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

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Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185

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Annual Site Environmental Report
Tonopah Test Range, Nevada & Kauai Test Facility, Hawaii

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ABSTRACT

Tonopah Test Range (TTR) in Nevada and Kauai Test Facility (KTF) in Hawaii are government-owned, contractor-operated facilities operated by Sandia Corporation, a 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, manages 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) 2003. The compliance status of environmental regulations applicable at these sites include state and federal regulations governing air emissions, wastewater effluent, waste management, terrestrial surveillance, and Environmental Restoration (ER) cleanup activities. Sandia Corporation is responsible only for those environmental program activities related to its operations. The DOE/NNSA, Nevada Site Office (NSO) retains responsibility for the cleanup and management of ER TTR sites. Currently, there are no ER Sites at KTF. Environmental monitoring and surveillance programs are required by DOE Order 450.1, *Environmental Protection Program* (DOE 2003) and DOE Order 231.1 Chg 2., *Environment, Safety, and Health Reporting* (DOE 1996).

Calendar Year 2003 Annual Site Environmental Report
Sandia National Laboratories, Tonopah Test Range, Nevada &
Kauai Test Facility, Hawaii
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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 [Chapter 5] 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 fill out the questionnaire at the end of this document or provide feedback, comments, or questions to:

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Attention: Karen Agogino

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FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

A	AEA	Atomic Energy Act
	ACM	Asbestos Containing Material
	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
	BMD	Ballistic Missile Defense
	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
	CEMP	Community Environmental Monitoring Program
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFR	Code of Federal Regulations
	CIS	Chemical Inventory System
	COD	chemical oxygen demand
	CV	Coefficient of Variation
	CWA	Clean Water Act
	CY	calendar year
D	D&D	decontamination and demolition
	DMR	Discharge Monitoring Report
	DoD	U.S. Department of Defense
	DOE	U.S. Department of Energy
	DOE/AL	U.S. Department of Energy, Albuquerque Operations Office
	DRI	Desert Research Institute, Water Resource Center, University of Nevada System
	DU	depleted uranium
E	EA	environmental assessment
	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
	ERDA	U.S. Energy Research and Development Administration
	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

	FONSI	Finding of No Significant Impact
	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
	IDW	Investigation Derived Waste
	IOC	Inorganic Compounds
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
	NFEC	National Facilities Engineer Command
	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
	OIG	Office of Inspector General
P	PA	Preliminary Assessment
	PCB	polychlorinated biphenyl
	pH	potential of Hydrogen
	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	SAIC	Science Applications International Corporation
	SARA	Superfund Amendments and Reauthorization Act
	SDI	Strategic Defense Initiative
	SDWA	Safe Drinking Water Act
	SHPO	State Historic Preservation Office
	SNL/KTF	Kauai Test Facility
	SNL/NM	Sandia National Laboratories, New Mexico
	SOC	Synthetic Organic Compounds
	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

ºC	Celsius degree	m	meter
cm	centimeter	m^2	square meter
ºF	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	Std Dev	standard deviation

Radioactivity Measurements

Ci	curie (unit of radioactivity)	pCi/g	picocurie per gram
mrem	millirem (unit of radiation dose)	rem	roentgen equivalent man (unit of radiation dose)
mrem/yr	millirem per year		
mR/yr	milliroentgen per year	mSv	millisievert (unit of radiation dose)
pCi	picocurie	µg/m^2	microgram per square meter
µR/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 (ºC)	°F = 9/5 °C + 32	Fahrenheit (ºF)
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

In this Chapter ...

Lycium andersonni at TTR

Sandia National Laboratories (a wholly-owned susidiary of Lockheed Martin Corporation) at Tonopah Test Range (TTR) and Kauai Test Facility (KTF) are government-owned, contractor-operated facilities owned by the U.S Department of Energy (DOE), National Nuclear Security Administration (NNSA) and managed by the Sandia Site Office, in Albuquerque, New Mexico. This report was prepared in accordance with, and as required, by DOE Order 450.1, *Environmental Protection Program* (DOE 2003) and DOE Order 231.1 Chg 2, *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) 2003. 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. 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 [Chapter 5] in length).

Tonopah Test Range

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

Environmental Programs

The following environmental programs are in place at TTR:

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

Waste Management

Waste generated at TTR in 2003 included hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA) and non-hazardous industrial and sanitary waste. All hazardous waste was shipped to permitted treatment, storage, and disposal facilities. (Sandia Corporation does not handle waste generated by ER activities).

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

Terrestrial Surveillance
Soil samples were collected from 14 off-site, eight perimeter, and 21 on-site locations in 2003. 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 results (a measure of ambient gamma radiation) showed no distinguishable statistical difference between on-site and off-site locations in 2003. Non-radiological soil analyses were not performed in 2003. Non-radiological analysis are performed every other year (during even numbered years). 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 ER Project.

Water Quality
Wastewater monitoring results confirmed that all permit conditions set by the State of Nevada were met in 2003.

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 2003. Westinghouse has two State of Nevada certified water operators on staff at TTR.

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

TTR's Class II Air Quality Permit requires emission reports from significant non-radionuclide sources. At TTR, these sources include the screening plant and portable screen. In 2003, the total emissions reported to the State of Nevada were 0.001 ton/yr from the portable screen replacement.

NEPA
At KTF, NEPA compliance is coordinated between Sandia Corporation and DOE/NNSA/SSO. Compliance is also supported with the assistance of the Desert Research Institute, a branch of the University of Nevada System. A total of eight NEPA Checklists were submitted to DOE/NNSA/SSO for proposed actions in 2003.

Kauai Test Facility

KTF is operated by Sandia Corporation as a rocket preparation, launching, and tracking facility for DOE/NNSA, as well as in support of other U.S. Military agencies. SNL/KTF exists as a facility within the boundaries of the U.S. Department of Defense Pacific Missile Range Facility. SNL/KTF, located on the island of Kauai at the north end of the Pacific Missile Range Facility near Nohili Point, has been an active rocket-launching facility since 1962. There were two rockets launched from SNL/KTF in 2003.

The following environmental programs are in place at KTF:

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

Air Quality
KTF's non-covered source permit requires biannual monitoring reports from significant stationary sources. At KTF, these sources include two diesel engine generators. In 2003, the total usage reported to the State of Hawaii was 12,098 gallons of fuel fired during 12 hours of operation.

NEPA
At KTF, NEPA compliance is coordinated between Sandia Corporation and DOE/NNSA/SSO. In 2003, Sandia National Laboratories/New Mexico (SNL/NM) 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, septic tanks were sampled in September 2003. No contaminants were identified above the reporting limits.

Terrestrial Surveillance
Terrestrial surveillance is conducted every five years. No sampling occurred this year.

In this Chapter ...

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

Evening Primrose at TTR

Environmental Snapshot

- *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.*

Chapter One
TTR Introduction

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) 2003.

TTR is located within the boundries 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.

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.

Wild horses at TTR

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 owned by the DOE/NNSA, managed by the SSO in Albuquerque, New Mexico and operated by Sandia Corporation, a subsidiary of Lockheed Martin Corporation. 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 231.1 Chg 2, *Environment, Safety, and Health Reporting* (DOE 1996);
- DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information* (DOE 1997) ;
- DOE Order 435.1, *Radioactive Waste Management* (DOE 2001);
- DOE Order 450.1, *Environmental Protection Program* (DOE 2003);
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993);
- SEN-22-90, *DOE Policy on* Signatures of RCRA Permit Applications (DOE 1990).

This ASER summarizes data from environmental protection and monitoring programs at TTR for CY03. 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 450.1 specifies the requirements for environmental monitoring conducted at and around the TTR site. The ASER represents an important component of DOE and Sandia Corporation's effort to keep the public informed about environmental conditions at DOE/NNSA facilities.

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 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

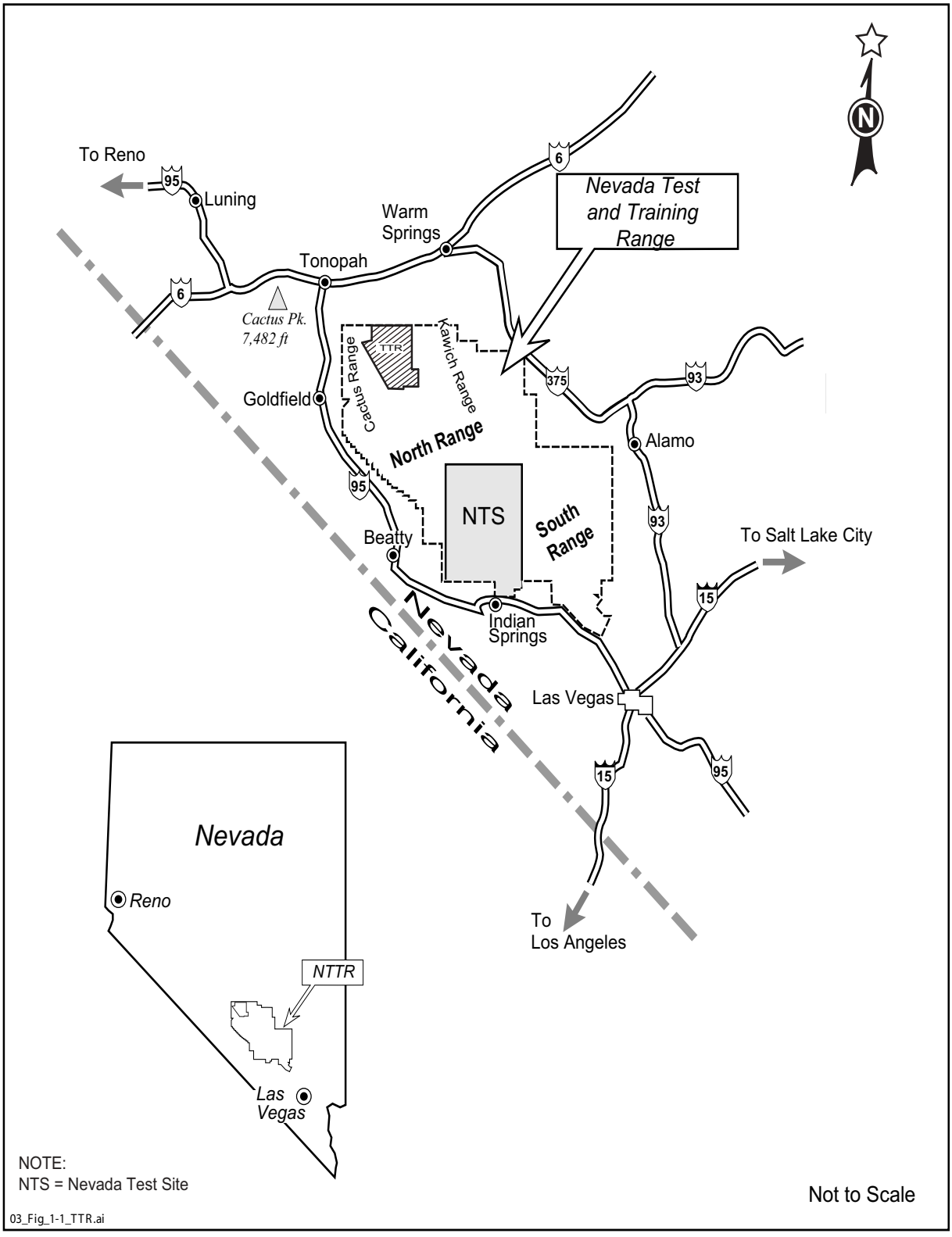

FIGURE 1-1. Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada.

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). Prior to the April 2002 lease agreement, the 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 2004). Las Vegas, Nevada is 140 mi from TTR. The total population within a 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 ºC (104 ºF) in the summer and approach -30 ºC (-22 ºF) in the winter. July and August are the hottest months with daily highs ranging from 32 to 37 ºC (90s ºF) and temperatures between 10 and 15 ºC (50s ºF) at night. January conditions vary from highs 5 to 10ºC (40s ºF) to lows -7 to -11ºC (teens ºF). An eight-year climatology developed from data taken in the 1960s identifies a record high of 38.8ºC (102 ºF) and a record low of -31ºC (-24 ºF) (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 (*Atriplex confertilfolia*), Russian thistle (*Salsola kali*), and sagebrush (*Artemesia 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 affect on the horse population or their grazing habits. The BLM routinely rounds up a portion of the herds for dispersal through the Horse Adoption Program.

Other mammals common to the area include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), kit fox (*Vulpes macrotis*), bobcat (*Zynx rufus*), coyote (*Canis latrans*), and gray fox (*Urocyon cinereoargenteus*). To a lesser extent, bighorn sheep (*Ovis canadensis*), mountain lion (*Felis concolor*), and burros (*Equus asinus*) are also present (USAF 1978, DRI 1991).

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

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

was conducted on the NTTR just west of TTR. The three Project Roller Coaster test sites at TTR are referred to as Clean Slates 1, 2, and 3 (Figure 1-2). The fourth test site at NTTR is referred to as Double Tracks. In 1996, Double Tracks was closed after soil contamination was remediated to a level of less than or equal to 200 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 μg/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 during the Project Roller Coaster tests. Radiation isopleths showing soil activity due to americium-241 (Am-241), plutonium-239 (Pu-239), and plutonium-240 (Pu-240) were drawn for each area. The cumulative area of the diffuse sources, as determined by the aerial radiological survey, is 20 million m^2 (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,

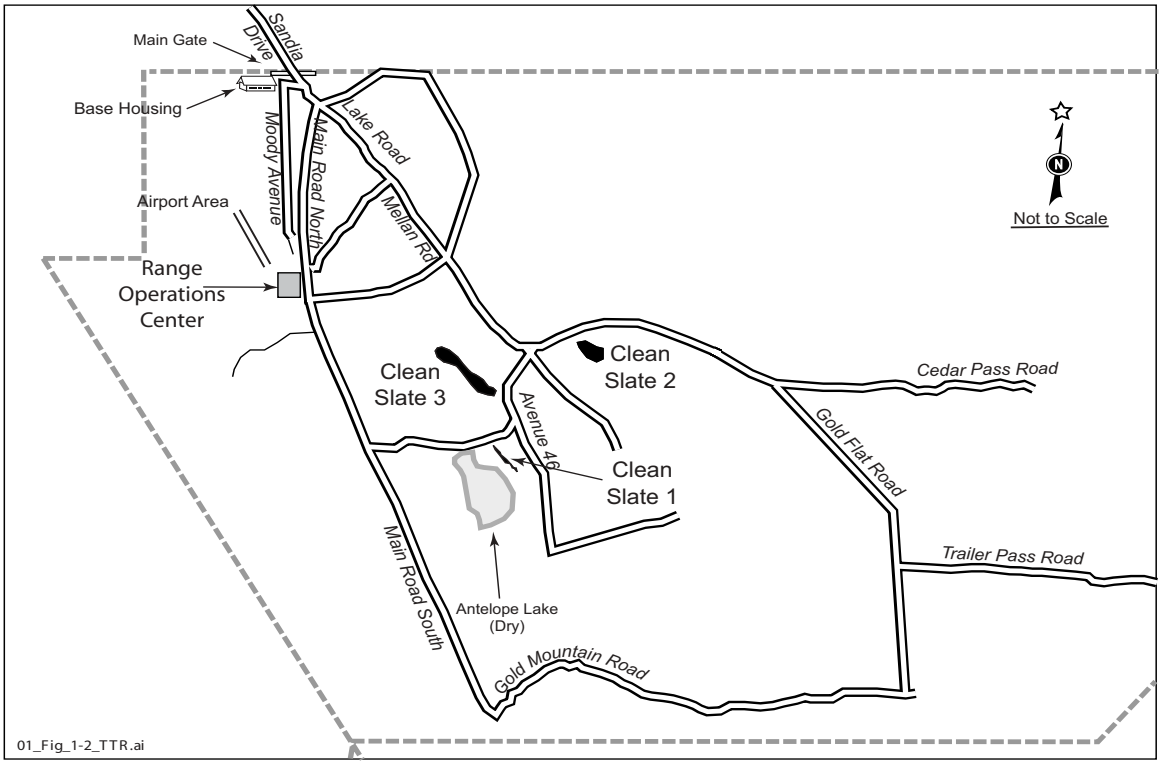

FIGURE 1-2. Location of Facilities Operated by SNL/NSO at TTR

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)

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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Chapter Two

TTR Compliance Summary

In this Chapter ...

Environmental Monitoring at TTR

Environmental Snap-

- *In 2003, Sandia Corporation submitted five National Environmental Policy Act (NEPA) Checklists to the U.S. Department of Energy (DOE) for proposed projects at TTR.*

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 2003 to identify issues that may have arisen from operations at TTR. There was one reportable environmental occurrence at TTR in 2003.

In 2003, Sandia Corporation and Westinghouse Government Service cooperated to ensure that TTR was in compliance with all permitting requirements.

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).

Environmental Monitoring at TTR

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 2003 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).

2.1 Compliance Status with Federal Regulations

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

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

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

CERCLA defines assessment activities and reporting requirements for inactive waste sites at federal facilities. As required by CERCLA, a Preliminary Assessment (PA) was submitted in 1988 for all facilities listed on the federal agency hazardous waste compliance docket. Sites with significant contamination were put on the National Priorities List (NPL) for cleanup (EPA 2004). There are no NPL or "Superfund" sites located at TTR.

Additional CERCLA requirements are given in the Superfund Amendments and Reauthorization Act (SARA) Title III for reportable quantity (RQ) releases and chemical inventory reporting. Sandia Corporation at TTR was in full compliance with CERCLA, SARA, and RQ in 2003. Table 2-1 lists SARA Title III reporting requirements.

2.1.2 Emergency Planning and Community Right-to-KnowAct (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 741 lbs of non-recovered lead in 2003. This information will be reported in the Reporting Year (RY) 2003 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.archives.gov/federal_register/executive_order/disposition_table.html

Federal Facility Compliance Act (FFCA)
Directs federal agencies regarding environmental compliance
http://tis.eh.doe.gov/oepa/laws/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/laws/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. 2003 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 2003.
311-312	MSDSs/ Chemical Purchase Inventory Report	✓		There are two "Community Right-to-Know" reporting requirements: (a) Sandia National Laboratories CIS Program 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 2003, a report was submitted for lead.

NOTE: MSDS = Material Safety Data Sheets (gives relevant chemical information)
RQ = reportable quantity
EHS = extremely hazardous substance
TRI = Toxic Release Inventory
DOE = U.S. Department of Energy
SSO = Sandia Site Office
EPA = U.S. Environmental Protection Agency
NNSA = National Nuclear Security Administration
RY = reporting year
CIS = Chemical Inventory System
lbs = pounds
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
EPCRA = Emergency Planning and Community Right-to-Know Act
SARA = Superfund Amendments and Reauthorization Act

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 a screening plant and a portable screen, are permitted under a Class II Air Quality Permit. Sandia Corporation tracks emissions and pays a fee to the State of Nevada based on the total standard tons emitted. Sandia Corporation met all air quality permit conditions in 2003.

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 2003* and Chapter 4 of this report discuss these monitoring results (SNL 2004).

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 2003 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 2003.

In 2003, preliminary work began on upgrading the TTR Area 3 Water System (The TTR Water and Fire Protection Project). Inspections of the storage tanks and Well 6 were accomplished to determine adequacy for future operations, state of repair, etc. Additional sampling was accomplished to determine specific treatment options for removal of arsenic and potential treatment to secondary standard SDWA requirements. As of this time, the project is funded, but specific plans have not been finalized.

2.1.8 Toxic Substances Control Act (TSCA)

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

Decontamination and demolition (D&D) operations conducted at TTR during 2003 generated 50 yd^3 of asbestos containing material (ACM) waste and 120 lb of light ballasts containing PCB. Local operations generated 20 lb of ACM from old brakes.

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 2003.

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 include this information in early project planning and decision making. NEPA mandates that an agency's decision process be open for public review. Additionally, if a

proposed action is determined to have environmentally "significant" impacts, the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before 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. 2003 NEPA activities are discussed in Section 3.4.

2.1.11 Endangered Species Act (ESA)

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

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

2.1.12 Migratory Bird Treaty Act (MBTA)

The MBTA of 1918, 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 and Ecology Program.

2.1.13 Cultural Resources Acts

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

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

DOE/NNSA/SSO is responsible for determining the level of applicability of cultural resources requirements. In 2003, 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

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

Common Name	Scientific Name	Federal Status	State of Nevada Status
PLANTS			
Sodaville milkvetch	*Astragalus lentiginosus var. sesquimetralis*	--	State Protected
Halfring milkvetch	*Astragalus mohavensis var hemigyrus*	--	State Protected
Milkvetch	*Astragalus phoenix*	Threatened	State Protected
Spring-loving centaury	*Centaurium namophilum*	Threatened	State Protected
Ash Meadows sunray	*Enceliopsis nudicaulis var. corrugata*	Threatened	State Protected
Sunnyside green gentian	*Frasera gypsicola*	--	State Protected
Ash Meadows gumplant	*Grindelia fraxinopratensis*	Threatened	State Protected
Ash Meadows ivesia	*Ivesia kingii var. eremica*	Threatened	State Protected
Ash Meadows blazingstar	*Mentzelia leucophylla*	Threatened	State Protected
Amargosa niterwort	*Nitrophila mohavensis*	Endangered	State Protected
Sand cholla	*Opuntia pulchella*	--	State Protected
Williams combleaf	*Polyctenium williamsiae*	--	State Protected
Tonopah fishhook cactus	*Sclerocactus nyensis*	--	State Protected
Hermit cactus	*Sclerocactus polyancistrus*	--	State Protected
INSECTS			
Ash Meadows naucorid	*Ambrysus amargosus*	Threatened	
FISH			
White River desert sucker	*Catostomus clarki intermedius*	--	State Protected
Moorman White River springfish	*Crenichthys baileyi thermophilus*	--	State Protected
Railroad Valley springfish	*Crenichthys nevadae*	Threatened	State Protected
Devils Hole pupfish	*Cyprinodon diabolis*	Endangered	State Protected
Ash Meadows Amargosa pupfish	*Cyprinodon nevadensis mionectes*	Endangered	State Protected
Warm Springs Amargosa pupfish	*Cyprinodon nevadensis pectoralis*	Endangered	State Protected
Pahrump poolfish	*Empetrichthys latos latos*	Endangered	State Protected
Big Smoky Valley tui chub	*Gila bicolor ssp.*	--	State Protected
Hot Creek Valley tui chub	*Gila bicolor ssp.*	--	State Protected
Little Fish Lake Valley tui chub	*Gila bicolor ssp.*	--	State Protected
Railroad Valley tui chub	*Gila bicolor ssp.*	--	State Protected
White River spinedace	*Lepidomeda albivallis*	Endangered	State Protected
Moapa dace	*Moapa coriacea*	Endangered	State Protected
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Threatened	State Protected
Big Smoky Valley speckled dace	*Rhinichthys osculus lariversi*	--	State Protected
Nevada speckled dace	*Rhinichthys osculus nevadensis*	Endangered	State Protected
AMPHIBIANS			
Amargosa toad	*Bufo nelsoni*	--	State Protected
REPTILES			
Banded Gila monster	*Heloderma suspectum cinctum*	--	State Protected
Desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	Threatened	State Protected
MAMMALS			
Spotted bat	*Euderma maculatum*	--	State Protected
Pygmy rabbit	*Brachylagus idahoensis*	--	State Protected
BIRDS			
Northern goshawk	*Accipiter gentilis*	--	State Protected
Western burrowing owl	*Athene cunicularia hypugaea*	--	State Protected
Ferruginous hawk	*Buteo regalis*	--	State Protected
Swainson's hawk	*Buteo swainsoni*	--	State Protected
Sage grouse	*Centrocercus urophasianus*	--	State Protected
Western snowy plover	*Charadrius alexandrinus nivosus*	Threatened	State Protected
Mountain Plover	*Charadrius montanus*	Proposed Threatened	State Protected
Black tern	*Chlidonias niger*	--	State Protected
Western least bittern	*Ixobrychus exilis hesperis*	--	State Protected
Flammulated owl	*Otus flammeolus*	--	State Protected
Phainopepla	*Phainopepla nitens*	--	State Protected
White-faced Ibis	*Plegadis chihi*	--	State Protected
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	State Protected

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 2003 Audits

Table 2-3 lists audits conducted in 2003, including an assessment made by Sandia Corporation.

2.3 2003 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.

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 2003. TTR was in full compliance with all permitting requirements for 2003.

TABLE 2-3. Summary of Environmental Audits Performed at TTR in 2003

Type/Subject	Date	Audit Organization	Findings Summary
Hazardous Waste Management	July 7 – 10	NNSA/SSO	There were no findings.
Safe Drinking Water Protection Program	July 7 – Sept. 26	NNSA/SSO	The Safe Drinking Water Protection Program Assessment identified five findings mostly related to TTR's old drinking water distribution system. These findings will be corrected once construction begins on the TTR Water and Fire Protection Replacement Project in late 2004.
Wastewater Sampling	July 7 – Sept. 8	NNSA/SSO	There were no findings.

NOTE: NNSA/SSO = National Nuclear Security Administration, Sandia Site Office
TTR = Tonopah Test Range

TABLE 2-4. 2003 Summary of Permit Ownership at TTR

Permit Type and Location	Permit Number	Issue Date	Expiration Date	Comments
Air Quality Permits				
Class II Air Quality Operation Permit	AP9611-0680.01	July 23, 2001	July 23, 2006	1- 3' x 5' Screening Plant 1- 7' x 7' Portable Screen **Non-Permit Equipment List** 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 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.

2.5 OCCURRENCE REPORTING

There was one reportable occurrence in February 2003. During a routine survey of salvage, eight tires in the salvage yard were discovered that were contaminated with depleted uranium shrapnel. These tires all have US Atomic Energy Commission (AEC) markings and it is believed they are a legacy from the 60's. After the incident, the salvage yard was posted as a controlled area. Most of the salvage yard has now been surveyed and no additional radiological material has been found.

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In this Chapter ...

Wild horses at TTR

Environmental Snapshot

- *There were no shipments of radioactive waste at TTR in 2003.*

Chapter Three

TTR Environmental Programs Information

Chapter Summary

The Environmental Restoration (ER) Project, the Waste Management Program, and the National Environmental Policy Act (NEPA) Program are some of the programs and activities Sandia Corporation's Tonopah Test Range (TTR) utilizes to meet compliance with various state and federal regulations, Executive Orders (EOs), and U.S. Department of Energy (DOE) Orders.

In 2003, Sandia Corporation progressed with many environmental initiatives. The ER Project generated 3,176,047 kg (6,987,303 lb) of non-Resource Conservation and Recovery Act (RCRA) waste, 3 kg (7 lb) of RCRA waste, and 108,862 kg (239,496 lb) of low-level waste (LLW) 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.

Wild Horses at TTR

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).

2003 ER Activities

In 2003, cleanup activities completed at ER sites generated a total of 3,284,909 kg (7,226,800 lb) of waste including 3,176,047 kg (6,987,303 lb) of non-RCRA waste, 3 kg (7 lb) of RCRA waste, and 108,862 kg (239,496 lb) of low-level waste (LLW). A total of 1,443,914 kg (3,176,611 lb) of non-RCRA waste, 108,862 kg (239,496 lb) of LLW waste, was shipped to the Nevada Test Site (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 2004. Non-RCRA waste consisted of 1,436,088 kg (3,159,393 lb) of hydrocarbon-impacted soil, 750 kg (1,650 lb) of non-impacted personal protective equipment (PPE), 7,076 kg (15,567 lb) of inert ordinance debris, and 1,732,133 kg (3,818,700 lb) of construction debris. Much of the waste discussed was generated from three large trenches under CAU-410 in 2003. This site was closed in December of 2003.

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs Calendar Year (CY) 2003 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 - ***Closed*** 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 2003 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 03-02-002-0308	UDP UDP	Bldg. 0360 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 – *Closed* 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* Test Area JTA Sites, TTR		
TA-52-002-TAML	DU Impact Site	Main Lake
TA-52-003-0960	DU Artillery Round #2	South of Area 9
TTR-001	1987 W-79 JTA	Unknown – South of Area 9
CAU-484 – *Investigation Phase* Antelope and NEDS Lakes Waste Sites, TTR		
TA-52-001-TANL	NEDS Detonation Area	NEDS Lake
TA-52-004-TAAL	Metal Particle Dispersion Test	Antelope Lake
TA-52-005-TAAL	JTA DU Sites	Antelope Lake
TA-54-001-TANL	Rocket Propellant Burn Area	NEDS Lake
RG-52-007-TAML	Davis Gun Site – Mellan	Test Range
TA-52-006-TAPL	DU Surface Debris	Colimbo Detonation Area, NEDS Lake

Refer to notes at end of table.

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs CY 2003 *(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 - *Closed* 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 – *Investigation Phase* 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
WWII = World War II
Pu = Plutonium
NNSA = National Nuclear Security Administration
NSO = Nevada Site Office
UDP = underground discharge points
UST = underground storage tank
UXO = unexploded ordnance
TTR = Tonopah Test Range
JTA = Joint Test Assembly

Hydrocarbon-impacted soil and LLW was transported to the NTS for disposal. Construction debris and PPE was disposed of at the U.S. Air Force (USAF) sanitary landfill in 2003. In addition, 272 kg (600 lb) of sanitary rinsate was disposed of in the TTR sanitary lagoons in 2003. Westinghouse Government Service participates in environmental cleanup and restoration activities.

3.2 Waste Management Programs

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

Waste generated and handled by Sandia Corporation at TTR in 2003 was as follows:

Waste Type	Weight
RCRA hazardous waste	1,068 kg (2,350 lb)
Non-RCRA-regulated hazardous or toxic waste	2,110 kg (4,782 lb)
Radioactive waste	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 3,508 kg (7,717 lb) and 2,055 gallons of 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 2003.

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

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

TABLE 3-2. Sandia Corporation TTR Generated RCRA-Regulated Hazardous Waste Shipped Off-site in 2003

Waste Description	Waste Codes	Generated (lbs)
WASTE MANAGEMENT		
Waste Water Reactive Solid, NOS, (Lithium Battery)	D001, D003, D005, D007	20
Hazardous Waste Solid, NOS, (Rag with Methylene Chloride)	F002, F003, F005, D035	215
Waste Aerosol Flammable (Petroleum Distillates)	D001	220
Waste Petroleum Distillates	D001	145
Waste Paint Related Material	D001	905
Wasted Batteries Dry, Containing Potassium Hydroxide (Nickel-Cadmium Batteries	D006	25
Waste Flammable Liquid, NOS (Petroleum Distillates)	D001	165
Waste Flammable Liquide, NOS (Gasoline/Diesel Fuel)	D001, D018	85
Waste Disel Fuel	D001, D018	445
Waste Corrosive Liquid Acidic, Inorganic, NOS, (Hydrofluoric Acid)	D002	50
Hazardous Waste, Solid, NOS, (Lead)	D008	5
Hazardous Waste, Solid, NOS	D009, U151	25
Hazardous Waste, Solid, NOS	D008, D009	45
	TOTAL	**2,350**

NOTE: NOS = not otherwise specified RCRA = Resource Conservation and Recovery Act
TTR = Tonopah Test Range lbs = pounds

TABLE 3-3. Non-RCRA-Regulated Hazardous or Toxic Waste Shipped Off-site in 2003

Waste Description	Waste Codes	Shipped	Generated (lbs)
Non-Reg Solid Waste	NRM		3,667
Non-Reg Liquid Waste (Ethylene Glycol)	NRM		765
Regulated Medical Waste	NRM		210
Asbestos	TSCA	20 lb	20
D&D Polychlorinated Biphenyl's (PCB) Ballasts	TSCA	120 lb	120
		Total	4,782
D&D Asbestos Waste	TSCA	50 yd^3	50 yd^3
Environmental Restoration (ER)			
Hydrocarbon impacted soil & debris			3,694,033
Soil IDW			1,654
LLW (soil, debris, and PPE)			240,000
Inert UXO debris			15,600
		Total	3,951,287

NOTE: NRM = Non-Regulated Material TSCA = Toxic Substances Control Act
RCRA = Resource Conservation and Recovery Act LLW = low level waste
IDW = Investigation-Derived Waste UXO = unexploded ordnance
D & D = decontamination and demolition PPE = personal protective equipment
yd^3 = cubic yard lbs = pounds

TABLE 3-4. Recycled Regulated Hazardous or Toxic Waste Shipped Off-site in 2003

Recycled Material or Energy Recovered Material	Generated (lbs)
WASTE MANAGEMENT	
Waste Batteries Wet, Filled with Acid	70
Lead For Recycle	675
Ammo Brass for Recycle	2,400
Empty Drums	300
Automotive/Equipment Lead Acid Batteries	5,752
Waste Batteries Dry, Alkaline	1,060
Fluorescent Lights	560
Incandescent Bulbs	35
Hazardous Waste, Solid, NOS,(Sodium Vapor Bulbs, Barium)	10
TOTAL	**10,862**
Non-RCRA, Non Hazardous Liquid, NOS (Used Oil)	2,055

NOTE: NOS = not otherwise specified RCRA = Resource Conservation and Recovery Act lbs = pounds

2003 NEPA Documentation
During 2003, Sandia Corporation submitted eight NEPA Checklists to DOE/NNSA/SSO for proposed projects at TTR that were determined to be within the NTS EIS envelope.

In support of activities at TTR, DOE completed consultation with the Nevada State Historic Preservation Office (SHPO) on 68 buildings. None were found to be of historic interest.

3.5 Environmental Monitoring Performed By Outside Agencies

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

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

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

DRI also provides external quality assurance (QA) on field measurements taken by the EPA at these community-monitoring stations. DRI monitors selected locations concurrently using a portable monitoring station (PMS) and thermoluminescent dosimeters (TLDs). DRI's *Community Radiation Monitoring Program Annual Report* now appears as part of the NTS Annual Site Environmental Report (ASER) (DOE 2003a).

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 2003, SNL/NV* (SNL 2004), requires that an annual report be submitted from each DOE/NNSA site where facility sources contribute a public dose of over 0.1 mrem/yr. The NESHAP report must be submitted to the EPA by June 30th each year, following the reporting year. The report includes the calculated effective dose equivalent (EDE) in mrem/yr for the maximally exposed individual (MEI).
- *State of Nevada Reports* – The State of Nevada requires copies of each hazardous waste manifest that accompanies each waste shipment.
- *State of Nevada Extremely Hazardous Material Reporting Requirements* – This is not currently required since Sandia Corporation does not use any extremely hazardous materials during its routine operations.
- *Toxic Chemical Release Reporting Community Right-to-Know: Calendar Year 2003* (SNL 2004b) submitted for lead released at the TTR firing range.

Chapter Four

TTR Environmental Monitoring

In this Chapter ...
Terrestrial Surveillance
Water Monitoring
Radiological Air Monitoring
Non-radiological Air Emissions

Lycium andersonii fruit at TTR

Environmental Snapshot

- *In 2003, total non-radiological air emissions reported to the State of Nevada were 0.001 ton per year from the TTR portable screen.*
- *Drinking water monitoring and wastewater monitoring results confirm that all permit conditions set by the state of Nevada were met.*

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 assisted in most environmental monitoring activities in 2003. 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 450.1, *Environmental Protection Program* (DOE 2003):

- 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 450.1, *Environmental Protection Program* (DOE 2003). 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 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 (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) 2001, the analysis was limited to a five-year period (this year beginning in 1999). 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

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.

years). Non-radiological analyses were not performed in CY 2003.

4.1.4 Sampling Locations

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

Routine terrestrial surveillance is conducted at on-site, perimeter, and off-site locations that remain essentially the same from year to year. Sample locations may be modified as necessary to reflect current operations or to supplement data from existing locations. For example, prior to 2000, locations formerly known as 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.

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.

- ***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 which Sandia Corporation does not control access within TTR.

4.1.5 Radiological Parameters and Results

Soil is the only terrestrial medium sampled at TTR. There are no bodies of water, other than the

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

Revised Location Number	Old Location Number	Sample Location	Replicate* Location
		South Plume	
S-48	T-14	N/S Mellan Airstrip – Antelope Tuff	Yes
S-49	T-16	N/S Mellan Airstrip – SW of S-48	--
S-50	T-17	N/S Mellan Airstrip – sign post	--
S-51	T-18	N/S Mellan Airstrip – NE of S-50	--
S-52	T-19	NE of NW/SE Mellan Airstrip	--
		Range Operations Center	
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	--
		Various On-site Locations	
S-02	T-02	N/S Mellan Airstrip (TLD at south fence post)	--
S-03	T-03	TLD at Clean Slate 2	Yes
S-04	T-04	TLD at Clean Slate 3	--
S-09	D-01	Roller Coaster Decon	Yes
S-10	T-10	Brownes Road/Denton Freeway	--
S-38	MH-03	Mellan Hill – Metal Scrap Pile	--
S-39	MH-04	Mellan Hill – North	--
S-53	T-20	Main Road/Lake Road SE	--

NOTE: TLD = thermoluminescent dosimeter TTR = Tonopah Test Range
N/S = North/South (runway runs North/South)
-- = 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.

TABLE 4-3. Off-site Terrestrial Surveillance Locations at TTR

Revised Location Number	Old Location Number	Sample Location	Replicate* Location
C-20	B-08	State Road 6 Rest Area	--
C-21	B-04	State Road 6/95 Rest Area	--
C-22	B-07	Rocket	--
C-23	B-01	Alkali/Silver Peak Turnoff	--
C-24	B-02	Cattle Guard	--
C-25	B-03	Tonopah Ranger Station	--
C-26	B-05	Gabbs Pole Line Road	--
C-27	B-06	State Roads 6/376 Junction	--
C-28	B-09	Stone Cabin/Willow Creek	--
C-29	B-10	State Roads 6 and 375 Junction	Yes
C-30	B-11	State Road 375 Ranch Cattle Gate	--
C-31	B-12	Golden Arrow/Silver Bow	--
C-32	B-13	Five miles south of Rocket	--
C-33	B-14	Nine miles south of Rocket	--

NOTE: TTR = Tonopah Test Range
-- = 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.

TABLE 4-4. Perimeter Terrestrial Surveillance Locations at TTR

Revised Location Number	Old Location Number	Sample Location	Replicate* Location
P-06	T-06	Cedar Pass Road Guard Station	--
P-08	T-08	On-Base Housing (Main guard gate/power pole CP17)	--
P-11	T-13	Cactus Springs (TLD south of P-35)	Yes
P-12	T-12	TLD at "US Gov't Property" Sign	--
P-34	OM-03	O&M Complex (Owan Drive post)	--
P-35	T-11	Cactus Springs (north fence post)	--
P-36	T-36	On-Base Housing (NE fence line)	--
P-37	T-37	On-Base Housing (guard station)	--

NOTE: TLD = thermoluminescent dosimeter
TTR = Tonopah Test Range
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.

playa lakes (dry lake beds with only occasional standing water), and vegetation is scarce. Soil samples are collected to ascertain the presence of air-deposited pollutants or contaminants that have been transported and deposited as a result of surface water runoff. Samples are collected from the top two inches of soil using a hand trowel. The CY 2003 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, 2003* (SNL 2004a). 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). It should be noted that no plutonium was reported in 2002.

- ***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.

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	105	0.137	0.011	0.556	-0.162	3.580
	Perimeter	40	-0.002	0.004	0.053	-0.145	0.175
	Off-site	70	-0.003	0.001	0.043	-0.152	0.103
Cs-137	On-site	105	0.291	0.305	0.203	-0.014	0.886
	Perimeter	40	0.216	0.149	0.176	0.004	0.642
	Off-site	70	0.231	0.196	0.167	0.000	0.930
Pu-238	On-site	31	0.0168	0.0080	0.0209	-0.0102	0.0823
	Perimeter	8	0.0068	0.0040	0.0088	0.0018	0.0280
	Off-site	14	0.0058	0.0049	0.0069	-0.0022	0.0238
Pu-239/240	On-site	31	0.6889	0.1220	1.2480	0.0011	4.9200
	Perimeter	8	0.0163	0.0122	0.0141	0.0014	0.0431
	Off-site	14	0.0115	0.0109	0.0095	-0.0011	0.0319
U-235	On-site	105	0.1184	0.1090	0.0712	-0.0428	0.389
	Perimeter	40	0.0970	0.0892	0.0603	0.0093	0.252
	Off-site	70	0.0949	0.0815	0.0672	-0.0347	0.293
U-238	On-site	105	1.585	1.610	0.551	0.315	3.13
	Perimeter	40	1.481	1.510	0.614	0.0476	2.65
	Off-site	70	1.594	1.575	0.615	0.178	3.37
Total Uranium (µg/g)	On-site	105	0.655	0.655	0.203	0.287	1.82
	Perimeter	40	0.629	0.623	0.182	0.301	1.11
	Off-site	70	0.682	0.644	0.229	0.301	1.44

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

TABLE 4-6. Summary Statistics for Soil Locations Noted as Priority-2 (All units in pCi/g)

Analyte	Location	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Am-241	S-09	5	2.198	2.59	1.49	0.546	3.58
Cs-137	S-38	5	0.554	0.526	0.115	0.458	0.742
	S-50	5	0.576	0.552	0.118	0.443	0.767
Pu-239/240	S-09	4	3.69	3.54	0.90	2.77	4.92

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

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. Two locations were reported as Priority-2 (higher than off-site) for Cs-137. One location was identified as Priority-2 (higher than off-site) for Plutonium-239/240. The Priority-2 locations along with the associated summary statistics are listed in Table 4-6. There were multiple locations listed as Priority-3 (increasing trend). While this increasing trend is "statistically significant," it is not operationally significant (of no importance and does not pose a safety and health threat to human health or the environment). These are discussed below in the appropriate section. The Priority-3 locations along with their associated summary statistics are listed in Table 4-7.

Am-241

One on-site location (S-09, formerly D-01) 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. No other on-site locations were identified as Priority-2. No perimeter location was identified as either Priority-2 or Priority-3.

Cs-137

Two on-site locations (S-38 and S-50) were identified as Priority-2 (higher than off-site) and two on-site locations (S-40 and S-49) were identified as Priority-3

TABLE 4-7. Summary Statistics For Soil Locations Noted As Priority-3 (All Units In pCi/g)

Analyte	Location	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Cs-137	S-40	5	0.151	0.132	0.064	0.075	0.235
	S-49	5	0.431	0.418	0.106	0.311	0.574
U-238	S-38	5	1.719	1.730	0.566	0.888	2.390
Total Uranium (µg/g)	S-02	5	0.738	0.777	0.179	0.479	0.962
	S-04	5	0.692	0.744	0.211	0.363	0.919
	S-09	5	0.541	0.590	0.148	0.287	0.648
	S-10	5	0.679	0.745	0.163	0.403	0.799
	S-38	5	0.515	0.537	0.126	0.312	0.661
	S-39	5	0.705	0.795	0.219	0.361	0.882
	S-40	5	0.731	0.736	0.234	0.359	0.971
	S-50	5	0.521	0.515	0.093	0.386	0.618
	S-51	5	0.640	0.704	0.132	0.445	0.760
	S-52	5	0.706	0.719	0.137	0.553	0.842
	P-06	5	0.605	0.653	0.183	0.301	0.774
	P-11	5	0.518	0.506	0.123	0.327	0.639
	P-34	5	0.595	0.555	0.200	0.321	0.820

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

(increasing trend) for Cs-137. The values observed for S-38 and S-50 ranged from 0.443 pCi/g to 0.767 pCi/g while the values observed for S-40 and S-49 ranged from 0.075 pCi/g to 0.574 pCi/g. Locations S-38, S-49 and S-50 are associated with the Mellan Hill area while S-40 is located at the Waste Water Monitoring station. There were no perimeter locations identified as either Priority-2 or Priority-3.

Pu-239/240

One on-site location (S-09, formerly D-01) was identified as Priority-2 (higher than off-site) for Pu-239/240. The highest value observed for this location was 4.92 pCi/g in 2003. No other site was identified as Priority-2 and no site was identified as Priority-3 (increasing trend).

U-238

One on-site location (S-38) was identified as Priority-3 (increasing trend) for U-238. The values at this location ranged from 0.888 pCi/g to 2.39 pCi/g with the highest value occurring in 2003. No on-site or perimeter location was noted to be Priority-2 (higher than off-site).

Total Uranium (U_{tot})

Ten on-site locations (S-02, S-04, S-09, S-10, S-38, S-39, S-40, S-50, S-51 and S-52) were identified as Priority-3 (increasing trend) for U_{tot}. Three perimeter locations (P-06, P-11, and P-34) were identified as Priority-3 (increasing trend) for U_{tot} as well. The on-site values ranged from 0.287 ug/g to 0.971 ug/g while the perimeter locations ranged from 0.301 ug/g to 0.820 ug/g. There were no Priority-2 (higher than off-site) locations noted for U_{tot}.

TLD Results

Sampling for 2003 was conducted from January 2003 through January 2004. TLD's were unrecovered (missing) at several locations during CY2003; when a TLD has a missing quarter the data is not included in the summary statistics.

On-site and perimeter locations are statistically indistinguishable from off-site locations. There does appear to be a statistical difference between years with 2002 being the highest recorded on-site year and 2001 being the lowest recorded off-site year. The results in 1999 are also statistically higher for on-site and off-site than those of 2001. Figure 4-1 graphically portrays the TLD results from 1999 to 2003. TLD results and TLD measurements by quarter and location type for 2003 are shown in Tables A-7 and A-8 of Appendix A, respectively.

4.1.6 Non-Radiological Parameters and Results

TTR soil samples are analyzed for 20 stable metals (ICP-20) plus mercury every other year (during even numbered years). Table 4-8 shows soil sample concentration data for these metals. In CY2003, non-radiological analyses were not performed. No statistical analyses were performed on the non-radiological data.

TABLE 4-8. Metal in Soil Concentration Data (complied from various sources)

	NV Surface Soil Concentration	EPA Region 9 PRG's		U.S. Surface Soil Concentration
Parameter	Range (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	Range (mg/kg)
Aluminum	5000 - 100,000	76,000	100,000	4,500 - 100,000
Antimony	<1 - 1.0	31	410	0.25 - 0.6
Arsenic	2.9 - 24	22	260	<1 - 93
Barium	150 - 3,000	5,400	67,000	20 - 1500
Beryllium	ND - 5.0	150	1,900	0.04 - 2.54
Cadmium	ND - 11	37	450	0.41 - 0.57
Calcium	600 - 320,000	NA	NA	NA
Chromium	7.0 - 150	210(1)	450(1)	7 - 1500
Cobalt	ND - 20	900	1,900	3 - 50
Copper	7.0 - 150	3,100	41,000	3 - 300
Iron	1000 - >100,000	23,000	100,000	5,000 - 50,000
Lead	ND - 70	400	750	<10 - 70
Magnesium	300 - >100,000	NA	NA	NA
Manganese	30 - 5000	1,800	19,000	20 - 3000
Mercury	0.01 - 0.82	23(2)	310(2)	0.02 - 1.5
Molybdenum	ND - 7.0	390	5,100	0.8 - 3.3
Nickel	5.0 - 50	1,600	20,000	<5 - 150
Potassium	1900 - 63,000	NA	NA	NA
Selenium	<0.1 - 1.1	390	5,100	<0.1 - 4.0
Silica (Silicon)	150,000 - 440,000	NA	NA	24,000 - 368,000
Silver	<0.5 - 5	390	5,100	0.2 - 3.2
Sodium	<500 - 100,000	NA	NA	NA
Strontium	100 - 1500	47,000	100,000	7 - 1000
Thallium	NA	5.2	67	.02 - 2.8
Titanium	700 - 5000	NA	NA	20 - 1000
Vanadium	30 - 150	550	7,200	0.7 - 98
Zinc	25 - 128	23,000	100,000	13 - 300

ND = not detectable
(1) total chromium
(2) mercury and compounds
NV Surface Soil Concentrations:
Dragun, James, A. Chiasson, Elements in North American Soils, 1991, Hazardous Materials Control Resources Institute
(Used "Nevada Soils" to determine values, if available, otherwise Western US values used.)
EPA Region 9 Preliminary Remediation Goals (PRGs):
Environmental Protection Region 9, "Region 9 PRGs Table Users Guide/Technical Background Document" EPA 2002 (http://www.epa.gov/region09/waste/sfund/prg/index.htm)
US Surface Soil Concentrations:
Kabata-Pendias, A., Pendias, H., CRC, Trace Elements in Soils and Plants, 2nd Edition, 1992

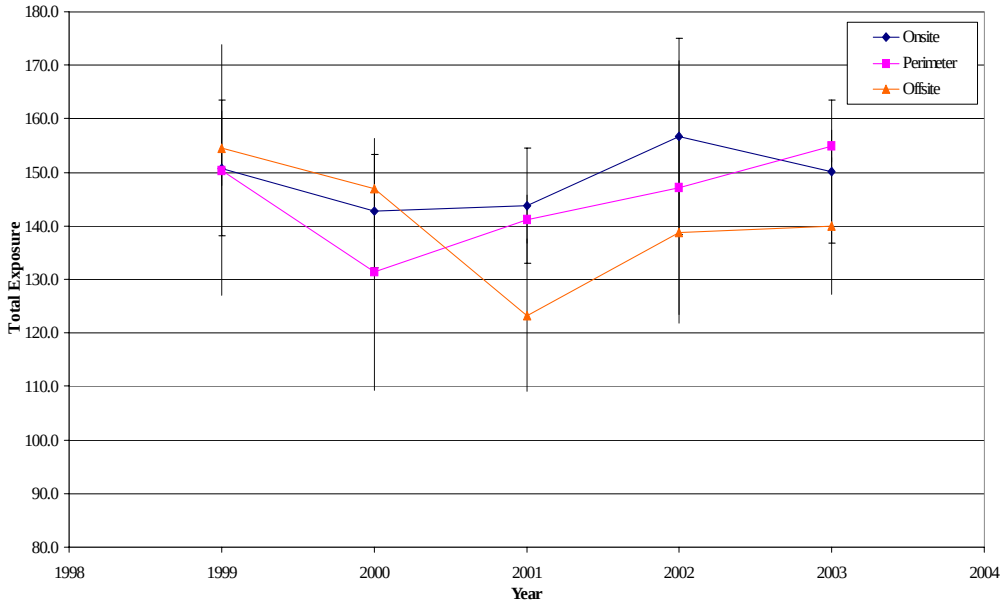

FIGURE 4-1. Tonopah Test Range TLD Exposure (1999-2003)

4.2 WATER MONITORING

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

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

4.2.1 Production Well Monitoring

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

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

Sampled parameters included, but were not limited to, total coliforms, nitrates, nitrites, volatile organic compounds (VOCs), lead, copper, and arsenic.

4.2.2 Sewage System and Septic Tank Monitoring

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

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

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

All analytical results for wastewater sampled at Area 3 were within regulatory limits in 2003.

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 2003. 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)

TABLE 4-9. Production Well Monitoring at TTR

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

NOTE: IOC = inorganic compounds
VOC = volatile organic compounds
SOC = synthetic organic compounds

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

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

NOTE: *Dose calculated from continuous monitoring February 1996 to February 1997.
EDE = effective dose equivalent
MEI = maximally exposed individual
mrem/yr = millirem per year
mSv/yr = millisievert per year
TTR = Tonopah Test Range
[1] Natural background is estimated at 250 mrem/yr nationwide.

or diffuse sources such as outdoor testing. However, diffuse radiological emissions are produced from the re-suspension of americium and plutonium present at the Clean Slate ER sites. Other ER sites with minor radiological contamination, such as DU, do not produce significant air emission sources from re-suspension.

National Emission Standards for Hazardous Air Pollutants (NESHAP)

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

The 1995 NESHAP report for TTR reported a calculated effective dose equivalent (EDE) to the maximally exposed individual (MEI) of 1.1 mrem/yr as a result of diffuse emissions from the Clean Slate sites (SNL 1996). Because the EPA requires continuous air monitoring for any radionuclide source that contributes a dose in excess of 0.1 mrem/yr to the MEI, Sandia Corporation instituted continuous air monitoring at the site for one year, from February 22, 1996 to February 25, 1997. The monitoring site was chosen at the TTR Airport, the location of the highest calculated dose for a member of the public. This site selection is discussed in the 1996 NESHAP report (SNL 1997). The dose assessment result from the continuous monitoring was 0.024 mrem/yr. This was about four times less than the 0.1 mrem/yr threshold cutoff for which continuous monitoring would be required by the EPA. The average air concentration in curies per cubic meter (Ci/m^3) were measured as follows:

Am-241	4.1×10^{-18} Ci/m^3
Pu-238	1.6×10^{-18} Ci/m^3
Pu-239/240	9.5×10^{-19} Ci/m^3

Although an annual calculated dose assessment is not required for the site, Sandia Corporation continues to produce an annual NESHAP report for TTR (SNL 2004). The results from the 1996 to 1997 monitoring will continue to be used for as long as there is no change in the status of the Clean Slate sites. Table 4-10 summarizes these dose assessment results. Future TTR activities are not expected to change; however, if new sources or modifications to the existing sources are anticipated, they will be evaluated for NESHAP applicability.

4.4 Non-Radiological Air Emissions

The TTR Class II Air Quality Operating Permit Renewal in 2002 exempted most emission sources used at TTR with the exception of the screening plant and portable screen. In 2003, the total emissions reported to the State of Nevada were 0.001 ton per yr from the portable screen. The screening plant was not used.

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In this Chapter ...
Facilities and Operations
2003 Rocket Launches
Demographics
Compliance Summary
Environmental Program Activities
Environmental Surveillance & Monitoring Activities

Hala Tree

Environmental Snapshot

- *On-site meteorological instruments are use during test periods to characterize atomspheric transport, diffusion conditions, and stability classes.*
- *There was one reportable occurrence at SNL/KTF in 2003.*

Chapter Five
2003 Annual Site Environmental Report for the Kauai Test Facility

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. SNL/KTF is owned by the DOE/NNSA and managed by 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) 2003. This report was prepared in accordance with DOE Order 450.1, *Environmental Protection Program* (DOE 2003) 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 Remote Range Interfaces Department, under Sandia Corporation, manages and conducts the rocket-launching activities at SNL/KTF. The site is primarily used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering re-entry vehicles, scientific studies of atmospheric and exoatmospheric phenomena, and Ballistic Missile Defense Organization (BMDO) programs. Nuclear devices have never been launched from SNL/KTF, nor have radiological materials been used at SNL/KTF.

Mountain Range in Kauai

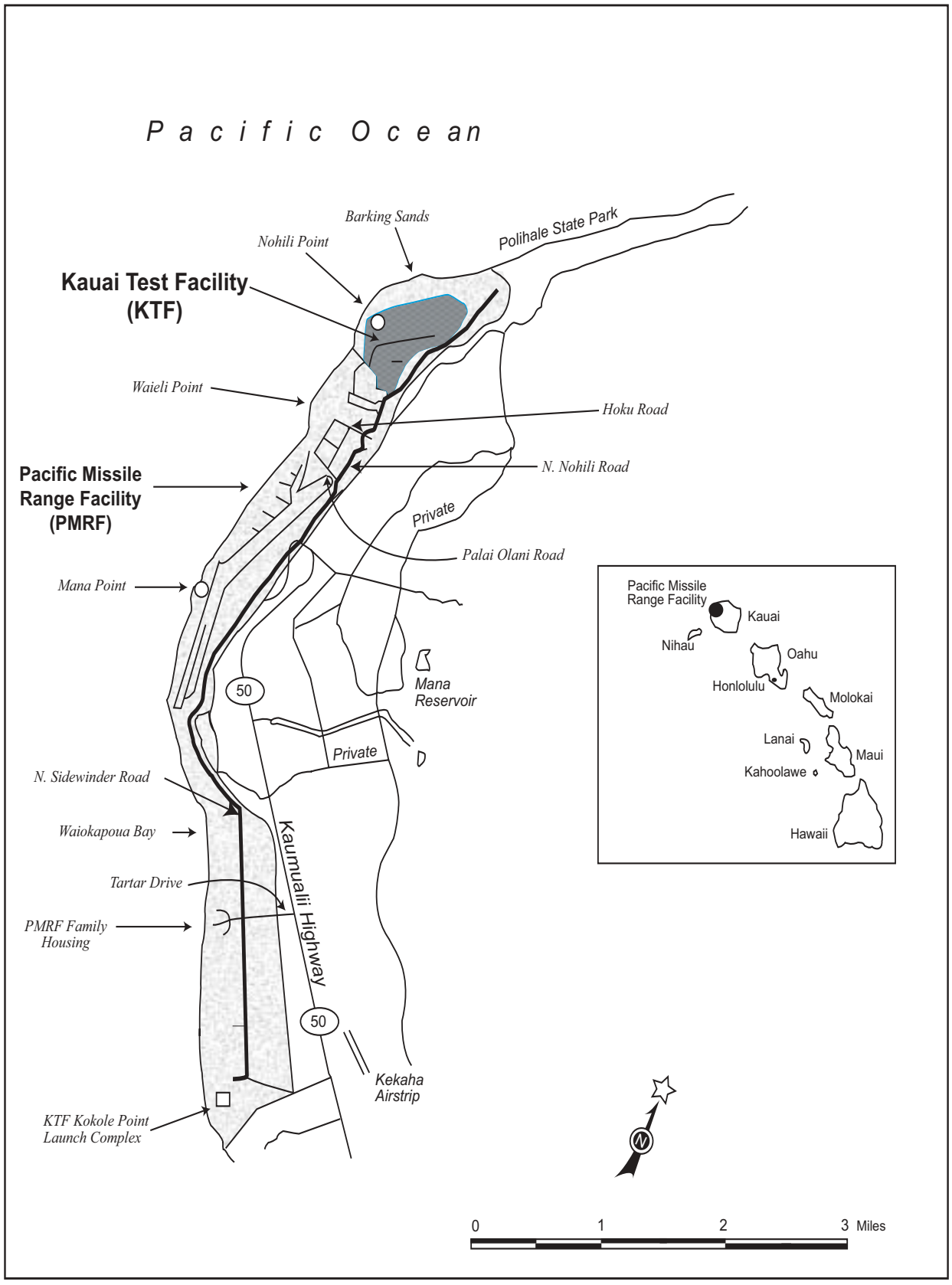


FIGURE 5-1. Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area (The Kauai Test Facility (KTF) is to the north, near Nohili Point)

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 2003, there have been 16 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 2003 Rocket Launches

There were two rockets launched from SNL/KTF in 2003. The launches were covered by the KTF Environmental Assessment (EA), published in July 1992 (DOE 1992a).

- AEGIS BMD, FM-4
  June 18, 2003
- AEGIS BMD, FM-5
  December 11, 2003

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 AEGIS Ballistic Missile Defense (BMD) Program.

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 5-5 provides an overview of compliance status for Sandia Corporation's operations at SNL/KTF in 2003. Table 5-1 lists the applicable permits in place at SNL/KTF.

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

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

Superfund Amendments and Reauthorization Act (SARA)
SARA Title III requires chemical inventory information and threshold quantity reporting as directed by the Emergency Planning and Community Right-to-Know Act (EPCRA), Sections 311 and 312. All required information has been submitted to the State of Hawaii. There were no reportable releases at SNL/KTF under EPCRA or CERCLA in 2003. Table 5-2 lists SARA Title III reporting requirements.

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	Sept. 15, 1998	Extension Approved	State of Hawaii
Resource Conservation and Recovery Act (RCRA)	HI-0000-363309	Sept. 23, 1994	Not specified	EPA Region IX and Hawaii Dept. of Health
UST (2,500)	Not applicable	Sept. 13, 1991	Indefinite	EPA Region IX and Hawaii Dept. of Health

NOTE: In 1999, there was a change in reporting fuel through put from annual reporting to biannual reporting to the State of Hawaii.
SNL/KTF = Sandia National Laboratories, Kauai Test Facility
EPA = U.S. Environmental Protection Agency
UST = Underground Storage Tank

TABLE 5-2. 2003 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 2003.
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 2003 for producing a TRI Report for SNL/KTF operations.

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

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.archives.gov/federal_register/executive_order/disposition_table.html

Federal Facility Compliance Act (FFCA)
Directs federal agencies regarding environmental compliance
http://tis.eh.doe.gov/oepa/laws/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/laws/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**

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 2003 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 include this information in early project planning and decision-making. NEPA mandates that an agency's decision process be open for public review. Additionally, 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 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. The DOE/NNSA/SSO coordinates NEPA compliance at SNL/KTF with Sandia National Labs, New Mexico (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 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

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

Common Name	Scientific Name	Federal Status	State Status
Plants			
Liliwai	*Acaena exigua*	Endangered	Endangered
No common name	*Achyranthes mutica*	Endangered	Endangered
Pendant kihi fern	*Adenophorus periens*	Endangered	Endangered
Mahoe	*Alectryon macrococcus var. macrococcus*	Endangered	Endangered
Kuawawaenohu	*Alsinidendron lychnoides*	Endangered	Endangered
No common name	*Alsinidendron viscosum*	Endangered	Endangered
No common name	*Bonamia menziesii*	Endangered	Endangered
Olulu	*Brighamia insignis*	Endangered	Endangered
Uhiuhi	*Caesalpinia kavaiensis*	Endangered	Endangered
'Awiwi	*Centaurium sebaeoides*	Endangered	Endangered
'Akoko	*Chamaesyce halemanui*	Endangered	Endangered
Pauoa	*Ctenitis squamigera*	Endangered	Endangered
Haha	*Cyanea asarifolia*	Endangered	Endangered
Haha	*Cyanea recta*	Threatened	Threatened
Haha	*Cyanea remyi*	Endangered	Endangered
Haha	*Cyanea undulata*	Endangered	Endangered
Pu'uka'a	*Cyperus trachysanthos*	Endangered	Endangered
Ha'iwale	*Cyrtandra limahuliensis*	Threatened	Threatened
Mapele	*Cyrtandra cyaneoides*	Endangered	Endangered
No common name	*Delissea rhytidosperma*	Endangered	Endangered
'Oha	*Delissea rivularis*	Endangered	Endangered
No common name	*Delissea undulata ssp. kauaiensis*	Endangered	Endangered
Asplenium leaved diella	*Diellia erecta*	Endangered	Endangered
No common name	*Diellia pallida (proposed as D. laciniata)*	Endangered	Endangered
No common name	*Diplazium molokaiense*	Endangered	Endangered
Kahalapehu	*Dubautia pauciflorula*	Endangered	Endangered
Na'ena'e	*Dubautia latifolia*	Endangered	Endangered
'Akoko	*Euphorbia haeleeleana*	Endangered	Endangered
Heau	*Exocarpos luteolus*	Endangered	Endangered
Mehamehame	*Flueggea neowawraea*	Endangered	Endangered
No common name	*Gouania meyenii*	Endangered	Endangered
No common name	*Haplostachys haplostachya*	Endangered	Endangered
'Awiwi	*Hedyotis cookiana*	Endangered	Endangered
Na Pali beach hedyotis	*Hedyotis st.-johnii*	Endangered	Endangered
No common name	*Hesperomannia lydgatei*	Endangered	Endangered
Hau kuahiwi	*Hibiscadelphus distans*	Endangered	Endangered
Hau kuahiwi	*Hibiscadelphus woodii*	Endangered	Endangered
Ma'o hau hele	*Hibiscus brackenridgei ssp. mokuleianus*	Endangered	Endangered
Koki'o 'ula'ula; aloalo	*Hibiscus clayi*	Endangered	Endangered
Koki'o ke'oke'o	*Hibiscus waimeae ssp. hannerae*	Endangered	Endangered
Hilo ischaemum	*Ischaemum byrone*	Endangered	Endangered

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

Aupaka	*Isodendrion laurifolium*	Endangered	Endangered
Aupaka	*Isodendrion longifolium*	Threatened	Threatened
Koki'o	*Kokis Kauaiensis*	Endangered	Endangered
Kamakahala	*Labordia lydgatei*	Endangered	Endangered
Kamakahala	*Labordia tinifolia var. wahiawaensis*	Endangered	Endangered
Nehe	*Lipochaeta fauriei*	Endangered	Endangered
Nehe	*Lipochaeta micrantha var. exigua*	Endangered	Endangered
Nehe	*Lipochaeta micrantha var. micrantha*	Endangered	Endangered
Nehe	*Lipochaeta waimeaensis*	Endangered	Endangered
No common name	*Lobelia niihauensis*	Endangered	Endangered
No common name	*Lysimachia filifolia*	Endangered	Endangered
No common name	*Mariscus pennatiformis ssp. pennatiformis*	Endangered	Endangered
Alani	*Melicope haupuensis*	Endangered	Endangered
Alani	*Melicope knudsenii*	Endangered	Endangered
Alani	*Melicope pallida*	Endangered	Endangered
Alani	*Melicope quadrangularis*	Endangered	Endangered
No common name	*Munroidendron racemosum*	Endangered	Endangered
Kolea	*Myrsine linearifolia*	Threatened	Threatened
'Aiea	*Nothocestrum peltatum*	Endangered	Endangered
Lau 'ehu	*Panicum niihauense*	Endangered	Endangered
Makou	*Peucedanum sandwicense*	Threatened	Threatened
Wawae'iole	*Phlegmariurus mannii (listed as Huperzia mannii)*	Endangered	Endangered
Wawae'iole	*Phlegmariurus nutans (listed as Lycopodium nutans)*	Endangered	Endangered
No common name	*Phyllostegia glabra var. lanaiensis*	Endangered	Endangered
No common name	*Phyllostegia knudsenii*	Endangered	Endangered
No common name	*Phyllostegia waimeae*	Endangered	Endangered
No common name	*Phyllostegia wawrana*	Endangered	Endangered
Ale	*Plantago princeps var. anomala*	Endangered	Endangered
Ale	*Plantago princeps var. longibracteata*	Endangered	Endangered
No common name	*Platanthera holochila*	Endangered	Endangered
Mann's bluegrass	*Poa mannii*	Endangered	Endangered
Hawaiian bluegrass	*Poa sandvicensis*	Endangered	Endangered
No common name	*Poa siphonoglossa*	Endangered	Endangered
Loulu	*Pritchardia napaliensis*	Endangered	Endangered
Loulu	*Pritchardia viscosa*	Endangered	Endangered
Kaulu	*Pteralyxia kauaiensis*	Endangered	Endangered
No common name	*Remya kauaiensis*	Endangered	Endangered
No common name	*Remya montgomeryi*	Endangered	Endangered
Dwarf naupaka	*Scaevola coriacea*	Endangered	Endangered
Ma'oli'oli	*Schiedea apokremnos*	Endangered	Endangered
No common name	*Schiedea helleri*	Endangered	Endangered
No common name	*Schiedea kauaiensis*	Endangered	Endangered
No common name	*Schiedea membranacea*	Endangered	Endangered
No common name	*Schiedea nuttallii*	Endangered	Endangered
No common name	*Schiedea spergulina var. leiopoda*	Endangered	Endangered
No common name	*Schiedea spergulina var. spergulina*	Threatened	Threatened
Laulihilihi	*Schiedea stellarioides*	Endangered	Endangered
'Ohai	*Sesbania tomentosa*	Endangered	Endangered
No common name	*Silene lanceolata*	Endangered	Endangered
Popolo ku mai	*Solanum incompletum*	Endangered	Endangered

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

Popolo 'aiakeakua	*Solanum sandwicense*	Endangered	Endangered
No common name	*Spermolepis hawaiiensis*	Endangered	Endangered
No common name	*Stenogyne campanulata*	Endangered	Endangered
No common name	*Viola helenae*	Endangered	Endangered
Nani wai'ale'ale	*Viola kauaensis var. wahiawaensis*	Endangered	Endangered
Iliau	*Wilkesia hobdyi*	Endangered	Endangered
No common name	*Xylosma crenatum*	Endangered	Endangered
A'e	*Zanthoxylum hawaiiense*	Endangered	Endangered
ANIMALS			
Mammals			
Hawaiian hoary bat	*Lasiurus cinereus semotus*	Endangered	Endangered
Hawaiian monk seal	*Monachus schauinslandi*	Endangered	Endangered
Birds			
Hawaiian Duck	*Anas wyvilliana*	Endangered	Endangered
Hawaiian coot	*Fulica americana alai*	Endangered	Endangered
Hawaiian gallinule	*Gallinula chloropus sandvicensis*	Endangered	Endangered
Kauai Nuku pu'u	*Hemignathus lucidus hanapepe*	Endangered	Endangered
Kauai 'Akia loa	*Hemignathus procerus*	Endangered	Endangered
Black-necked stilt	*Himantopus mexicanus knudseni*	Endangered	Endangered
Kauai 'O'o	*Moho braccatus*	Endangered	Endangered
Large Kauai thrush	*Myadestes myadestinus*	Endangered	Endangered
Small Kauai solitare	*Myadestes palmeri*	Endangered	Endangered
Hawaiian goose	*Nesochen sandvicensis*	Endangered	Endangered
No common name	*Psittirostra psittacea*	Endangered	Endangered
Dark-rumped petrel	*Pterodroma phaeopygia sandwichensis*	Endangered	Endangered
Newell's shearwater	*Puffinus auricularis*	Threatened	Threatened
Reptiles			
Loggerhead sea turtle (incidental in Hawaii)	*Caretta caretta*	Threatened	Threatened
Green sea turtle	*Chelonia mydas*	Threatened	Threatened
Leatherback sea turtle (incidental in Hawaii)	*Dermochelys coriaceae*	Endangered	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Endangered	Endangered
Snails			
Newcomb's snail	*Erinna newcombi*	Threatened	Threatened
Arachnids			
Kauai cave wolf spider	*Adelocosa anops*	Endangered	Endangered
Insects			
Blackburn's sphinx moth	*Manduca blackburni*	Endangered	Endangered
Kauai pomace fly	*Drosophila musaphila*	Proposed Endangered	Proposed Endangered
Crustaceans			
Kauai cave amphipod	*Spelaeorchestia koloana*	Endangered	Endangered

operation by the State of Hawaii under a "Noncovered Source Permit (NSP)" (Hawaii Department of Health 1998), for which we have received an extension in 2003.

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

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

Clean Water Act (CWA)
There were no compliance issues with respect to any state or federal water pollution regulations in 2003. 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 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).

A minor procedural error in our annual monitoring program led to a minor EPA violation which resulted in a fine of $50.00 (see Releases and Occurrences for additional information). We have corrected this oversight by scheduling our annual inspections in conjunction with PMRF.

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 was one reportable occurrence at SNL/KTF in 2003: On April 29, 2003, a program manager for the EPA and a supervisor for the Hawaii Department of Health visited KTF to conduct a leak detection compliance inspection of regulated underground storage tanks. SNL/KTF was in compliance with all requirements except for the sensor annual maintenance, which had not been done since January 2000. The EPA inspector wrote a field citation, No. UST-09 1433, which stated that the violation was "Failure to have annual maintenance on leak detection system." The citation carried with it a $50.00 fine.

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 2003, 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. The three ER sites identified in 1995 were given a No Further Action (NFA) determination by the EPA on September 30, 1996. This confirmed that SNL/KTF met all CERCLA requirements and no additional sampling or remediation would be necessary in the three areas. This, however, does not preclude that other environmental sampling activities will take place at SNL/KTF.

5.6 Environmental Surveillance and Monitoring Activities

Wastewater Monitoring

Sandia Corporation's activities at SNL/KTF produce only sanitary sewage, which is directed into 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 2003, 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.

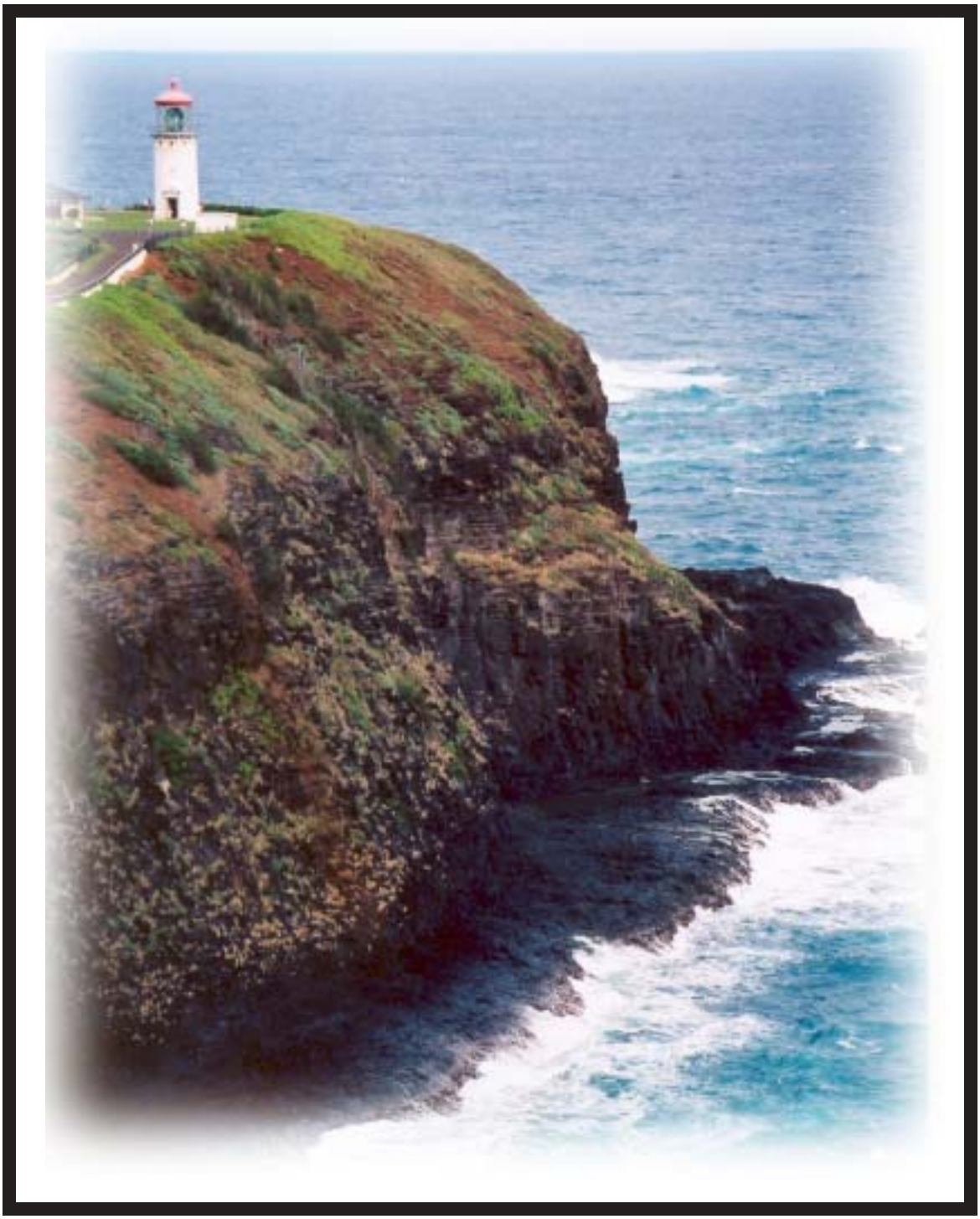
Noise Monitoring

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.

Terrestrial Surveillance

Terrestrial surveillance sampling of soil is conducted every five years. No sampling occurred in 2003.

Third Annual KTF Photo Contest Winner



First Place Winner:
Reginald Tibbetts Jr.

Chapter Six

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40 CFR 112 "Oil Pollution Prevention"

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"

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STATE OF NEVADA
ENVIRONMENTAL REGULATIONS

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

A listing of the Nevada Administrative Code (NAC) can be found at:
http://www.leg.state.nv.us/NAC/CHAPTERS.HTML

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

Chapter 444, *Sanitation*	**Applicable Sources or Activities**
NAC 444.570 to 444.7499, "Solid Waste Disposal"	• Disposal of construction debris • Disposal of routine non-hazardous solid wastes • Disposal of septic sludge
NAC 444A.005 to 444A.500, "Programs for Recycling"	• Recyclable materials including waste tires
Chapter 445A, *Water Controls*	
NAC 445A.070 to 445A.348, "Water Pollution Control"	• Septic tanks • Surface water runoff
NAC 445A.450 to 445A. 6731, "Public Water Systems"	• Production well sampling
Chapter 445B, *Air Controls*	
NAC 445B.001 to 445B.3497, "Air Pollution"	• 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"	• 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"	• Road construction • Construction activities
NAC 504.800 to 504.865, "Preservation of Wild Horses"**	• 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"	• Drilling, operation, and abandonment of wells

NOTE: *This regulation provides protection to endangered, threatened, and sensitive species.
**Two wild horse units encompass areas within the Nellis Air Force Range:
"Unit 252: That portion of Nye County ….. and those portions of the Nellis Air Force Range as authorized by the United States Department of Defense."
"Unit 253: That portion of Nye County … including those portions of the Nellis Air Force Range as authorized by the United States Department of Defense and the Nevada Test Site as authorized by the United States Department of Energy."
TTR = Tonopah Test Range

Appendix A

Terrestrial Surveillance Results and Sampling Location Maps For TTR

B2 Drop at Tonopah Test Range

CONTENTS

FIGURES

TABLES

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TABLE A-1. Radiological Results for Off-site Soil Sampling Locations at TTR, 2003

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
C-20	Americium-241	pCi/g	0 ± 0.0868	0.055	0.111	UX
	Cesium-137	pCi/g	0.26 ± 0.0335	0.00837	0.0171	
	Potassium-40	pCi/g	31.7 ± 3.08	0.0647	0.135	
	Uranium-235	pCi/g	0.0678 ± 0.109	0.0591	0.12	U
	Uranium-238	pCi/g	1.79 ± 1.1	0.46	0.929	
	Uranium	mg/kg	0.565	0.00589	0.0393	
C-21	Americium-241	pCi/g	0.00401 ± 0.0408	0.0388	0.0785	U
	Cesium-137	pCi/g	0.203 ± 0.0285	0.00769	0.0158	
	Potassium-40	pCi/g	27.4 ± 2.54	0.0638	0.134	
	Uranium-235	pCi/g	0.0789 ± 0.0997	0.0484	0.0979	U
	Uranium-238	pCi/g	1.48 ± 0.669	0.311	0.628	
	Uranium	mg/kg	0.738 ± 0	0.00593	0.0395	
C-22	Americium-241	pCi/g	-0.0275 ± 0.0236	0.0193	0.039	U
	Cesium-137	pCi/g	0.0804 ± 0.0286	0.0155	0.0318	
	Potassium-40	pCi/g	31.2 ± 2.85	0.129	0.271	
	Uranium-235	pCi/g	0.128 ± 0.13	0.0667	0.135	U
	Uranium-238	pCi/g	2.19 ± 0.653	0.187	0.378	
	Uranium	mg/kg	0.557	0.00595	0.0397	
C-23	Americium-241	pCi/g	-0.003 ± 0.0467	0.0424	0.0858	U
	Cesium-137	pCi/g	0.177 ± 0.0234	0.00944	0.0193	
	Potassium-40	pCi/g	26 ± 1.69	0.079	0.165	
	Uranium-235	pCi/g	0.0684 ± 0.13	0.0591	0.119	U
	Uranium-238	pCi/g	1.41 ± 0.788	0.344	0.694	
	Uranium	mg/kg	0.541 ± 0	0.00598	0.0398	
C-24	Americium-241	pCi/g	-0.0148 ± 0.0527	0.0442	0.0894	U
	Cesium-137	pCi/g	0.254 ± 0.0337	0.01	0.0205	
	Potassium-40	pCi/g	29.2 ± 3.06	0.0875	0.183	
	Uranium-235	pCi/g	0.0798 ± 0.0865	0.0587	0.119	U
	Uranium-238	pCi/g	2.1 ± 0.897	0.362	0.731	
	Uranium	mg/kg	1.28 ± 0	0.00599	0.0399	
C-25	Americium-241	pCi/g	-0.0138 ± 0.052	0.046	0.093	U
	Cesium-137	pCi/g	0.445 ± 0.0584	0.0109	0.0223	
	Potassium-40	pCi/g	21.8 ± 2.12	0.631	1.27	
	Uranium-235	pCi/g	0.0646 ± 0.108	0.0625	0.126	U
	Uranium-238	pCi/g	2.08 ± 0.991	0.37	0.748	
	Uranium	mg/kg	1.11 ± 0	0.00599	0.0399	
C-26	Americium-241	pCi/g	-0.000463 ± 0.0787	0.0639	0.129	U
	Cesium-137	pCi/g	0.515 ± 0.0606	0.0111	0.0228	
	Potassium-40	pCi/g	28.4 ± 2.75	0.0945	0.198	
	Uranium-235	pCi/g	0.0832 ± 0.106	0.0611	0.124	U
	Uranium-238	pCi/g	1.87 ± 1.07	0.475	0.962	
	Uranium	mg/kg	0.789 ± 0	0.00599	0.0399	

See notes at end of table.

TABLE A-1. Radiological Results for Off-site Soil Sampling Locations at TTR, 2003 *(continued)*

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
C-27	Americium-241	pCi/g	0 ± 0.0491	0.0422	0.0854	UX
	Cesium-137	pCi/g	0.38 ± 0.0463	0.00914	0.0187	
	Potassium-40	pCi/g	28.8 ± 2.79	0.0838	0.175	
	Uranium-235	pCi/g	0.033 ± 0.0991	0.0535	0.108	U
	Uranium-238	pCi/g	1.5 ± 0.752	0.343	0.694	
	Uranium	mg/kg	0.747 ± 0	0.00591	0.0394	
C-28	Americium-241	pCi/g	0.0173 ± 0.0479	0.0383	0.0774	U
	Cesium-137	pCi/g	0.107 ± 0.056	0.0176	0.0362	
	Potassium-40	pCi/g	27 ± 2.53	0.132	0.282	
	Uranium-235	pCi/g	0.155 ± 0.208	0.0963	0.195	U
	Uranium-238	pCi/g	0.883 ± 0.805	0.348	0.704	
	Uranium	mg/kg	0.726	0.00596	0.0398	
C-29	Americium-241	pCi/g	0.0408 ± 0.0916	0.0715	0.145	U
	Cesium-137	pCi/g	0.222 ± 0.0321	0.0109	0.0224	
	Potassium-40	pCi/g	24.4 ± 2.39	0.105	0.221	
	Uranium-235	pCi/g	0.0731 ± 0.13	0.069	0.14	U
	Uranium-238	pCi/g	1.89 ± 1.04	0.547	1.11	
	Uranium	mg/kg	0.913	0.00592	0.0394	
C-30	Americium-241	pCi/g	-0.145 ± 0.107	0.0819	0.166	U
	Cesium-137	pCi/g	0.317 ± 0.0304	0.0106	0.0217	
	Potassium-40	pCi/g	31.2 ± 1.95	0.085	0.179	
	Uranium-235	pCi/g	0.0876 ± 0.132	0.0778	0.157	U
	Uranium-238	pCi/g	0.969 ± 1.31	0.637	1.29	U
	Uranium	mg/kg	0.556 ± 0	0.00594	0.0396	
C-31	Americium-241	pCi/g	0.00526 ± 0.0583	0.0525	0.106	U
	Cesium-137	pCi/g	0.163 ± 0.0281	0.0138	0.0282	
	Potassium-40	pCi/g	31.7 ± 2.07	0.0993	0.209	
	Uranium-235	pCi/g	0.0249 ± 0.082	0.0703	0.142	U
	Uranium-238	pCi/g	1.11 ± 0.899	0.429	0.868	
	Uranium	mg/kg	0.65	0.00599	0.0399	
C-32	Americium-241	pCi/g	-0.00198 ± 0.0162	0.0144	0.0291	U
	Cesium-137	pCi/g	0.17 ± 0.0289	0.0103	0.0211	
	Potassium-40	pCi/g	30.9 ± 2.79	0.078	0.165	
	Uranium-235	pCi/g	0.0361 ± 0.0878	0.0505	0.102	U
	Uranium-238	pCi/g	1.57 ± 0.475	0.137	0.277	
	Uranium	mg/kg	0.557	0.00588	0.0392	

See notes at end of table.

TABLE A-1. Radiological Results for Off-site Soil Sampling Locations at TTR, 2003 (concluded)

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
C-33	Americium-241	pCi/g	0.00457 ± 0.0214	0.0187	0.0378	U
	Cesium-137	pCi/g	0.235 ± 0.0396	0.0129	0.0264	
	Potassium-40	pCi/g	29.6 ± 2.66	0.112	0.233	
	Uranium-235	pCi/g	0.173 ± 0.134	0.0661	0.134	
	Uranium-238	pCi/g	2.07 ± 0.583	0.18	0.363	
	Uranium	mg/kg	0.603	0.00592	0.0394	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.
X = Presumptive evidence that analyte is not present.

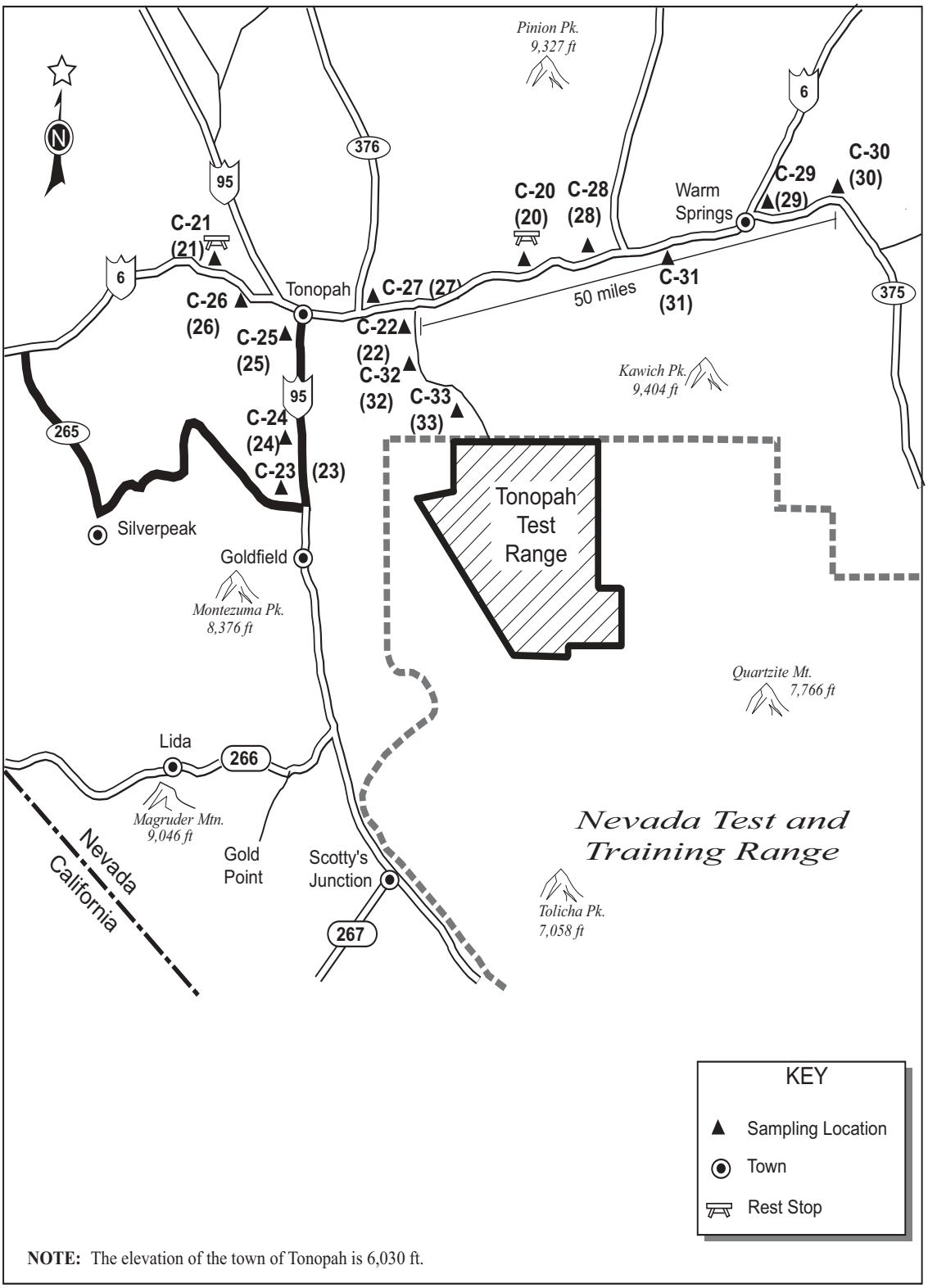

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FIGURE A-1. Off-site Soil Sampling Locations
(14 Locations)

TABLE A-2. Radiological Results for Perimeter Soil Sampling Locations at TTR, 2003

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
P-06	Americium-241	pCi/g	-0.0156 ± 0.0797	0.0553	0.112	U
	Cesium-137	pCi/g	0.172 ± 0.0272	0.00925	0.0189	
	Potassium-40	pCi/g	30.6 ± 2.94	0.0707	0.148	
	Uranium-235	pCi/g	0.081 ± 0.0976	0.0525	0.106	U
	Uranium-238	pCi/g	2.35 ± 1.26	0.425	0.859	
	Uranium	mg/kg	0.774 ± 0	0.00588	0.0392	
P-08	Americium-241	pCi/g	-0.00809 ± 0.048	0.0427	0.0866	U
	Cesium-137	pCi/g	0.082 ± 0.0263	0.00975	0.02	
	Potassium-40	pCi/g	30.8 ± 3	0.0841	0.177	
	Uranium-235	pCi/g	0.129 ± 0.11	0.0528	0.107	
	Uranium-238	pCi/g	1.18 ± 0.789	0.344	0.696	
	Uranium	mg/kg	0.571	0.00599	0.0399	
P-11	Americium-241	pCi/g	0.0213 ± 0.0253	0.0218	0.0439	U
	Cesium-137	pCi/g	0.164 ± 0.0343	0.0144	0.0295	
	Potassium-40	pCi/g	31.8 ± 2.87	0.129	0.268	
	Uranium-235	pCi/g	0.2 ± 0.0892	0.075	0.152	
	Uranium-238	pCi/g	2.41 ± 0.724	0.208	0.42	
	Uranium	mg/kg	0.506 ± 0	0.00594	0.0396	
P-12	Americium-241	pCi/g	0.0222 ± 0.0582	0.0503	0.102	U
	Cesium-137	pCi/g	0.408 ± 0.0527	0.0119	0.0243	
	Potassium-40	pCi/g	31.8 ± 3.1	0.0947	0.199	
	Uranium-235	pCi/g	0.0651 ± 0.115	0.0636	0.129	U
	Uranium-238	pCi/g	1.47 ± 0.96	0.408	0.826	
	Uranium	mg/kg	0.483 ± 0	0.00595	0.0397	
P-34	Americium-241	pCi/g	-0.00245 ± 0.0496	0.0462	0.0933	U
	Cesium-137	pCi/g	0.456 ± 0.056	0.00966	0.0197	
	Potassium-40	pCi/g	31.8 ± 2.94	0.0738	0.154	
	Uranium-235	pCi/g	0.0369 ± 0.104	0.0571	0.115	U
	Uranium-238	pCi/g	1.52 ± 0.95	0.375	0.757	
	Uranium	mg/kg	0.82 ± 0	0.00598	0.0398	
P-35	Americium-241	pCi/g	-0.0344 ± 0.0646	0.0567	0.115	U
	Cesium-137	pCi/g	0.573 ± 0.0669	0.0125	0.0257	
	Potassium-40	pCi/g	26 ± 2.56	0.103	0.215	
	Uranium-235	pCi/g	0.0938 ± 0.137	0.0765	0.155	U
	Uranium-238	pCi/g	1.8 ± 0.911	0.474	0.957	
	Uranium	mg/kg	0.936 ± 0	0.006	0.04	
P-36	Americium-241	pCi/g	0 ± 0.0491	0.0476	0.0964	UX
	Cesium-137	pCi/g	0.042 ± 0.0202	0.0102	0.0209	
	Potassium-40	pCi/g	29.8 ± 2.77	0.083	0.174	
	Uranium-235	pCi/g	0.144 ± 0.117	0.0588	0.119	
	Uranium-238	pCi/g	1.69 ± 1.01	0.372	0.753	
	Uranium	mg/kg	0.696	0.00594	0.0396	

See notes at end of table.

TABLE A-2. Radiological Results for Perimeter Soil Sampling Locations at TTR, 2003 *(concluded)*

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
P-37	Americium-241	pCi/g	-0.00328 ± 0.0678	0.0598	0.121	U
	Cesium-137	pCi/g	0.0228 ± 0.0172	0.00958	0.0197	
	Potassium-40	pCi/g	30.9 ± 2.99	0.0779	0.164	
	Uranium-235	pCi/g	0.0168 ± 0.115	0.0566	0.115	U
	Uranium-238	pCi/g	0.833 ± 1.12	0.45	0.911	U
	Uranium	mg/kg	0.737	0.00595	0.0397	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.
X = Presumptive evidence that analyte is not present.

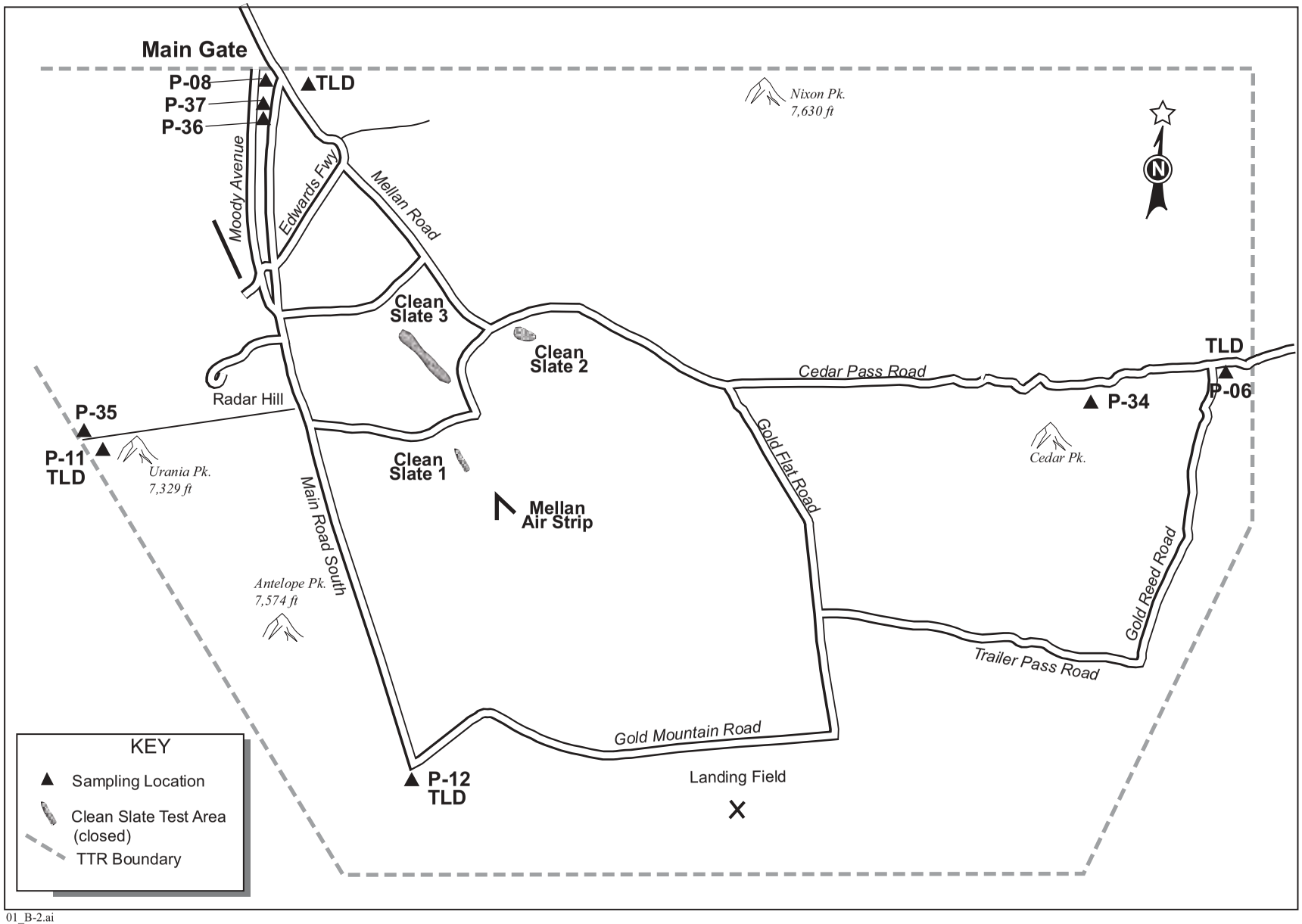

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FIGURE A-2. Perimeter Soil Sampling Locations
(Eight Locations)

TABLE A-3. Radiological Results for South Plume Area On-site Soil Sampling Locations at TTR, 2003

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
S-48	Americium-241	pCi/g	-0.042 ± 0.0804	0.0613	0.124	U
	Cesium-137	pCi/g	0.488 ± 0.0551	0.00957	0.0196	
	Potassium-40	pCi/g	31.7 ± 3.08	0.0797	0.166	
	Uranium-235	pCi/g	0.0463 ± 0.127	0.0683	0.138	U
	Uranium-238	pCi/g	0.853 ± 0.952	0.479	0.968	U
	Uranium	mg/kg	0.54 ± 0	0.00598	0.0398	
S-49	Americium-241	pCi/g	0.554 ± 0.119	0.056	0.113	
	Cesium-137	pCi/g	0.574 ± 0.0606	0.0122	0.025	
	Potassium-40	pCi/g	31 ± 2.02	0.0967	0.204	
	Uranium-235	pCi/g	0.109 ± 0.146	0.075	0.152	U
	Uranium-238	pCi/g	2.15 ± 1.11	0.44	0.891	
	Uranium	mg/kg	0.548 ± 0	0.00599	0.0399	
S-50	Americium-241	pCi/g	0.115 ± 0.0909	0.052	0.105	
	Cesium-137	pCi/g	0.767 ± 0.0876	0.012	0.0246	
	Potassium-40	pCi/g	30.1 ± 3.18	0.103	0.218	
	Uranium-235	pCi/g	0.214 ± 0.143	0.0687	0.139	
	Uranium-238	pCi/g	0.762 ± 0.947	0.424	0.859	U
	Uranium	mg/kg	0.515 ± 0	0.00598	0.0398	
S-51	Americium-241	pCi/g	0.0953 ± 0.12	0.0715	0.145	U
	Cesium-137	pCi/g	0.575 ± 0.0666	0.0111	0.0228	
	Potassium-40	pCi/g	31.6 ± 3.07	0.0916	0.194	
	Uranium-235	pCi/g	0.0503 ± 0.13	0.0647	0.131	U
	Uranium-238	pCi/g	1.66 ± 1.11	0.544	1.1	
	Uranium	mg/kg	0.76 ± 0	0.00591	0.0394	
S-52	Americium-241	pCi/g	0.184 ± 0.0492	0.0158	0.0318	
	Cesium-137	pCi/g	0.416 ± 0.0548	0.0101	0.0208	
	Potassium-40	pCi/g	31.1 ± 2.79	0.0809	0.171	
	Uranium-235	pCi/g	0.179 ± 0.118	0.0547	0.111	
	Uranium-238	pCi/g	1.53 ± 0.472	0.149	0.3	
	Uranium	mg/kg	0.842 ± 0	0.00588	0.0392	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

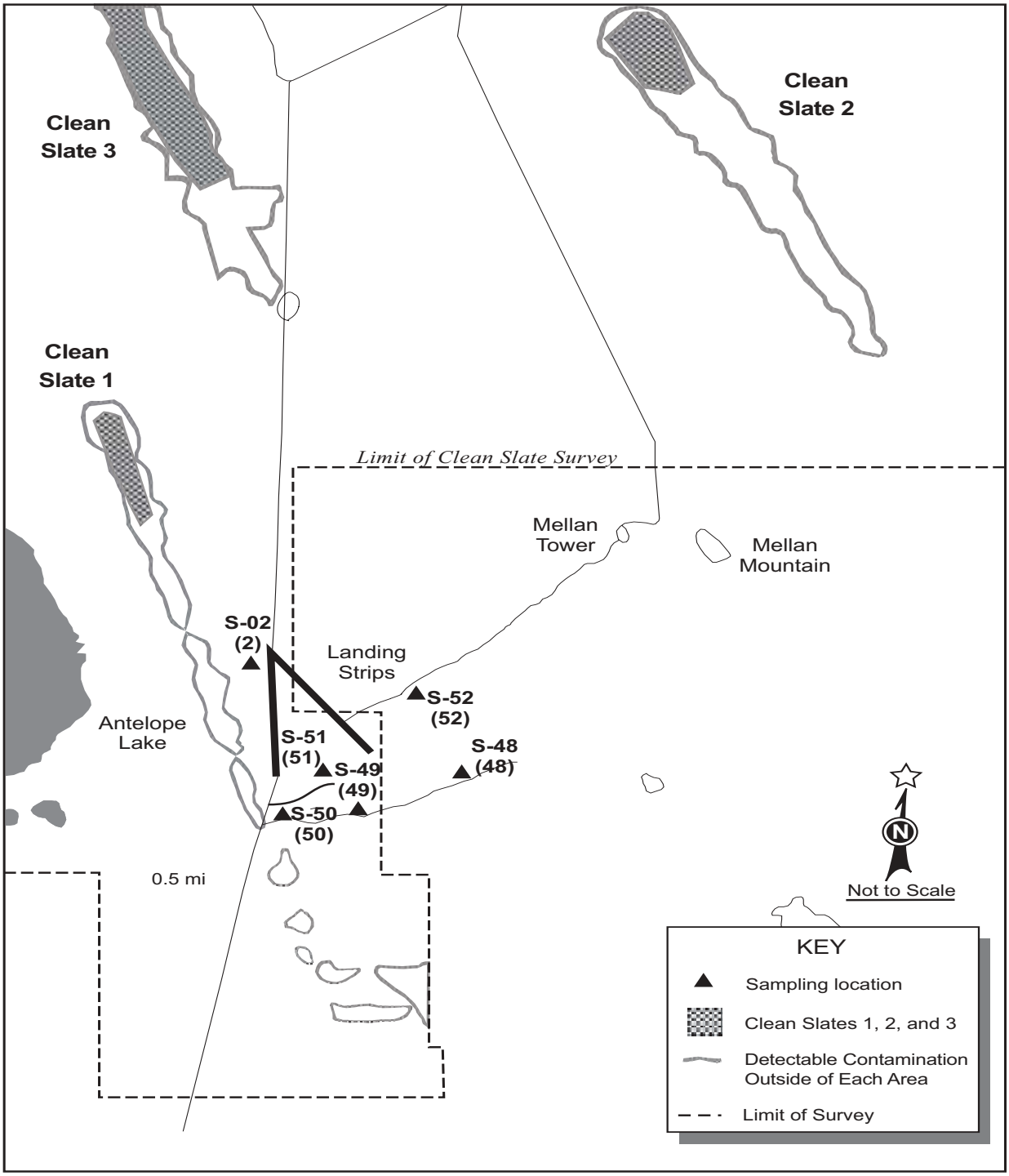

FIGURE A-3. Soil Sampling Locations in the South Plume Area (on-site) (Five Locations)

TABLE A-4. Radiological Results for Range Operations Center On- site Soil Sampling Locations at TTR, 2003

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
S-40	Americium-241	pCi/g	-0.0882 ± 0.152	0.116	0.234	U
	Cesium-137	pCi/g	0.132 ± 0.0324	0.0167	0.0341	
	Potassium-40	pCi/g	33.4 ± 2.16	0.122	0.257	
	Uranium-235	pCi/g	0 ± 0.131	0.104	0.21	UX
	Uranium-238	pCi/g	1.82 ± 1.67	0.894	1.81	
	Uranium	mg/kg	0.736	0.00596	0.0398	
S-41	Americium-241	pCi/g	-0.0228 ± 0.0198	0.0157	0.0317	U
	Cesium-137	pCi/g	0.141 ± 0.0269	0.0109	0.0224	
	Potassium-40	pCi/g	32.4 ± 2.92	0.0892	0.188	
	Uranium-235	pCi/g	0.206 ± 0.13	0.056	0.113	
	Uranium-238	pCi/g	1.44 ± 0.494	0.155	0.314	
	Uranium	mg/kg	0.609	0.00588	0.0392	
S-42	Americium-241	pCi/g	0 ± 0.0551	0.0482	0.0976	UX
	Cesium-137	pCi/g	0.461 ± 0.0575	0.0115	0.0235	
	Potassium-40	pCi/g	28.7 ± 2.8	0.0896	0.189	
	Uranium-235	pCi/g	0.122 ± 0.117	0.0591	0.12	
	Uranium-238	pCi/g	1.42 ± 0.85	0.383	0.776	
	Uranium	mg/kg	0.602	0.00595	0.0397	
S-43	Americium-241	pCi/g	-0.000521 ± 0.0588	0.0532	0.108	U
	Cesium-137	pCi/g	0.053 ± 0.0222	0.012	0.0246	
	Potassium-40	pCi/g	29 ± 1.9	0.108	0.227	
	Uranium-235	pCi/g	0.178 ± 0.145	0.0728	0.147	
	Uranium-238	pCi/g	1.63 ± 1.01	0.433	0.875	
	Uranium	mg/kg	0.71	0.00594	0.0396	
S-44	Americium-241	pCi/g	-0.00172 ± 0.0423	0.0379	0.0765	U
	Cesium-137	pCi/g	0.175 ± 0.0463	0.0164	0.0337	
	Potassium-40	pCi/g	27.5 ± 2.56	0.139	0.292	
	Uranium-235	pCi/g	0.165 ± 0.173	0.0922	0.187	U
	Uranium-238	pCi/g	1.56 ± 0.835	0.342	0.691	
	Uranium	mg/kg	0.969	0.00589	0.0393	
S-45	Americium-241	pCi/g	-0.153 ± 0.144	0.109	0.221	U
	Cesium-137	pCi/g	0.015 ± 0.0247	0.0126	0.0259	U
	Potassium-40	pCi/g	33.8 ± 2.16	0.107	0.226	
	Uranium-235	pCi/g	0.0809 ± 0.146	0.101	0.205	U
	Uranium-238	pCi/g	0.833 ± 1.49	0.857	1.73	U
	Uranium	mg/kg	0.669	0.00594	0.0396	
S-46	Americium-241	pCi/g	0.0968 ± 0.0937	0.0499	0.101	U
	Cesium-137	pCi/g	0.0373 ± 0.0184	0.0126	0.0259	
	Potassium-40	pCi/g	29.7 ± 1.95	0.097	0.204	
	Uranium-235	pCi/g	0.0944 ± 0.142	0.0707	0.143	U
	Uranium-238	pCi/g	1.75 ± 1.06	0.408	0.826	
	Uranium	mg/kg	0.698	0.00598	0.0398	

See notes at end of table.

TABLE A-4. Radiological Results for Range Operations Center On- site Soil Sampling Locations at TTR, 2003 *(concluded)*

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
S-47	Americium-241	pCi/g	0.0149 ± 0.052	0.0486	0.0986	U
	Cesium-137	pCi/g	0.136 ± 0.0261	0.0111	0.0228	
	Potassium-40	pCi/g	30.7 ± 2.96	0.0832	0.178	
	Uranium-235	pCi/g	0.0938 ± 0.128	0.0658	0.133	U
	Uranium-238	pCi/g	1.51 ± 0.988	0.398	0.806	
	Uranium	mg/kg	0.519	0.00592	0.0394	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.
X = Presumptive evidence that analyte is not present.

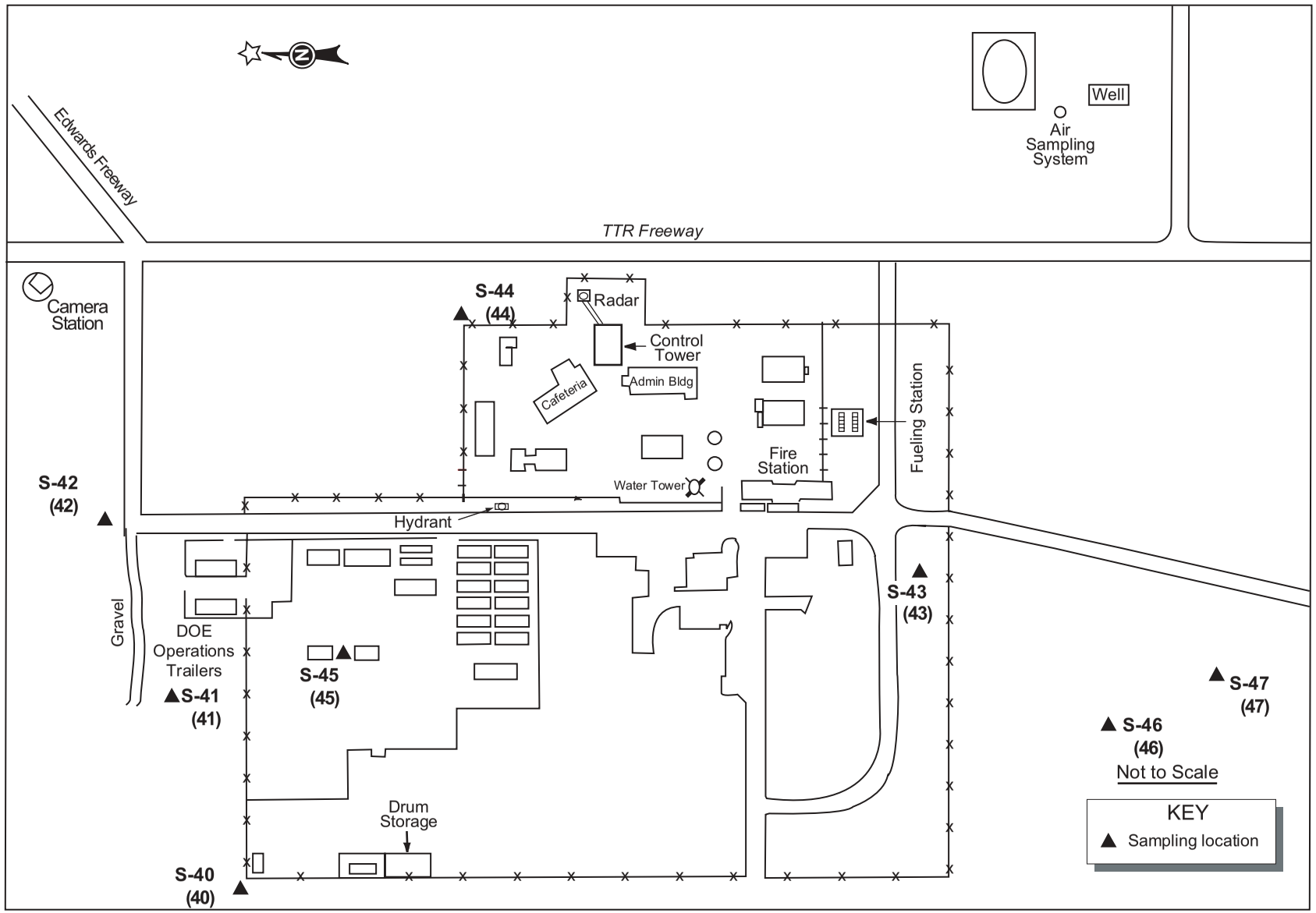

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FIGURE A-4a. Soil Sampling Locations in the Range Operations Center and Compound (on-site) (Six Locations)

TABLE A-5. Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2003

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
S-02	Americium-241	pCi/g	0.0254 ± 0.0581	0.0542	0.11	U
	Cesium-137	pCi/g	0.37 ± 0.0484	0.0106	0.0218	
	Potassium-40	pCi/g	31.4 ± 2.92	0.0893	0.188	
	Uranium-235	pCi/g	0.0915 ± 0.117	0.066	0.134	U
	Uranium-238	pCi/g	0.666 ± 0.986	0.438	0.886	U
	Uranium	mg/kg	0.808 ± 0	0.00592	0.0394	
S-03	Americium-241	pCi/g	-0.0357 ± 0.12	0.0952	0.192	U
	Cesium-137	pCi/g	0.459 ± 0.0418	0.0136	0.0277	
	Potassium-40	pCi/g	33.4 ± 2.07	0.0922	0.193	
	Uranium-235	pCi/g	0.165 ± 0.143	0.0841	0.17	U
	Uranium-238	pCi/g	1.03 ± 1.48	0.703	1.42	U
	Uranium	mg/kg	0.761 ± 0	0.006	0.04	
S-04	Americium-241	pCi/g	0.0568 ± 0.107	0.0522	0.105	U
	Cesium-137	pCi/g	0.236 ± 0.0297	0.0076	0.0155	
	Potassium-40	pCi/g	32.8 ± 3.17	0.0645	0.134	
	Uranium-235	pCi/g	0.104 ± 0.0996	0.0562	0.114	U
	Uranium-238	pCi/g	1.08 ± 0.766	0.39	0.787	
	Uranium	mg/kg	0.802 ± 0	0.00596	0.0398	
S-09	Americium-241	pCi/g	2.59 ± 0.369	0.0528	0.107	
	Cesium-137	pCi/g	0.168 ± 0.0253	0.00994	0.0203	
	Potassium-40	pCi/g	28.5 ± 2.78	0.0798	0.167	
	Uranium-235	pCi/g	0.147 ± 0.117	0.0635	0.128	
	Uranium-238	pCi/g	1.64 ± 0.782	0.436	0.879	
	Uranium	mg/kg	0.648 ± 0	0.00595	0.0397	
S-10	Americium-241	pCi/g	0.00279 ± 0.0203	0.0179	0.0362	U
	Cesium-137	pCi/g	0.228 ± 0.04	0.0135	0.0277	
	Potassium-40	pCi/g	31.7 ± 2.87	0.107	0.224	
	Uranium-235	pCi/g	0.0726 ± 0.116	0.0597	0.121	U
	Uranium-238	pCi/g	1.36 ± 0.497	0.169	0.342	
	Uranium	mg/kg	0.799 ± 0	0.00591	0.0394	
S-38	Americium-241	pCi/g	0.0548 ± 0.0342	0.0162	0.0327	
	Cesium-137	pCi/g	0.458 ± 0.0583	0.0108	0.022	
	Potassium-40	pCi/g	30.6 ± 2.73	0.0956	0.198	
	Uranium-235	pCi/g	0.059 ± 0.113	0.0572	0.116	U
	Uranium-238	pCi/g	2.39 ± 0.582	0.156	0.315	
	Uranium	mg/kg	0.54 ± 0	0.00589	0.0393	
S-39	Americium-241	pCi/g	0.0263 ± 0.0684	0.0584	0.118	U
	Cesium-137	pCi/g	0.422 ± 0.0479	0.00869	0.0177	
	Potassium-40	pCi/g	33 ± 3.18	0.0711	0.147	
	Uranium-235	pCi/g	0.1 ± 0.11	0.0644	0.13	U
	Uranium-238	pCi/g	1.38 ± 0.925	0.456	0.92	
	Uranium	mg/kg	0.867 ± 0	0.006	0.04	

See notes at end of table.

TABLE A-5. Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2003 *(concluded)*

Location	Analyte	Units	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier
S-53	Americium-241	pCi/g	-0.00679 ± 0.0608	0.0538	0.109	U
	Cesium-137	pCi/g	0.102 ± 0.0241	0.0114	0.0235	
	Potassium-40	pCi/g	31.9 ± 3.12	0.0903	0.191	
	Uranium-235	pCi/g	0.194 ± 0.148	0.0754	0.153	
	Uranium-238	pCi/g	1.05 ± 0.844	0.458	0.926	
	Uranium	mg/kg	0.748	0.00596	0.0398	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.

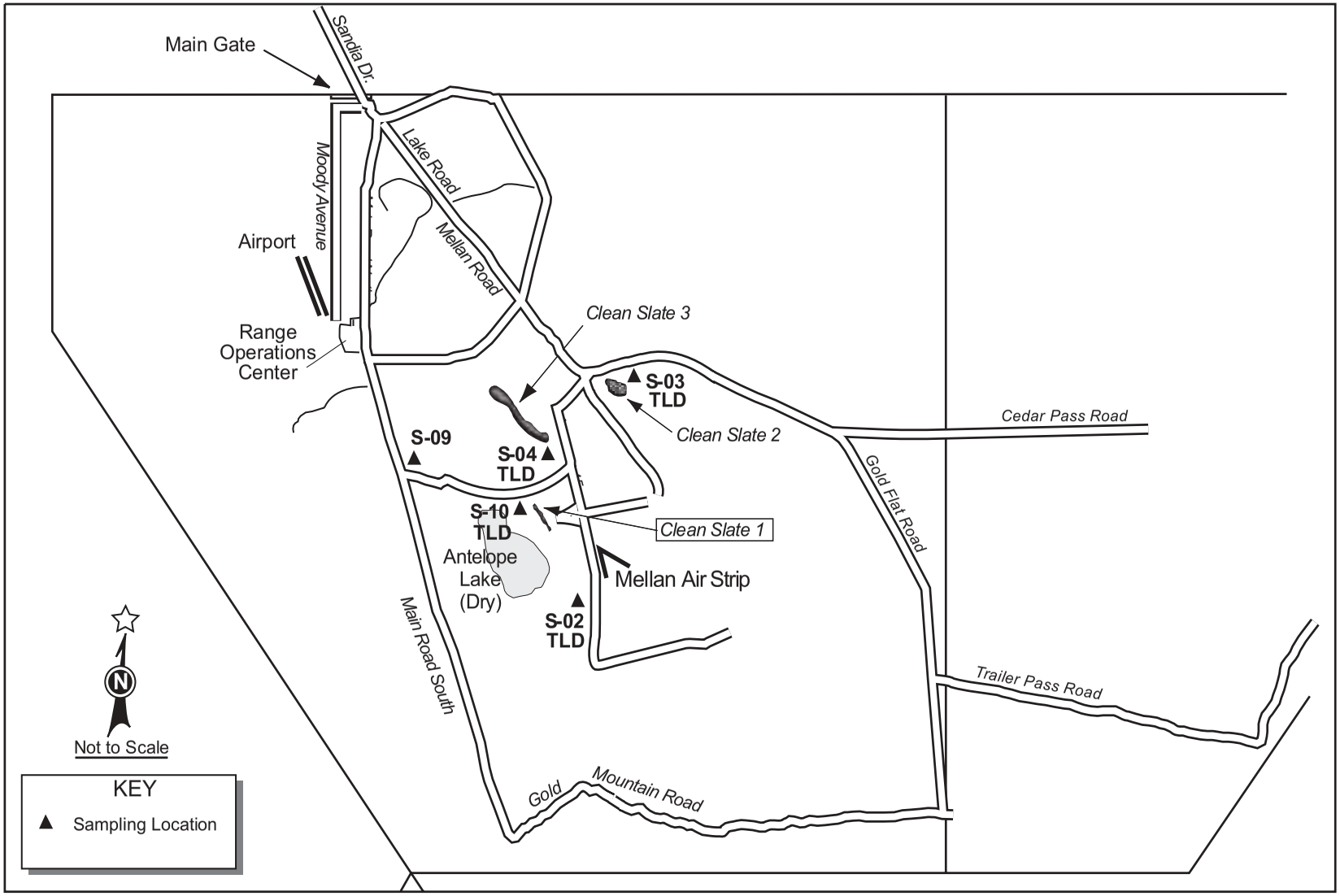

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FIGURE A-5a. Various On-site Soil Sampling Locations
(Five Locations)

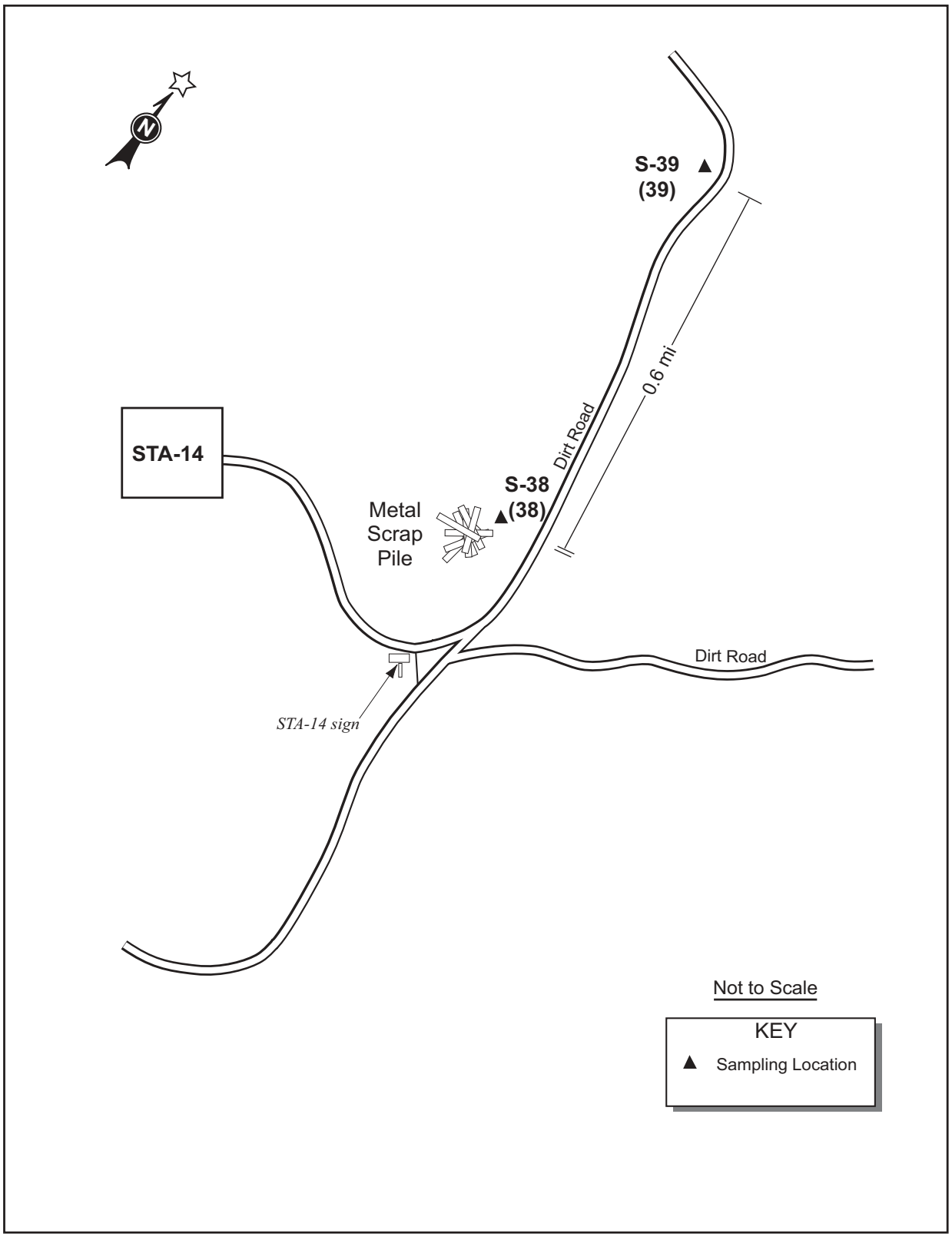

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FIGURE A-5b Various Soil Sampling Locations at Mellan Hill Area
(Two Locations)

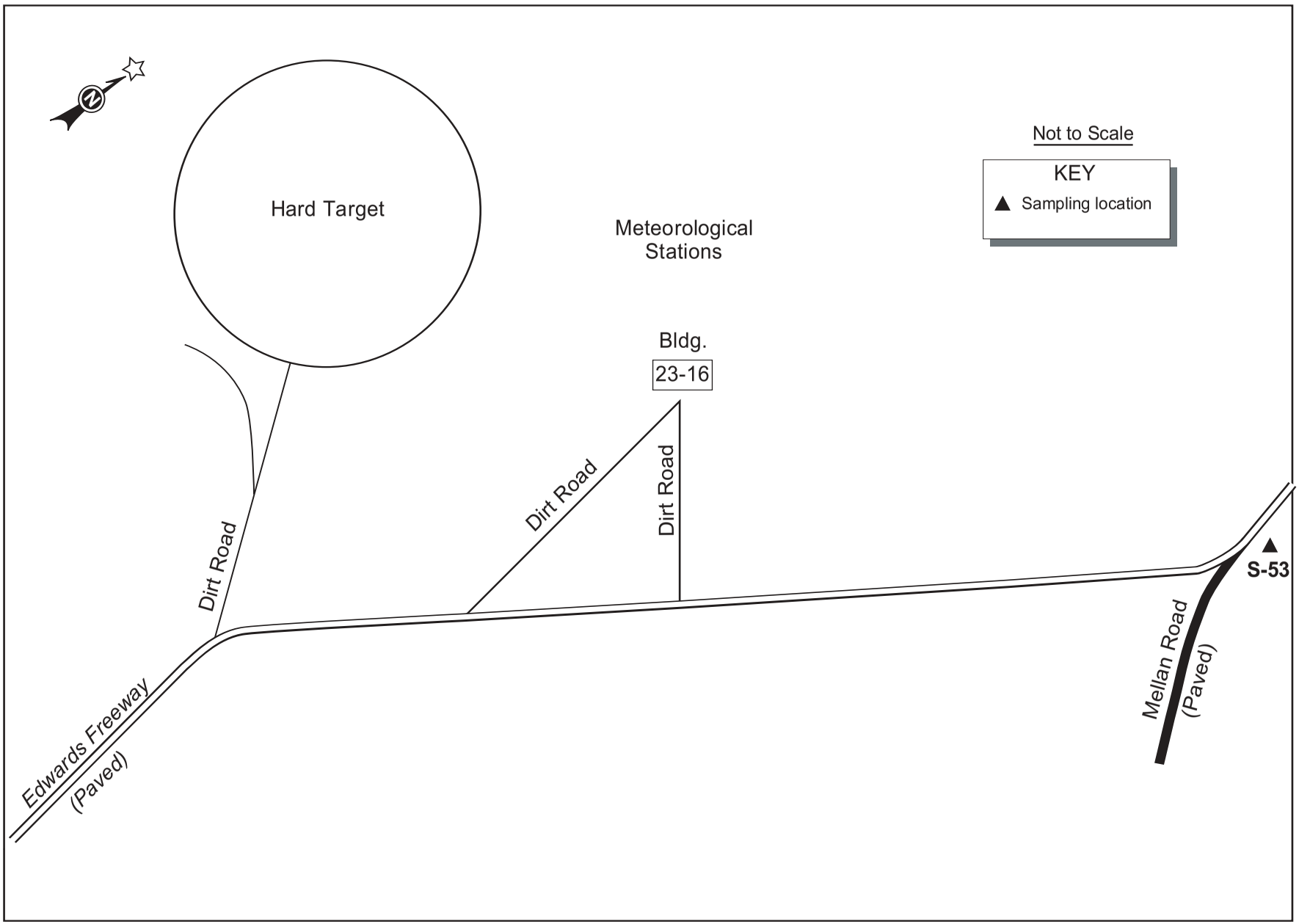

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FIGURE A-5c. Soil Sampling Location Near the Hard Target/Depleted Uranium Area (One Location)

TABLE A-6. Radiological Replicate Sampling for Soil Sampling Locations, 2003

Location Type	Location	Analyte	Units	Sample ID	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier	Avg	Std Dev	Min	Max	CV%
Off-Site	**C-29**	Americium-241	pCi/g	061499-001	0.0408 ± 0.0916	0.0715	0.145	U	0.0077	0.0306	-0.0195	0.0408	4.00%
				061499-002	-0.0195 ± 0.0633	0.0529	0.107	U					
				061499-003	0.00165 ± 0.0502	0.0462	0.0934	U					
		Cesium-137	pCi/g	061499-001	0.222 ± 0.0321	0.0109	0.0224		0.1840	0.0396	0.1430	0.2220	0.22%
				061499-002	0.143 ± 0.0259	0.0112	0.0232						
				061499-003	0.187 ± 0.0272	0.0097	0.0199						
		Potassium-40	pCi/g	061499-001	24.4 ± 2.39	0.105	0.221		24.2667	0.1528	24.1000	24.4000	0.01%
				061499-002	24.3 ± 2.58	0.105	0.22						
				061499-003	24.1 ± 2.32	0.0912	0.191						
		Uranium	µg/g	061499-001	0.913	0.00592	0.0394		0.9893	0.1057	0.9130	1.1100	0.11%
				061499-002	0.945	0.006	0.04						
				061499-003	1.11 ± 0	0.00595	0.0397						
Perimeter	**P-11**	Americium-241	pCi/g	061523-001	0.0213 ± 0.0253	0.0218	0.0439	U	0.0333	0.0407	0.0000	0.0787	1.22%
				061523-002	0.0787 ± 0.0378	0.0198	0.04						
				061523-003	0 ± 0.0454	0.0363	0.0731	UX					
		Cesium-137	pCi/g	061523-001	0.164 ± 0.0343	0.0144	0.0295		0.5173	0.3421	0.1640	0.8470	0.66%
				061523-002	0.847 ± 0.0993	0.015	0.0307						
				061523-003	0.541 ± 0.0745	0.0171	0.035						
		Potassium-40	pCi/g	061523-001	31.8 ± 2.87	0.129	0.268		30.9000	1.0817	29.7000	31.8000	0.04%
				061523-002	31.2 ± 2.84	0.117	0.247						
				061523-003	29.7 ± 2.73	0.131	0.275						
		Uranium	µg/g	061523-001	0.506 ± 0	0.00594	0.0396		0.4790	0.0503	0.4210	0.5100	0.10%
				061523-002	0.421 ± 0	0.00592	0.0394						
				061523-003	0.51 ± 0	0.00594	0.0396						
South Plume Area (on-site)	**S-48**	Americium-241	pCi/g	061516-001	-0.042 ± 0.0804	0.0613	0.124	U	-0.0752	0.0805	-0.1670	-0.0167	-1.07%
				061516-002	-0.0167 ± 0.0512	0.0481	0.0975	U					
				061516-003	-0.167 ± 0.151	0.114	0.231	U					
		Cesium-137	pCi/g	061516-001	0.488 ± 0.0551	0.00957	0.0196		0.4717	0.0534	0.4120	0.5150	0.11%
				061516-002	0.515 ± 0.0571	0.011	0.0226						
				061516-003	0.412 ± 0.0433	0.016	0.0328						
		Potassium-40	pCi/g	061516-001	31.7 ± 3.08	0.0797	0.166		31.1667	1.5695	29.4000	32.4000	0.05%
				061516-002	29.4 ± 2.83	0.0888	0.188						
				061516-003	32.4 ± 2.07	0.114	0.241						
		Uranium	µg/g	061516-001	0.54 ± 0	0.00598	0.0398		0.5487	0.0913	0.4620	0.6440	0.17%
				061516-002	0.462 ± 0	0.00589	0.0393						
				061516-003	0.644 ± 0	0.00594	0.0396						

TABLE A-6. Radiological Replicate Sampling for Soil Sampling Locations, 2003

Various On-Site	**S-03**	Americium-241	pCi/g	061510-001	-0.0357 ± 0.12	0.0952	0.192	U	0.0952	0.1481	-0.0357	0.2560	1.56%
				061510-002	0.256 ± 0.105	0.0479	0.0966						
				061510-003	0.0653 ± 0.0761	0.0416	0.084	U					
		Cesium-137	pCi/g	061510-001	0.459 ± 0.0418	0.0136	0.0277		0.4113	0.0600	0.3440	0.4590	0.15%
				061510-002	0.344 ± 0.0337	0.00972	0.0199						
				061510-003	0.431 ± 0.0498	0.00999	0.0204						
		Potassium-40	pCi/g	061510-001	33.4 ± 2.07	0.0922	0.193		32.1000	1.3000	30.8000	33.4000	0.04%
				061510-002	30.8 ± 1.97	0.0883	0.183						
				061510-003	32.1 ± 3.08	0.0793	0.166						
		Uranium	µg/g	061510-001	0.761 ± 0	0.006	0.04		0.7417	0.0633	0.6710	0.7930	0.09%
				061510-002	0.793 ± 0	0.00596	0.0398						
				061510-003	0.671 ± 0	0.00599	0.0399						
	S-09	Americium-241	pCi/g	061507-001	2.59 ± 0.369	0.0528	0.107		1.4027	1.1001	0.4180	2.5900	0.78%
				061507-002	0.418 ± 0.0689	0.0168	0.0339						
				061507-003	1.2 ± 0.128	0.0145	0.0292						
		Cesium-137	pCi/g	061507-001	0.168 ± 0.0253	0.00994	0.0203		0.1440	0.0235	0.1210	0.1680	0.16%
				061507-002	0.121 ± 0.0294	0.0121	0.0247						
				061507-003	0.143 ± 0.0238	0.00938	0.0192						
		Potassium-40	pCi/g	061507-001	28.5 ± 2.78	0.0798	0.167		28.4667	0.6506	27.8000	29.1000	0.02%
				061507-002	29.1 ± 2.6	0.0969	0.201						
				061507-003	27.8 ± 2.5	0.0772	0.161						
		Uranium	µg/g	061507-001	0.648 ± 0	0.00595	0.0397		0.6590	0.0135	0.6480	0.6740	0.02%
				061507-002	0.655 ± 0	0.00599	0.0399						
				061507-003	0.674 ± 0	0.00594	0.0396						

Notes:
pCi/g = picocurie per gram
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.
X = Preseumptive evidence that analyte is not present.
Std Dev = Standard deviaition
CV = Coefficient of variation

TABLE A-7. Summary TLD Results for Calendar Year 2003, Tonopah Test Range

Location Class	Number of Locations	Mean Exposure Rate (μR/hour)	Median Exposure Rate (μR/hour)	Std Dev.	Minimum	Maximum
Off-Site	3	16.3	17.1	1.5	14.6	17.4
Perimeter	4	17.5	17.9	1.1	15.8	18.3
On-Site	13	17.5	17.7	1.4	14.1	20.6

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

TABLE A-8. TLD Measurements by Quarter and Location Class for Calendar Year 2003

Location Class	Location Number	1st Quarter (78 Days)		2nd Quarter (97 Days)		3rd Quarter (84 Days)		4th Quarter (99 Days)		Exposure Rate	
		Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	?R per hour	Error
Off-Site	T-19	28.1	1.7	34.7	2.6	21.9	1	40.9	1.4	14.6	0.4
	T-22	36.4	0.6	40.2	1.3	28.2	2	40	0.9	16.9	0.3
	T-21	38	0.9	42.9	1.3	29.6	1.9	39.3	2.1	17.4	0.4
Perimeter	T-06	35.7	2.7	45.1	1.6	31.4	1	39.5	1.9	17.7	0.4
	T-08	33.2	1.9	39.5	1.2	25.8	0.9	*	*	15.8	0.4
	T-11	38.2	1.9	43.8	1.4	30.2	1.3	45.2	4	18.3	0.6
	T-12	36.9	2.9	46.4	3.4	29.5	0.9	42.8	1.8	18.1	0.6
On-Site	T-01	40.6	1	50.9	3.6	35.9	1.2	49.9	4.3	20.6	0.7
	T-02	36.3	0.9	45.7	1.2	29.7	1.4	43.7	3.6	18.1	0.5
	T-03	*	*	*	0	29.5	1.8	44.4	4.8	16.8	1.2
	T-04	36.6	1.2	43.5	1.7	30.6	0.8	43.7	2	18.0	0.3
	T-05	35.2	1.1	41	2.7	28.7	0.8	42.9	1.5	17.2	0.4
	T-07	33.2	2.3	39.6	1.4	26.2	0.8	42.8	1	16.5	0.3
	T-09	34	1	40	1.7	27.7	0.8	42.7	0.9	16.8	0.3
	T-10	37.5	0.8	44.6	1.2	30.9	4.4	*	*	18.2	0.7
	T-13	37.1	1.2	43	1.3	29.3	0.9	40.6	1.8	17.5	0.3
	T-14	7.4	0.6	40.6	1.3	28.4	2.5	44.5	2.6	14.1	0.5
	T-15	35.7	3.8	44.3	2.3	28.9	1.5	46.1	4.5	18.0	0.8
	T-16	37	2	44.1	1.1	29.7	1.2	42.3	1.2	17.8	0.3
	T-17	36.6	1.9	43.2	2.7	27.8	1.4	42.9	0.9	17.5	0.4

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

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

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Tonopah Test Range and Kauai Test Facility, Hawaii
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