 CFR 122 "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System"

Nevada regulatory information can be found at the Nevada State Legislature website:

<http://www.leg.state.nv.us/>

A listing of the Nevada Administrative Code (NAC) can be found at:

<http://www.leg.state.nv.us/NAC/Index.htm>

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"> • Disposal of construction debris • Disposal of routine non-hazardous solid wastes • Disposal of septic sludge
NAC 444A.005 to 444A.470, "Programs for Recycling"	<ul style="list-style-type: none"> • Recyclable materials including waste tires
Chapter 445A, Water Controls	
NAC 445A.070 to 445A.348, "Water Pollution Control"	<ul style="list-style-type: none"> • Septic tanks • Surface water runoff
NAC 445A.450 to 445A. 6731, "Public Water Systems"	<ul style="list-style-type: none"> • Production well sampling
Chapter 445B, Air Controls	
NAC 445B.001 to 445B.3485, "Air Pollution"	<ul style="list-style-type: none"> • Open burning • Hazardous air pollutants from stacks and vents • Disturbance of soils during construction (particulate matter)
NAC 445B.400 to 445B.774, "Emissions From Engines"	<ul style="list-style-type: none"> • Generators • Mobile sources
Chapter 504, Wildlife Management and Propagation *	
NAC 504.110 to 504.340, "Wildlife Management Areas" NAC 504.510 to 504.550, "Alteration of Stream System or Watershed"	<ul style="list-style-type: none"> • Road construction • Construction activities
NAC 504.800 to 504.865, "Preservation of Wild Horses" **	<ul style="list-style-type: none"> • General activities on the range in wild horse areas
Chapter 534, Underground Water and Wells	
NAC 534.010 to 534.450, "Underground Water and Wells"	<ul style="list-style-type: none"> • Drilling, operation, and abandonment of wells

NOTE: * This law 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."

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Appendix A

**Terrestrial Surveillance Results and
Sampling Location Maps For TTR**



B2 Drop at Tonopah Test Range

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TABLE A-1. Radiological Results for Off-site Soil Sampling Locations, 2002

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
C-20	Americium-241	pCi/g	-0.0103 \pm 0.0639	0.0538	0.109	U
	Cesium-137	pCi/g	0.0808 \pm 0.0262	0.0125	0.0258	
	Potassium-40	pCi/g	30.3 \pm 3.33	0.121	0.254	
	Uranium-235	pCi/g	0.0969 \pm 0.126	0.0728	0.148	U
	Uranium-238	pCi/g	1.36 \pm 0.894	0.436	0.885	
	Uranium	mg/kg	0.722	0.0058	0.0387	
C-21	Americium-241	pCi/g	-0.0256 \pm 0.0913	0.0814	0.166	U
	Cesium-137	pCi/g	0.145 \pm 0.0344	0.0118	0.0245	
	Potassium-40	pCi/g	28.5 \pm 3.28	0.1	0.215	
	Uranium-235	pCi/g	0.168 \pm 0.134	0.0727	0.148	
	Uranium-238	pCi/g	0.773 \pm 1.36	0.618	1.26	U
	Uranium	mg/kg	0.737	0.0056	0.0373	
C-22	Americium-241	pCi/g	0.0276 \pm 0.0833	0.0675	0.138	U
	Cesium-137	pCi/g	0.0863 \pm 0.0386	0.0179	0.0371	
	Potassium-40	pCi/g	28.9 \pm 3.16	0.114	0.248	
	Uranium-235	pCi/g	0.0718 \pm 0.0983	0.0907	0.185	U
	Uranium-238	pCi/g	2.03 \pm 1.19	0.548	1.12	
	Uranium	mg/kg	0.678	0.00585	0.039	
C-23	Americium-241	pCi/g	-0.0585 \pm 0.0774	0.0656	0.134	U
	Cesium-137	pCi/g	0.22 \pm 0.039	0.0149	0.031	
	Potassium-40	pCi/g	25.8 \pm 2.84	0.107	0.234	
	Uranium-235	pCi/g	0.0663 \pm 0.116	0.086	0.176	U
	Uranium-238	pCi/g	2.38 \pm 1.42	0.53	1.08	
	Uranium	mg/kg	0.663	0.00561	0.0374	
C-24	Americium-241	pCi/g	0.0547 \pm 0.0656	0.0562	0.114	U
	Cesium-137	pCi/g	0.201 \pm 0.0327	0.0125	0.0258	
	Potassium-40	pCi/g	27.5 \pm 3.03	0.124	0.26	
	Uranium-235	pCi/g	0.076 \pm 0.147	0.0775	0.157	U
	Uranium-238	pCi/g	2.7 \pm 1.09	0.436	0.884	
	Uranium	mg/kg	0.965	0.0058	0.0387	
C-25	Americium-241	pCi/g	0 \pm 0.0367	0.0181	0.0367	U
	Cesium-137	pCi/g	0.322 \pm 0.052	0.0155	0.032	
	Potassium-40	pCi/g	26.4 \pm 2.74	0.106	0.226	
	Uranium-235	pCi/g	0.0873 \pm 0.129	0.0681	0.138	U
	Uranium-238	pCi/g	1.82 \pm 0.457	0.169	0.343	
	Uranium	mg/kg	1.13	0.00566	0.0377	
C-26	Americium-241	pCi/g	0.056 \pm 0.103	0.0675	0.137	U
	Cesium-137	pCi/g	0.556 \pm 0.0645	0.0143	0.0295	
	Potassium-40	pCi/g	27.7 \pm 3.21	0.12	0.255	
	Uranium-235	pCi/g	0.125 \pm 0.144	0.0899	0.182	U
	Uranium-238	pCi/g	2.01 \pm 1.3	0.554	1.12	
	Uranium	mg/kg	0.823	0.00555	0.037	

See notes at end of table.

TABLE A-1. Radiological Results for Off-site Soil Sampling Locations, 2002 (concluded)

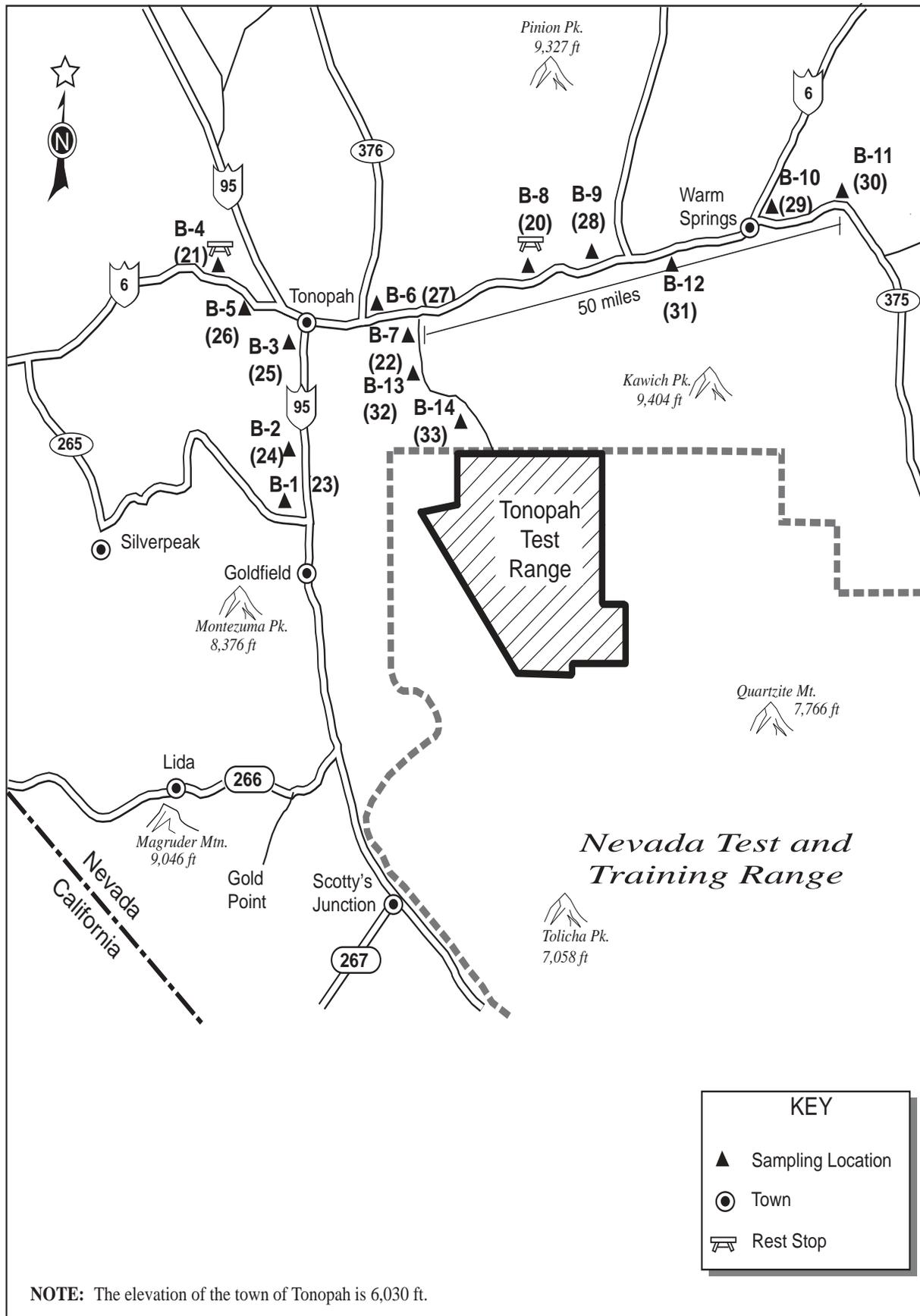
Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
C-27	Americium-241	pCi/g	0.0276 \pm 0.0459	0.0399	0.081	U
	Cesium-137	pCi/g	0.52 \pm 0.0682	0.0115	0.0237	
	Potassium-40	pCi/g	27.1 \pm 3	0.0995	0.209	
	Uranium-235	pCi/g	0.121 \pm 0.141	0.0759	0.154	U
	Uranium-238	pCi/g	2.3 \pm 0.979	0.362	0.734	
	Uranium	mg/kg	0.907	0.00584	0.0389	
C-28	Americium-241	pCi/g	0.007 \pm 0.0191	0.0168	0.0341	U
	Cesium-137	pCi/g	0.124 \pm 0.0274	0.0128	0.0264	
	Potassium-40	pCi/g	29.7 \pm 3.04	0.0992	0.212	
	Uranium-235	pCi/g	0.0518 \pm 0.124	0.0629	0.128	U
	Uranium-238	pCi/g	1.4 \pm 0.474	0.164	0.332	
	Uranium	mg/kg	0.747	0.00585	0.039	
C-29	Americium-241	pCi/g	0.0308 \pm 0.0474	0.0446	0.0906	U
	Cesium-137	pCi/g	0.272 \pm 0.0417	0.0116	0.0239	
	Potassium-40	pCi/g	23.4 \pm 2.61	0.101	0.213	
	Uranium-235	pCi/g	0.0657 \pm 0.118	0.0809	0.164	U
	Uranium-238	pCi/g	2.16 \pm 0.925	0.379	0.77	
	Uranium	mg/kg	1.11	0.00594	0.0396	
C-30	Americium-241	pCi/g	-0.0011 \pm 0.0641	0.0603	0.123	U
	Cesium-137	pCi/g	0.639 \pm 0.0757	0.0159	0.0329	
	Potassium-40	pCi/g	32.4 \pm 3.66	0.117	0.25	
	Uranium-235	pCi/g	0.248 \pm 0.234	0.0873	0.178	
	Uranium-238	pCi/g	0.905 \pm 0.995	0.498	1.01	U
	Uranium	mg/kg	0.735	0.00574	0.0382	
C-31	Americium-241	pCi/g	-0.0419 \pm 0.0788	0.0654	0.133	U
	Cesium-137	pCi/g	0.223 \pm 0.0337	0.0111	0.0228	
	Potassium-40	pCi/g	33.6 \pm 3.71	0.088	0.185	
	Uranium-235	pCi/g	0.0467 \pm 0.0815	0.0724	0.147	U
	Uranium-238	pCi/g	0.68 \pm 1.05	0.527	1.07	U
	Uranium	mg/kg	0.752	0.00574	0.0382	
C-32	Americium-241	pCi/g	0.0234 \pm 0.0588	0.055	0.112	U
	Cesium-137	pCi/g	0.157 \pm 0.0305	0.0136	0.0281	
	Potassium-40	pCi/g	31.4 \pm 3.53	0.113	0.241	
	Uranium-235	pCi/g	0.0119 \pm 0.143	0.0756	0.154	U
	Uranium-238	pCi/g	0.803 \pm 1.04	0.436	0.885	U
	Uranium	mg/kg	0.682	0.00579	0.0386	
C-33	Americium-241	pCi/g	0.0311 \pm 0.0724	0.0602	0.122	U
	Cesium-137	pCi/g	0.2 \pm 0.0345	0.0129	0.0267	
	Potassium-40	pCi/g	30.6 \pm 2.99	0.103	0.22	
	Uranium-235	pCi/g	0.0913 \pm 0.142	0.0853	0.173	U
	Uranium-238	pCi/g	1.77 \pm 1.2	0.487	0.988	
	Uranium	mg/kg	0.671	0.00579	0.0386	

Notes:

pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

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 (14 Locations)

TABLE A-2. Radiological Results for Perimeter Soil Sampling Locations, 2002

Location	Analyte	Units	Activity (! 2 σ)	Decision Level	Detection Limit	Lab Qualifier
P-06	Americium-241	pCi/g	0.0123 \pm 0.0266	0.0231	0.0467	U
	Cesium-137	pCi/g	0.14 \pm 0.0425	0.017	0.0347	
	Potassium-40	pCi/g	30.8 \pm 3.11	0.128	0.268	
	Uranium-235	pCi/g	0.0719 \pm 0.147	0.0812	0.164	U
	Uranium-238	pCi/g	2.27 \pm 0.686	0.222	0.449	
	Uranium	mg/kg	0.707	0.00571	0.0381	
P-08	Americium-241	pCi/g	-0.0217 \pm 0.0708	0.0597	0.121	U
	Cesium-137	pCi/g	0.101 \pm 0.027	0.0145	0.03	
	Potassium-40	pCi/g	31.7 \pm 3.58	0.112	0.241	
	Uranium-235	pCi/g	0.0282 \pm 0.0915	0.0824	0.168	U
	Uranium-238	pCi/g	1.32 \pm 1.23	0.481	0.977	
	Uranium	mg/kg	0.687	0.00586	0.0391	
P-11	Americium-241	pCi/g	0.0113 \pm 0.0256	0.0224	0.0453	U
	Cesium-137	pCi/g	0.168 \pm 0.0409	0.0158	0.0323	
	Potassium-40	pCi/g	31.7 \pm 3.18	0.127	0.266	
	Uranium-235	pCi/g	0.252 \pm 0.163	0.0807	0.163	
	Uranium-238	pCi/g	2.65 \pm 0.833	0.219	0.443	
	Uranium	mg/kg	0.639	0.00586	0.0391	
P-12	Americium-241	pCi/g	0.0183 \pm 0.0745	0.0612	0.124	U
	Cesium-137	pCi/g	0.475 \pm 0.0541	0.0133	0.0272	
	Potassium-40	pCi/g	32.1 \pm 3.11	0.0966	0.206	
	Uranium-235	pCi/g	0.0774 \pm 0.0967	0.0841	0.17	U
	Uranium-238	pCi/g	2.03 \pm 1.14	0.502	1.02	
	Uranium	mg/kg	0.639	0.00592	0.0394	
P-34	Americium-241	pCi/g	0.0208 \pm 0.0591	0.0523	0.106	U
	Cesium-137	pCi/g	0.473 \pm 0.0541	0.0115	0.0237	
	Potassium-40	pCi/g	31.1 \pm 3.4	0.101	0.213	
	Uranium-235	pCi/g	0.0331 \pm 0.113	0.0686	0.139	U
	Uranium-238	pCi/g	1.02 \pm 1.01	0.415	0.84	
	Uranium	mg/kg	0.76	0.00583	0.0388	
P-35	Americium-241	pCi/g	-0.0064 \pm 0.0383	0.0356	0.072	U
	Cesium-137	pCi/g	0.431 \pm 0.0548	0.0094	0.0192	
	Potassium-40	pCi/g	28.5 \pm 3.12	0.0821	0.171	
	Uranium-235	pCi/g	0.0687 \pm 0.118	0.0643	0.13	U
	Uranium-238	pCi/g	1.31 \pm 0.782	0.307	0.621	
	Uranium	mg/kg	1.01	0.00583	0.0388	
P-36	Americium-241	pCi/g	-0.0105 \pm 0.0707	0.068	0.139	U
	Cesium-137	pCi/g	0.158 \pm 0.043	0.0162	0.0337	
	Potassium-40	pCi/g	30.1 \pm 3.71	0.129	0.276	
	Uranium-235	pCi/g	0.216 \pm 0.176	0.0806	0.164	
	Uranium-238	pCi/g	0.773 \pm 1.28	0.553	1.13	U
	Uranium	mg/kg	0.733	0.0056	0.0373	

See notes at end of table.

TABLE A-2. Radiological Results for Perimeter Soil Sampling Locations, 2002 (concluded)

Location	Analyte	Units	Activity (! 2 σ)	Decision Level	Detection Limit	Lab Qualifier
P-37	Americium-241	pCi/g	0.0218 \pm 0.0629	0.0592	0.12	U
	Cesium-137	pCi/g	0.0252 \pm 0.0204	0.0136	0.028	U
	Potassium-40	pCi/g	30.6 \pm 2.99	0.0979	0.21	
	Uranium-235	pCi/g	0.0708 \pm 0.138	0.0805	0.163	U
	Uranium-238	pCi/g	1.36 \pm 0.995	0.472	0.958	
	Uranium	mg/kg	0.727	0.00583	0.0388	

Notes:

pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

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.

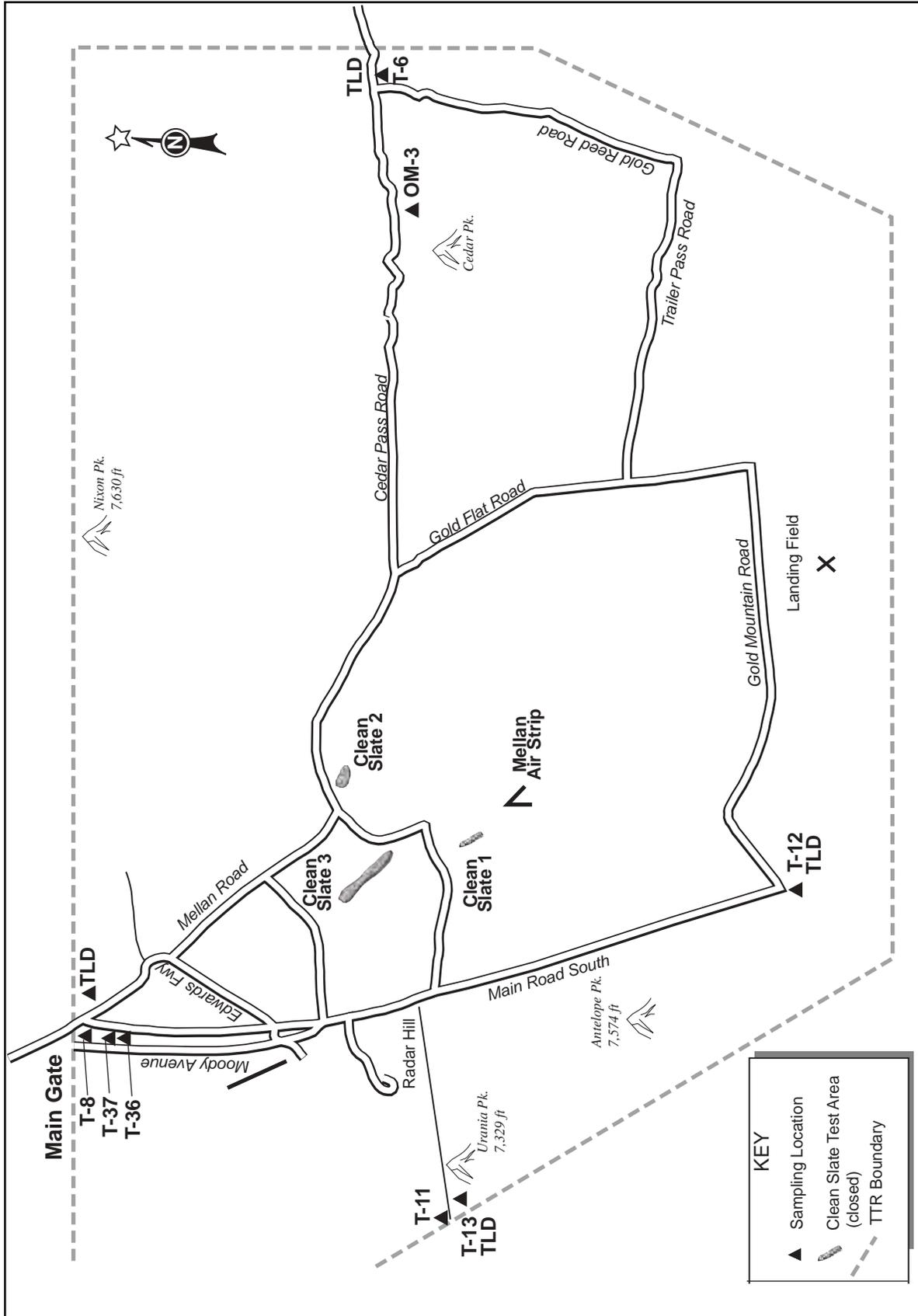
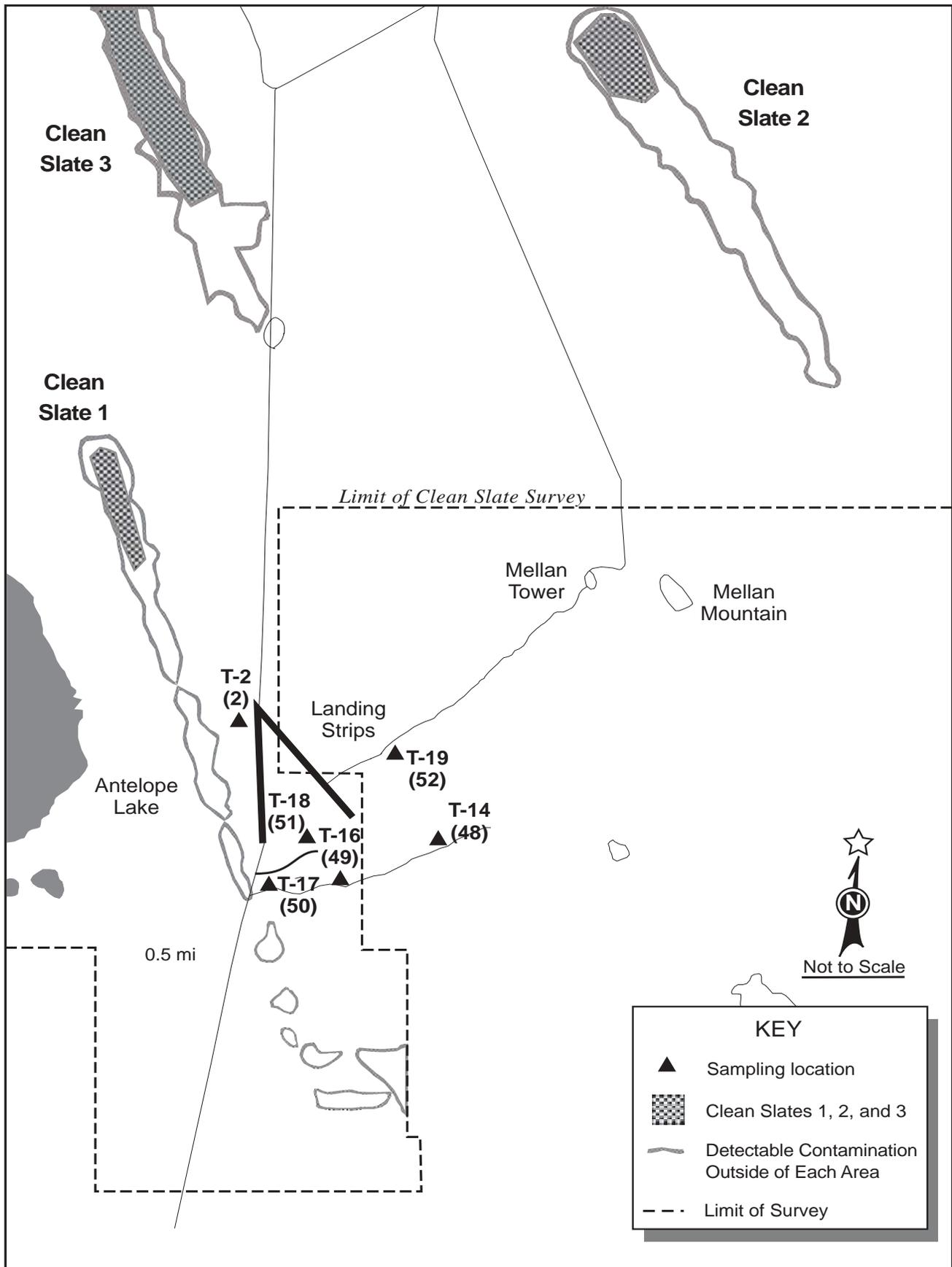


FIGURE A-2. Perimeter Soil Sampling Locations (Eight Locations)

TABLE A-3. Radiological Results for South Plume Area Soil Sampling Locations, 2002

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-48	Americium-241	pCi/g	0.0571 ± 0.0772	0.0727	0.148	U
	Cesium-137	pCi/g	0.409 ± 0.06	0.0166	0.0343	
	Potassium-40	pCi/g	28.8 ± 3.43	0.11	0.239	
	Uranium-235	pCi/g	0.259 ± 0.204	0.0997	0.203	
	Uranium-238	pCi/g	1.56 ± 1.26	0.564	1.15	
	Uranium	mg/kg	0.607	0.00577	0.0385	
S-49	Americium-241	pCi/g	0.521 ± 0.186	0.0656	0.133	
	Cesium-137	pCi/g	0.497 ± 0.0622	0.0158	0.0324	
	Potassium-40	pCi/g	31.3 ± 3.52	0.129	0.274	
	Uranium-235	pCi/g	0.123 ± 0.165	0.087	0.177	U
	Uranium-238	pCi/g	1.24 ± 0.924	0.515	1.04	
	Uranium	mg/kg	0.711	0.00586	0.0391	
S-50	Americium-241	pCi/g	-0.00257 ± 0.0632	0.0583	0.118	U
	Cesium-137	pCi/g	0.58 ± 0.0698	0.0124	0.0256	
	Potassium-40	pCi/g	0 ± 2.85	0.103	0.218	U
	Uranium-235	pCi/g	0.0962 ± 0.135	0.0798	0.162	U
	Uranium-238	pCi/g	2.1 ± 1.18	0.45	0.912	
	Uranium	mg/kg	0.618	0.00583	0.0388	
S-51	Americium-241	pCi/g	0.0648 ± 0.116	0.0768	0.156	U
	Cesium-137	pCi/g	0.454 ± 0.0885	0.0206	0.0425	



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FIGURE A-3. Soil Sampling Locations in the South Plume Area (Five Locations)

TABLE A-4. Radiological Results for Range Operations Center & Compound Soil Sampling Locations, 2002

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-40	Americium-241	pCi/g	0.0387 \pm 0.0731	0.0601	0.122	U
	Cesium-137	pCi/g	0.235 \pm 0.0367	0.0137	0.0283	
	Potassium-40	pCi/g	30.1 \pm 3.33	0.123	0.262	
	Uranium-235	pCi/g	0.0483 \pm 0.118	0.0793	0.161	U
	Uranium-238	pCi/g	0.573 \pm 1	0.484	0.983	U
	Uranium	mg/kg	0.971	0.00596	0.0398	
S-41	Americium-241	pCi/g	-0.0415 \pm 0.067	0.0609	0.124	U
	Cesium-137	pCi/g	0.073 \pm 0.0277	0.0149	0.0308	
	Potassium-40	pCi/g	32.4 \pm 3.65	0.118	0.252	
	Uranium-235	pCi/g	0.112 \pm 0.172	0.0869	0.176	U
	Uranium-238	pCi/g	0.945 \pm 0.99	0.51	1.03	U
	Uranium	mg/kg	0.739	0.00593	0.0395	
S-42	Americium-241	pCi/g	0.00908 \pm 0.0245	0.0214	0.0433	U
	Cesium-137	pCi/g	0.377 \pm 0.058	0.0151	0.031	
	Potassium-40	pCi/g	29.1 \pm 2.94	0.118	0.249	
	Uranium-235	pCi/g	0.131 \pm 0.141	0.0774	0.157	U
	Uranium-238	pCi/g	1.95 \pm 0.657	0.206	0.417	
	Uranium	mg/kg	0.742	0.00585	0.039	
S-43	Americium-241	pCi/g	-0.0344 \pm 0.0756	0.0672	0.136	U
	Cesium-137	pCi/g	0.0405 \pm 0.0217	0.0146	0.0302	
	Potassium-40	pCi/g	29.7 \pm 3.44	0.122	0.258	
	Uranium-235	pCi/g	0.191 \pm 0.176	0.0911	0.185	
	Uranium-238	pCi/g	1.73 \pm 1.15	0.547	1.11	
	Uranium	mg/kg	0.962	0.00586	0.0391	
S-44	Americium-241	pCi/g	0.000978 \pm 0.0664	0.0568	0.115	U
	Cesium-137	pCi/g	0.0653 \pm 0.0224	0.0135	0.0278	
	Potassium-40	pCi/g	31.1 \pm 3.34	0.11	0.233	

TABLE A-4. Radiological Results for Range Operations Center & Compound Soil Sampling Locations, 2002 (*concluded*)

Location	Analyte	Units	Activity (! 2 σ)	Decision Level	Detection Limit	Lab Qualifier
S-47	Americium-241	pCi/g	0 \pm 0.0253	0.0221	0.0448	U
	Cesium-137	pCi/g	0.211 \pm 0.0378	0.0153	0.0313	
	Potassium-40	pCi/g	31.4 \pm 3.16	0.127	0.265	
	Uranium-235	pCi/g	0.0569 \pm 0.154	0.0781	0.158	U
	Uranium-238	pCi/g	2.61 \pm 0.774	0.209	0.424	
	Uranium	mg/kg	0.643	0.00577	0.0385	

Notes:

pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

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.

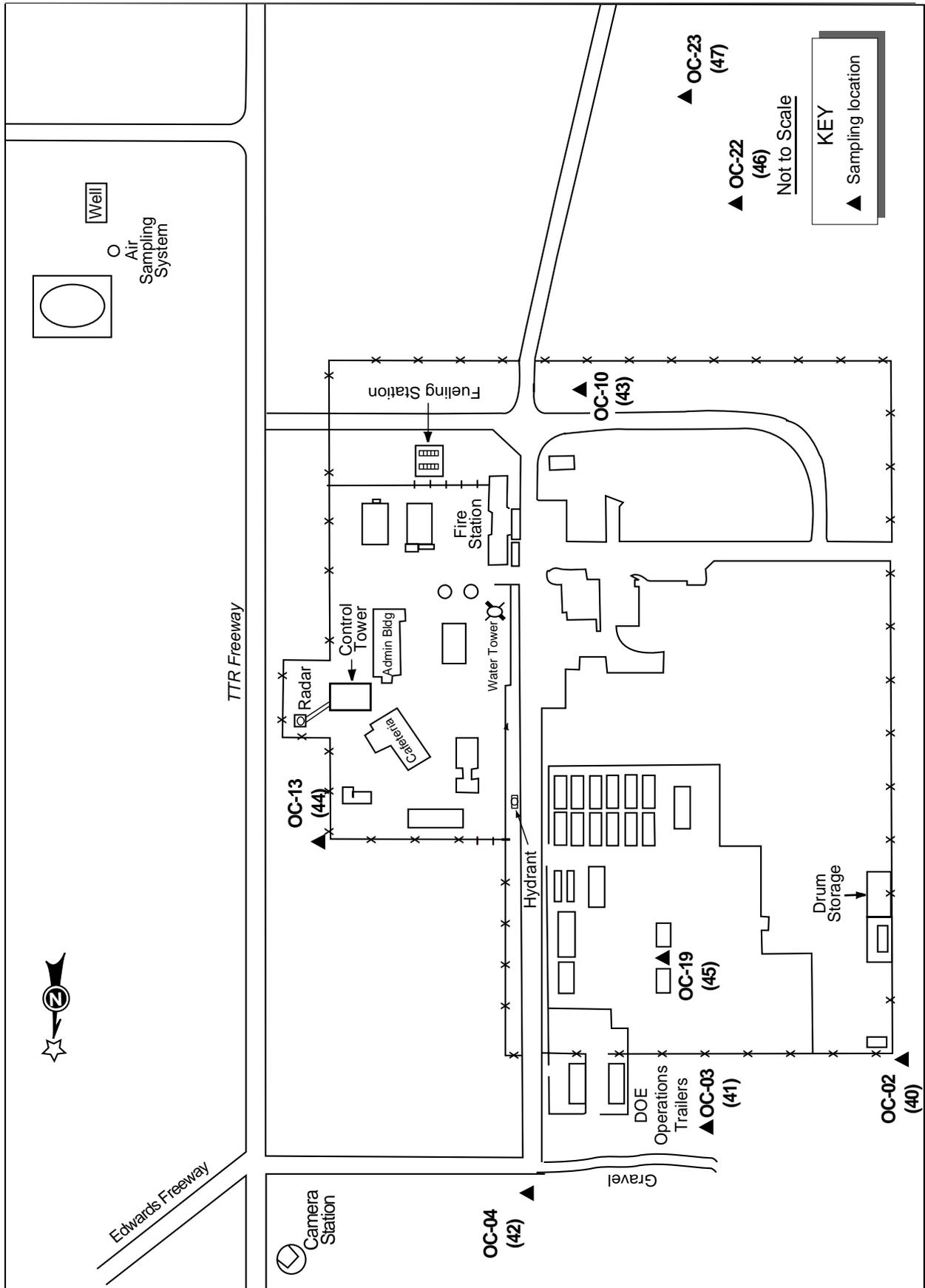


FIGURE A-4a. Soil Sampling Locations in the Range Operations Center and Compound (Six Locations)

Table A-5. Radiological Results for Various On-Site Soil Sampling Locations, 2002

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-02	Americium-241	pCi/g	0.00741 \pm 0.0474	0.0446	0.0904	U
	Cesium-137	pCi/g	0.577 \pm 0.0757	0.0114	0.0235	
	Potassium-40	pCi/g	33.8 \pm 3.72	0.0905	0.192	
	Uranium-235	pCi/g	0.15 \pm 0.116	0.079	0.16	U
	Uranium-238	pCi/g	1.7 \pm 0.962	0.377	0.764	
	Uranium	mg/kg	0.962	0.00596	0.0398	
S-03	Americium-241	pCi/g	0.234 \pm 0.144	0.0619	0.125	
	Cesium-137	pCi/g	0.508 \pm 0.0562	0.0126	0.0259	
	Potassium-40	pCi/g	31.6 \pm 3.07	0.104	0.219	
	Uranium-235	pCi/g	0.119 \pm 0.151	0.0803	0.163	U
	Uranium-238	pCi/g	1.99 \pm 1.03	0.482	0.975	
	Uranium	mg/kg	0.824	0.0056	0.0373	
S-04	Americium-241	pCi/g	0.0284 \pm 0.0279	0.0169	0.0342	U
	Cesium-137	pCi/g	0.505 \pm 0.0688	0.0132	0.0271	
	Potassium-40	pCi/g	31.3 \pm 3.2	0.115	0.242	
	Uranium-235	pCi/g	0.0584 \pm 0.116	0.0623	0.126	U
	Uranium-238	pCi/g	1.54 \pm 0.475	0.166	0.336	
	Uranium	mg/kg	0.919	0.00559	0.0372	
S-09	Americium-241	pCi/g	3.56 \pm 0.514	0.0766	0.156	
	Cesium-137	pCi/g	0.0915 \pm 0.0294	0.0166	0.0343	
	Potassium-40	pCi/g	26.5 \pm 3.16	0.133	0.284	
	Uranium-235	pCi/g	0.0974 \pm 0.182	0.097	0.197	U
	Uranium-238	pCi/g	1.37 \pm 1.19	0.553	1.12	
	Uranium	mg/kg	0.639	0.00559	0.0372	
S-10	Americium-241	pCi/g	-0.039 \pm 0.0864	0.0721	0.146	U
	Cesium-137	pCi/g	0.181 \pm 0.0377	0.0132	0.0272	
	Potassium-40	pCi/g	32.3 \pm 3.75	0.106	0.224	
	Uranium-235	pCi/g	0 \pm 0.0802	0.0715	0.145	U
	Uranium-238	pCi/g	1.09 \pm 1.09	0.559	1.13	U
	Uranium	mg/kg	0.786	0.00588	0.0392	
S-38	Americium-241	pCi/g	0.0545 \pm 0.0932	0.064	0.13	U
	Cesium-137	pCi/g	0.526 \pm 0.0619	0.0139	0.0287	
	Potassium-40	pCi/g	32.2 \pm 3.7	0.123	0.259	
	Uranium-235	pCi/g	0.141 \pm 0.163	0.0894	0.181	U
	Uranium-238	pCi/g	2.05 \pm 1.16	0.507	1.03	
	Uranium	mg/kg	0.661	0.00599	0.0399	
S-39	Americium-241	pCi/g	-0.00344 \pm 0.0847	0.0672	0.136	U
	Cesium-137	pCi/g	0.344 \pm 0.047	0.0155	0.0319	
	Potassium-40	pCi/g	30.5 \pm 3.29	0.124	0.263	
	Uranium-235	pCi/g	0.0897 \pm 0.133	0.0865	0.176	U
	Uranium-238	pCi/g	1.77 \pm 1.16	0.546	1.11	
	Uranium	mg/kg	0.882	0.00599	0.0399	

See notes at end of table.

Table A-5. Radiological Results for Various On-Site Soil Sampling Locations, 2002 (*concluded*)

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-53	Americium-241	pCi/g	0.0052 \pm 0.075	0.0725	0.148	U
	Cesium-137	pCi/g	0.335 \pm 0.0674	0.0173	0.0359	
	Potassium-40	pCi/g	29.4 \pm 3.64	0.121	0.262	
	Uranium-235	pCi/g	-0.0428 \pm 0.093	0.0842	0.172	U
	Uranium-238	pCi/g	1.15 \pm 1.4	0.595	1.21	U
	Uranium	mg/kg	0.628	0.00588	0.0392	

Notes:

pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

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.

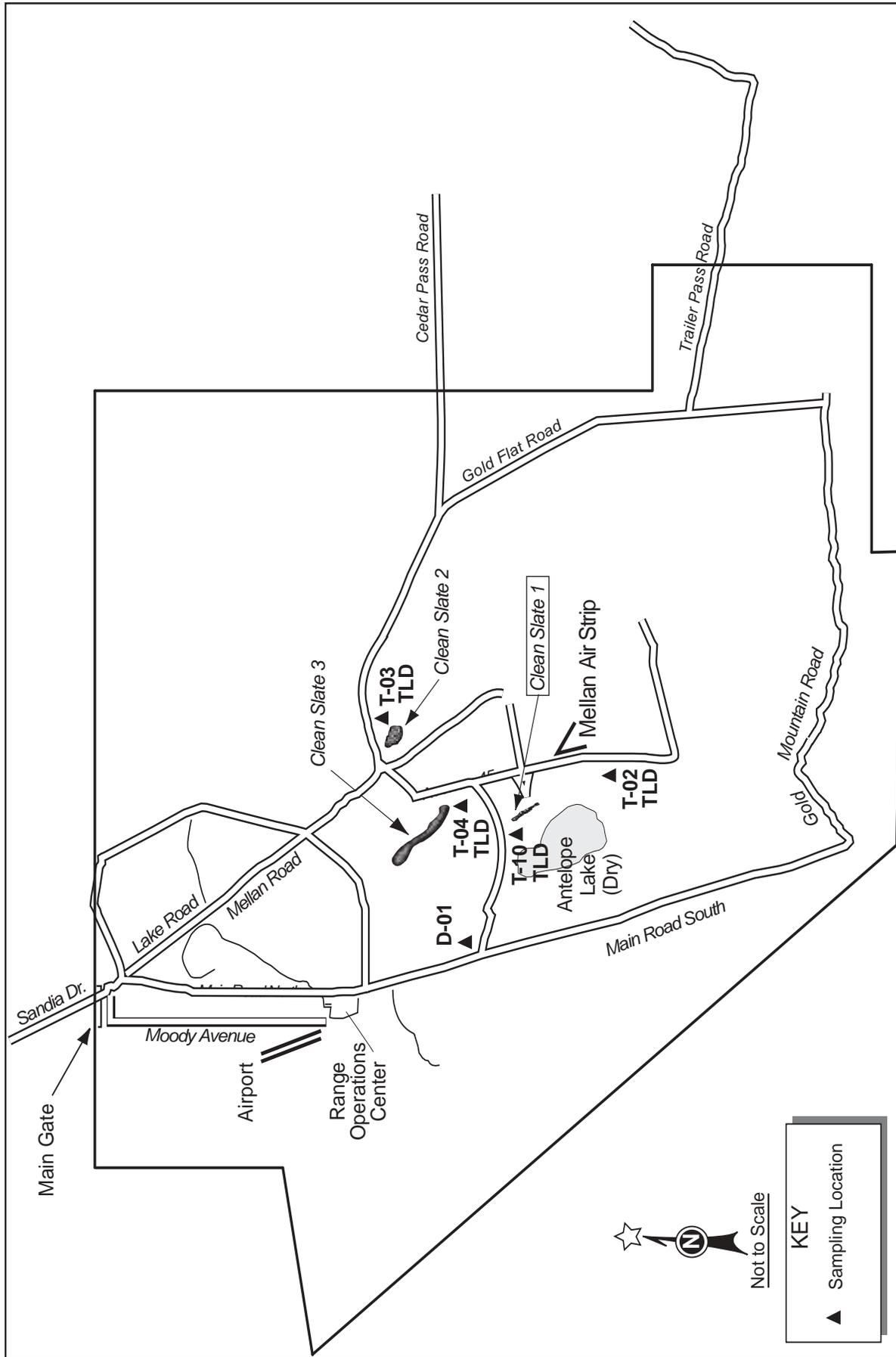
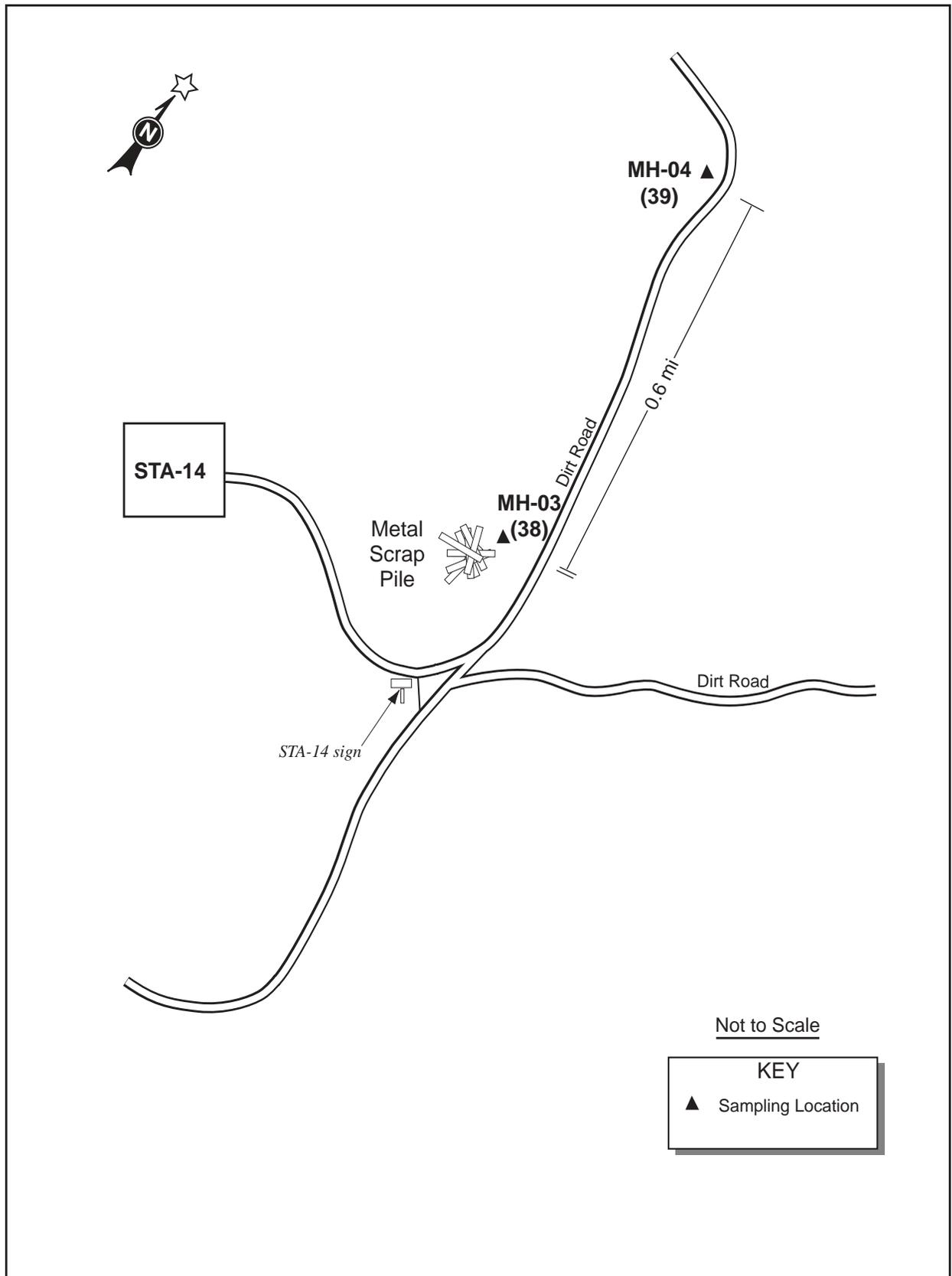
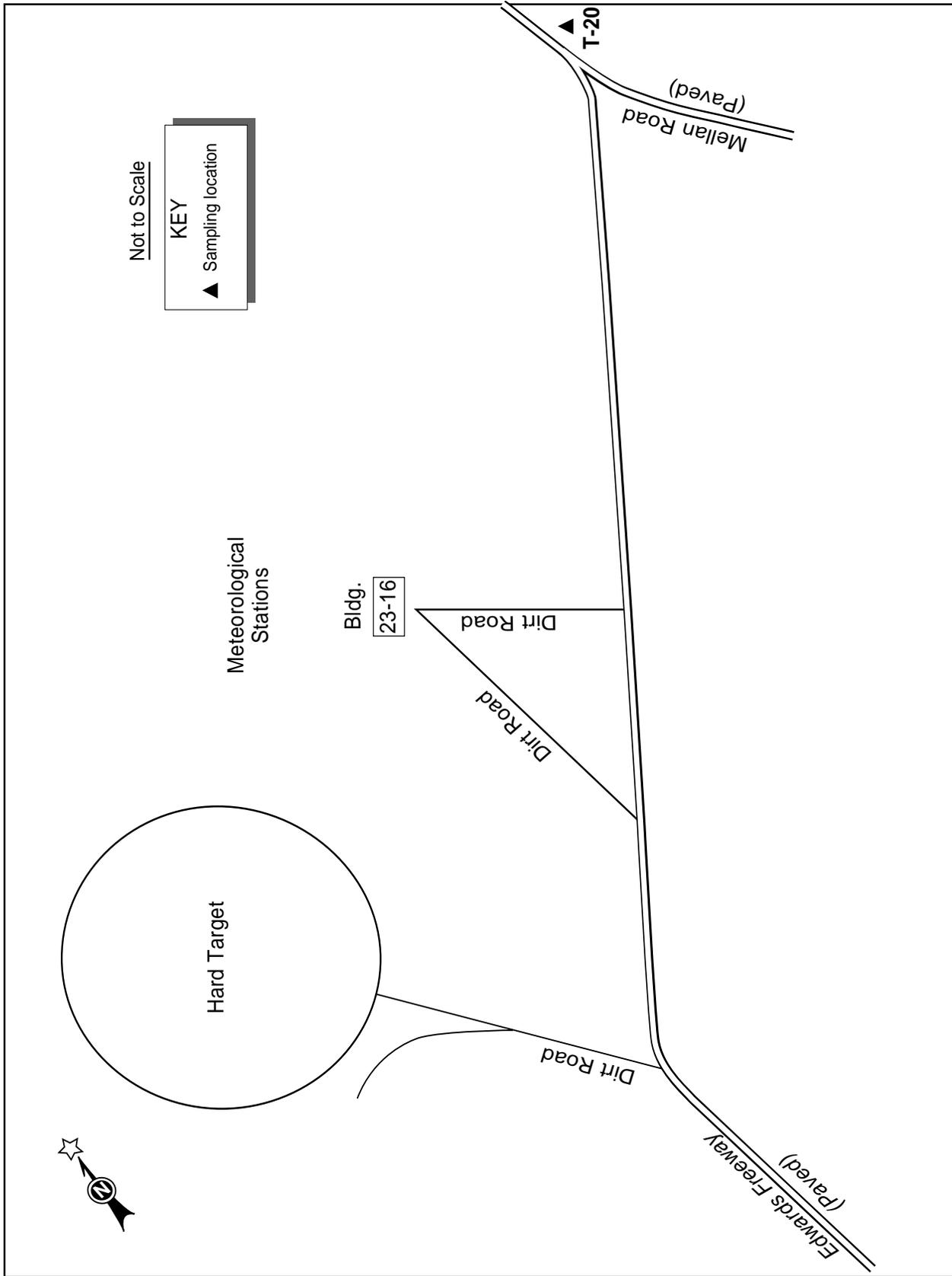


FIGURE A-5a. Various On-site Soil Sampling Locations (Five Locations)



01_B-5b.ai

FIGURE A-5b Various Soil Sampling Locations at Mellan Hill Area (Two Locations)



01_B-5c.ai

FIGURE A-5c. Various Soil Sampling Locations Near the Hard Target/Depleted Uranium Area (Two Locations)

TABLE A-6. Radiological Replicate Sampling at [Redacted] Locations, 2002

Location Type	Location	Analyte	Units	Sam	(±2σ)	Decision Level	Detection Limit	Lab Qualifier	Avg	Std Dev	Min	Max	CV%		
Off-Site	C-29	Americium-241	pCi/g	0586	0.0474	0.0446	0.0906	U	0.0025	0.0289	-0.0270	0.0308	11.61%		
				0586	±0.0255	0.0218	0.0441	U							
				0586	0.0706	0.0636	0.129	U							
		Potassium-40	pCi/g	0586	0.0417	0.0116	0.0239				0.2380	0.0362	0.2000	0.2720	0.15%
				0586	0.0418	0.0148	0.0303								
				0586	0.0316	0.0128	0.0264								
				0586	2.61	0.101	0.213			23.6667	0.8327	23.0000	24.6000	24.6000	0.04%
		Uranium	mg/kg	0586	2.49	0.134	0.278								
				0586	2.28	0.12	0.252								
				0586	1	0.00594	0.0396			1.0767	0.0351	1.0400	1.1100	1.1100	0.03%
Perimeter	P-35	Americium-241	pCi/g	0586	0.00577	0.0385									
				0586	0.00576	0.0384									
				058718-001	-0.0064 ± 0.0383	0.0356	0.072	U	0.0044	0.0100	-0.0064	0.0152	0.0152	2.26%	
		Cesium-137	pCi/g	058718-002	0.0132 ± 0.107	0.0857	0.174	U							
				058718-003	0.0064 ± 0.0713	0.0618	0.125	U							
				058718-001	0.431 ± 0.0548	0.0094	0.0192			0.3167	0.1670	0.1250	0.4310	0.4310	0.53%
				058718-002	0.394 ± 0.0502	0.0132	0.0271								
		Potassium-40	pCi/g	058718-003	0.125 ± 0.0328	0.0105	0.0216								
				058718-001	28.5 ± 3.12	0.0821	0.171			25.8333	3.1214	22.4000	28.5000	28.5000	0.12%
				058718-002	26.6 ± 3.05	0.105	0.222								
				058718-003	22.4 ± 2.62	0.0898	0.189								

TABLE A-6. Radiological Replicate Sampling for Soil Sampling Locations, 2002 (concluded)

Location Type	Location	Analyte	Units	Sample ID	Activity ($\pm 2\sigma$)	Decision Level	Detection Limit	Lab Qualifier	Avg	Std Dev	Min	Max	CV%		
Various On-Site (concluded)	S-09	Americium-241	pCi/g	058703-001	3.56 \pm 0.514	0.0766	0.156		2.2170	1.4142	0.7410	3.5600	0.64%		
				058703-002	0.741 \pm 0.202	0.0772	0.157								
				058703-003	2.35 \pm 0.269	0.0462	0.0937								
	Cesium-137	pCi/g	058703-001	0.0915 \pm 0.0294	0.0166	0.0343			0.1442	0.0750	0.0915	0.2300	0.52%		
			058703-002	0.23 \pm 0.0389	0.0116	0.024									
			058703-003	0.111 \pm 0.0275	0.0121	0.0248									
	Potassium-40	pCi/g	058703-001	26.5 \pm 3.16	0.133	0.284			27.6333	1.0263	26.5000	28.5000	0.04%		
			058703-002	28.5 \pm 3.18	0.0875	0.187									
			058703-003	27.9 \pm 3.08	0.102	0.213									
Uranium	mg/kg	058703-001	0.639	0.00559	0.0372			0.6243	0.0372	0.5820	0.6520	0.06%			
		058703-002	0.582	0.00583	0.0388										
		058703-003	0.652	0.00585	0.039										
South Plume Area	S-48	Americium-241	pCi/g	058712-001	0.0571 \pm 0.0772	0.0727	0.148	U	0.0648	0.0479	0.0212	0.1160	0.74%		
				058712-002	0.0212 \pm 0.0366	0.0195	0.0395	U							
				058712-003	0.116 \pm 0.13	0.082	0.167	U							
	Cesium-137	pCi/g	058712-001	0.409 \pm 0.06	0.0166	0.0343			0.4813	0.0641	0.4090	0.5310	0.13%		
			058712-002	0.531 \pm 0.0709	0.0139	0.0288									
			058712-003	0.504 \pm 0.0585	0.0127	0.0262									
	Potassium-40	pCi/g	058712-001	28.8 \pm 3.43	0.11	0.239			29.5667	1.0786	28.8000	30.8000	0.04%		
			058712-002	30.8 \pm 3.17	0.112	0.239									
			058712-003	29.1 \pm 3.34	0.0994	0.211									
Uranium	mg/kg	058712-001	0.607	0.00577	0.0385			0.6457	0.1064	0.5640	0.7660	0.16%			
		058712-002	0.564	0.00549	0.0366										
		058712-003	0.766	0.006	0.04										

Notes:

pCi/g = picocurie per gram

mg/kg = milligrams per kilogram

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.

Std Dev = Standard deviation

CV = Coefficient of variation

TABLE A-7. Non-radiological Results for Off-Site Soil Sampling Locations, 2002

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-20	Aluminum	mg/kg	9280	0.778	4.9	B
	Antimony	mg/kg	0.343	0.343	1	U
	Arsenic	mg/kg	2.61	0.202	0.49	
	Barium	mg/kg	128	0.0654	0.49	
	Beryllium	mg/kg	0.445	0.049	0.49	J
	Cadmium	mg/kg	0.0882	0.0469	0.49	J
	Calcium	mg/kg	2720	1.28	9.8	B
	Chromium	mg/kg	5.38	0.158	0.49	
	Cobalt	mg/kg	2.65	0.0782	0.49	
	Copper	mg/kg	5.33	0.199	0.49	
	Iron	mg/kg	10800	1.54	4.9	
	Lead	mg/kg	8.69	0.278	0.49	
	Magnesium	mg/kg	2620	0.573	1.96	B
	Manganese	mg/kg	328	0.128	0.98	
	Mercury	mg/kg	0.0124	0.000903	0.00919	H
	Nickel	mg/kg	3.61	0.0837	0.49	
	Potassium	mg/kg	2680	3.51	9.8	
	Selenium	mg/kg	0.258	0.159	0.49	J
	Silver	mg/kg	0.0884	0.0884	0.49	U
	Sodium	mg/kg	369	3.56	9.8	
Thallium	mg/kg	0.98	0.98	0.98	U	
Vanadium	mg/kg	18.8	0.089	0.49		
Zinc	mg/kg	35.2	0.165	0.49		
C-21	Aluminum	mg/kg	6160	0.793	5	
	Antimony	mg/kg	0.524	0.34	0.99	J
	Arsenic	mg/kg	5.86	0.206	0.5	
	Barium	mg/kg	98.6	0.0667	0.5	
	Beryllium	mg/kg	0.292	0.05	0.5	J
	Cadmium	mg/kg	0.0829	0.0478	0.5	J
	Calcium	mg/kg	4660	1.3	10	
	Chromium	mg/kg	5.14	0.161	0.5	
	Cobalt	mg/kg	1.94	0.0798	0.5	
	Copper	mg/kg	6.66	0.203	0.5	
	Iron	mg/kg	8190	1.57	5	
	Lead	mg/kg	11	0.284	0.5	
	Magnesium	mg/kg	3140	0.585	2	
	Manganese	mg/kg	213	0.131	1	
	Mercury	mg/kg	0.00358	0.000922	0.00938	HJ
	Nickel	mg/kg	3.25	0.0854	0.5	
	Potassium	mg/kg	2060	3.58	10	
	Selenium	mg/kg	0.272	0.162	0.5	J
	Silver	mg/kg	0.723	0.0902	0.5	
	Sodium	mg/kg	310	3.63	10	
Thallium	mg/kg	1	1	1	U	
Vanadium	mg/kg	17.1	0.0908	0.5		
Zinc	mg/kg	33	0.168	0.5		

See notes at end of table.

TABLE A-7. Non-radiological Results for Off-Site Soil Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-22	Aluminum	mg/kg	9610	0.672	4.24	B
	Antimony	mg/kg	0.426	0.327	0.952	J
	Arsenic	mg/kg	5.41	0.175	0.424	
	Barium	mg/kg	168	0.0565	0.424	
	Beryllium	mg/kg	0.532	0.0424	0.424	
	Cadmium	mg/kg	0.142	0.0405	0.424	J
	Calcium	mg/kg	5360	1.11	8.47	B
	Chromium	mg/kg	5.29	0.137	0.424	
	Cobalt	mg/kg	3.75	0.0676	0.424	
	Copper	mg/kg	7.27	0.172	0.424	
	Iron	mg/kg	11800	1.33	4.24	
	Lead	mg/kg	14.6	0.24	0.424	
	Magnesium	mg/kg	3860	0.496	1.69	B
	Manganese	mg/kg	517	0.111	0.847	
	Mercury	mg/kg	0.00853	0.000879	0.00894	HJ
	Nickel	mg/kg	4.87	0.0724	0.424	
	Potassium	mg/kg	3400	7.58	21.2	
	Selenium	mg/kg	0.253	0.137	0.424	J
	Silver	mg/kg	0.0764	0.0764	0.424	U
	Sodium	mg/kg	379	3.08	8.47	
Thallium	mg/kg	0.847	0.847	0.847	U	
Vanadium	mg/kg	16.2	0.0769	0.424		
Zinc	mg/kg	45.2	0.143	0.424		
C-23	Aluminum	mg/kg	9690	0.77	4.85	
	Antimony	mg/kg	0.597	0.324	0.943	J
	Arsenic	mg/kg	9.01	0.2	0.485	
	Barium	mg/kg	142	0.0648	0.485	
	Beryllium	mg/kg	0.514	0.0485	0.485	
	Cadmium	mg/kg	0.368	0.0464	0.485	J
	Calcium	mg/kg	13900	1.27	9.71	
	Chromium	mg/kg	6.29	0.156	0.485	
	Cobalt	mg/kg	4.05	0.0775	0.485	
	Copper	mg/kg	9.05	0.197	0.485	
	Iron	mg/kg	12700	1.52	4.85	
	Lead	mg/kg	15.6	0.275	0.485	
	Magnesium	mg/kg	3970	0.568	1.94	
	Manganese	mg/kg	452	0.127	0.971	
	Mercury	mg/kg	0.00487	0.000907	0.00923	HJ
	Nickel	mg/kg	5.8	0.0829	0.485	
	Potassium	mg/kg	2720	3.47	9.71	
	Selenium	mg/kg	0.157	0.157	0.485	U
	Silver	mg/kg	0.0876	0.0876	0.485	U
	Sodium	mg/kg	584	3.53	9.71	
Thallium	mg/kg	0.971	0.971	0.971	U	
Vanadium	mg/kg	24.4	0.0882	0.485		
Zinc	mg/kg	45.7	0.163	0.485		

See notes at end of table.

TABLE A-7. Non-radiological Results for Off-Site Soil Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-26	Aluminum	mg/kg	11400	0.785	4.95	
	Antimony	mg/kg	0.824	0.318	0.926	J
	Arsenic	mg/kg	7.48	0.204	0.495	
	Barium	mg/kg	151	0.066	0.495	
	Beryllium	mg/kg	0.551	0.0495	0.495	
	Cadmium	mg/kg	0.194	0.0473	0.495	J
	Calcium	mg/kg	18400	1.29	9.9	
	Chromium	mg/kg	8.48	0.16	0.495	
	Cobalt	mg/kg	3.88	0.079	0.495	
	Copper	mg/kg	17.8	0.201	0.495	
	Iron	mg/kg	12400	1.55	4.95	
	Lead	mg/kg	12.5	0.281	0.495	
	Magnesium	mg/kg	5230	0.579	1.98	
	Manganese	mg/kg	348	0.13	0.99	
	Mercury	mg/kg	0.0101	0.000884	0.009	H
	Nickel	mg/kg	6.7	0.0846	0.495	
	Potassium	mg/kg	3310	8.85	24.8	
	Selenium	mg/kg	0.16	0.16	0.495	U
	Silver	mg/kg	0.328	0.0893	0.495	J
	Sodium	mg/kg	589	3.6	9.9	
	Thallium	mg/kg	0.99	0.99	0.99	U
Vanadium	mg/kg	26.4	0.0899	0.495		
Zinc	mg/kg	40.6	0.167	0.495		
C-27	Aluminum	mg/kg	13700	0.728	4.59	
	Antimony	mg/kg	0.739	0.34	0.99	J
	Arsenic	mg/kg	9.52	0.189	0.459	
	Barium	mg/kg	257	0.0612	0.459	
	Beryllium	mg/kg	0.622	0.0459	0.459	
	Cadmium	mg/kg	0.219	0.0439	0.459	J
	Calcium	mg/kg	6300	1.2	9.17	
	Chromium	mg/kg	9.61	0.148	0.459	
	Cobalt	mg/kg	4.89	0.0732	0.459	
	Copper	mg/kg	17	0.186	0.459	
	Iron	mg/kg	14800	1.44	4.59	
	Lead	mg/kg	15.3	0.26	0.459	
	Magnesium	mg/kg	5000	0.537	1.83	
	Manganese	mg/kg	480	0.12	0.917	
	Mercury	mg/kg	0.00957	0.000888	0.00904	H
	Nickel	mg/kg	7.21	0.0783	0.459	
	Potassium	mg/kg	4070	8.2	22.9	
	Selenium	mg/kg	0.343	0.149	0.459	J
	Silver	mg/kg	0.0828	0.0828	0.459	U
	Sodium	mg/kg	936	3.33	9.17	
	Thallium	mg/kg	0.917	0.917	0.917	U
Vanadium	mg/kg	33	0.0833	0.459		
Zinc	mg/kg	44.5	0.154	0.459		

See notes at end of table.

TABLE A-7. Non-radiological Results for Off-Site Soil Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-28	Aluminum	mg/kg	12700	0.77	4.85	B
	Antimony	mg/kg	0.337	0.337	0.98	U
	Arsenic	mg/kg	3.71	0.2	0.485	
	Barium	mg/kg	159	0.0648	0.485	
	Beryllium	mg/kg	0.643	0.0485	0.485	
	Cadmium	mg/kg	0.0464	0.0464	0.485	U
	Calcium	mg/kg	3370	1.27	9.71	B
	Chromium	mg/kg	8.33	0.156	0.485	
	Cobalt	mg/kg	3.55	0.0775	0.485	
	Copper	mg/kg	8.72	0.197	0.485	
	Iron	mg/kg	13600	1.52	4.85	
	Lead	mg/kg	19.1	0.275	0.485	
	Magnesium	mg/kg	3630	0.568	1.94	B
	Manganese	mg/kg	338	0.127	0.971	
	Mercury	mg/kg	0.0114	0.00092	0.00936	H
	Nickel	mg/kg	6.19	0.0829	0.485	
	Potassium	mg/kg	4140	8.68	24.3	
	Selenium	mg/kg	0.539	0.157	0.485	
	Silver	mg/kg	0.0876	0.0876	0.485	U
	Sodium	mg/kg	346	3.53	9.71	
	Thallium	mg/kg	0.971	0.971	0.971	U
	Vanadium	mg/kg	22.6	0.0882	0.485	
Zinc	mg/kg	40	0.163	0.485		
C-29	Aluminum	mg/kg	9260	0.734	4.63	B
	Antimony	mg/kg	2.22	0.312	0.909	
	Arsenic	mg/kg	23.7	0.191	0.463	
	Barium	mg/kg	358	0.0618	0.463	
	Beryllium	mg/kg	0.805	0.0463	0.463	
	Cadmium	mg/kg	0.698	0.0443	0.463	
	Calcium	mg/kg	43000	1.21	9.26	B
	Chromium	mg/kg	9.31	0.149	0.463	
	Cobalt	mg/kg	3.8	0.0739	0.463	
	Copper	mg/kg	15.8	0.188	0.463	
	Iron	mg/kg	13400	1.45	4.63	
	Lead	mg/kg	33.1	0.263	0.463	
	Magnesium	mg/kg	18000	0.541	1.85	B
	Manganese	mg/kg	321	0.121	0.926	
	Mercury	mg/kg	0.0298	0.000973	0.0099	H
	Nickel	mg/kg	19.2	0.0791	0.463	
	Potassium	mg/kg	3220	8.28	23.1	
	Selenium	mg/kg	0.922	0.15	0.463	
	Silver	mg/kg	0.0835	0.0835	0.463	U
	Sodium	mg/kg	327	3.36	9.26	
	Thallium	mg/kg	1.58	0.926	0.926	
	Vanadium	mg/kg	39.3	0.0841	0.463	
Zinc	mg/kg	95.1	0.156	0.463		

See notes at end of table.

TABLE A-7. Non-radiological Results for Off-Site Soil Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-30	Aluminum	mg/kg	10100	0.728	4.59	
	Antimony	mg/kg	0.353	0.343	1	J
	Arsenic	mg/kg	5.29	0.189	0.459	
	Barium	mg/kg	166	0.0612	0.459	
	Beryllium	mg/kg	0.413	0.0459	0.459	J
	Cadmium	mg/kg	0.0985	0.0439	0.459	J
	Calcium	mg/kg	17500	1.2	9.17	
	Chromium	mg/kg	5.97	0.148	0.459	
	Cobalt	mg/kg	3.1	0.0732	0.459	
	Copper	mg/kg	4.97	0.186	0.459	
	Iron	mg/kg	11000	1.44	4.59	
	Lead	mg/kg	9.56	0.26	0.459	
	Magnesium	mg/kg	4490	0.537	1.83	
	Manganese	mg/kg	348	0.12	0.917	
	Mercury	mg/kg	0.00429	0.000927	0.00943	HJ
	Nickel	mg/kg	4.48	0.0783	0.459	
	Potassium	mg/kg	4050	8.2	22.9	
	Selenium	mg/kg	0.149	0.149	0.459	U
	Silver	mg/kg	0.0828	0.0828	0.459	U
	Sodium	mg/kg	1220	3.33	9.17	
	Thallium	mg/kg	0.917	0.917	0.917	U
	Vanadium	mg/kg	26.8	0.0833	0.459	
	Zinc	mg/kg	28.8	0.154	0.459	
	C-31	Aluminum	mg/kg	10300	0.77	4.85
Antimony		mg/kg	0.558	0.324	0.943	J
Arsenic		mg/kg	4.19	0.2	0.485	
Barium		mg/kg	164	0.0648	0.485	
Beryllium		mg/kg	0.519	0.0485	0.485	
Cadmium		mg/kg	0.157	0.0464	0.485	J
Calcium		mg/kg	5880	1.27	9.71	B
Chromium		mg/kg	5.11	0.156	0.485	
Cobalt		mg/kg	3.11	0.0775	0.485	
Copper		mg/kg	6	0.197	0.485	
Iron		mg/kg	9870	1.52	4.85	
Lead		mg/kg	9.61	0.275	0.485	
Magnesium		mg/kg	3350	0.568	1.94	B
Manganese		mg/kg	488	0.127	0.971	
Mercury		mg/kg	0.00999	0.000894	0.00909	H
Nickel		mg/kg	4.23	0.0829	0.485	
Potassium		mg/kg	4450	8.68	24.3	
Selenium		mg/kg	0.296	0.157	0.485	J
Silver		mg/kg	0.0876	0.0876	0.485	U
Sodium		mg/kg	1140	3.53	9.71	
Thallium		mg/kg	0.971	0.971	0.971	U
Vanadium		mg/kg	14.5	0.0882	0.485	
Zinc		mg/kg	32.1	0.163	0.485	

See notes at end of table.

TABLE A-7. Non-radiological Results for Off-Site Soil Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
C-32	Aluminum	mg/kg	8120	0.748	4.72	B
	Antimony	mg/kg	0.369	0.312	0.909	J
	Arsenic	mg/kg	2.76	0.195	0.472	
	Barium	mg/kg	118	0.0629	0.472	
	Beryllium	mg/kg	0.412	0.0472	0.472	J
	Cadmium	mg/kg	0.0451	0.0451	0.472	U
	Calcium	mg/kg	2640	1.23	9.43	B
	Chromium	mg/kg	4.15	0.152	0.472	
	Cobalt	mg/kg	1.63	0.0753	0.472	
	Copper	mg/kg	3.66	0.192	0.472	
	Iron	mg/kg	7970	1.48	4.72	
	Lead	mg/kg	6.18	0.268	0.472	
	Magnesium	mg/kg	2380	0.552	1.89	B
	Manganese	mg/kg	161	0.123	0.943	
	Mercury	mg/kg	0.00615	0.000965	0.00982	HJ
	Nickel	mg/kg	2.79	0.0806	0.472	
	Potassium	mg/kg	3510	8.43	23.6	
	Selenium	mg/kg	0.153	0.153	0.472	U
	Silver	mg/kg	0.0851	0.0851	0.472	U
	Sodium	mg/kg	229	3.43	9.43	
Thallium	mg/kg	0.943	0.943	0.943	U	
Vanadium	mg/kg	13.4	0.0857	0.472		
Zinc	mg/kg	21.6	0.159	0.472		
C-33	Aluminum	mg/kg	7430	0.708	4.46	B
	Antimony	mg/kg	0.462	0.315	0.917	J
	Arsenic	mg/kg	2.49	0.184	0.446	
	Barium	mg/kg	115	0.0596	0.446	
	Beryllium	mg/kg	0.369	0.0446	0.446	J
	Cadmium	mg/kg	0.0427	0.0427	0.446	U
	Calcium	mg/kg	2180	1.16	8.93	B
	Chromium	mg/kg	4.15	0.144	0.446	
	Cobalt	mg/kg	1.61	0.0713	0.446	
	Copper	mg/kg	3.83	0.181	0.446	
	Iron	mg/kg	7850	1.4	4.46	
	Lead	mg/kg	5.41	0.253	0.446	
	Magnesium	mg/kg	2080	0.522	1.79	B
	Manganese	mg/kg	148	0.117	0.893	
	Mercury	mg/kg	0.00583	0.000872	0.00888	HJ
	Nickel	mg/kg	2.69	0.0763	0.446	
	Potassium	mg/kg	2470	3.19	8.93	
	Selenium	mg/kg	0.186	0.145	0.446	J
	Silver	mg/kg	0.0805	0.0805	0.446	U
	Sodium	mg/kg	196	3.24	8.93	
Thallium	mg/kg	0.893	0.893	0.893	U	
Vanadium	mg/kg	12.5	0.0811	0.446		
Zinc	mg/kg	20.2	0.15	0.446		

See notes at end of table.

TABLE A-7. Non-radiological Results for Off-Site Soil Sampling Locations, 2002 (*concluded*)**Notes:**

mg/kg = milligrams per kilogram

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

H = Holding time exceeded.

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-8. Non-radiological Results for Perimeter Soil Sampling Locations, 2002

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
P-06	Aluminum	mg/kg	11800	0.624	3.94	
	Antimony	mg/kg	0.264	0.264	0.769	U
	Arsenic	mg/kg	3.95	0.163	0.394	
	Barium	mg/kg	115	0.0525	0.394	
	Beryllium	mg/kg	0.664	0.0394	0.394	
	Cadmium	mg/kg	0.1	0.0376	0.394	J
	Calcium	mg/kg	6640	1.03	7.87	
	Chromium	mg/kg	7.42	0.127	0.394	
	Cobalt	mg/kg	3.33	0.0628	0.394	
	Copper	mg/kg	7.37	0.16	0.394	
	Iron	mg/kg	10500	1.23	3.94	
	Lead	mg/kg	12.1	0.223	0.394	
	Magnesium	mg/kg	4260	0.46	1.57	
	Manganese	mg/kg	369	0.103	0.787	
	Mercury	mg/kg	0.00123	0.000936	0.00952	HJ
	Nickel	mg/kg	6.04	0.0672	0.394	
	Potassium	mg/kg	4010	7.04	19.7	
	Selenium	mg/kg	0.128	0.128	0.394	U
	Silver	mg/kg	0.071	0.071	0.394	U
	Sodium	mg/kg	354	2.86	7.87	
Thallium	mg/kg	0.787	0.787	0.787	U	
Vanadium	mg/kg	16.7	0.0715	0.394		
Zinc	mg/kg	80.5	0.133	0.394		
P-08	Aluminum	mg/kg	5460	0.785	4.95	B
	Antimony	mg/kg	0.312	0.312	0.909	U
	Arsenic	mg/kg	3.48	0.204	0.495	
	Barium	mg/kg	96.8	0.066	0.495	
	Beryllium	mg/kg	0.325	0.0495	0.495	J
	Cadmium	mg/kg	0.0473	0.0473	0.495	U
	Calcium	mg/kg	1970	1.29	9.9	B
	Chromium	mg/kg	2.73	0.16	0.495	
	Cobalt	mg/kg	1.13	0.079	0.495	
	Copper	mg/kg	3.29	0.201	0.495	
	Iron	mg/kg	6980	1.55	4.95	
	Lead	mg/kg	4.44	0.281	0.495	
	Magnesium	mg/kg	1530	0.579	1.98	B
	Manganese	mg/kg	138	0.13	0.99	
	Mercury	mg/kg	0.00667	0.000957	0.00974	HJ
	Nickel	mg/kg	2.01	0.0846	0.495	
	Potassium	mg/kg	2000	3.54	9.9	
	Selenium	mg/kg	0.16	0.16	0.495	U
	Silver	mg/kg	0.0893	0.0893	0.495	U
	Sodium	mg/kg	148	3.6	9.9	
Thallium	mg/kg	0.99	0.99	0.99	U	
Vanadium	mg/kg	9.84	0.0899	0.495		
Zinc	mg/kg	19.5	0.167	0.495		

See notes at end of table.

TABLE A-8. Non-radiological Results for Perimeter Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
P-11	Aluminum	mg/kg	4420	0.661	4.17	
	Antimony	mg/kg	0.309	0.309	0.901	U
	Arsenic	mg/kg	6.51	0.172	0.417	
	Barium	mg/kg	135	0.0556	0.417	
	Beryllium	mg/kg	0.717	0.0417	0.417	
	Cadmium	mg/kg	0.108	0.0398	0.417	J
	Calcium	mg/kg	2000	1.09	8.33	
	Chromium	mg/kg	1.89	0.134	0.417	
	Cobalt	mg/kg	3.22	0.0665	0.417	
	Copper	mg/kg	3.99	0.169	0.417	
	Iron	mg/kg	9830	1.31	4.17	
	Lead	mg/kg	12.9	0.236	0.417	
	Magnesium	mg/kg	1290	0.487	1.67	
	Manganese	mg/kg	434	0.109	0.833	
	Mercury	mg/kg	0.00599	0.000861	0.00876	HJ
	Nickel	mg/kg	2.04	0.0712	0.417	
	Potassium	mg/kg	1780	2.98	8.33	
	Selenium	mg/kg	0.135	0.135	0.417	U
	Silver	mg/kg	0.0752	0.0752	0.417	U
	Sodium	mg/kg	80.2	3.03	8.33	B
Thallium	mg/kg	0.833	0.833	0.833	U	
Vanadium	mg/kg	7.79	0.0757	0.417		
Zinc	mg/kg	43.5	0.14	0.417		
P-12	Aluminum	mg/kg	10100	0.748	4.72	
	Antimony	mg/kg	0.333	0.309	0.901	J
	Arsenic	mg/kg	9.42	0.195	0.472	
	Barium	mg/kg	148	0.0629	0.472	
	Beryllium	mg/kg	0.647	0.0472	0.472	
	Cadmium	mg/kg	0.21	0.0451	0.472	J
	Calcium	mg/kg	4750	1.23	9.43	
	Chromium	mg/kg	6.25	0.152	0.472	
	Cobalt	mg/kg	3.8	0.0753	0.472	
	Copper	mg/kg	7.4	0.192	0.472	
	Iron	mg/kg	12300	1.48	4.72	
	Lead	mg/kg	13.8	0.268	0.472	
	Magnesium	mg/kg	3980	0.552	1.89	
	Manganese	mg/kg	521	0.123	0.943	
	Mercury	mg/kg	0.00516	0.000876	0.00892	HJ
	Nickel	mg/kg	5.47	0.0806	0.472	
	Potassium	mg/kg	3370	16.9	47.2	
	Selenium	mg/kg	0.153	0.153	0.472	U
	Silver	mg/kg	0.0851	0.0851	0.472	U
	Sodium	mg/kg	316	3.43	9.43	B
Thallium	mg/kg	0.943	0.943	0.943	U	
Vanadium	mg/kg	20.6	0.0857	0.472		
Zinc	mg/kg	42.5	0.159	0.472		

See notes at end of table.

TABLE A-8. Non-radiological Results for Perimeter Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
P-34	Aluminum	mg/kg	9540	0.592	3.73	
	Antimony	mg/kg	0.367	0.27	0.787	J
	Arsenic	mg/kg	3.33	0.154	0.373	
	Barium	mg/kg	111	0.0498	0.373	
	Beryllium	mg/kg	0.487	0.0373	0.373	
	Cadmium	mg/kg	0.131	0.0357	0.373	J
	Calcium	mg/kg	2770	0.973	7.46	
	Chromium	mg/kg	6.16	0.12	0.373	
	Cobalt	mg/kg	2.94	0.0596	0.373	
	Copper	mg/kg	6.05	0.151	0.373	
	Iron	mg/kg	10000	1.17	3.73	
	Lead	mg/kg	9.02	0.212	0.373	
	Magnesium	mg/kg	3110	0.436	1.49	
	Manganese	mg/kg	385	0.0976	0.746	
	Mercury	mg/kg	0.00263	0.000907	0.00923	HJ
	Nickel	mg/kg	4.82	0.0637	0.373	
	Potassium	mg/kg	2710	6.67	18.7	
	Selenium	mg/kg	0.298	0.121	0.373	J
	Silver	mg/kg	0.0673	0.0673	0.373	U
	Sodium	mg/kg	289	2.71	7.46	
Thallium	mg/kg	0.746	0.746	0.746	U	
Vanadium	mg/kg	17.2	0.0678	0.373		
Zinc	mg/kg	32	0.126	0.373		
P-35	Aluminum	mg/kg	13300	0.65	4.1	
	Antimony	mg/kg	0.333	0.333	0.971	U
	Arsenic	mg/kg	6.78	0.169	0.41	
	Barium	mg/kg	125	0.0547	0.41	
	Beryllium	mg/kg	1.18	0.041	0.41	
	Cadmium	mg/kg	0.211	0.0392	0.41	J
	Calcium	mg/kg	4460	1.07	8.2	
	Chromium	mg/kg	11.4	0.132	0.41	
	Cobalt	mg/kg	8.16	0.0654	0.41	
	Copper	mg/kg	26.7	0.166	0.41	
	Iron	mg/kg	19700	1.28	4.1	
	Lead	mg/kg	20.1	0.233	0.41	
	Magnesium	mg/kg	4670	0.479	1.64	
	Manganese	mg/kg	917	0.268	2.05	
	Mercury	mg/kg	0.01	0.000874	0.00889	H
	Nickel	mg/kg	12.8	0.07	0.41	
	Potassium	mg/kg	2960	7.33	20.5	
	Selenium	mg/kg	0.388	0.133	0.41	J
	Silver	mg/kg	0.0739	0.0739	0.41	U
	Sodium	mg/kg	341	2.98	8.2	B
Thallium	mg/kg	0.82	0.82	0.82	U	
Vanadium	mg/kg	40.3	0.0744	0.41		
Zinc	mg/kg	99	0.138	0.41		

See notes at end of table.

Report, TTR & KTF

002 (continued)

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TABLE A-8. Non-radiological Results for Perimeter Sampling Locations, 2002 (*concluded*)**Notes:**

mg/kg = milligrams per kilogram

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

H = Holding time exceeded.

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-9. Non-radiological Results for On-Site Soil Sampling Locations, 2002

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-02	Aluminum	mg/kg	11100	0.734	4.63	
	Antimony	mg/kg	0.312	0.312	0.909	U
	Arsenic	mg/kg	7.06	0.191	0.463	
	Barium	mg/kg	152	0.0618	0.463	
	Beryllium	mg/kg	0.661	0.0463	0.463	
	Cadmium	mg/kg	0.0741	0.0443	0.463	J
	Calcium	mg/kg	3320	1.21	9.26	
	Chromium	mg/kg	5.52	0.149	0.463	
	Cobalt	mg/kg	2.79	0.0739	0.463	
	Copper	mg/kg	5.48	0.188	0.463	
	Iron	mg/kg	9860	1.45	4.63	
	Lead	mg/kg	9.53	0.263	0.463	
	Magnesium	mg/kg	3230	0.541	1.85	
	Manganese	mg/kg	307	0.121	0.926	
	Mercury	mg/kg	0.0088	0.000945	0.00962	HJ
	Nickel	mg/kg	5.29	0.0791	0.463	
	Potassium	mg/kg	4030	16.6	46.3	
	Selenium	mg/kg	0.203	0.15	0.463	J
	Silver	mg/kg	0.0835	0.0835	0.463	U
	Sodium	mg/kg	237	3.36	9.26	B
	Thallium	mg/kg	0.926	0.926	0.926	U
	Vanadium	mg/kg	15.9	0.0841	0.463	
Zinc	mg/kg	31.3	0.156	0.463		
S-03	Aluminum	mg/kg	10800	0.696	4.39	
	Antimony	mg/kg	0.758	0.337	0.98	J
	Arsenic	mg/kg	5.26	0.181	0.439	
	Barium	mg/kg	111	0.0585	0.439	
	Beryllium	mg/kg	0.587	0.0439	0.439	
	Cadmium	mg/kg	0.104	0.0419	0.439	J
	Calcium	mg/kg	3270	1.14	8.77	
	Chromium	mg/kg	6.74	0.141	0.439	
	Cobalt	mg/kg	3.16	0.07	0.439	
	Copper	mg/kg	7.15	0.178	0.439	
	Iron	mg/kg	11400	1.37	4.39	
	Lead	mg/kg	9.31	0.249	0.439	
	Magnesium	mg/kg	3710	0.513	1.75	
	Manganese	mg/kg	362	0.115	0.877	
	Mercury	mg/kg	0.00475	0.000878	0.00893	HJ
	Nickel	mg/kg	5.22	0.0749	0.439	
	Potassium	mg/kg	3860	7.84	21.9	
	Selenium	mg/kg	0.169	0.142	0.439	J
	Silver	mg/kg	0.0791	0.0791	0.439	U
	Sodium	mg/kg	282	3.19	8.77	
	Thallium	mg/kg	0.877	0.877	0.877	U
	Vanadium	mg/kg	19.5	0.0796	0.439	
Zinc	mg/kg	34.2	0.148	0.439		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-04	Aluminum	mg/kg	8680	0.734	4.63	
	Antimony	mg/kg	0.584	0.284	0.826	J
	Arsenic	mg/kg	4.57	0.191	0.463	
	Barium	mg/kg	108	0.0618	0.463	
	Beryllium	mg/kg	0.515	0.0463	0.463	
	Cadmium	mg/kg	0.13	0.0443	0.463	J
	Calcium	mg/kg	2950	1.21	9.26	
	Chromium	mg/kg	4.67	0.149	0.463	
	Cobalt	mg/kg	2.35	0.0739	0.463	
	Copper	mg/kg	5.54	0.188	0.463	
	Iron	mg/kg	9260	1.45	4.63	
	Lead	mg/kg	7.53	0.263	0.463	
	Magnesium	mg/kg	3080	0.541	1.85	
	Manganese	mg/kg	375	0.121	0.926	
	Mercury	mg/kg	0.00609	0.000888	0.00904	HJ
	Nickel	mg/kg	3.73	0.0791	0.463	
	Potassium	mg/kg	2680	3.31	9.26	
	Selenium	mg/kg	0.15	0.15	0.463	U
	Silver	mg/kg	0.0835	0.0835	0.463	U
	Sodium	mg/kg	250	3.36	9.26	
Thallium	mg/kg	0.926	0.926	0.926	U	
Vanadium	mg/kg	15.8	0.0841	0.463		
Zinc	mg/kg	29.5	0.156	0.463		
S-09	Aluminum	mg/kg	10500	0.728	4.59	
	Antimony	mg/kg	0.584	0.309	0.901	J
	Arsenic	mg/kg	4.27	0.189	0.459	
	Barium	mg/kg	131	0.0612	0.459	
	Beryllium	mg/kg	0.612	0.0459	0.459	
	Cadmium	mg/kg	0.0649	0.0439	0.459	J
	Calcium	mg/kg	5980	1.2	9.17	
	Chromium	mg/kg	7.09	0.148	0.459	
	Cobalt	mg/kg	5.41	0.0732	0.459	
	Copper	mg/kg	7.4	0.186	0.459	
	Iron	mg/kg	15100	1.44	4.59	
	Lead	mg/kg	11	0.26	0.459	
	Magnesium	mg/kg	4430	0.537	1.83	
	Manganese	mg/kg	391	0.12	0.917	
	Mercury	mg/kg	0.00398	0.000968	0.00985	HJ
	Nickel	mg/kg	5.29	0.0783	0.459	
	Potassium	mg/kg	3210	8.2	22.9	
	Selenium	mg/kg	0.212	0.149	0.459	J
	Silver	mg/kg	0.0828	0.0828	0.459	U
	Sodium	mg/kg	249	3.33	9.17	
Thallium	mg/kg	0.917	0.917	0.917	U	
Vanadium	mg/kg	23.3	0.0833	0.459		
Zinc	mg/kg	36.3	0.154	0.459		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-10	Aluminum	mg/kg	10600	0.748	4.72	
	Antimony	mg/kg	0.281	0.281	0.82	U
	Arsenic	mg/kg	3.96	0.195	0.472	
	Barium	mg/kg	125	0.0629	0.472	
	Beryllium	mg/kg	0.609	0.0472	0.472	
	Cadmium	mg/kg	0.342	0.0451	0.472	J
	Calcium	mg/kg	4750	1.23	9.43	
	Chromium	mg/kg	5.69	0.152	0.472	
	Cobalt	mg/kg	2.96	0.0753	0.472	
	Copper	mg/kg	6.7	0.192	0.472	
	Iron	mg/kg	10200	1.48	4.72	
	Lead	mg/kg	8.32	0.268	0.472	
	Magnesium	mg/kg	3770	0.552	1.89	
	Manganese	mg/kg	421	0.123	0.943	
	Mercury	mg/kg	0.0213	0.000922	0.00938	H
	Nickel	mg/kg	4.8	0.0806	0.472	
	Potassium	mg/kg	4810	8.43	23.6	
	Selenium	mg/kg	0.398	0.153	0.472	J
	Silver	mg/kg	0.0851	0.0851	0.472	U
	Sodium	mg/kg	661	3.43	9.43	
Thallium	mg/kg	0.943	0.943	0.943	U	
Vanadium	mg/kg	16.3	0.0857	0.472		
Zinc	mg/kg	32.8	0.159	0.472		
S-38	Aluminum	mg/kg	9500	0.708	4.46	
	Antimony	mg/kg	0.534	0.284	0.826	J
	Arsenic	mg/kg	5.65	0.184	0.446	
	Barium	mg/kg	96.8	0.0596	0.446	
	Beryllium	mg/kg	0.522	0.0446	0.446	
	Cadmium	mg/kg	0.147	0.0427	0.446	J
	Calcium	mg/kg	4180	1.16	8.93	
	Chromium	mg/kg	6.55	0.144	0.446	
	Cobalt	mg/kg	2.47	0.0713	0.446	
	Copper	mg/kg	5.9	0.181	0.446	
	Iron	mg/kg	10700	1.4	4.46	
	Lead	mg/kg	9.76	0.253	0.446	
	Magnesium	mg/kg	3370	0.522	1.79	
	Manganese	mg/kg	266	0.117	0.893	
	Mercury	mg/kg	0.00669	0.000965	0.00982	HJ
	Nickel	mg/kg	4.72	0.0763	0.446	
	Potassium	mg/kg	3250	7.98	22.3	
	Selenium	mg/kg	0.212	0.145	0.446	J
	Silver	mg/kg	0.0805	0.0805	0.446	U
	Sodium	mg/kg	270	3.24	8.93	
Thallium	mg/kg	0.893	0.893	0.893	U	
Vanadium	mg/kg	18.2	0.0811	0.446		
Zinc	mg/kg	35.1	0.15	0.446		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-39	Aluminum	mg/kg	11000	0.624	3.94	
	Antimony	mg/kg	0.333	0.333	0.971	U
	Arsenic	mg/kg	8.11	0.163	0.394	
	Barium	mg/kg	163	0.0525	0.394	
	Beryllium	mg/kg	0.627	0.0394	0.394	
	Cadmium	mg/kg	0.196	0.0376	0.394	J
	Calcium	mg/kg	6070	1.03	7.87	
	Chromium	mg/kg	8.13	0.127	0.394	
	Cobalt	mg/kg	4.01	0.0628	0.394	
	Copper	mg/kg	8.4	0.16	0.394	
	Iron	mg/kg	13300	1.23	3.94	
	Lead	mg/kg	11	0.223	0.394	
	Magnesium	mg/kg	4310	0.46	1.57	
	Manganese	mg/kg	653	0.103	0.787	
	Mercury	mg/kg	0.00306	0.000899	0.00915	HJ
	Nickel	mg/kg	6.37	0.0672	0.394	
	Potassium	mg/kg	3650	7.04	19.7	
	Selenium	mg/kg	0.214	0.128	0.394	J
	Silver	mg/kg	0.071	0.071	0.394	U
	Sodium	mg/kg	413	2.86	7.87	
Thallium	mg/kg	0.787	0.787	0.787	U	
Vanadium	mg/kg	25.2	0.0715	0.394		
Zinc	mg/kg	38.9	0.133	0.394		
S-40	Aluminum	mg/kg	20000	0.728	4.59	B
	Antimony	mg/kg	0.751	0.343	1	J
	Arsenic	mg/kg	8.18	0.189	0.459	
	Barium	mg/kg	193	0.0612	0.459	
	Beryllium	mg/kg	1.14	0.0459	0.459	
	Cadmium	mg/kg	0.35	0.0439	0.459	J
	Calcium	mg/kg	22600	1.2	9.17	B
	Chromium	mg/kg	12	0.148	0.459	
	Cobalt	mg/kg	5.79	0.0732	0.459	
	Copper	mg/kg	16.7	0.186	0.459	
	Iron	mg/kg	19300	1.44	4.59	
	Lead	mg/kg	18.5	0.26	0.459	
	Magnesium	mg/kg	8120	0.537	1.83	B
	Manganese	mg/kg	490	0.12	0.917	
	Mercury	mg/kg	0.0306	0.000944	0.0096	H
	Nickel	mg/kg	11	0.0783	0.459	
	Potassium	mg/kg	6780	16.4	45.9	
	Selenium	mg/kg	0.36	0.149	0.459	J
	Silver	mg/kg	0.184	0.0828	0.459	J
	Sodium	mg/kg	614	3.33	9.17	
Thallium	mg/kg	1.51	0.917	0.917		
Vanadium	mg/kg	30.4	0.0833	0.459		
Zinc	mg/kg	141	0.154	0.459		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-41	Aluminum	mg/kg	9110	0.77	4.85	B
	Antimony	mg/kg	0.606	0.33	0.962	J
	Arsenic	mg/kg	5.02	0.2	0.485	
	Barium	mg/kg	133	0.0648	0.485	
	Beryllium	mg/kg	0.578	0.0485	0.485	
	Cadmium	mg/kg	0.0542	0.0464	0.485	J
	Calcium	mg/kg	8600	1.27	9.71	B
	Chromium	mg/kg	5.93	0.156	0.485	
	Cobalt	mg/kg	3.44	0.0775	0.485	
	Copper	mg/kg	6.98	0.197	0.485	
	Iron	mg/kg	12200	1.52	4.85	
	Lead	mg/kg	10.2	0.275	0.485	
	Magnesium	mg/kg	3380	0.568	1.94	B
	Manganese	mg/kg	385	0.127	0.971	
	Mercury	mg/kg	0.00907	0.000939	0.00955	HJ
	Nickel	mg/kg	5.12	0.0829	0.485	
	Potassium	mg/kg	3470	8.68	24.3	
	Selenium	mg/kg	0.271	0.157	0.485	J
	Silver	mg/kg	0.0876	0.0876	0.485	U
	Sodium	mg/kg	430	3.53	9.71	
Thallium	mg/kg	0.971	0.971	0.971	U	
Vanadium	mg/kg	21.8	0.0882	0.485		
Zinc	mg/kg	33.9	0.163	0.485		
S-42	Aluminum	mg/kg	10900	0.77	4.85	B
	Antimony	mg/kg	0.468	0.337	0.98	J
	Arsenic	mg/kg	5.66	0.2	0.485	
	Barium	mg/kg	163	0.0648	0.485	
	Beryllium	mg/kg	0.619	0.0485	0.485	
	Cadmium	mg/kg	0.0567	0.0464	0.485	J
	Calcium	mg/kg	9200	1.27	9.71	B
	Chromium	mg/kg	6.93	0.156	0.485	
	Cobalt	mg/kg	4.41	0.0775	0.485	
	Copper	mg/kg	8.33	0.197	0.485	
	Iron	mg/kg	13800	1.52	4.85	
	Lead	mg/kg	9.37	0.275	0.485	
	Magnesium	mg/kg	4110	0.568	1.94	B
	Manganese	mg/kg	357	0.127	0.971	
	Mercury	mg/kg	0.0135	0.00097	0.00987	H
	Nickel	mg/kg	6.47	0.0829	0.485	
	Potassium	mg/kg	2860	3.47	9.71	
	Selenium	mg/kg	0.462	0.157	0.485	J
	Silver	mg/kg	0.0876	0.0876	0.485	U
	Sodium	mg/kg	676	3.53	9.71	
Thallium	mg/kg	0.987	0.971	0.971		
Vanadium	mg/kg	29.7	0.0882	0.485		
Zinc	mg/kg	34.5	0.163	0.485		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-43	Aluminum	mg/kg	10800	0.748	4.72	B

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-45	Aluminum	mg/kg	10200	0.793	5	B
	Antimony	mg/kg	1.42	0.312	0.909	
	Arsenic	mg/kg	5.63	0.206	0.5	
	Barium	mg/kg	108	0.0667	0.5	
	Beryllium	mg/kg	0.702	0.05	0.5	
	Cadmium	mg/kg	1.37	0.0478	0.5	
	Calcium	mg/kg	9150	1.3	10	B
	Chromium	mg/kg	11.7	0.161	0.5	
	Cobalt	mg/kg	3.85	0.0798	0.5	
	Copper	mg/kg	8.35	0.203	0.5	
	Iron	mg/kg	13000	1.57	5	
	Lead	mg/kg	29.8	0.284	0.5	
	Magnesium	mg/kg	3720	0.585	2	B
	Manganese	mg/kg	367	0.131	1	
	Mercury	mg/kg	0.0196	0.000973	0.0099	H
	Nickel	mg/kg	6.24	0.0854	0.5	
	Potassium	mg/kg	3730	8.94	25	
	Selenium	mg/kg	0.33	0.162	0.5	J
	Silver	mg/kg	0.0902	0.0902	0.5	U
	Sodium	mg/kg	1140	3.63	10	
	Thallium	mg/kg	1	1	1	U
Vanadium	mg/kg	21.5	0.0908	0.5		
Zinc	mg/kg	59.5	0.168	0.5		
S-46	Aluminum	mg/kg	10000	0.748	4.72	B
	Antimony	mg/kg	0.35	0.337	0.98	J
	Arsenic	mg/kg	7.61	0.195	0.472	
	Barium	mg/kg	266	0.0629	0.472	
	Beryllium	mg/kg	0.577	0.0472	0.472	
	Cadmium	mg/kg	0.129	0.0451	0.472	J
	Calcium	mg/kg	7900	1.23	9.43	B
	Chromium	mg/kg	7.28	0.152	0.472	
	Cobalt	mg/kg	3.5	0.0753	0.472	
	Copper	mg/kg	9.13	0.192	0.472	
	Iron	mg/kg	11900	1.48	4.72	
	Lead	mg/kg	12.9	0.268	0.472	
	Magnesium	mg/kg	3030	0.552	1.89	B
	Manganese	mg/kg	285	0.123	0.943	
	Mercury	mg/kg	0.00718	0.000961	0.00977	HJ
	Nickel	mg/kg	5.17	0.0806	0.472	
	Potassium	mg/kg	4430	8.43	23.6	
	Selenium	mg/kg	0.221	0.153	0.472	J
	Silver	mg/kg	0.0851	0.0851	0.472	U
	Sodium	mg/kg	785	3.43	9.43	
	Thallium	mg/kg	0.958	0.943	0.943	
Vanadium	mg/kg	20.8	0.0857	0.472		
Zinc	mg/kg	124	0.159	0.472		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-47	Aluminum	mg/kg	10700	0.785	4.95	B
	Antimony	mg/kg	0.469	0.312	0.909	J
	Arsenic	mg/kg	4.81	0.204	0.495	
	Barium	mg/kg	142	0.066	0.495	
	Beryllium	mg/kg	0.597	0.0495	0.495	
	Cadmium	mg/kg	0.0898	0.0473	0.495	J
	Calcium	mg/kg	9610	1.29	9.9	B
	Chromium	mg/kg	7.46	0.16	0.495	
	Cobalt	mg/kg	4.04	0.079	0.495	
	Copper	mg/kg	8.69	0.201	0.495	
	Iron	mg/kg	14100	1.55	4.95	
	Lead	mg/kg	10.6	0.281	0.495	
	Magnesium	mg/kg	4360	0.579	1.98	B
	Manganese	mg/kg	396	0.13	0.99	
	Mercury	mg/kg	0.0157	0.000887	0.00902	H
	Nickel	mg/kg	6.43	0.0846	0.495	
	Potassium	mg/kg	4570	8.85	24.8	
	Selenium	mg/kg	0.383	0.16	0.495	J
	Silver	mg/kg	0.101	0.0893	0.495	J
	Sodium	mg/kg	726	3.6	9.9	
	Thallium	mg/kg	1.24	0.99	0.99	
	Vanadium	mg/kg	25.2	0.0899	0.495	
Zinc	mg/kg	40.9	0.167	0.495		
S-48	Aluminum	mg/kg	13700	0.734	4.63	
	Antimony	mg/kg	0.327	0.327	0.952	U
	Arsenic	mg/kg	3.88	0.191	0.463	
	Barium	mg/kg	276	0.0618	0.463	
	Beryllium	mg/kg	0.627	0.0463	0.463	
	Cadmium	mg/kg	0.175	0.0443	0.463	J
	Calcium	mg/kg	6140	1.21	9.26	
	Chromium	mg/kg	8.25	0.149	0.463	
	Cobalt	mg/kg	4.07	0.0739	0.463	
	Copper	mg/kg	8.78	0.188	0.463	
	Iron	mg/kg	13900	1.45	4.63	
	Lead	mg/kg	11.4	0.263	0.463	
	Magnesium	mg/kg	4810	0.541	1.85	
	Manganese	mg/kg	588	0.121	0.926	
	Mercury	mg/kg	0.0147	0.000914	0.0093	H
	Nickel	mg/kg	6.65	0.0791	0.463	
	Potassium	mg/kg	5300	16.6	46.3	
	Selenium	mg/kg	0.204	0.15	0.463	J
	Silver	mg/kg	0.0835	0.0835	0.463	U
	Sodium	mg/kg	588	3.36	9.26	B
	Thallium	mg/kg	0.926	0.926	0.926	U
	Vanadium	mg/kg	26.5	0.0841	0.463	
Zinc	mg/kg	41.4	0.156	0.463		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-49	Aluminum	mg/kg	13400	0.715	4.5	
	Antimony	mg/kg	0.33	0.33	0.962	U
	Arsenic	mg/kg	4.21	0.186	0.45	
	Barium	mg/kg	255	0.0601	0.45	
	Beryllium	mg/kg	0.628	0.045	0.45	
	Cadmium	mg/kg	0.226	0.0431	0.45	J
	Calcium	mg/kg	7480	1.17	9.01	
	Chromium	mg/kg	7.06	0.145	0.45	
	Cobalt	mg/kg	3.88	0.0719	0.45	
	Copper	mg/kg	8.72	0.183	0.45	
	Iron	mg/kg	11900	1.41	4.5	
	Lead	mg/kg	14	0.256	0.45	
	Magnesium	mg/kg	4950	0.527	1.8	
	Manganese	mg/kg	570	0.118	0.901	
	Mercury	mg/kg	0.0147	0.000891	0.00906	H
	Nickel	mg/kg	6.28	0.0769	0.45	
	Potassium	mg/kg	5730	16.1	45	
	Selenium	mg/kg	0.16	0.146	0.45	J
	Silver	mg/kg	0.0813	0.0813	0.45	U
	S-50	Sodium	mg/kg	601	3.27	9.01
Thallium		mg/kg	0.901	0.901	0.901	U
Vanadium		mg/kg	20.2	0.0818	0.45	
Zinc		mg/kg	40.4	0.152	0.45	
Aluminum		mg/kg	10900	0.763	4.81	
Antimony		mg/kg	0.372	0.337	0.98	J
Arsenic		mg/kg	4.18	0.198	0.481	
Barium		mg/kg	204	0.0641	0.481	
Beryllium		mg/kg	0.512	0.0481	0.481	
Cadmium		mg/kg	0.153	0.046	0.481	J
Calcium		mg/kg	5010	1.25	9.62	
Chromium		mg/kg	7.39	0.155	0.481	
Cobalt		mg/kg	3.65	0.0767	0.481	
Copper		mg/kg	7.42	0.195	0.481	
Iron		mg/kg	12500	1.51	4.81	
Lead		mg/kg	10.3	0.273	0.481	
Magnesium		mg/kg	4180	0.562	1.92	
Manganese		mg/kg	471	0.126	0.962	
Mercury		mg/kg	0.00729	0.000967	0.00984	HJ
Nickel		mg/kg	5.61	0.0821	0.481	
Potassium	mg/kg	4850	17.2	48.1		
Selenium	mg/kg	0.156	0.156	0.481	U	
Silver	mg/kg	0.0867	0.0867	0.481	U	
Sodium	mg/kg	449	3.49	9.62	B	
Thallium	mg/kg	0.962	0.962	0.962	U	
Vanadium	mg/kg	24	0.0873	0.481		
Zinc	mg/kg	39.8	0.162	0.481		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-51	Aluminum	mg/kg	13400	0.605	3.82	
	Antimony	mg/kg	0.277	0.277	0.806	U
	Arsenic	mg/kg	4.43	0.158	0.382	
	Barium	mg/kg	213	0.0509	0.382	
	Beryllium	mg/kg	0.622	0.0382	0.382	
	Cadmium	mg/kg	0.214	0.0365	0.382	J
	Calcium	mg/kg	6130	0.995	7.63	
	Chromium	mg/kg	10.2	0.123	0.382	
	Cobalt	mg/kg	4.3	0.0609	0.382	
	Copper	mg/kg	9.78	0.155	0.382	
	Iron	mg/kg	15300	1.2	3.82	
	Lead	mg/kg	9.91	0.217	0.382	
	Magnesium	mg/kg	4790	0.446	1.53	
	Manganese	mg/kg	419	0.0998	0.763	
	Mercury	mg/kg	0.00615	0.000895	0.0091	HJ
	Nickel	mg/kg	7.63	0.0652	0.382	
	Potassium	mg/kg	5250	13.7	38.2	
	Selenium	mg/kg	0.124	0.124	0.382	U
	Silver	mg/kg	0.0689	0.0689	0.382	U
	Sodium	mg/kg	762	2.77	7.63	B
Thallium	mg/kg	0.763	0.763	0.763	U	
Vanadium	mg/kg	31	0.0693	0.382		
Zinc	mg/kg	44.3	0.128	0.382		
S-52	Aluminum	mg/kg	7360	0.645	4.07	
	Antimony	mg/kg	0.296	0.296	0.862	U
	Arsenic	mg/kg	3.6	0.168	0.407	
	Barium	mg/kg	92.3	0.0542	0.407	
	Beryllium	mg/kg	0.408	0.0407	0.407	
	Cadmium	mg/kg	0.148	0.0389	0.407	J
	Calcium	mg/kg	2810	1.06	8.13	
	Chromium	mg/kg	3.89	0.131	0.407	
	Cobalt	mg/kg	2.17	0.0649	0.407	
	Copper	mg/kg	4.53	0.165	0.407	
	Iron	mg/kg	7270	1.27	4.07	
	Lead	mg/kg	7.17	0.231	0.407	
	Magnesium	mg/kg	2360	0.475	1.63	
	Manganese	mg/kg	323	0.106	0.813	
	Mercury	mg/kg	0.00659	0.00091	0.00926	HJ
	Nickel	mg/kg	3.28	0.0694	0.407	
	Potassium	mg/kg	2520	14.5	40.7	
	Selenium	mg/kg	0.283	0.132	0.407	J
	Silver	mg/kg	0.0733	0.0733	0.407	U
	Sodium	mg/kg	178	2.95	8.13	B
Thallium	mg/kg	0.813	0.813	0.813	U	
Vanadium	mg/kg	11.3	0.0738	0.407		
Zinc	mg/kg	24	0.137	0.407		

See notes at end of table.

TABLE A-9. Non-radiological Results for On-Site Sampling Locations, 2002 (concluded)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
S-53	Aluminum	mg/kg	6080	0.721	4.55	B
	Antimony	mg/kg	0.327	0.327	0.952	U
	Arsenic	mg/kg	3.79	0.188	0.455	
	Barium	mg/kg	194	0.0606	0.455	
	Beryllium	mg/kg	0.342	0.0455	0.455	J
	Cadmium	mg/kg	0.0435	0.0435	0.455	U
	Calcium	mg/kg	6920	1.19	9.09	B
	Chromium	mg/kg	3.71	0.146	0.455	
	Cobalt	mg/kg	1.74	0.0725	0.455	
	Copper	mg/kg	4.26	0.185	0.455	
	Iron	mg/kg	7250	1.42	4.55	
	Lead	mg/kg	5.67	0.258	0.455	
	Magnesium	mg/kg	2390	0.532	1.82	B
	Manganese	mg/kg	192	0.119	0.909	
	Mercury	mg/kg	0.0044	0.000891	0.00906	HJ
	Nickel	mg/kg	2.57	0.0776	0.455	
	Potassium	mg/kg	2610	3.25	9.09	
	Selenium	mg/kg	0.147	0.147	0.455	U
	Silver	mg/kg	0.082	0.082	0.455	U
	Sodium	mg/kg	564	3.3	9.09	
	Thallium	mg/kg	0.909	0.909	0.909	U
Vanadium	mg/kg	12.3	0.0825	0.455		
Zinc	mg/kg	18.6	0.153	0.455		

Notes:

mg/kg = milligrams per kilogram

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

H = Holding time exceeded.

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 Special Project Soil Sampling Locations, 2002

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
FTB-1	Aluminum	mg/kg	9890	0.734	4.63	
	Antimony	mg/kg	0.372	0.318	0.926	J
	Arsenic	mg/kg	4.65	0.191	0.463	
	Barium	mg/kg	179	0.0618	0.463	
	Beryllium	mg/kg	0.559	0.0463	0.463	
	Cadmium	mg/kg	0.0443	0.0443	0.463	U
	Calcium	mg/kg	4970	1.21	9.26	
	Chromium	mg/kg	5.05	0.149	0.463	
	Cobalt	mg/kg	2.58	0.0739	0.463	
	Copper	mg/kg	5.52	0.188	0.463	
	Iron	mg/kg	9360	1.45	4.63	
	Lead	mg/kg	7.27	0.263	0.463	
	Magnesium	mg/kg	3180	0.541	1.85	
	Manganese	mg/kg	237	0.121	0.926	
	Mercury	mg/kg	0.00177	0.000965	0.00982	HJ
	Nickel	mg/kg	3.96	0.0791	0.463	
	Potassium	mg/kg	3120	8.28	23.1	
	Selenium	mg/kg	0.15	0.15	0.463	U
	Silver	mg/kg	0.0835	0.0835	0.463	U
	Sodium	mg/kg	570	3.36	9.26	
	Thallium	mg/kg	0.926	0.926	0.926	U
Vanadium	mg/kg	14.4	0.0841	0.463		
Zinc	mg/kg	28	0.156	0.463	B	
FTB-2	Aluminum	mg/kg	10900	0.684	4.31	
	Antimony	mg/kg	0.442	0.296	0.862	J
	Arsenic	mg/kg	4.87	0.178	0.431	
	Barium	mg/kg	107	0.0575	0.431	
	Beryllium	mg/kg	0.655	0.0431	0.431	
	Cadmium	mg/kg	0.0412	0.0412	0.431	U
	Calcium	mg/kg	5950	1.12	8.62	
	Chromium	mg/kg	5.23	0.139	0.431	
	Cobalt	mg/kg	2.37	0.0688	0.431	
	Copper	mg/kg	4.94	0.175	0.431	
	Iron	mg/kg	9080	1.35	4.31	
	Lead	mg/kg	7.16	0.245	0.431	
	Magnesium	mg/kg	3270	0.504	1.72	
	Manganese	mg/kg	223	0.113	0.862	
	Mercury	mg/kg	0.00591	0.00098	0.00997	HJ
	Nickel	mg/kg	4.12	0.0736	0.431	
	Potassium	mg/kg	3320	7.71	21.6	
	Selenium	mg/kg	0.14	0.14	0.431	U
	Silver	mg/kg	0.0778	0.0778	0.431	U
	Sodium	mg/kg	258	3.13	8.62	
	Thallium	mg/kg	0.862	0.862	0.862	U
Vanadium	mg/kg	13.1	0.0783	0.431		
Zinc	mg/kg	28.1	0.145	0.431	B	

See notes at end of table.

TABLE A-10. Non-radiological Results for Special Project Soil Sampling Locations, 2002
(continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
FTB-3	Aluminum	mg/kg	7120	0.785	4.95	
	Antimony	mg/kg	0.482	0.34	0.99	J
	Arsenic	mg/kg	5.25	0.204	0.495	
	Barium	mg/kg	132	0.066	0.495	
	Beryllium	mg/kg	0.412	0.0495	0.495	J
	Cadmium	mg/kg	0.0473	0.0473	0.495	U
	Calcium	mg/kg	4660	1.29	9.9	
	Chromium	mg/kg	3.54	0.16	0.495	
	Cobalt	mg/kg	1.83	0.079	0.495	
	Copper	mg/kg	3.99	0.201	0.495	
	Iron	mg/kg	7460	1.55	4.95	
	Lead	mg/kg	8.93	0.281	0.495	
	Magnesium	mg/kg	2320	0.579	1.98	
	Manganese	mg/kg	256	0.13	0.99	
	Mercury	mg/kg	0.00172	0.000886	0.00901	HJ
	Nickel	mg/kg	2.62	0.0846	0.495	
	Potassium	mg/kg	2060	3.54	9.9	
	Selenium	mg/kg	0.16	0.16	0.495	U
	Silver	mg/kg	0.0893	0.0893	0.495	U
	Sodium	mg/kg	342	3.6	9.9	
	Thallium	mg/kg	0.99	0.99	0.99	U
	Vanadium	mg/kg	11.4	0.0899	0.495	
	Zinc	mg/kg	23.6	0.167	0.495	B
FTB-4	Aluminum	mg/kg	10700	0.61	3.85	
	Antimony	mg/kg	0.303	0.264	0.769	J
	Arsenic	mg/kg	4.88	0.159	0.385	
	Barium	mg/kg	168	0.0513	0.385	
	Beryllium	mg/kg	0.591	0.0385	0.385	
	Cadmium	mg/kg	0.0561	0.0368	0.385	J
	Calcium	mg/kg	5330	1	7.69	
	Chromium	mg/kg	6.07	0.124	0.385	
	Cobalt	mg/kg	2.76	0.0614	0.385	
	Copper	mg/kg	6.53	0.156	0.385	
	Iron	mg/kg	10300	1.21	3.85	
	Lead	mg/kg	7.33	0.218	0.385	
	Magnesium	mg/kg	3510	0.45	1.54	
	Manganese	mg/kg	250	0.101	0.769	
	Mercury	mg/kg	0.00968	0.000947	0.00963	H
	Nickel	mg/kg	4.66	0.0657	0.385	
	Potassium	mg/kg	3640	6.88	19.2	
	Selenium	mg/kg	0.125	0.125	0.385	U
	Silver	mg/kg	0.0694	0.0694	0.385	U
	Sodium	mg/kg	424	2.79	7.69	
	Thallium	mg/kg	0.769	0.769	0.769	U
	Vanadium	mg/kg	15.9	0.0698	0.385	
	Zinc	mg/kg	30.5	0.129	0.385	B

See notes at end of table.

TABLE A-10. Non-radiological Results for Special Project Soil Sampling Locations, 2002
(continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
FTB-5	Aluminum	mg/kg	12800	0.629	3.97	
	Antimony	mg/kg	0.287	0.272	0.794	J
	Arsenic	mg/kg	5.68	0.164	0.397	
	Barium	mg/kg	147	0.0529	0.397	
	Beryllium	mg/kg	0.76	0.0397	0.397	
	Cadmium	mg/kg	0.0379	0.0379	0.397	U
	Calcium	mg/kg	7430	1.04	7.94	
	Chromium	mg/kg	6.17	0.128	0.397	
	Cobalt	mg/kg	2.82	0.0633	0.397	
	Copper	mg/kg	6	0.161	0.397	
	Iron	mg/kg	10600	1.24	3.97	
	Lead	mg/kg	8.1	0.225	0.397	
	Magnesium	mg/kg	3860	0.464	1.59	
	Manganese	mg/kg	266	0.104	0.794	
	Mercury	mg/kg	0.00915	0.000941	0.00957	HJ
	Nickel	mg/kg	4.88	0.0678	0.397	
	Potassium	mg/kg	3690	7.1	19.8	
	Selenium	mg/kg	0.129	0.129	0.397	U
	Silver	mg/kg	0.0716	0.0716	0.397	U
	Sodium	mg/kg	449	2.88	7.94	
	Thallium	mg/kg	0.794	0.794	0.794	U
Vanadium	mg/kg	15.7	0.0721	0.397		
Zinc	mg/kg	32	0.134	0.397	B	
FTB-6	Aluminum	mg/kg	7240	0.64	4.03	
	Antimony	mg/kg	0.277	0.277	0.806	U
	Arsenic	mg/kg	3.61	0.166	0.403	
	Barium	mg/kg	127	0.0538	0.403	
	Beryllium	mg/kg	0.396	0.0403	0.403	J
	Cadmium	mg/kg	0.0723	0.0385	0.403	J
	Calcium	mg/kg	3210	1.05	8.06	
	Chromium	mg/kg	4.57	0.13	0.403	
	Cobalt	mg/kg	2.04	0.0644	0.403	
	Copper	mg/kg	4.75	0.164	0.403	
	Iron	mg/kg	8250	1.26	4.03	
	Lead	mg/kg	6.83	0.229	0.403	
	Magnesium	mg/kg	2300	0.472	1.61	
	Manganese	mg/kg	234	0.105	0.806	
	Mercury	mg/kg	0.00509	0.000935	0.00951	HJ
	Nickel	mg/kg	3.19	0.0689	0.403	
	Potassium	mg/kg	2190	2.88	8.06	
	Selenium	mg/kg	0.131	0.131	0.403	U
	Silver	mg/kg	0.0727	0.0727	0.403	U
	Sodium	mg/kg	338	2.93	8.06	
	Thallium	mg/kg	0.806	0.806	0.806	U
Vanadium	mg/kg	13.4	0.0732	0.403		
Zinc	mg/kg	24.2	0.136	0.403	B	

See notes at end of table.

TABLE A-10. Non-radiological Results for Special Project Soil Sampling Locations, 2002
(continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
FTB-7	Aluminum	mg/kg	13200	0.696	4.39	
	Antimony	mg/kg	0.398	0.301	0.877	J
	Arsenic	mg/kg	5.9	0.181	0.439	
	Barium	mg/kg	155	0.0585	0.439	
	Beryllium	mg/kg	0.827	0.0439	0.439	
	Cadmium	mg/kg	0.0422	0.0419	0.439	J
	Calcium	mg/kg	8410	1.14	8.77	
	Chromium	mg/kg	6.28	0.141	0.439	
	Cobalt	mg/kg	2.89	0.07	0.439	
	Copper	mg/kg	6.23	0.178	0.439	
	Iron	mg/kg	10600	1.37	4.39	
	Lead	mg/kg	10.6	0.249	0.439	
	Magnesium	mg/kg	4070	0.513	1.75	
	Manganese	mg/kg	285	0.115	0.877	
	Mercury	mg/kg	0.00434	0.000961	0.00977	HJ
	Nickel	mg/kg	5.01	0.0749	0.439	
	Potassium	mg/kg	4390	7.84	21.9	
	Selenium	mg/kg	0.142	0.142	0.439	U
	Silver	mg/kg	0.0791	0.0791	0.439	U
	Sodium	mg/kg	690	3.19	8.77	
Thallium	mg/kg	0.877	0.877	0.877	U	
Vanadium	mg/kg	15.6	0.0796	0.439		
Zinc	mg/kg	33.4	0.148	0.439	B	
FTB-8	Aluminum	mg/kg	7670	0.793	5	
	Antimony	mg/kg	0.647	0.343	1	J
	Arsenic	mg/kg	4.46	0.206	0.5	
	Barium	mg/kg	125	0.0667	0.5	
	Beryllium	mg/kg	0.442	0.05	0.5	J
	Cadmium	mg/kg	0.0478	0.0478	0.5	U
	Calcium	mg/kg	3950	1.3	10	
	Chromium	mg/kg	4.09	0.161	0.5	
	Cobalt	mg/kg	1.76	0.0798	0.5	
	Copper	mg/kg	3.99	0.203	0.5	
	Iron	mg/kg	7740	1.57	5	
	Lead	mg/kg	5.97	0.284	0.5	
	Magnesium	mg/kg	2220	0.585	2	
	Manganese	mg/kg	190	0.131	1	
	Mercury	mg/kg	0.00513	0.000968	0.00985	HJ
	Nickel	mg/kg	2.86	0.0854	0.5	
	Potassium	mg/kg	2330	3.58	10	
	Selenium	mg/kg	0.162	0.162	0.5	U
	Silver	mg/kg	0.0902	0.0902	0.5	U
	Sodium	mg/kg	189	3.63	10	
Thallium	mg/kg	1	1	1	U	
Vanadium	mg/kg	12.3	0.0908	0.5		
Zinc	mg/kg	22.5	0.168	0.5	B	

See notes at end of table.

TABLE A-10. Non-radiological Results for Special Project Soil Sampling Locations, 2002
(continued)

Location	Analyte	Units	Result	Decision Level	Detection Limit	Lab Qualifier
FTB-9	Aluminum	mg/kg	6750	0.77	4.85	
	Antimony	mg/kg	0.578	0.333	0.971	J
	Arsenic	mg/kg	4.49	0.2	0.485	
	Barium	mg/kg	103	0.0648	0.485	
	Beryllium	mg/kg	0.4	0.0485	0.485	J
	Cadmium	mg/kg	0.0464	0.0464	0.485	U
	Calcium	mg/kg	3160	1.27	9.71	
	Chromium	mg/kg	3.38	0.156	0.485	
	Cobalt	mg/kg	1.48	0.0775	0.485	
	Copper	mg/kg	3.62	0.197	0.485	
	Iron	mg/kg	6890	1.52	4.85	
	Lead	mg/kg	5.58	0.275	0.485	
	Magnesium	mg/kg	1980	0.568	1.94	
	Manganese	mg/kg	157	0.127	0.971	
	Mercury	mg/kg	0.00319	0.000948	0.00965	HJ
	Nickel	mg/kg	2.37	0.0829	0.485	
	Potassium	mg/kg	2030	3.47	9.71	
	Selenium	mg/kg	0.157	0.157	0.485	U
	Silver	mg/kg	0.0876	0.0876	0.485	U
	Sodium	mg/kg	131	3.53	9.71	
	Thallium	mg/kg	0.971	0.971	0.971	U
Vanadium	mg/kg	10.5	0.0882	0.485		
Zinc	mg/kg	20.3	0.163	0.485	B	
FTB-10	Aluminum	mg/kg	6330	0.684	4.31	
	Antimony	mg/kg	0.483	0.296	0.862	J
	Arsenic	mg/kg	3.44	0.178	0.431	
	Barium	mg/kg	105	0.0575	0.431	
	Beryllium	mg/kg	0.351	0.0431	0.431	J
	Cadmium	mg/kg	0.0412	0.0412	0.431	U
	Calcium	mg/kg	2250	1.12	8.62	
	Chromium	mg/kg	3.36	0.139	0.431	
	Cobalt	mg/kg	1.52	0.0688	0.431	
	Copper	mg/kg	3.52	0.175	0.431	
	Iron	mg/kg	7100	1.35	4.31	
	Lead	mg/kg	5.53	0.245	0.431	
	Magnesium	mg/kg	1870	0.504	1.72	
	Manganese	mg/kg	186	0.113	0.862	
	Mercury	mg/kg	0.0185	0.000907	0.00923	H
	Nickel	mg/kg	2.33	0.0736	0.431	
	Potassium	mg/kg	1810	3.08	8.62	
	Selenium	mg/kg	0.14	0.14	0.431	U
	Silver	mg/kg	0.0778	0.0778	0.431	U
	Sodium	mg/kg	144	3.13	8.62	
	Thallium	mg/kg	0.862	0.862	0.862	U
Vanadium	mg/kg	11	0.0783	0.431		
Zinc	mg/kg	20.9	0.145	0.431	B	

See notes at end of table.

TABLE A-10. Non-radiological Results for Special Project Soil Sampling Locations, 2002
(concluded)

Notes:

Non-radiological (metals) analysis for the Flat Top Bunkers (FTB) was performed at the request of the line organization.

mg/kg = milligrams per kilogram

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

H = Holding time exceeded.

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-11. Summary TLD Results for Calendar Year 2002, Tonopah Test Range

Location Class	Number of Locations	Mean Exposure Rate (uR/hour)	Median Exposure Rate (uR/hour)	Std Dev.	Minimum	Maximum
Community	5	15.8	15.6	1.9	13.8	18.5
Perimeter	4	16.6	17.7	2.7	12.6	18.3
On-Site	13	18.0	17.9	1.2	16.5	21.2

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

TABLE A-12. TLD Measurements by Quarter and Location Class for Calendar Year 2002

Location Class	Location Number	1 st Quarter (92 Days)		2 nd Quarter (110 Days)		3 rd Quarter (63 Days)		4 th Quarter (105 Days)		Exposure Rate	
		Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	uR per hour	Error
Community	T-18	35.5	5.2	*		22.4	1.2	6.5*	0.9	15.6	1.4
	T-19	34.7	4.6	36.3	3.2	23.5	1.4	32.3	1.4	14.3	0.7
	T-20	*		*		20.8	1.3	6.3*	0.8	13.8	0.9
	T-21	44.1	4.4	48.9	6.3	*		43.2	1.9	18.5	1.1
	T-22	43.3	8.3	44.2	2.2	21.2	1.3	42.2	0.8	17.0	1.0
Perimeter	T-06	44.5	0.8	48.6	3.4	21.6	1.2	44.3	1.2	17.9	0.4
	T-08	41.5	0.9	42.6	2.9	22.2	1.3	5.6*	0.9	12.6	0.4
	T-11	47.4	4.7	46.9	2.4	15.8	1.5	45.4	1.8	17.5	0.7
	T-12	45.2	4.6	48.1	2.2	25.6	4.2	43.4	1.2	18.3	0.8
On-Site	T-01	49.5	1.1	60.4	4.7	27.4	1.4	50.8	1.9	21.2	0.6
	T-02	46.1	1.8	47.3	2	23.4	1.2	45.5	1.2	18.3	0.4
	T-03	44.3	0.7	47	1.6	22.3	2.1	46	2.6	18.0	0.4
	T-04	45.5	1.3	47.1	2.4	23	1.9	44.9	1.5	18.1	0.4
	T-05	43.5	0.9	47.6	1.4	24.3	1.4	42.6	0.9	17.8	0.3
	T-07	41.5	1.3	41.5	2.9	23.3	1.2	40.6	0.8	16.5	0.4
	T-09	41.4	0.9	43.2	3.9	23.5	1.7	40.8	0.8	16.8	0.5
	T-10	45	0.8	48.4	4.5	5.1*	1.2	47.3	3.1	19.1	0.7
	T-13	43.9	4.2	45.8	4.4	5.3*	1.5	42.3	0.8	17.9	0.8
	T-14	41.6	4.2	43.6	2.7	21.2	1.6	*		16.7	0.8
	T-15	44.9	5.3	46.7	1.3	21.9	1.3	42.9	0.9	17.6	0.6
	T-16	45.4	3.4	44.5	3.8	23.2	1.9	45	0.9	17.8	0.6
T-17	44.5	2.4	45.4	4.1	24.4	1.5	44.5	1.9	17.9	0.6	

NOTES: mR = Milliroentgen (10^{-3} roentgen); uR = microroentgen (10^{-6} roentgen)

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

Appendix B

Terrestrial Surveillance Results for KTF

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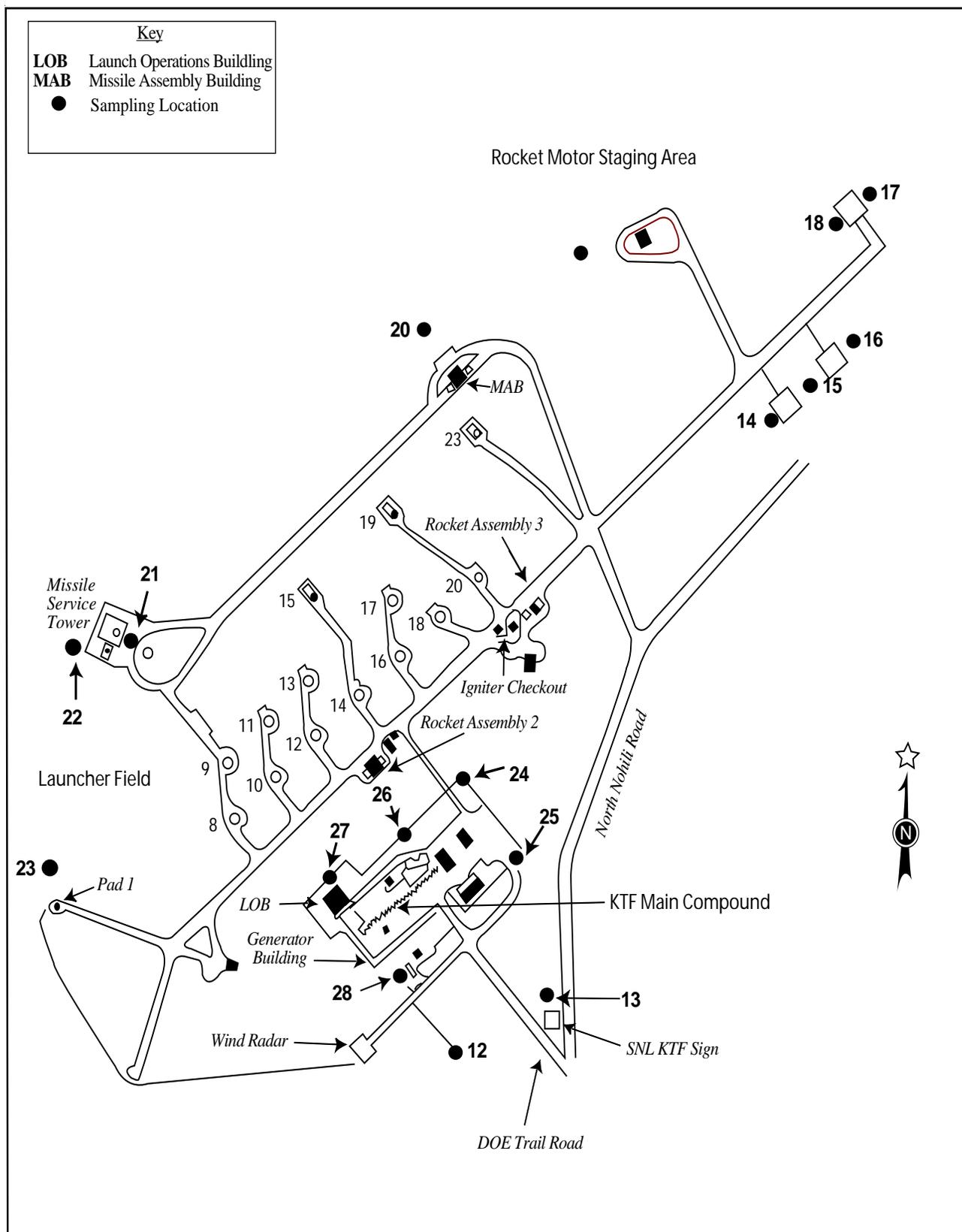


FIGURE B-1 On-site Sample Locations at the Kauai Test Facility

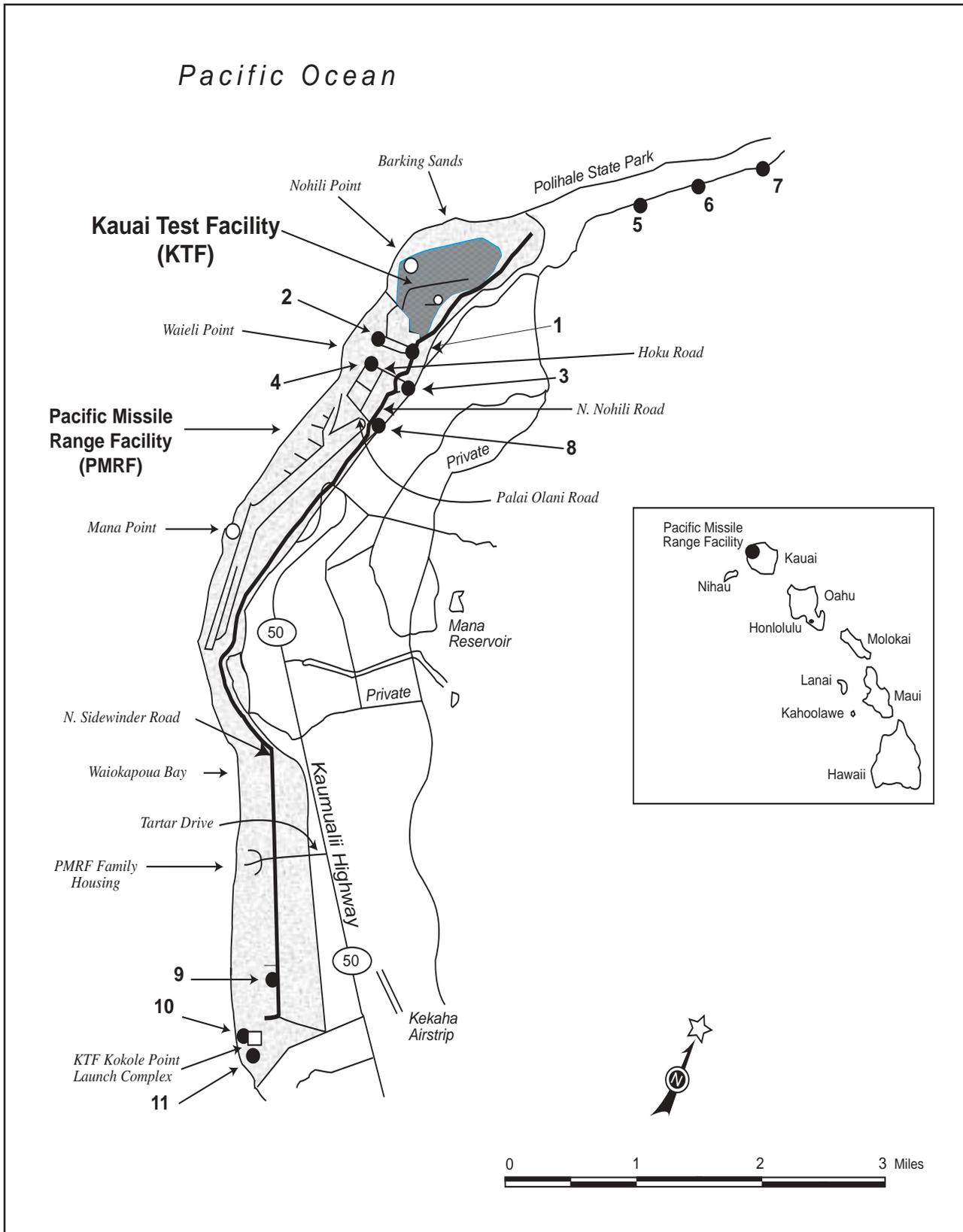


FIGURE B-2 Off-site Sampling Locations Near the Kauai Test Facility

TABLE B-1. Non-radiological Results for Kauai Test Facility for Community Locations for Calendar Year 2002, Soil
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	1			2			3		
		Result	Decision Level	Detection Limit	Result	Detection Limit	Detection Limit	Result	Decision Level	Detection Limit
Community	Aluminum	6550 B	0.755	9.52	1880 B	0.785	9.9	7780 B	0.702	8.85
	Antimony	0.327 U	0.327	0.952	0.34 U	0.34	0.99	0.304 U	0.304	0.885
	Arsenic	7.91 B	0.197	0.476	6.14 B	0.204	0.495	6.16 B	0.183	0.442
	Barium	13.7	0.0635	0.476	4.34	0.066	0.495	8.57	0.059	0.442
	Beryllium	0.0831 J	0.0476	0.476	0.0495 U	0.0495	0.495	0.0873 J	0.0442	0.442
	Cadmium	0.162 J	0.0455	0.476	0.0473 U	0.0473	0.495	0.253 J	0.0423	0.442
	Calcium	312000 B	31.1	238	369000 B	32.3	248	242000 B	28.9	221
	Chromium	62.1	0.153	0.476	11.6	0.16	0.495	86.3	0.143	0.442
	Cobalt	14.9	0.076	0.476	1.45	0.079	0.495	24.5	0.0706	0.442
	Copper	8.99	0.193	0.476	1.9	0.201	0.495	9.21	0.18	0.442
	Iron	14700	1.49	9.52	2580	1.55	9.9	20700	1.39	8.85
	Lead	2.39	0.27	0.476	1.29	0.281	0.495	0.364 J	0.251	0.442
	Magnesium	35300 B	0.557	9.52	23700 B	0.579	9.9	52700 B	12.9	221
	Manganese	319	0.125	0.952	108	0.13	0.99	517	0.116	0.885
	Mercury	0.0079 J	0.000894	0.00909	0.00181 J	0.000906	0.00922	0.00619 J	0.000917	0.00933
	Nickel	195	0.0813	0.476	10.8	0.0846	0.495	342	0.0756	0.442
	Potassium	183	3.41	9.52	74.6	3.54	9.9	247	3.16	8.85
	Selenium	0.154 U	0.154	0.476	0.16 U	0.16	0.495	0.346 J	0.143	0.442
	Silver	0.0859 U	0.0859	0.476	0.0893 U	0.0893	0.495	0.0798 U	0.0798	0.442
	Sodium	1980	3.46	9.52	2200	3.6	9.9	2100	3.21	8.85
Thallium	4.71	0.952	0.952	7.81	0.99	0.99	3.47	0.885	0.885	
Vanadium	24.3	0.0865	0.476	7.9	0.0899	0.495	28.9	0.0804	0.442	
Zinc	26.5 B	0.16	0.476	2.74 B	0.167	0.495	27.9 B	0.149	0.442	

Refer to notes at end of table.

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ium	0.103	J	0.0451	0.472	0.211	J	0.0447	0.467	0.0962	J	0.0416	0.435
ium	330000	B	30.8	236	240000	B	30.5	234	265000	B	28.4	217
mium	29.3		0.152	0.472	82.8		0.151	0.467	47.4		0.14	0.435
it	4.36		0.0753	0.472	9.67		0.0746	0.467	8.82		0.0694	0.435
er	10		0.192	0.472	23		0.19	0.467	7.26		0.177	0.435
	5750		1.48	9.43	16900		1.46	9.35	9850		1.36	8.7
	6.77		0.268	0.472	5.78		0.265	0.467	1.26		0.247	0.435
esium	25600	B	0.552	9.43	17100	B	0.547	9.35	28300	B	0.509	8.7
anese	150		0.123	0.943	259		0.122	0.935	214		0.114	0.87
ury	0.00384	J	0.000939	0.00955	0.023		0.000936	0.00952	0.0142		0.000957	0.0097
l	53.2		0.0806	0.472	92.7		0.0798	0.467	118		0.0743	0.435
sium	119		3.37	9.43	1170		3.34	9.35	339		3.11	8.7
ium	0.153	U	0.153	0.472	0.696		0.151	0.467	0.225	J	0.141	0.435
	0.0851	U	0.0851	0.472	0.0843	U	0.0843	0.467	0.0784	U	0.0784	0.435
m	2140		3.43	9.43	1520		3.39	9.35	1730		3.16	8.7
ium	5.7		0.943	0.943	3.73		0.935	0.935	4.98		0.87	0.87
dium	13.6		0.0857	0.472	31.2		0.0849	0.467	14.9		0.079	0.435
	23.2	B	0.159	0.472	54.5	B	0.157	0.467	17.2	B	0.146	0.435

ble.

TABLE B-1. Non-radiological Results for Kauai Test Facility for Community Locations for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	7			8			9			
		Result	Decision Level	Detection Limit	Result	Detection Limit	Detection Limit	Result	Decision Level	Detection Limit	
Community <i>(continued)</i>	Aluminum	17600	0.748	9.43	8820	0.708	8.93	2020	0.748	9.43	
	Antimony	0.324	U	0.943	0.307	U	0.893	0.324	U	0.943	
	Arsenic	12.8	0.195	0.472	7.37	0.184	0.446	7.82	0.195	0.472	
	Barium	19.2	0.0629	0.472	14.4	0.0596	0.446	18.9	0.0629	0.472	
	Beryllium	0.21	J	0.472	0.103	J	0.446	0.0472	U	0.472	
	Cadmium	0.383	J	0.472	0.336	J	0.446	0.19	J	0.472	
	Calcium	154000	B	94.3	233000	B	11.6	301000	B	12.3	94.3
	Chromium	119	B	0.472	79.4	B	0.144	19.8	B	0.152	0.472
	Cobalt	20.9	0.0753	0.472	20.6	0.0713	0.446	1.63	0.0753	0.472	
	Copper	33.2	0.192	0.472	16.9	0.181	0.446	16.5	0.192	0.472	
	Iron	27800	1.48	9.43	19600	1.4	8.93	3930	1.48	9.43	
	Lead	2.41	0.268	0.472	1.53	0.253	0.446	3.52	0.268	0.472	
	Magnesium	23500	B	9.43	36900	B	0.522	18700	B	0.552	9.43
	Manganese	378	0.123	0.943	599	0.117	0.893	90.2	0.123	0.943	
	Mercury	0.0224	0.000972	0.00988	0.00993	0.000844	0.00858	0.0103	0.000914	0.0093	
	Nickel	191	0.0806	0.472	273	0.0763	0.446	19.9	0.0806	0.472	
	Potassium	790	3.37	9.43	448	3.19	8.93	125	3.37	9.43	
	Selenium	0.153	U	0.472	0.145	U	0.446	0.153	U	0.472	
	Silver	0.0851	U	0.472	0.0805	U	0.446	0.0851	U	0.472	
	Sodium	1540	B	9.43	1980	B	3.24	1900	B	3.43	9.43
Thallium	1.4	0.943	0.943	2.51	0.893	0.893	4.57	0.943	0.943		
Vanadium	48.7	0.0857	0.472	28.2	0.0811	0.446	7.56	0.0857	0.472		
Zinc	39.5	0.159	0.472	38.3	0.15	0.446	14.2	0.159	0.472		

Refer to notes at end of table.

TABLE B-1. Non-radiological Results for Kauai Test Facility for Community Locations for Calendar Year 2002, Soil (concluded)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	10			11		
		Result	Decision Level	Detection Limit	Result	Detection Limit	Detection Limit
Community (concluded)	Aluminum	2810	0.77	9.71	2360	0.77	9.71
	Antimony	0.333	0.333	0.971	0.333	U	0.333
	Arsenic	8.29	0.2	0.485	7.99		0.2
	Barium	22.5	0.0648	0.485	19		0.0648
	Beryllium	0.0598	J	0.485	0.0485	U	0.485
	Cadmium	0.16	J	0.485	0.224	J	0.485
	Calcium	296000	B	97.1	307000	B	97.1
	Chromium	27.8	B	0.485	22.4	B	0.485
	Cobalt	4.36		0.485	3.15		0.485
	Copper	6.53		0.485	13.1		0.485
	Iron	6200		9.71	5550		9.71
	Lead	3.79		0.485	2.22		0.485
	Magnesium	22600	B	9.71	21100	B	9.71
	Manganese	120		0.971	112		0.971
	Mercury	0.00349	J	0.000919	0.00288	J	0.00912
	Nickel	46.5		0.485	30.5		0.485
	Potassium	245		9.71	215		9.71
	Selenium	0.157	U	0.485	0.157	U	0.485
	Silver	0.0876	U	0.485	0.0876	U	0.485
	Sodium	2270	B	9.71	2240	B	9.71
	Thallium	4.31		0.971	4.44		0.971
	Vanadium	11.3		0.485	9.17		0.485
	Zinc	371		0.485	212		0.485

NOTES: 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 MDL. For radiochemical analytes the result is less than the decision level.

TABLE B-2. Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2002, Soil
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	12			13			14		
		Result	Decision Level	Detection Limit	Result	Detection Limit	Detection Limit	Result	Decision Level	Detection Limit
On-Site	Aluminum	9230 B	0.741	9.35	10800 B	0.734	9.26	8720	0.778	9.8
	Antimony	0.321 U	0.321	0.935	0.328 J	0.318	0.926	0.395 BJ	0.337	0.98
	Arsenic	12.7 B	0.193	0.467	8.98 B	0.191	0.463	8.1	0.202	0.49
	Barium	9.82	0.0623	0.467	10.9	0.0618	0.463	9.07	0.0654	0.49
	Beryllium	0.126 J	0.0467	0.467	0.118 J	0.0463	0.463	0.106 J	0.049	0.49
	Cadmium	0.153 J	0.0447	0.467	0.28 J	0.0443	0.463	0.597	0.0469	0.49
	Calcium	263000 B	30.5	234	187000 B	30.2	231	187000 B	12.8	98
	Chromium	58.4	0.151	0.467	107	0.149	0.463	110	0.158	0.49
	Cobalt	15.5	0.0746	0.467	32.2	0.0739	0.463	33.1	0.0782	0.49
	Copper	11.1	0.19	0.467	13.1	0.188	0.463	30.1	0.199	0.49
	Iron	17500	1.46	9.35	28700	1.45	9.26	27700	1.54	9.8
	Lead	22.8	0.265	0.467	0.617	0.263	0.463	0.481 J	0.278	0.49
	Magnesium	26900 B	0.547	9.35	52700 B	13.5	231	63900	5.73	98
	Manganese	361	0.122	0.935	546	0.121	0.926	483	0.128	0.98
	Mercury	0.0083 J	0.0009	0.009	0.0087 J	0.0009	0.0095	0.0063 J	0.0009	0.0092
	Nickel	160	0.0798	0.467	439	0.0791	0.463	474 B	0.0837	0.49
	Potassium	255	3.34	9.35	292	3.31	9.26	247	3.51	9.8
	Selenium	0.241 J	0.151	0.467	0.15 U	0.15	0.463	0.159 U	0.159	0.49
	Silver	0.0843 U	0.0843	0.467	0.0835 U	0.0835	0.463	0.0884 U	0.0884	0.49
	Sodium	2460	3.39	9.35	2450	3.36	9.26	2150	3.56	9.8
Thallium	4.73	0.935	0.935	2.13	0.926	0.926	2.28	0.98	0.98	
Vanadium	34	0.0849	0.467	39.3	0.0841	0.463	32.6	0.089	0.49	
Zinc	47.6 B	0.157	0.467	39.1 B	0.156	0.463	152	0.165	0.49	

See notes at end of table.

TABLE B-2. Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	15			16			17				
		Result	Decision Level	Detection Limit	Result	Detection Limit	Detection Limit	Result	Decision Level	Detection Limit		
<i>(continued)</i>	Aluminum	9310	0.734	9.26	10800	B	0.778	9.8	5150	0.755	9.52	
	Antimony	0.318	BU	0.926	0.337	U	0.337	0.98	0.741	BJ	0.952	
	Arsenic	9.73	0.191	0.463	10.7	B	0.202	0.49	6.44	0.197	0.476	
	Barium	9.57	0.0618	0.463	12.8		0.0654	0.49	6.54	0.0635	0.476	
	Beryllium	0.112	J	0.463	0.146	J	0.049	0.49	0.0743	J	0.476	
	Cadmium	0.589	0.0443	0.463	0.238	J	0.0469	0.49	0.285	J	0.476	
	Calcium	195000	B	92.6	182000	B	32	245	305000	B	95.2	
	Chromium	111	0.149	0.463	92.3		0.158	0.49	53.6	0.153	0.476	
	Cobalt	34.6	0.0739	0.463	29.2		0.0782	0.49	12.8	0.076	0.476	
	Copper	13.6	0.188	0.463	17.6		0.199	0.49	9.58	0.193	0.476	
	Iron	28000	1.45	9.26	27400		1.54	9.8	11600	1.49	9.52	
	Lead	0.541	0.263	0.463	0.278	U	0.278	0.49	0.954	0.27	0.476	
	Magnesium	64500	5.41	92.6	46300	B	14.3	245	17200	0.557	9.52	
	Manganese	533	0.121	0.926	491		0.128	0.98	204	0.125	0.952	
	Mercury	0.0091	0.0009	0.0091	0.0072	J	0.0009	0.0095	0.007	J	0.0009	
	Nickel	478	B	0.0791	0.463	370		0.0837	0.49	159	B	0.476
	Potassium	290	3.31	9.26	277		3.51	9.8	191	3.41	9.52	
	Selenium	0.945	J	0.375	1.16	0.417	J	0.159	0.49	0.154	U	0.476
	Silver	0.0835	U	0.0835	0.463	0.0884	U	0.0884	0.49	0.0859	U	0.476
	Sodium	2200	3.36	9.26	2650		3.56	9.8	1060	3.46	9.52	
Thallium	1.95	0.926	0.926	2.57		0.98	0.98	5.32	0.952	0.952		
Vanadium	34	0.0841	0.463	37.8		0.089	0.49	22	0.0865	0.476		
Zinc	43	0.156	0.463	43.4	B	0.165	0.49	34.6	0.16	0.476		

See notes at end of table.

TABLE B-2. Non-radiological Results for Kaul Test Facility for On-Site Locations for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	18			19			20					
		Result	Decision Level	Detection Limit	Result	Detection Limit	Decision Level	Result	Detection Limit	Decision Level			
On-Site (continued)	Aluminum	10600	B	0.728	9.17	8680		0.778	9.8	9180	B	0.702	8.85
	Antimony	0.315	U	0.315	0.917	0.421	Bl	0.337	0.98	0.304	U	0.304	0.885
	Arsenic	8.41	B	0.189	0.459	13.2		0.202	0.49	11.6	B	0.183	0.442
	Barium	10		0.0612	0.459	16.3		0.0654	0.49	12.7		0.059	0.442
	Beryllium	0.114	J	0.0459	0.459	0.106	J	0.049	0.49	0.107	J	0.0442	0.442
	Cadmium	0.177	J	0.0439	0.459	0.499		0.0469	0.49	0.246	J	0.0423	0.442
	Calcium	203000	B	29.9	229	232000	B	12.8	98	212000	B	28.9	221
	Chromium	73.2		0.148	0.459	74.1		0.158	0.49	74.7		0.143	0.442
	Cobalt	20.3		0.0732	0.459	21.6		0.0782	0.49	21.2		0.0706	0.442
	Copper	12.9		0.186	0.459	20		0.199	0.49	11.3		0.18	0.442
	Iron	20500		1.44	9.17	19200		1.54	9.8	21300		1.39	8.85
	Lead	0.526		0.26	0.459	1.5		0.278	0.49	0.724		0.251	0.442
	Magnesium	38400	B	0.537	9.17	39200		0.573	9.8	37200	B	0.518	8.85
	Manganese	370		0.12	0.917	385		0.128	0.98	412		0.116	0.885
	Mercury	0.0077	J	0.0009	0.0091	0.0049	J	0.001	0.0097	0.0163		0.0009	0.0096
	Nickel	263		0.0783	0.459	279	B	0.0837	0.49	262		0.0756	0.442
	Potassium	348		3.28	9.17	205		3.51	9.8	359		3.16	8.85
	Selenium	0.517		0.149	0.459	0.397	U	0.397	1.23	0.337	J	0.143	0.442
	Silver	0.0828	U	0.0828	0.459	0.0884	U	0.0884	0.49	0.0798	U	0.0798	0.442
	Sodium	2490		3.33	9.17	2170		3.56	9.8	2270		3.21	8.85
Thallium	3.45		0.917	0.917	3.43		0.98	0.98	3.14		0.885	0.885	
Vanadium	35.3		0.0833	0.459	30.9		0.089	0.49	32.7		0.0804	0.442	
Zinc	30	B	0.154	0.459	35.2		0.165	0.49	36.2	B	0.149	0.442	

See notes at end of table.

TABLE B-2. Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	21			22			23					
		Result	Decision Level	Detection Limit	Result	Detection Limit	Decision Level	Result	Detection Limit	Decision Level			
On-Site (continued)	Aluminum	7590	B	0.715	9.01	2660	B	0.763	9.62	3700	B	0.77	9.71
	Antimony	0.309	U	0.309	0.901	0.33	U	0.33	0.962	0.333	U	0.333	0.971
	Arsenic	12.9	B	0.186	0.45	9.07	B	0.198	0.481	7.58	B	0.2	0.485
	Barium	10.7		0.0601	0.45	5.07		0.0641	0.481	7.47		0.0648	0.485
	Beryllium	0.104	J	0.045	0.45	0.0481	U	0.0481	0.481	0.0485	U	0.0485	0.485
	Cadmium	0.209	J	0.0431	0.45	0.0567	J	0.046	0.481	0.0901	J	0.0464	0.485
	Calcium	269000	B	29.4	225	310000	B	31.3	240	303000	B	31.7	243
	Chromium	42.6		0.145	0.45	23.4		0.155	0.481	24.2		0.156	0.485
	Cobalt	10.6		0.0719	0.45	2.77		0.0767	0.481	2.9		0.0775	0.485
	Copper	13.4		0.183	0.45	2.79		0.195	0.481	4.66		0.197	0.485
	Iron	13000		1.41	9.01	4320		1.51	9.62	5320		1.52	9.71
	Lead	1.48		0.256	0.45	4.18		0.273	0.481	2.02		0.275	0.485
	Magnesium	23600	B	0.527	9.01	24700	B	0.562	9.62	22600	B	0.568	9.71
	Manganese	275		0.118	0.901	110		0.126	0.962	131		0.127	0.971
	Mercury	0.005	J	0.0009	0.0089	0.002	J	0.0009	0.0088	0.007	J	0.0009	0.0092
	Nickel	105		0.0769	0.45	33.7		0.0821	0.481	30.4		0.0829	0.485
	Potassium	271		3.22	9.01	85.5		3.44	9.62	159		3.47	9.71
Selenium	0.146	U	0.146	0.45	0.156	U	0.156	0.481	0.157	U	0.157	0.485	

TABLE B-2 Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	24			25			26					
		Result	Decision Level	Detection Limit	Result	Detection Limit	Detection Limit	Result	Decision Level	Detection Limit			
On-Site (continued)	Aluminum	7890	B	0.778	98	8660	B	0.778	98	7160		0.785	9.9
	Antimony	0.661	J	0.337	0.98	1.06		0.337	0.98	0.505	BI	0.34	0.99
	Arsenic	49	B	0.202	0.49	50	B	0.202	0.49	16.8		0.204	0.495
	Barium	11.6		0.0654	0.49	19.3		0.0654	0.49	30.3		0.066	0.495
	Beryllium	0.116	J	0.049	0.49	0.122	J	0.049	0.49	0.0958	J	0.0495	0.495
	Cadmium	0.519		0.0469	0.49	0.599		0.0469	0.49	0.492	J	0.0473	0.495
	Calcium	255000	B	32	245	263000	B	32	245	280000	B	12.9	99
	Chromium	56.7		0.158	0.49	60		0.158	0.49	41.2		0.16	0.495
	Cobalt	15.9		0.0782	0.49	16.8		0.0782	0.49	10.3		0.079	0.495
	Copper	12.8		0.199	0.49	17.9		0.199	0.49	17.9		0.201	0.495
	Iron	19700		1.54	98	18500		1.54	98	11800		1.55	9.9
	Lead	28.1		0.278	0.49	29		0.278	0.49	5.8		0.281	0.495
	Magnesium	28000	B	0.573	98	29700	B	0.573	98	20800		0.579	9.9
	Manganese	386		0.128	0.98	376		0.128	0.98	270		0.13	0.99
	Mercury	0.0055	J	0.0009	0.0097	0.0059	J	0.0009	0.0092	0.0082	J	0.0009	0.009
	Nickel	162		0.0837	0.49	181		0.0837	0.49	93.6	B	0.0846	0.495
	Potassium	221		3.51	98	256		3.51	98	258		3.54	9.9
	Selenium	0.358	J	0.159	0.49	0.159	U	0.159	0.49	0.16	U	0.16	0.495
	Silver	0.0884	U	0.0884	0.49	0.0884	U	0.0884	0.49	0.0893	U	0.0893	0.495
	Sodium	2630		3.56	98	2530		3.56	98	2110		3.6	9.9
Thallium	3.6		0.98	0.98	3.91		0.98	0.98	4.33		0.99	0.99	
Vanadium	32		0.089	0.49	34.3		0.089	0.49	24.1		0.0899	0.495	
Zinc	2880	B	4.13	12.3	329	B	0.165	0.49	185		0.167	0.495	

See notes at end of table.

TABLE B-2. Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2002, Soil (concluded)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	27			28		
		Result	Decision Level	Detection Limit	Result	Detection Limit	Detection Limit
On-Site (concluded)	Aluminum	4430 B	0.778	9.8	7710	0.785	9.9
	Antimony	0.337 U	0.337	0.98	0.504 BJ	0.34	0.99
	Arsenic	16.6 B	0.202	0.49	14.2	0.204	0.495
	Barium	38.5	0.0654	0.49	27.1	0.066	0.495
	Beryllium	0.0562 J	0.049	0.49	0.109 J	0.0495	0.495
	Cadmium	0.324 J	0.0469	0.49	0.374 J	0.0473	0.495
	Calcium	269000 B	32	245	275000 B	12.9	99
	Chromium	37.5	0.158	0.49	43	0.16	0.495
	Cobalt	7.38	0.0782	0.49	11.7	0.079	0.495
	Copper	7.43	0.199	0.49	40.8	0.201	0.495
	Iron	8410	1.54	9.8	14300	1.55	9.9
	Lead	4.1	0.278	0.49	7.23	0.281	0.495
	Magnesium	27400 B	0.573	9.8	21600	0.579	9.9
	Manganese	188	0.128	0.98	358	0.13	0.99
	Mercury	0.0064 J	0.0009	0.0092	0.0118	0.0009	0.0096
	Nickel	89.2	0.0837	0.49	102 B	0.0846	0.495
	Potassium	149	3.51	9.8	341	3.54	9.9
	Selenium	0.378 J	0.159	0.49	0.16 U	0.16	0.495
	Silver	0.0884 U	0.0884	0.49	0.781	0.0893	0.495
	Sodium	2100	3.56	9.8	2380	3.6	9.9
Thallium	5.3	0.98	0.98	3.95	0.99	0.99	
Vanadium	15.7	0.089	0.49	29.5	0.0899	0.495	
Zinc	79.3 B	0.165	0.49	49.2	0.167	0.495	

NOTES: 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 MDL. For radiochemical analytes the result is less than the decision level.

TABLE B-3. Radiological Results for Kauai Test Facility (KTF) by Location for Calendar Year 2002, Soil

Location Type	Location	Cesium-137 (pCi/g)		Tritium (pCi/mL)		Total Uranium (µg/g)						
		Activity (±2 σ)	Decision Level	Detection Limit	Activity	Decision Level	Detection Limit	Concentration	Decision Level	Detection Limit		
Community	07	0.0307 ± 0.0171	0.00628	0.0131	-0.141 ± 0.113	U	0.1	0.209	0.835	U	0.1	0.209
	08	0.0481 ± 0.0128	0.00377	0.00778	-0.171 ± 0.113	U	0.101	0.211	1.12	U	0.101	0.211
	09	0.0756 ± 0.0162	0.00423	0.00894	-0.0852 ± 0.116	U	0.101	0.21	1.15	U	0.101	0.21
	10	0.0147 ± 0.00993	0.00472	0.00985	-0.0848 ± 0.116	U	0.101	0.209	1.17	U	0.101	0.209
	11	0.0209 ± 0.00886	0.005	0.0104	-0.113 ± 0.114	U	0.1	0.209	1.14	U	0.1	0.209

NOTES: pCi/g = picocurie per gram

pCi/mL = picocurie per milliliter

µg/g = microgram per gram

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 B-3. Radiological Results for Kauai Test Facility (KTF) by Location for Calendar Year 2002, Soil (concluded)

Location Type	Location	Cesium-137 (pCi/g)		Tritium (pCi/g)		Total Uranium (µg/g)							
		Activity (±2 σ)	Decision Level	Detection Limit	Activity (±2 σ)	Decision Level	Detection Limit	Concentration	Decision Level	Detection Limit			
Community	01	0.00439 ± 0.0111	U	0.00986	0.0213	0.194 ± 1.69	U	1.41	2.82	1.16	U	1.41	2.82
	02	-0.007 ± 0.00977	U	0.00771	0.017	0.0553 ± 1.68	U	1.4	2.81	1.07	U	1.4	2.81
	03	0 ± 0.0131	U	0.0128	0.0278	1.12 ± 1.83	U	1.48	2.97	1.02	U	1.48	2.97
	04	0.00881 ± 0.013	U	0.012	0.0258	0.534 ± 1.65	U	1.36	2.72	1.12	U	1.36	2.72
	05	0.0359 ± 0.0245		0.0104	0.0213	0.808 ± 2.49	U	2.05	4.11	1.18	U	2.05	4.11
	06	0.117 ± 0.0215		0.00698	0.0145	1.58 ± 2.81	U	2.29	4.58	1.14	U	2.29	4.58
On-Site	12	0.0235 ± 0.0239		0.009	0.0197	0.718 ± 1.56	U	1.28	2.56	1.28	U	1.28	2.56
	13	0.0285 ± 0.0236		0.0102	0.0222	-0.0848 ± 1.71	U	1.44	2.88	0.885	U	1.44	2.88
	14	0.0613 ± 0.0231		0.0109	0.0228	0.142 ± 0.518	U	0.428	0.856	0.968	U	0.428	0.856
	15	0.0858 ± 0.0205		0.00569	0.012	0 ± 0.475	U	0.399	0.797	1.06	U	0.399	0.797
	16	0.0172 ± 0.0145		0.00709	0.0152	-0.147 ± 1.77	U	1.49	2.98	1.07	U	1.49	2.98
	17	0.0225 ± 0.0101		0.00463	0.00972	-0.146 ± 0.512	U	0.437	0.874	0.771	U	0.437	0.874
	18	0.0445 ± 0.0321		0.0121	0.0264	0.368 ± 1.5	U	1.25	2.49	0.986	U	1.25	2.49
	19	0.038 ± 0.0198		0.00589	0.0126	-0.287 ± 0.497	U	0.431	0.862	1.05	U	0.431	0.862
	20	0.143 ± 0.0373		0.00953	0.0215	-0.735 ± 1.74	U	1.5	2.99	1	U	1.5	2.99
	21	0.0194 ± 0.012	U	0.0103	0.0224	-0.345 ± 1.8	U	1.52	3.05	1.31	U	1.52	3.05
	22	0.00863 ± 0.00947	U	0.00905	0.0196	0.0563 ± 1.71	U	1.43	2.86	1.38	U	1.43	2.86
	23	0.0391 ± 0.0278		0.00767	0.017	1.11 ± 1.75	U	1.42	2.83	1.03	U	1.42	2.83
	24	0.0452 ± 0.0193		0.00899	0.0198	0.611 ± 1.72	U	1.41	2.82	1.33	U	1.41	2.82
	25	0.034 ± 0.0254		0.0101	0.0219	-0.6 ± 1.66	U	1.42	2.84	1.26	U	1.42	2.84
	26	0.0598 ± 0.0151		0.00517	0.0109	-0.288 ± 0.499	U	0.433	0.865	1.27	U	0.433	0.865
	27	0.0059 ± 0.00804	U	0.00732	0.0156	0.498 ± 1.8	U	1.49	2.98	1.4	U	1.49	2.98
	28	0.0101 ± 0.0084	U	0.00504	0.0106	0 ± 0.492	U	0.413	0.825	1.48	U	0.413	0.825

NOTES: pCi/g = picocurie per gram
 pCi/mL = picocurie per milliliter
 µg/g = microgram per gram
 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.
 Tritium results reported in pCi/g due to inadequate soil moisture to run standard analytical method.

Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2002, Soil
 (All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location	Sample ID	Analyte	Result	Decision Level	Detection Limit	Average	Std Dev	CV	
07	059738-001	Aluminum	17600	0.748	9.43	8820	6145	69.67%	
	059738-002	Aluminum	20300	0.708	8.93				
	059738-003	Aluminum	11700	0.778	9.8				
	059738-001	Antimony	0.324	0.324	0.943	0.337	0.059	17.54%	
	059738-002	Antimony	0.307	0.307	0.893				
	059738-003	Antimony	0.337	0.337	0.98				
	059738-001	Arsenic	12.8	0.195	0.472	9.9	3.8	37.97%	
	059738-002	Arsenic	11.6	0.184	0.446				
	059738-003	Arsenic	13	0.202	0.49				
	059738-001	Barium	19.2	0.0629	0.472	13.8	5.7	41.30%	
	059738-002	Barium	19.9	0.0596	0.446				
	059738-003	Barium	15.4	0.0654	0.49				
	059738-001	Beryllium	3.52		4727	0			0170073.550
		059738-003	Cadmium	0.382	0.0469	0.49			
		059738-001	Calcium	154000	12.3	94.3	258818	64465	24.91%
		059738-002	Calcium	183000	11.6	89.3			
		059738-003	Calcium	218000	12.8	98			
		059738-001	Chromium	119	0.152	0.472	73	45	61.78%
	059738-001	Copper	33.2	0.192	0.472	17.1	11.3	66.16%	
	059738-002	Copper	38.2	0.181	0.446				
	059738-003	Copper	23	0.199	0.49				
	059738-001	Iron	27800	1.48	9.43	16537	10422	63.02%	
	059738-002	Iron	35000	1.4	8.93				
	059738-003	Iron	25100	1.54	9.8				
	059738-001	Lead	2.41	0.268	0.472	2.64	1.98	75.12%	
	059738-002	Lead	2.09	0.253	0.446				
	059738-003	Lead	1.62	0.278	0.49				

See notes at end of table.

TABLE B-4. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result	Decision Level	Detection Limit	Average	Std Dev	CV	
Community (concluded)	07	059738-001	Magnesium	23500	B	9.43	29427	10117	34.38%	
		059738-002	Magnesium	26700	B	8.93				
		059738-003	Magnesium	35200	B	9.8				
		059738-001	Manganese	378		0.123	0.943	317	171	53.82%
		059738-002	Manganese	486		0.117	0.893			
		059738-003	Manganese	369		0.128	0.98			
		059738-001	Mercury	0.0224		0.000972	0.00988	0.012	0.007	59.50%
		059738-002	Mercury	0.0182		0.000903	0.00919			
		059738-003	Mercury	0.0132		0.000896	0.00912			
		059738-001	Nickel	191		0.0806	0.472	162	110	68.01%
		059738-002	Nickel	237		0.0763	0.446			
		059738-003	Nickel	245		0.0837	0.49			
		059738-001	Potassium	790		3.37	9.43	400	331	82.81%
		059738-002	Potassium	515		3.19	8.93			
		059738-003	Potassium	386		3.51	9.8			
		059738-001	Selenium	0.153	U	0.153	0.472	0.226	0.167	73.74%
		059738-002	Selenium	0.145	U	0.145	0.446			
		059738-003	Selenium	0.159	U	0.159	0.49			
		059738-001	Silver	0.0851	U	0.0851	0.472	0.0839	0.0036	4.27%
		059738-002	Silver	0.0805	U	0.0805	0.446			
		059738-003	Silver	0.0884	U	0.0884	0.49			
		059738-001	Sodium	1540	B	3.43	9.43	1848	260	14.06%
		059738-002	Sodium	1470	B	3.24	8.93			
		059738-003	Sodium	1770	B	3.56	9.8			
		059738-001	Thallium	1.4		0.943	0.943	3.92	1.90	48.65%
		059738-002	Thallium	1.56		0.893	0.893			
		059738-003	Thallium	2.63		0.98	0.98			
		059738-001	Vanadium	48.7		0.0857	0.472	27.5	16.6	60.47%
		059738-002	Vanadium	60.1		0.0811	0.446			
		059738-003	Vanadium	37.1		0.089	0.49			
		059738-001	Zinc	39.5		0.159	0.472	29.0	14.6	50.28%
		059738-002	Zinc	42.2		0.15	0.446			
		059738-003	Zinc	32.5		0.165	0.49			

See notes at end of table.

TABLE B-4. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result	Decision Level	Detection Limit	Average	Std Dev	CV	
On-Site	21	059724-001	Aluminum	7590	B	0.715	7493	2651	35.39%	
		059724-002	Aluminum	8820	B	0.763				
		059724-003	Aluminum	7450		0.793	10			
		059724-001	Antimony	0.309	U	0.309	0.901	0.527	0.449	85.24%
		059724-002	Antimony	0.33	U	0.33	0.962			
		059724-003	Antimony	0.538	BJ	0.343	1			
		059724-001	Arsenic	12.9	B	0.186	0.45	17.7	15.6	88.17%
		059724-002	Arsenic	12.4	B	0.198	0.481			
		059724-003	Arsenic	10.2		0.206	0.5			
		059724-001	Barium	10.7		0.0601	0.45	16.2	9.3	57.41%
		059724-002	Barium	11.9		0.0641	0.481			
		059724-003	Barium	11.6		0.0667	0.5			
		059724-001	Beryllium	0.104	J	0.045	0.45	0.100	0.029	29.55%
		059724-002	Beryllium	0.112	J	0.0481	0.481			
		059724-003	Beryllium	0.0955	J	0.05	0.5			
		059724-001	Cadmium	0.209	J	0.0431	0.45	0.347	0.201	57.86%
		059724-002	Cadmium	0.222	J	0.046	0.481			
		059724-003	Cadmium	0.298	J	0.0478	0.5			
		059724-001	Calcium	269000	B	29.4	225	253565	42387	16.72%
		059724-002	Calcium	276000	B	31.3	240			
		059724-003	Calcium	287000	B	13	100			
059724-001	Chromium	42.6		0.145	0.45	58.3	27.2	46.60%		
059724-002	Chromium	44.7		0.155	0.481					
059724-003	Chromium	36.8		0.161	0.5					
059724-001	Cobalt	10.6		0.0719	0.45	15.7	9.6	61.58%		
059724-002	Cobalt	10.7		0.0767	0.481					
059724-003	Cobalt	8.81		0.0798	0.5					
059724-001	Copper	13.4		0.183	0.45	16.4	9.5	57.76%		
059724-002	Copper	20.6		0.195	0.481					
059724-003	Copper	35.3		0.203	0.5					
059724-001	Iron	13000		1.41	9.01	16235	7628	46.99%		
059724-002	Iron	14000		1.51	9.62					
059724-003	Iron	10500		1.57	10					
059724-001	Lead	1.48		0.256	0.45	9.76	16.33	167.30%		
059724-002	Lead	1.87		0.273	0.481					
059724-003	Lead	1.72		0.284	0.5					

See notes at end of table.

TABLE B-4. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result	Decision Level	Detection Limit	Average	Std Dev	CV	
On-Site (concluded)	21	059724-001	Magnesium	23600	B	0.527	31874	13401	42.04%	
		059724-002	Magnesium	23600	B	0.562				
		059724-003	Magnesium	22000		0.585	10			
		059724-001	Manganese	275		0.118	0.901	325	135	41.51%
		059724-002	Manganese	284		0.126	0.962			
		059724-003	Manganese	248		0.131	1			
		059724-001	Mercury	0.005	J	0.000872	0.00888	0.0068	0.0030	43.98%
		059724-002	Mercury	0.00521	J	0.000951	0.00968			
		059724-003	Mercury	0.00661	J	0.000845	0.0086			
		059724-001	Nickel	105		0.0769	0.45	187	140	74.77%
		059724-002	Nickel	101		0.0821	0.481			
		059724-003	Nickel	82.5	B	0.0854	0.5			
		059724-001	Potassium	271		3.22	9.01	255	67	26.41%
		059724-002	Potassium	299		3.44	9.62			
		059724-003	Potassium	266		3.58	10			
		059724-001	Selenium	0.146	U	0.146	0.45	0.276	0.185	67.08%
		059724-002	Selenium	0.185	J	0.156	0.481			
		059724-003	Selenium	0.162	U	0.162	0.5			
		059724-001	Silver	0.0813	U	0.0813	0.45	0.1165	0.1449	124.42%
		059724-002	Silver	0.0867	U	0.0867	0.481			
		059724-003	Silver	0.0902	U	0.0902	0.5			
		059724-001	Sodium	2350		3.27	9.01	2294	330	14.37%
		059724-002	Sodium	2530		3.49	9.62			
059724-003	Sodium	2400		3.63	10					
059724-001	Thallium	4.39		0.901	0.901	3.97	1.08	27.30%		
059724-002	Thallium	4.64		0.962	0.962					
059724-003	Thallium	4.51		1	1					
059724-001	Vanadium	26.9		0.0818	0.45	27.5	9.5	34.37%		
059724-002	Vanadium	30.4		0.0873	0.481					
059724-003	Vanadium	24.6		0.0908	0.5					
059724-001	Zinc	33.5	B	0.152	0.45	249.5	602	241.31%		
059724-002	Zinc	49.5	B	0.162	0.481					
059724-003	Zinc	28.9		0.168	0.5					

See notes at end of table.

TABLE B-4. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2002, Soil (continued)
(All results reported in milligrams per kilogram [mg/kg], unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result	Decision Level	Detection Limit	Average	Std Dev	CV	
On-Site	25	059728-001	Aluminum	8660	B	0.778	7493	2651	35.39%	
		059728-002	Aluminum	9510	B	0.741				
		059728-003	Aluminum	9120	B	0.755	9.52			
		059728-001	Antimony	1.06		0.337	0.98	0.53	0.45	85.24%
		059728-002	Antimony	0.66	J	0.321	0.935			
		059728-003	Antimony	2.4		0.327	0.952			
		059728-001	Arsenic	50	B	0.202	0.49	17.7	15.6	88.17%
		059728-002	Arsenic	49.9	B	0.193	0.467			
		059728-003	Arsenic	53.3	B	0.197	0.476			
		059728-001	Barium	19.3		0.0654	0.49	16.2	9.3	57.41%
		059728-002	Barium	34.2		0.0623	0.467			
		059728-003	Barium	26.4		0.0635	0.476			
		059728-001	Beryllium	0.122	J	0.049	0.49	0.100	0.029	29.55%
		059728-002	Beryllium	0.14	J	0.0467	0.467			
		059728-003	Beryllium	0.126	J	0.0476	0.476			
		059728-001	Cadmium	0.599		0.0469	0.49	0.347	0.201	57.86%
		059728-002	Cadmium	0.484		0.0447	0.467			
		059728-003	Cadmium	0.872		0.0455	0.476			
		059728-001	Calcium	263000	B	32	245	253565	42387	16.72%
		059728-002	Calcium	222000	B	30.5	234			
		059728-003	Calcium	254000	B	31.1	238			
		059728-001	Chromium	60		0.158	0.49	58.3	27.179	46.60%
		059728-002	Chromium	63.3		0.151	0.467			
		059728-003	Chromium	63.5		0.153	0.476			
		059728-001	Cobalt	16.8		0.0782	0.49	15.7	9.640	61.58%
		059728-002	Cobalt	16.9		0.0746	0.467			
		059728-003	Cobalt	17.3		0.076	0.476			
		059728-001	Copper	17.9		0.199	0.49	16.4	9.457	57.76%
		059728-002	Copper	16.5		0.19	0.467			
		059728-003	Copper	27.6		0.193	0.476			
		059728-001	Iron	18500		1.54	9.8	16235	7628	46.99%
		059728-002	Iron	19300		1.46	9.35			
		059728-003	Iron	20600		1.49	9.52			
059728-001	Lead	29		0.278	0.49	9.8	16.3	167.30%		
059728-002	Lead	64.2		0.265	0.467					
059728-003	Lead	40.3		0.27	0.476					

See notes at end of table.

TABLE B-5. Radiological Replicate Results for Kauai Test Facility for Calendar Year 2002, Soil

Location Type	Location	Sample ID	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Average	Std Dev	CV		
Community	07	059738-001	Cesium-137	pCi/g	0.0307 \pm 0.0171	0.00628	0.0131	0.03343	0.03668	109.74%		
		059738-002	Cesium-137	pCi/g	0.0367 \pm 0.0139	0.00561	0.0118					
		059738-003	Cesium-137	pCi/g	0.0175 \pm 0.00753	0.0046	0.00952					
		059738-001	Tritium	pCi/mL	-0.141 \pm 0.113 U	0.1	0.209	-0.04544	0.14667		-322.77%	
		059738-002	Tritium	pCi/mL	-0.028 \pm 0.117 U	0.0996	0.208					
		059738-003	Tritium	pCi/mL	0.198 \pm 0.131 U	0.101	0.210					
		059738-001	Uranium	μ g/g	0.835	0.03	0.2	1.08409	0.09907		9.14%	
		059738-002	Uranium	μ g/g	1.01	0.0294	0.196					
		059738-003	Uranium	μ g/g	1.12	0.0294	0.196					
		On-Site	21	059724-001	Cesium-137	pCi/g	0.0194 \pm 0.012 U	0.0103	0.0224	0.03627	0.03078	84.88%
				059724-002	Cesium-137	pCi/g	0 \pm 0.029 U	0.0105	0.023			
				059724-003	Cesium-137	pCi/g	0.0373 \pm 0.0225	0.0107	0.0222			
059724-001	Tritium			pCi/g	-0.345 \pm 1.8 U	1.52	3.05	0.02055	0.44186		2150.44%	
059724-002	Tritium			pCi/g	0.139 \pm 1.7 U	1.42	2.83					
059724-003	Tritium			pCi/g	-0.13 \pm 0.459 U	0.391	0.782					
059724-001	Uranium			μ g/g	1.31	0.00595	0.0397	1.16861	0.19822		16.96%	
059724-002	Uranium			μ g/g	1.32	0.00585	0.039					
059724-003	Uranium			μ g/g	0.918	0.0298	0.198					
25	059728-001			Cesium-137	pCi/g	0.034 \pm 0.0254	0.0101	0.0219	0.03627	0.03078		84.88%
	059728-002			Cesium-137	pCi/g	0.0475 \pm 0.0197	0.0101	0.0221				
	059728-003			Cesium-137	pCi/g	0.0273 \pm 0.0188	0.00978	0.0212				
	059728-001	Tritium	pCi/g	-0.6 \pm 1.66 U	1.42	2.84	0.02055	0.44186		2150.44%		
	059728-002	Tritium	pCi/g	-0.138 \pm 1.67 U	1.41	2.81						
	059728-003	Tritium	pCi/g	-0.31 \pm 2.33 U	1.97	3.94						
	059728-001	Uranium	μ g/g	1.26	0.00593	0.0395	1.16861	0.19822		16.96%		
	059728-002	Uranium	μ g/g	1.44	0.00591	0.0394						
	059728-003	Uranium	μ g/g	1.36	0.00584	0.0389						

NOTES: pCi/g = picocurie per gram
 pCi/mL = picocurie per milliliter
 μ g/g = microgram per gram
 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.

Std Dev = standard deviation
 CV = coefficient of variation

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