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2010 Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U. S. Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94AL85000.

Sandia National Laboratories

National Nuclear Security Administration

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Calendar Year 2010
Annual Site Environmental Report
Tonopah Test Range, Nevada & Kauai Test Facility, Hawaii

PRODUCED BY:
Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-1042

ABSTRACT

Tonopah Test Range (TTR) in Nevada and Kauai Test Facility (KTF) in Hawaii are government-owned, contractor-operated facilities managed and operated by Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation. The U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA), through the Sandia Site Office (SSO), in Albuquerque, New Mexico, administers the contract and oversees contractor operations at TTR and KTF. Sandia manages and conducts operations at TTR in support of the DOE/NNSA's Weapons Ordnance Program and has operated the site since 1957. Washington Group International (WGI) subcontracts to Sandia in administering most of the environmental programs at TTR. Sandia 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) 2010. The compliance status of environmental regulations applicable at these sites include state and federal regulations governing air emissions, wastewater effluent, waste management, terrestrial surveillance, Environmental Restoration (ER) cleanup activities, and the National Environmental Policy Act (NEPA). Sandia 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 TTR ER sites. Environmental monitoring and surveillance programs are required by DOE Order 450.1A, *Environmental Protection Program* (DOE 2008) and DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting Manual* (DOE 2007).

Calendar Year 2010 Annual Site Environmental Report
Sandia National Laboratories, Tonopah Test Range, Nevada &
Kauai Test Facility, Hawaii
Final Approval date: August 2011

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Prepared by:
Sandia Corporation, Albuquerque, New Mexico
ES&H and Emergency Management Center

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NOTE TO THE READER

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

We are striving to improve the quality of the contents as well as include information that is important to you. Please provide feedback, comments, questions, or requests for copies of this report and/or appendices to:

U.S. Department of Energy
National Nuclear Security Administration
Sandia Site Office
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The TTR and KTF Annual Site Environmental Reports can be found at the following website:
http://www.sandia.gov/news/publications/environmental/index.html

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NOTE: Appendices are located on the CD that is affixed to the back cover of this report.

FIGURES

TABLES

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Acronyms and Abbreviations

A	AEC	U.S. Atomic Energy Commission
	AIRFA	American Indian Religious Freedom Act
	AML	Appropriate Management Level
	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
	BMP	Best Management Practice
	BSA	Bulk Storage Area
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
	CGP	Construction General Permit
	COD	chemical oxygen demand
	CWA	Clean Water Act
	CY	Calendar Year
D	DMR	Discharge Monitoring Report
	DoD	U.S. Department of Defense
	DOE	U.S. Department of Energy
	DRI	Desert Research Institute
E	EA	environmental assessment
	EDE	effective dose equivalent
	EG&G	Edgerton, Gemeshausen and Grier, Inc.
	EHS	extremely hazardous substance
	EIS	environmental impact statement
	EM	environmental management
	EMS	Environmental Management System
	EO	Executive Order
	EPA	U.S. Environmental Protection Agency
	EPCRA	Emergency Planning and Community Right-to-Know Act
	ER	Environmental Restoration
	ERDA	U.S. Energy Research and Development Administration
	ESA	Endangered Species Act
	ES&H	Environment, Safety, and Health
F	FFACO	Federal Facility Agreement and Consent Order
	FFCA	Federal Facility Compliance Act
	FFPAR	Federal Facility Preliminary Assessment Review
	FIDLER	field instrument for the detection of low-energy radiation
	FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
	FONSI	Finding of No Significant Impact

	FR	Federal Register
	FTU-1	Flight Test Unit 1
	FY	Fiscal Year
G	GOES	Geostationary Operational Environmental Satellite
	GPS	Global Positioning System
H	HAPS	hazardous air pollutants
	HAR	Hawaii Administrative Rules
	HQ	Headquarters
	HVAC	heating, ventilation, and air conditioning
I	IOC	inorganic compound
	ISMS	Integrated Safety Management System
J	JTA	Joint Test Assembly
K	KTF	Kauai Test Facility
L	LMC	Lockheed Martin Corporation
	LOB	Launch Operations Building
M	M&O	Management and Operating Contract
	MAB	Missile Assembly Building
	MBTA	Migratory Bird Treaty Act
	MCL	maximum contaminant level
	MCLG	maximum contaminant level goal
	MDA	minimum detectable activity (Chapter 4)
	MDA	Missile Defense Agency (applies to Chapter 5.1 only)
	MEI	maximally exposed individual
	MSDS	Material Safety Data Sheet
	MST	Missile Service Tower
N	NAA	No Action Alternative
	NAEG	Nevada Applied Ecology Group
	NAFB	U.S. Nellis Air Force Base (Range Complex)
	NDEP	Nevada Division of Environmental Protection
	NEDS	Non-Explosive Destruction Site
	NEPA	National Environmental Policy Act
	NESHAP	National Emission Standards for Hazardous Air Pollutants
	NHPA	National Historic Preservation Act
	NNSA	National Nuclear Security Administration
	NNSS	Nevada National Security Site
	NOI	Notice of Intent
	NPDES	National Pollutant Discharge Elimination System
	NPL	National Priorities List
	NSO	Nevada Site Office
	NSP	Non-covered Source Permit
	NSPS	New Source Performance Standard
	NTTR	Nevada Test and Training Range
	NWHR	Nevada Wild Horse Range

O	O&M	Operations and Maintenance
	OCC	Operations Control Center
P	PA	Preliminary Assessment
	PCB	polychlorinated biphenyl
	PEMS	Portable Environmental Monitoring Station
	pH	potential Hydrogen
	PIC	pressured ion chamber
	PM	particulate matter
	PMRF	Pacific Missile Range Facility
	PMS	portable monitoring station
	PRG	Protective Remediation Goal
	PSD	Prevention of Significant Deterioration
	PWS	public water system
Q	QA	quality assurance
R	R&D	research and development
	RCRA	Resource Conservation and Recovery Act
	ROC	Range Operations Center
	ROD	Record of Decision
	RQ	Reportable Quantity
S	Sandia	Sandia Corporation
	SARA	Superfund Amendments and Reauthorization Act
	SDWA	Safe Drinking Water Act
	SEA	Site Evaluation Accomplished
	SHPO	State Historic Preservation Office
	SME	Subject Matter Expert
	SNL	Sandia National Laboratories
	SNL/NM	Sandia National Laboratories, New Mexico
	SNL/TTR	Sandia National Laboratories, Tonopah Test Range
	SOC	Species of Concern (Chapter 2 - Table 2-3 only)
	SOC	Synthetic Organic Compound (applies to Chapter 4 - Table 4-11 only)
	SPCC	Spill Prevention, Control, and Countermeasures
	SSL	Soil Screening Level
	SSO	Sandia Site Office
	Std Dev	Standard Deviation
	SVOC	semi-volatile organic compound
	SDWA	Safe Drinking Water Act
	SWEIS	Site Wide Environmental Impact Statement
T	TAL	toxic analyte list (metals)
	TLD	thermoluminescent dosimeter
	TPH	total petroleum hydrocarbon
	TQ	threshold quantity
	TRI	Toxic Release Inventory
	TSCA	Toxic Substances Control Act
	TSD	treatment, storage, and disposal
	TSS	total suspended solids
	TTR	Tonopah Test Range

U	UDP	underground discharge point
	UMC	Unneeded Materials and Chemicals
	USAF	U.S. Air Force
	U.S.	United States
	USFS	U.S. Forest Service
	USGS	U.S. Geological Survey
	USN	United States Navy
	UST	underground storage tank
V	VOC	volatile organic compound
W	WFO	Work for Others
	WGI	Washington Group International
	WRCC	Western Regional Climate Center

Units of Measure and Radioactivity Measurements

°C	degree Celsius
cm	centimeter
°F	degree Fahrenheit
ft	feet
g	gram
gal	gallon
in.	inch
yd	yard
yd^3	cubic yard
yr	year
Ci	curie (unit of radioactivity)
mrem/yr	millirem per year
mSv	millisievert (unit of radiation dose)
Bq/m	becquerel per cubic meter
m	meter
m^2	square meter
m^3	cubic meter
mg	milligram
mi	mile
ppm	parts per million
kg	kilogram
km	kilometer
lb	pound
m/s	meters per second
pCi/g	picocurie per gram
µg/L	microgram per liter
$µg/m^2$	microgram per square meter
ppb	parts per billion

TTR & KTF Executive Summary

Sandia Corporation (Sandia), a wholly-owned subsidiary of Lockheed Martin Corporation (LMC) manages and operates the Tonopah Test Range (TTR) in Nevada and the Kauai Test Facility (KTF) in Hawaii for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA). The DOE/NNSA, Sandia Site Office (SSO) administers the contract and oversees contractor operations at the sites.

This Annual Site Environmental Report (ASER) was prepared in accordance with and as required by:

- DOE Order 450.1A, *Environmental Protection Program* (DOE 2008),
- DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting* (DOE 2007);
- DOE Manual 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003);
- DOE Order 430.2B, *Departmental Energy, Renewable Energy and Transportation Management* (DOE 2008a);
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001); and
- DOE Order 5400.5, Chg 2, *Radiation Protection of the Public and the Environment* (DOE 1993).

This ASER summarizes data from environmental protection and monitoring programs at TTR and KTF for Calendar Year (CY) 2010. It also covers Sandia'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's and DOE's efforts to keep the public informed about environmental conditions throughout the DOE/NNSA complex.

TTR

Sandia conducts operations at TTR in support of the DOE/NNSA's Weapons Ordnance Program. Sandia's activities involve research and development (R&D) and the testing of weapon components and delivery systems. Many of these activities require a remote testing range with a long flight corridor for air drops and rocket launches. Other activities include explosive tests and gun firings. There were no reportable environmental occurrences and one drinking water public notice in 2010.

Environmental Programs

The following environmental programs are in place at TTR:

- Waste Management,
- Environmental Restoration (ER) Project,
- Terrestrial Surveillance,
- Water Quality monitoring,
- Air Quality Compliance (AQC), and
- National Environmental Policy Act (NEPA).

Waste Management
Waste generated during 2010 at TTR included hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA) and non-hazardous industrial and sanitary waste. All hazardous waste was shipped to permitted treatment, storage, and disposal (TSD) facilities. Sandia 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 that are scheduled for remediation, or that have been closed at TTR, include areas impacted from target tests and detonations, including non-impacted surface debris and areas impacted by ordnance, depleted uranium, heavy metals, and fuel spills.

Terrestrial Surveillance
Soil is the only terrestrial medium routinely sampled at TTR. Samples are collected to detect air-deposited pollutants or contaminants transported and deposited as a result of surface water runoff. During 2010, soil samples were collected from 15 off-site, 10 perimeter, and 27 on-site locations.

In 2010, soils were analyzed for radiological and non-radiological constituents. The results showed that continued investigation for elevated americium-241 is required in 2011 at location S-51, where it continued to be identified as a Priority-1 for americium-241. The location in the "South Plume Area" is expected to have elevated readings. This year's observation shows expected but elevated levels that justify additional sampling in 2011 to understand the significance of this single sample. The 2009 higher than normal plutonium-239/240 result returned to "historical" levels in 2010, which confirms the "hot particle" theory suggested in the 2009 ASER. Plutonium 239/240 exhibited an anomalous spike at S-09 in 2010. It is near the "Roller Coaster Decon" area. It, like S-51, will be investigated by additional sampling in 2011.

Non-radiological monitoring of toxic analyte list (TAL) metals for soil samples was conducted at 13 on-site sentinel locations, which confirmed no anomalous conditions. A summary report for non-radiological constituents collected between 1994 and 2005 was prepared, analyzed, and published in a summary report (SNL 2006) which was included in the *Calendar Year 2007 Annual Site Environmental Report for TTR, Nevada and KTF, Hawaii* (SNL 2008a).

Water Quality Monitoring
Sandia's wastewater discharges did not negatively impact the U.S. Air Force (USAF)-held National Pollutant Discharge Elimination System (NPDES) permit in 2010.

The public water system (PWS) at TTR is permitted by the Nevada Division of Environmental Protection (NDEP) as a non-transient, non-community water system under the identification number NV003014. Production Well 6 supplies potable water for the TTR Area 3 Drinking Water Distribution System and the Area 3 Fire Protection Water Distribution Systems. The well water is routinely sampled and analyzed per the requirements of the NDEP to demonstrate conformance with primary drinking water standards.

There was one Drinking Water Public Notice issued to Area 3 personnel in December 2010. A drinking water sample collected from a watercooler in Building 03-57 indicated an excessive lead level. Corrective action included removal of two old Building 03-57 watercoolers that were directly connected to the water distribution system and replaced with bottled water coolers.

In 2010, all sample results were below the maximum contaminant levels (MCL) established for the substances monitored. Total trihalomethanes and total haloacetic acid results are well below established MCLs.

In addition, Di (2-Ethylhexyl) Phthalate was not detected in the 2010 sample. NDEP continues to require TTR to collect annual Di (2-Ethylhexyl) Phthalate samples as it has been periodically detected in past monitoring results.

The State of Nevada NDEP also continues to require annual monitoring of copper and lead until it is determined that lead levels are consistently maintained below a 90th percentile level of 0.015 milligrams per liter (mg/L).

TTR has a NDEP permitted treatment system for arsenic (Permit Number NV-3014-TP-11-12NTNC). The arsenic removal system has performed very well since coming back on-line with the carbon dioxide (potential hydrogen [pH] adjustment) system in June of 2008. All samples collected during the year were "non-detect" for arsenic.

Air Quality Compliance

Radiological air emissions are regulated by National Emission Standards for Hazardous Air Pollutants (NESHAP). The only radionuclide sources at TTR are the three Clean Slate sites, which are sources of diffuse 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 (MEI) was 0.024 millirem per year (mrem/yr), which is approximately 400 times less than the 10 mrem/yr standard set by the U.S. Environmental Protection Agency (EPA). Based on this value, an annual dose assessment is not required to be calculated for the TTR site.

TTR's Class II Air Quality Permit requires emission reports from significant non-radionuclide sources. At TTR, these sources include portable screen and maintenance shop activities.

National Environmental Policy Act (NEPA)

At TTR, NEPA compliance is coordinated between personnel from TTR, Sandia National Laboratories, New Mexico (SNL/NM), and the DOE/NNSA/SSO. The SNL/NM NEPA Team completed two DOE NEPA checklists for TTR in 2010, which were transmitted to DOE/NNSA/SSO for review and determination.

As described in the July 24, 2009 Federal Register Notice of Intent (NOI), NNSA is preparing a new Site-Wide Environmental Impact Statement (SWEIS) for the continued operation of DOE/NNSA activities at the Nevada National Security Site (NNSS) and certain off-site locations (e.g., the Nevada Test and Training Range (NTTR) including activities at TTR) (DOE/NNSA 2009). The new NNSS SWEIS will consider a No Action Alternative, which is to continue current operations through implementation of the 1996 Record of Decision (ROD) (DOE 1996), and subsequent decisions. Three action alternatives proposed for consideration in the SWEIS would be compared to the No Action Alternative. The three action alternatives would differ by either their type or level of ongoing operations, and may include proposals for new operations, or the reduction or elimination of certain operations. NNSA issued the draft NNSS SWEIS for public review in 2011. Personnel from SSO, TTR, and the SNL/NM NEPA Team supported ongoing NNSS SWEIS data calls for TTR in 2010.

Kauai Test Facility (KTF)

KTF is operated by Sandia as a rocket preparation, launching, and tracking facility for DOE/NNSA, as well as providing support of other U.S. military agencies. KTF exists as a facility within the boundaries

of the U.S. Department of Defense (DoD), Pacific Missile Range Facility (PMRF). KTF is located on the island of Kauai at the north end of the PMRF near Nohili Point; it has been used as an active rocket launching facility since 1962.

The EPA recommended continued reevaluation for environmental contamination due to past ordnance activity near the site. Rocket exhaust continues to be the main source of metals and other non-reportable air emission releases. Sandia addresses EPA's recommendation by collecting environmental soil samples for TAL metal analysis every five years.

There were no reportable occurrences at KTF in 2010.

Environmental Programs
The following environmental programs are in place at KTF:

- NEPA,
- Water quality monitoring,
- Air Emission Monitoring,
- Terrestrial Surveillance (every five years at the KTF location), and
- PMRF Spill Prevention Control & Countermeasures (SPCC) Plan (for diesel fuel aboveground storage tank [AST] and hazmat storage areas).

NEPA
At KTF, NEPA compliance is coordinated between personnel from KTF, SNL/NM, and the DOE/ NNSA/ SSO. The SNL/NM NEPA Team completed two DOE NEPA checklists for KTF, which were transmitted to DOE/NNSA/SSO for review and determination in 2010.

Water Quality Monitoring
In 2010, there were no compliance issues with respect to any state or federal water pollution regulations at KTF.

Drinking water at KTF is obtained through local facilities and suppliers. No wells provide drinking water at the site.

The limited quantity of sanitary sewage released at the facility does not impact any protected waters; no state inspections were conducted during 2010. As a best management practice (BMP), Sandia periodically performs sampling. No contaminants were identified above the reporting limits from past sampling events.

Air Emissions Monitoring
Sandia was in compliance with all air quality regulations in 2010. The State of Hawaii requires an Annual and Semi-Annual Monitoring Report for air emissions. The Semi-Annual report for the first half of 2010 was submitted to the State of Hawaii in July 2010. The Annual Monitoring Report for air emissions was submitted in February 2011.

For the period of January 1, 2010 through June 30, 2010, the total fuel usage from activities that was reported to the State of Hawaii was 16,585 gals of diesel fuel. The highest total hours of operation for the permitted generators in a rolling 6-month period during the first half of CY 2010 was 1,760 hours. An Annual Air Monitoring Report for CY 2010 was submitted to the State of Hawaii in February 2011.

For the period of January 1, 2010 through December 31, 2010, the total fuel usage from activities that was reported to the State of Hawaii was 20,900 gals of diesel fuel. The highest total hours of operation for the permitted generators in a rolling 12-month period for CY 2010 was 1,806 hours.

Terrestrial Surveillance

Terrestrial surveillance is conducted every five years at KTF. Sampling conducted in 2007 confirmed that KTF operations made no detectable environmental impact. There was no sampling conducted at KTF in 2010.

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1.0 TTR Introduction

Sandia Corporation (Sandia), a wholly-owned subsidiary of Lockheed Martin Corporation (LMC), manages and operates the Tonopah Test Range (TTR) in Nevada for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA), Sandia Site Office (SSO). TTR is owned by DOE/NNSA and overseen by the DOE/NNSA/SSO in Albuquerque, New Mexico.

TTR is located on approximately 280 square miles (179,200 acres) of withdrawn land permitted from the U.S. Air Force (USAF) within the boundaries of the Nevada Test and Training Range (NTTR) and is used to support DOE/NNSA and USAF activities and missions. Washington Group International (WGI) performs or supports most environmental program functions on behalf of Sandia, including environmental media sampling, wastewater effluent and drinking water monitoring, water treatment, spill response, and waste management operations. WGI also supports TTR during tests by operating optics equipment and recovering test objects.

This Annual Site Environmental Report (ASER) is prepared in accordance and as required by:

- DOE Order 450.1A, *Environmental Protection Program* (DOE 2008);
- DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting* (DOE 2007);
- DOE Manual 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003);
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- DOE Order 430.2B, *Departmental Energy, Renewable Energy and Transportation Management* (DOE 2008a).

This ASER summarizes data from environmental protection and monitoring programs at TTR during Calendar Year (CY) 2010. It also discusses Sandia's compliance with environmental statutes, regulations, permit provisions, and other significant environmental activities. The environmental programs summarized here include waste management, air, water, and terrestrial monitoring and surveillance, the Environmental Restoration (ER) Project, and the National Environmental Policy Act (NEPA). DOE Order 450.1A specifies the requirements for environmental monitoring conducted at and around the TTR site. This ASER is an important component of DOE's and Sandia's efforts to keep the public informed about environmental conditions at DOE/NNSA facilities.

Sandia's strategy for managing and implementing its Environment, Safety, and Health (ES&H) Program is described in the Integrated Safety Management System (ISMS). The ISMS is structured around five safety management functions and provides processes to guide line management in identifying and controlling hazards. Sandia is utilizing an Environmental Management System (EMS) as an enhancement of the ISMS. The EMS is that part of the ISMS that addresses the environmental consequences of Sandia activities, products, and services. On December 2, 2005, Sandia informed

the DOE/NNSA/SSO that it had fully implemented an EMS in accordance with the requirements outlined in DOE Order 450.1A. Since 2006, Sandia has continued working to improve environmental management (EM) based on best management practices (BMP), bench marking, and process improvements.

1.1 TTR History and Operations

In 1940, President Franklin Delano Roosevelt withdrew approximately 5,000 square miles of federal land in Nevada to establish the Las Vegas Bombing and Gunnery Range (now referred to as NTTR), which is part of the U.S. Nellis Air Force Base (NAFB).

Before acquiring TTR in 1956, Sandia used three other ranges: the Los Lunas (Kirtland airfield's practice bombing range), Salton Sea Test Base, and Yucca Flat test sites. TTR was selected as a test range after these facilities became inadequate. The atmosphere at Salton Sea Test Base became permeated with haze, which limited visibility and hampered photography in the mid 1950's. 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 is located in the northwest corner of the (then) Las Vegas Bombing and Gunnery Range. A land use permit from the USAF was obtained in 1956 and TTR became operational to test new weapon systems in 1957. The facilities built at TTR were designed and equipped to gather data on aircraft-delivered inert test vehicles under U.S. Atomic Energy Commission (AEC) cognizance (now DOE). As technologies changed, the facilities and capabilities at TTR were expanded to accommodate tests related to DOE/NNSA's Weapons Ordnance Program.

The NAFB Complex includes several auxiliary small arms ranges and the NTTR, which is divided into the North Range and the South Range (Figure 1-1).

The Nevada National Security Site (NNSS), formerly known as the Nevada Test Site, is located between these two ranges. The entire NAFB Complex is comprised of approximately three million acres. TTR is located 32 miles southeast of Tonopah, Nevada. In April 2002, a Land Use Permit was signed between the USAF and NNSA entitled, "Department of the Air Force Permit to the National Nuclear Security Administration to Use Property Located on the Nevada Test and Training Range, Nevada" (USAF/DOE/NNSA 2002). The current size of TTR is now approximately 280 square miles (179,200 acres). Prior to the April 2002 lease agreement, the footprint was 335,655 acres.

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 range from 5,347 feet (ft) at the valley floor to 7,482 ft at Cactus Peak. The elevation of the town of Tonopah is 6,030 ft.

TTR Activities

Principal DOE activities at TTR are flight test airdrops of joint DOE, Department of Defense (DoD) test units. Sandia National Laboratories, TTR (SNL/TTR), on a secondary basis, also supports test activities of other federal agencies under the Work for Others (WFO) Program. No nuclear devices are tested at TTR.

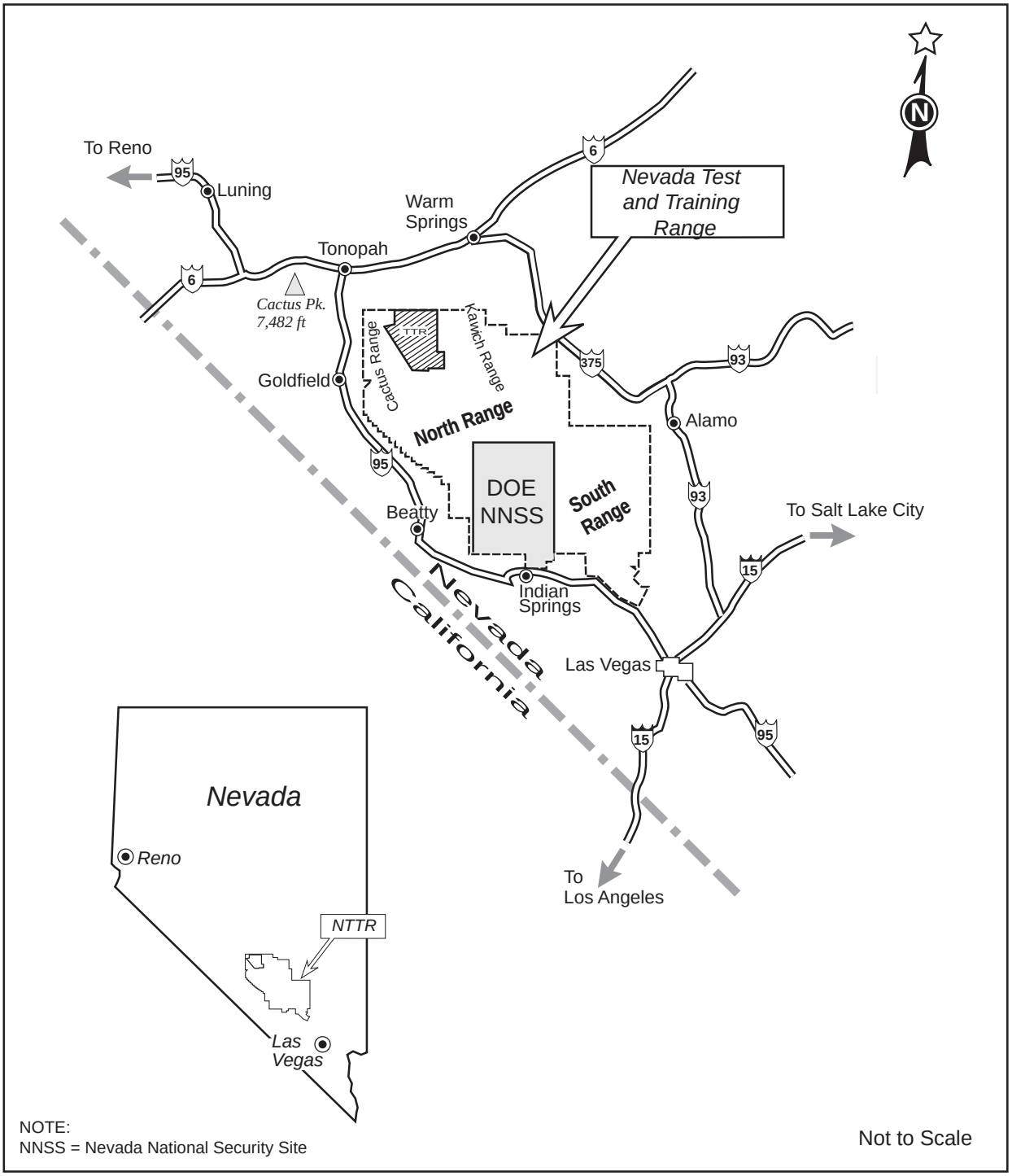

FIGURE 1-1. Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada.

Current DOE activities at TTR include:

- Air Drop Operations (Test Units Dropped from Aircraft),
- Explosives Operations (Render-Safe, Handling, Transporting and Storage of Explosives), and
- Missile Operations (Ground and Air Launched Missiles).

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.

Operations Control Center (OCC)
The OCC is a four story structure that affords a 360 degree view of the site. Personnel at the OCC including the Test Director, Test Project Engineer, Camera Controller, and Range Communicator operate the consoles and control and coordinate all test-related activities during test operations.

TTR is instrumented with a wide array of signal tracking equipment that includes video, high-speed cameras, and radar tracking devices that are used to characterize ballistics, aerodynamics, and parachute performance of Test Units.

Environmental Restoration (ER)
The ER Project at TTR was initiated 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) and the Albuquerque and Nevada field offices to designate responsibility for all ER sites to DOE's Nevada Site Office (NSO). The NNSA was established during 2000 and 2001. Today, responsibility for all ER sites still resides with the NNSA/NSO. However the environmental program management of TTR as discussed in this ASER, is a joint effort between SNL/TTR and Sandia National Laboratories, New Mexico (SNL/NM) employees and contractors, with oversight from DOE/NNSA/SSO.

1.2 Site Description and Demographics

TTR is located within the NTTR at its northwestern boundary. The area north of the TTR boundary is comprised of sparsely populated public lands jointly administered by the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). Cattle graze this land in the winter and spring. There also is a substantial irrigated farming operation north of the range. TTR also lies within a portion of the Nevada Wild Horse Range (NWHR) herd area, which is administered by BLM.

The nearest residents are located in the towns of Goldfield, Nevada (2000 Census population 356) and Tonopah, Nevada (2000 Census population 2,940). Goldfield is located approximately 22 miles southwest of the site boundary. Las Vegas, Nevada is approximately 140 miles southeast of TTR. The total population within the 50-mile 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 occur within TTR's boundaries: Cactus Springs, Antelope Springs, and Silverbow Springs. Water from these springs does not travel more than several tens of meters before it dissipates 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 near the northern 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 at the test range vary from highs near 40 degrees Celsius (º C) 104 degrees Fahrenheit (º F) in summer, with lows approaching -30º C (-22º F) in winter. July and August are the hottest months with highs generally between 32º C to 37º C (90sº F) during the day and dropping to between 10º C and 15º C (50sº F) at night. January conditions vary from highs of 5º C to 10º C (40sº F) to lows -7º C to -11º C (teensº F). An eight year climatology developed from data taken in the 1960s identified the record high of 38.8º C (102º F) with a record low of -31º C (24º F) (Schaeffer 1970).

Rainfall, though sparse, is dependent on elevation. Annual average rainfall in the desert valley floor is four inches, while in nearby mountains as much as 12 inches occurs (USAF 1999).

Winds are generally from the northwest in winter and early spring, switching to southerly directions during summer. The mountain/valley system channels the wind such that the wind seldom blows from eastern or southwestern directions. Dust storms are common in the spring, when monthly average wind speeds reach 15 miles per hour (mph). During the spring and fall, a diurnal cycle to the wind may occur, bringing northwest winds in the early hours, and shifting to southerly winds by afternoon.

Vegetation

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

TTR's vegetation is divided into two basic types by elevation: salt desert shrub in low areas and northern desert shrub at high elevations (USAF 1999, DRI 1991). Salt desert shrub is characteristic of poorly drained soils and common along dry lakebeds. Specific plants in this group include shadscale (*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*), longleaf squirreltail (*Elymus longifolius*), juniper (*Juniperus species pluralis*), and Nevada bluegrass (*Poa nevadensis*). Joshua tree (*Yucca brevifolia*) and juniper grow in the transition zone at the base of the mountains.

Wildlife

The NWHR comprises an area of 1,301,628 acres (2,034 square miles) and encompasses a significant portion of the Northern NTTR with herds common in Cactus and Gold Flats, Kawich Valley, Goldfield Hills, and the Stonewall Mountains. The BLM has published Appropriate Management Levels (AML), (BLM's estimate of the maximum number of animals that are sustainable in a specific Herd Management Area), for the NWHR at 500 wild horses (BLM 2009). There are now, according to BLM estimates, approximately 250 wild horses roaming the NWHR. Wild horses used to be prevalent throughout TTR but since the last BLM gather in 2007 they are seldom seen and then only in very small groups.

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

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

1.4 Clean Slates and Double Track Sites

In May and June 1963, Project Roller Coaster conducted a series of four nuclear weapons destruction tests that resulted in plutonium dispersal in 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 and 1997, interim corrective actions were performed at Double Tracks and Clean Slate 1. These actions resulted in remediation of the soil contamination to a level of less than or equal to 400 picocuries per gram (pCi/g) of transuranics.

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

In addition to the activities conducted in 1996 at Double Tracks and 1997 at Clean Slates 1, the initial cleanup of each Clean Slate site was conducted shortly after each test. Test-related debris was bladed into a hole at test ground zero and backfilled. An initial fence was built around each test area where the soil contamination was set at approximately 1,000 micrograms per square meter ($\mu g/m^2$) of plutonium. The soil survey was conducted on 61 meter grids with a hand-held survey meter, or field instrument, for the detection of low-energy radiation (FIDLER). In 1973, additional outer fences were set at 40 pCi/g of plutonium in soil also using the hand-held meter method. The areas are visually inspected each year to determine whether any fence repairs or sign replacement is required.

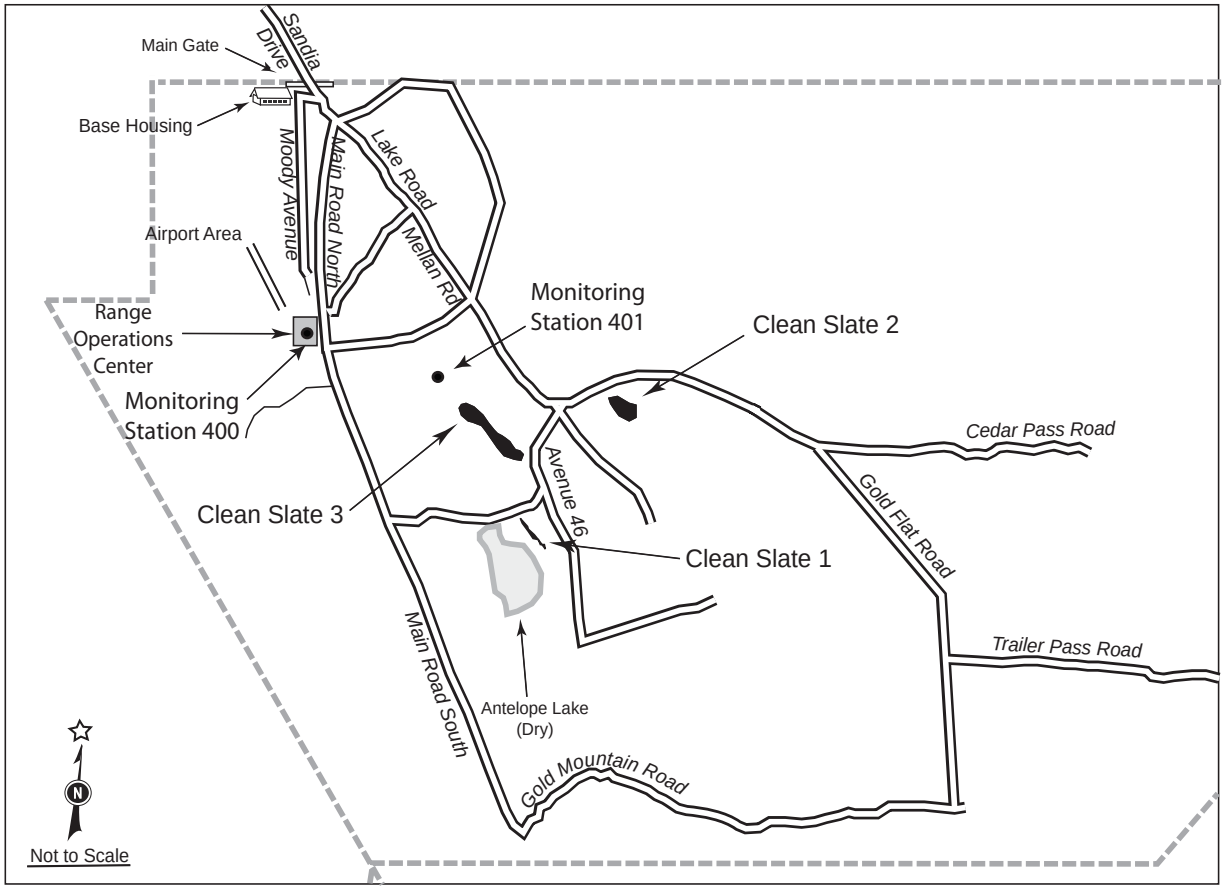

FIGURE 1-2. Location of Facilities Operated by SNL/NSO and Air Monitoring Stations at TTR.

TABLE 1-1. Project Roller Coaster Test Information

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

NOTES: TTR = Tonopah Test Range
NTTR = Nevada Test and Training Range
Source: *Sampling and Analysis Plan for Clean Slate 1*, September 1996 (IT 1996)

In 1977, an aerial radiological survey was performed by Edgerton, Gemeshausen and Grier, Inc. (EG&G) 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 Project Roller Coaster tests. Radiation isopleths showing soil activity due to americium-241, plutonium-239 and plutonium-240 were drawn for each area. The cumulative area of the diffuse sources, as determined by the aerial radiological survey, is 20 million square meters (approximately 4,900 acres). The results of the survey found transuranic contamination outside the fenced area in the downwind direction (EG&G 1995). Subsequent aerial surveys were conducted in 1993 and 2006. These surveys confirmed the results of the previous surveys in terms of extent. Comparing the 2006 to the 1993 survey, it can be determined that significant migration has not occurred.

Air Monitoring at ER sites

Remediation activities were conducted at Clean Slate 1 in 1997. The Desert Research Institute (DRI) collected air monitoring data from several locations in the vicinity of Clean Slate 1 before, during, and after remediation activities. The data has been presented to DOE/NNSA/NSO in the form of a draft report (DRI 1997). The report documented the as-left condition at the site, but does not require follow-up action.

During CY 2010, at the request of DOE/NNSA/NSO, the DRI maintained two portable environmental monitoring stations at the TTR as part of the ER Project Soils Sub-Project. The primary objective of the monitoring stations is to evaluate whether and under what conditions there is wind transport of radiological contaminants from one of the three Soil Sub-Project Corrective Action Units (CAU) associated with Operation Roller Coaster on TTR.

One station is located in the general vicinity of the Range Operations Center (ROC) and the second station is located on the north edge of Clean Slate 3. The ROC station measures potential radionuclide concentrations at the closest location where there are regular site workers. The station at Clean Slate 3 is located at the perimeter of the largest of the three TTR Soils Sub-Project CAUs. Clean Slate 3 covers an area of approximately 1.82 square kilometers (km^2) (450 acres), of which, 0.404685 km^2 (100 acres) is estimated to contain soils with plutonium concentrations as high as 3,200 pCi/g. This station measures the radionuclide concentration at the boundary of the site in one of the predominant downwind directions.

The fundamental design of these stations is similar to that used in the Community Environmental Monitoring Program (CEMP). The TTR stations collect data on selected meteorological and environmental parameters (e.g., wind speed and direction and airborne particulate concentration as a function of particulate size). In addition, airborne particulate samplers are deployed at each location to collect particulate samples for radiological analyses. Data are provided to the Western Regional Climatic Center (WRCC) for management and incorporation into a TTR-specific database. Both stations have been in continuous operations since July 2008.

Monitoring Station Locations and Capabilities

The Station 400 Portable Environmental Monitoring Station (PEMS) is located south of the ROC. This station was located to provide data at the ROC where there is the greatest concentration of personnel associated with Sandia, who manages TTR for the DOE/NNSA. In addition, Station 400 was located where line power was available to operate the instruments. The second, Station 401, Solar Powered Air Sampler and Meteorological Tower, consists of two components: 1) the air sampler, and 2) the auxiliary meteorological tower. These components are located along the fenced perimeter of the north end of Clean Slate 3. Their locations were selected based on a review of wind speed and direction

data collected at the Tonopah Airport (Engelbrecht 2008) as well as for ease of access. Although these data are of limited time duration, they are continuous and less influenced by local topography than the CEMP in Tonopah, Nevada. Figure 1-2 shows the location of the monitoring stations at TTR.

Both stations are equipped with continuous low volume air samplers (flow rate of approximately 0.05663 cubic meters [m^3] 2 cubic feet [ft^3] per minute) whose filters are routinely collected every two weeks. These filters are delivered to the Radiological Services Laboratory at the University of Nevada, in Las Vegas, Nevada for analyses. Standard analyses include gross alpha/beta measurements, and gamma spectral analysis; samples may undergo alpha spectral analysis if initial gamma spectral analyses indicated the presence of americium-241, which could indicate that plutonium particles are being transported.

Station 400: Range Operations Center

Station 400 is a portable station with all monitoring and sampling systems mounted on a 7 ft by 4 ft trailer. The station is located approximately 91.44 meters (100 yards) south-southwest of the ROC. The station configuration as currently deployed is shown below. Sensors include an anemometer, wind direction, pyranometer, tipping rain bucket, temperature/relative humidity probe, barometric pressure, soil temperature probe, pressurized ion chamber (PIC), and a ambient air particulate size profiler. Data from these sensors are collected and stored on a Campbell Scientific™ data logger and is then transmitted through a Geostationary Operational Environmental Satellite (GOES) transmitter to the WRCC. Regular quality assurance procedures include checking the PIC response and air volume throughput on the air sampler on a monthly basis. In addition to the real-time instruments, this station is equipped with two low volume air samplers (AirMetrics MiniVols™) that can collect air samples on quartz and Teflon® filter media, which allows for different types of chemical and elemental analysis. These air samplers are intended to run in case of nearby wild fire or in conditions of extreme dust storms in which there may be value in distinguishing the relative contribution of organic and inorganic constituents. In addition, the station is equipped with an ambient air particulate size profiler (DustTrak™). The DustTrak™ measures the concentration of suspended particulates in real time. Data can be used to determine whether high wind events are always associated with higher concentrations, and whether there are correlations between particulate concentrations and radionuclide concentration.

Station 400: Air Sampling Results

Station 400 is equipped with a continuous air particulate sampler from which a 4 inch air filter sample is collected every two weeks. Between December 30, 2009 and December 29, 2010, 26 air particulate filter samples were collected and analyzed by gamma spectroscopy and for gross alpha/beta activity. Only naturally occurring radionuclides were identified and measured on these samples. Beryllium-7 and lead-210 were the most frequently measured radionuclides followed by only a couple of detections of potassium-40 and bismuth-214. No anthropogenic gamma emitting radionuclides, e.g., cesium-137, cobalt-60, or americium-241 have been detected on any sample. The mean annual gross alpha activity from all samples (Table 1-2) was 2.66×10^{-15} microcuries per milliliter (μCi/mL), with a maximum of 4.79×10^{-15} μCi/mL, a minimum of 0.16×10^{-15} μCi/mL, and a standard deviation of 1.17×10^{-15} μCi/mL. The mean annual gross beta activity from all samples (Table 1-3) was 0.97×10^{-14} μCi/mL, with a maximum of 1.56×10^{-14} μCi/mL, a minimum of 0.30×10^{-14} μCi/mL, and a standard deviation of 0.31×10^{-14} μCi/mL.

Station 401: Clean Slate 3

Station 401 consists of a solar powered air sampler (sampler and solar panels) mounted on a 7 ft by 14 ft trailer, plus a portable meteorological tower, with an anemometer, a temperature/relative humidity probe, and a DustTrak™. The station is located on the north end of Clean Slate 3. Working with Hi-Q Products Inc., DRI constructed this mobile version of a solar powered air sampler based on a design currently being used by the USAF on the NTTR. Internal airflow monitoring and self-adjustment

TABLE 1-2. Gross Alpha Results for TTR Sampling Stations in 2010

Sampling Location	Number of Samples	Concentration (x 10^{-15} µCi/mL [3.7 x 10^{-5} Becquerel (Bq)/m^3])			
		Mean	Standard Deviation	Minimum	Maximum
400	26	2.66	1.17	0.16	4.79
401	24	2.32	1.26	0.33	5.19

NOTES: TTR = Tonopah Test Range
µCi/mL = microcurie per milliliter
m^3 = cubic meter

TABLE 1-3. Gross Beta Results for TTR Sampling Stations in 2010

Sampling Location	Number of Samples	Concentration (x 10^{-14} µCi/mL [3.7 x 10^{-4} Becquerel (Bq)/m^3])			
		Mean	Standard Deviation	Minimum	Maximum
400	26	0.97	0.31	0.30	1.56
401	24	0.82	0.28	0.35	1.47

NOTES: TTR = Tonopah Test Range
µCi/mL = microcurie per milliliter
m^3 = cubic meter

capabilities allow the air sampler to maintain a near constant flow rate. An internal totalizer is used to collect and store airflow data. Data from the sensors are collected and stored on a Campbell Scientific™ data logger, and periodically downloaded to a personal computer and transmitted to the WRCC. Solar panels, with battery assist, provide power for the air sampler and the meteorological station. Configuration of the solar powered air sampler and the location and configuration of the portable meteorological station are shown below.

Station 401: Air Sampling Results

Air samples are collected every two weeks from Station 401 and delivered to the laboratory on a quarterly basis for batch processing. Between December 30, 2009 and December 29, 2010, 24 air particulate filter samples were collected and analyzed. Only naturally occurring radionuclides were measured on the samples. Beryllium-7 and lead-210 were the most frequently measured radionuclides followed by only a couple of detections of potassium-40 and bismuth-214. No anthropogenic gamma emitting radionuclides have been detected on any sample. The mean annual gross alpha activity (Table 1-2) from all samples was 2.32 x 10^{-15} µCi/mL, with a maximum of 5.19 x 10^{-15} µCi/mL, a minimum of 0.33 x 10^{-15} µCi/mL, and a standard deviation of 1.26 x 10^{-15} µCi/mL. The mean annual gross beta activity from all samples (Table 1-3) was 0.82 x 10^{-14} µCi/mL, with a maximum of 1.47 x 10^{-14} µCi/mL, a minimum of 0.35 x 10^{-14} µCi/mL, and a standard deviation of 0.28 x 10^{-14} µCi/mL.

TTR Air Monitoring Network Online Database

Data from the network at TTR are stored and managed via a database at the WRCC in Reno, Nevada. Most variables in the database can be accessed via the web at http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?nvcttr for Station 400 data and http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?nvctcs for Station 401 data. Available data include:

- Solar radiation,
- Wind speed and direction,

- Ambient air temperature (minimum, maximum, and average),
- Relative humidity (minimum, maximum, and average),
- Barometric pressure,
- Precipitation (hourly and cumulative),
- At Station 400, ambient gamma exposure rate (minimum, maximum, and average),
- Soil temperature at 4 inch depth (minimum, maximum, and average), and
- Air particulate counts by size (0.3, 0.5, 0.7,1, 2, 2.5, and 10 micrometers [mm]) as a function of time.

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2.0 TTR Compliance Summary

Sandia Corporation (Sandia) is responsible for environment, safety, and health (ES&H) compliance with federal environmental statutes, regulations, and U.S. Department of Energy (DOE) directives in the Prime contract between Sandia and DOE. Presidential Executive Orders (EO) and DOE guidance documents are also used to establish program criteria.

This chapter discusses Sandia's ES&H responsibilities and the status of ES&H compliance. Environmental audit summaries, occurrence reporting, and environmental permit status for 2010 are also presented in this chapter.

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

2.1 Compliance Status with Federal Regulations

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

The major federal laws applicable to environmental compliance at TTR are presented on Table 2-1.

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 2011). There are no NPL or "Superfund" sites located at TTR. The Superfund Amendments and Reauthorization Act (SARA) Title III amended CERCLA requirements for reportable quantity (RQ) releases and chemical inventory reporting. Sandia at TTR was in full compliance with CERCLA/SARA in 2010. Table 2-2 lists SARA Title III reporting requirements.

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

SARA Title III (also known as EPCRA) requires the submittal of a Toxic Release Inventory (TRI) report for chemical releases over a given threshold quantity (TQ). The release reporting limit for lead is 100 pounds (lb). The TTR Firing Range released approximately 397.2 lbs of non-recovered lead in 2010. This information was reported in the *Calendar Year 2010 Chemical Inventory Report* (SNL 2011e).

TABLE 2-1. Major Environmental Regulations & Statutes Applicable to TTR

Regulation/Statute	Description	Where to go for more information
Clean Air Act (CAA) and CAA Amendments (CAAA)	Provides standards to protect the nation's air quality	*http://www.epa.gov/air/caa/*
Clean Water Act (CWA)	Provides general water quality standards to protect the nation's water sources and byways	*http://www.epa.gov/region9/water/*
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances	*http://www.epa.gov/lawsregs/laws/cercla.html*
Cultural Resources Acts	Includes various acts that protect archeological, historical, religious sites, and resources	*http://recreation.usgs.gov/laws_regs.html*
Endangered Species Act (ESA)	Provides special protection status for federally listed endangered or threatened species	*http://www.epa.gov/lawsregs/laws/esa.html*
Executive Orders (EOs)	Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and encourages greening the government through leadership in Environmental Management	*http://www.archives.gov/federal-register/executive-orders/disposition.html*
Federal Facility Compliance Act (FFCA)	Directs federal agencies regarding environmental compliance	*http://www.hss.doe.gov/sesa/environment/policy/ffca.html*
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	Controls the distribution and use of various pesticides	*http://www.epa.gov/lawsregs/laws/fifra.html*
Migratory Bird Treaty Act (MBTA) of 1918	Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests	*http://www.fws.gov/migratorybirds/RegulationsPolicies/treatlaw.html#mbta*
National Emission Standards for Hazardous Air Pollutants (NESHAP)	Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA	*http://www.epa.gov/radiation/neshaps/*
National Environmental Policy Act (NEPA)	Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making	*http://nepa.energy.gov/*
Resource Conservation and Recovery Act (RCRA)	Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (UST)	*http://www.epa.gov/lawsregs/laws/rcra.html*
Safe Drinking Water Act (SDWA)	Enacts specific health standards for drinking water sources	*http://ndep.nv.gov/* *also see* *http://water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm*
Superfund Amendments and Reauthorization Act (SARA)	SARA, Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community	*http://www.epa.gov/lawsregs/laws/epcra.html*
Toxic Substances Control Act (TSCA)	Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCB)	*http://www.epa.gov/compliance/civil/tsca/index.html*

NOTES: TTR = Tonopah Test Range

TABLE 2-2. 2010 SARA Title III (or EPCRA) Reporting Requirements Applicable to TTR

Section	SARA Title III Section Title	Requires Reporting?		Description
		Yes	No	
302-303	Emergency Planning	X		Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/SSO, which distributes it to the required entities.
304	Emergency Notification		X	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2010.
311-312	Hazardous Chemical Storage Reporting Requirements	X		There are two "Community Right-to-Know" reporting requirements: (a) SNL/NM completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) TTR provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA's alternative MSDS reporting, which is detailed in 40 CFR Part 370.21 (SNL 2011a).
313	Toxic Chemical Release Forms	X		EPCRA, Section 313, requires that facilities that use toxic chemicals listed in SARA Tile III over a threshold value must submit a TRI report. In 2010, a report was submitted for lead (SNL 2011c).

NOTES:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
SSO = Sandia Site Office
EHS = extremely hazardous substance
lbs = pounds
SARA = Superfund Amendments and Reauthorization Act
EPCRA = Emergency Planning and Community Right-to-Know Act
TTR = Tonopah Test Range
DOE = U.S. Department of Energy
NNSA = National Nuclear Security Administration
CFR = Code of Federal Regulations
EPA = U.S. Environmental Protection Agency
TRI = Toxic Release Inventory
RQ = reportable quantity
MSDS = material safety data sheet
SNL/NM = Sandia National Laboratories, New Mexico

2.1.3 Resource Conservation and Recovery Act (RCRA)

RCRA and the Nevada Revised Statutes regulate the generation, transportation, treatment, storage, and disposal of hazardous chemical waste and non-hazardous solid wastes. Applicable regulations are listed in Chapter 6.

Sandia generates some hazardous waste through normal operations at TTR, is classified as a "small quantity generator," and is subject to the applicable requirements (see Chapter 3, which summarizes Sandia's hazardous waste management activities during 2010, and specifically Section 3.2 - Waste Management). Under this designation, hazardous waste can only be stored on-site for 180 days before it must be shipped off-site for treatment and disposal at an EPA permitted facility. 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. In November 2007, a contract was obtained with the Republic Services landfill located at Apex just north of Las Vegas to dispose of bulk non-regulated solid waste. The main purpose for obtaining this contract is clean-up of the Area 3 Salvage Yard. This waste material is not being disposed of in the USAF Landfill on Range due to volume restrictions.

Underground Storage Tanks (UST) and Aboveground Storage Tanks (AST)
RCRA, Subchapter I (40 Code of Federal Regulations [CFR] 280) sets forth requirements for USTs that contain hazardous materials or petroleum products. USTs and ASTs, although not registered by the state, are subject to EPA regulations 40 CFR 112, *Oil Pollution Prevention* and 40 CFR 110, *Discharge of Oil*. The last five USTs were removed in August 1995. This included the removal of two diesel tanks and two gasoline tanks from a former gas station in Area 3, and one diesel tank that had supplied generator fuel in Area 9. There are no ASTs requiring registration with the State of Nevada at TTR.

2.1.4 Federal Facility Compliance Act (FFCA)

The FFCA requires federal facilities to comply with all federal, state, and local requirements for hazardous and solid waste, including full compliance with the restrictions and prohibitions on extended storage of wastes that do not meet the applicable hazardous waste treatment standards. Extended storage at DOE facilities is typically associated with mixed wastes (wastes that have hazardous and radioactive components) that have been generated on-site. Since SNL operations at TTR do not generate mixed waste and Sandia currently has no mixed waste stored on-site, these requirements are not applicable to SNL 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 State of Nevada air quality regulations. Air emissions from non-radionuclide sources, such as a portable screen or maintenance shop activities, are permitted under a Class II Air Quality Permit. Sandia tracks emissions and pays a standard $500 permit fee to the State of Nevada. Sandia met all air quality permit conditions in 2010.

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 2010* (SNL 2011) and Chapter 4 of this report discuss these monitoring results.

2.1.6 Wastewater

TTR wastewater discharges are controlled by the Nevada Division of Environmental Protection (NDEP), which administers regulations relevant to water pollution and sanitary waste systems. Wastewater that enters the sanitary sewer system is treated in the TTR sewage lagoon permitted by the NDEP and operated by the USAF. Sandia also maintains five active and one inactive septic tank system in remote areas at TTR, which are used only for domestic sanitary sewage collection. These systems are periodically sampled as a Best Management Practice (BMP) and do not require sampling by the NDEP. During Calendar Year (CY) 2010 there were no excursions or violation of concentration limits.

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." 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 has cognizance over all storm water issues at the site. The State of Nevada has determined that there are no industrial activities at TTR that require permitting. New construction activities that exceed one acre of soil disturbance may require permitting under the Construction General Permit (CGP). One CGP obtained in 2009 was terminated in January 2010. It covered grading a site on the Main Lake in Area 9 that collected storm water runoff. Construction consisted of filling the low areas with soil and re-grading the site to prevent accumulation of storm water. The completed site matches the existing dry lake bed that surrounds the area.

2.1.7 Safe Drinking Water Act (SDWA)

Sandia meets standards for drinking water as defined in the SDWA and NDEP public water supply and public water system (PWS) regulations. Well 6 normally provides all drinking water for Sandia's Area 3 compound. TTR operates under permits (one for the PWS and one for the arsenic treatment system) issued by the NDEP. The USAF PWS and the Sandia PWS are designed such that they can, on an as-needed basis, provide backup drinking water to each other. Chapter 4 of this report discusses monitoring activities. The NDEP, Bureau of Safe Drinking Water, characterizes this PWS as a Non-Transient Non-Community system.

2.1.8 Toxic Substances Control Act (TSCA)

Compliance with TSCA at TTR primarily concerns the management of asbestos and polychlorinated biphenyls (PCB). As defined by 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 "PCB contaminated." In 1993, sampling was performed on TTR transformers to determine if PCBs were present in the soil (IT 1993). All samples contained less than 50 ppm of PCBs.

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

Chemical pesticides used at TTR include herbicides, rodenticides, and insecticides, as required. All chemicals used are EPA approved and applied in accordance with applicable label guidelines and regulations. Sandia retains records of the quantities and types of pesticides that are used as well as Material Safety Data Sheets (MSDS) for each pesticide. There were no violations of FIFRA in 2010.

2.1.10 National Environmental Policy Act (NEPA)

NEPA requires federal agencies (and other organizations that perform federally sponsored projects) to consider the environmental issues associated with proposed actions, to be aware of the potential environmental impacts associated with these issues, and to include this information in early project planning and decision making. Additionally, if a proposed action is determined to have environmentally "significant" impacts, the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before making an irretrievable commitment of resources or funding. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to choose a course of action with the least environmental impact. The DOE, National Nuclear Security Administration (NNSA), Sandia Site Office (SSO) coordinates NEPA compliance at SNL/TTR with personnel from Sandia National Laboratories, New Mexico (SNL/NM). NEPA activities are discussed in Section 3.4.

2.1.11 Endangered Species Act (ESA)

The ESA applies to both private individuals and federal agencies. Federal agencies must ensure that any action authorized, funded, or carried out by them will not jeopardize the continued existence of a threatened or endangered species, or result in adverse modifications of its habitat. The ESA is addressed under the NEPA Program and the 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 2-3 lists all federal and state protected species occurring within Nye County and having the potential to occur at TTR.

2.1.12 Migratory Bird Treaty Act (MBTA)

The MBTA of 1918 implemented the 1916 Convention for the Protection of Migratory Birds. The original statute implemented the agreement between the U.S. and Great Britain (for Canada) and later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and Russia. The MBTA prevents the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, or nests. Federal institutions are not exempt from the MBTA. At TTR, the MBTA is coordinated through NEPA reviews and the Ecology Program.

2.1.13 Cultural Resources Acts

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

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

The DOE/NNSA/SSO is responsible for determining the level of applicability of cultural resources requirements. In 2010, the only impact Sandia's operations had on cultural resources was the remodel of Building 03-56. This action was mitigated via photographic documentation of the building prior to any changes; a written report is in preparation.

TABLE 2-3. Protected Species Potentially Occurring in Nye County, Nevada

Common Name	Scientific Name	Federal Status	State of Nevada Protected Status
PLANTS			
Sodaville milkvetch	*Astragalus lentiginosus var. sesquimetralis*	- - - - - - - - -	State Protected
Halfring milkvetch	*Astragalus mohavensis var hemigyrus*	SOC	State Protected
Ash Meadows milkvetch	*Astragalus phoenix*	Threatened	State Protected
Spring-loving centaury	*Centaurium namophilum*	Threatened	State Protected
Clokey pincushion	*Escobaria vivipara* var. *rosea*	- - - - - - - - -	State Protected
Armored hedgehog cactus	*Echinocereus engelmannii var. armatus*	- - - - - - - - -	State Protected
Ash meadows sunray	*Enceliopsis nudicaulis var. corrugata*	Threatened	State Protected
Mojave barrel cactus	*Ferocactus cylindraceus var. lecontei*	- - - - - - - - -	State Protected
Sunnyside green gentian	*Frasera gypsicola*	- - - - - - - - -	State Protected
Ash Meadows gumplant	*Grindelia fraxinopratensis*	Threatened	State Protected
Sand cholla	*Grusonia pulchella*	- - - - - - - - -	State Protected
Ash Meadows mousetails	*Ivesia kingii var. eremica*	Threatened	State Protected
Ash Meadows blazingstar	*Mentzelia leucophylla*	Threatened	State Protected
Amargosa niterwort	*Nitrophila mohavensis*	Endangered	State Protected
Williams combleaf	*Polyctenium williamsiae*	- - - - - - - - -	State Protected
Blaine pincushion	*Sclerocactus blainei*	- - - - - - - - -	State Protected
Tonopah pincushion	*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
White River spinedace	*Lepidomeda albivallis*	Endangered	State Protected
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Threatened	State Protected
Big Smoky Valley speckled dace	*Rhinichthys osculus lariversi*	- - - - - - - - -	State Protected
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*	Endangered	State Protected
Duckwater Creektui chub	*Gila siphateles bicolor* ssp. 3	- - - - - - - - -	State Protected
Hot Creek Valley tui chub	*Gila bicolor* ssp. 5	- - - - - - - - -	State Protected
Little Fish Lake Valley tui chub	*Gila bicolor* ssp. 6	- - - - - - - - -	State Protected
Railroad Valley tui chub	*Gila bicolor* ssp. 7	- - - - - - - - -	State Protected
Big Smokey Valley tui chub	*Gila bicolor* ssp. 8	- - - - - - - - -	State Protected
Charnock Springs tui chub	*Gila bicolor* ssp. 10	- - - - - - - - -	State Protected

TABLE 2-3. Protected Species Potentially Occurring in Nye County, Nevada (Continued)

Common Name	Scientific Name	Federal Status	State of Nevada Protected Status
AMPHIBIANS			
Amargosa toad	*Bufo nelsoni*	- - - - - - - - -	State Protected
Columbia spotted frog	*Rana luteiventris* pop. 3	Candidate	- - - - - - - - -
REPTILES			
Banded gila monster	*Heloderma suspectum cinctum*	SOC	State Protected
Desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	Threatened	State Protected
MAMMALS			
Pallid bat	*Antrozous pallidus*	- - - - - - - - -	State Protected
Pygmy rabbit	*Brachylagus idahoensis*	- - - - - - - - -	State Protected
Townsend's big-eared bat	*Corynorhinus townsendii*	- - - - - - - - -	State Protected
Spotted bat	*Euderma maculatum*	- - - - - - - - -	State Protected
Ash Meadows montane vole	*Microtus thysanodes*	SOC	State Protected
American pika	*Ochotona princeps*	- - - - - - - - -	State Protected
Brazilian free-tailed bat	*Tadarida brasiliensis*	- - - - - - - - -	State Protected
Kit fox	*Vulpes macrotis*	- - - - - - - - -	State Protected
BIRDS			
Northern goshawk	*Accipiter gentilis*	- - - - - - - - -	State Protected
Golden eagle	*Aquila chrysaetos*	- - - - - - - - -	State Protected
Long-eared owl	*Asio otus*	- - - - - - - - -	State Protected
Western burrowing owl	*Athene cunicularia hypugaea*	SOC	State Protected
Juniper titmouse	*Baeolophus griseus*	- - - - - - - - -	State Protected
Ferruginous hawk	*Buteo regalis*	- - - - - - - - -	State Protected
Swainson's hawk	*Buteo swainsoni*	- - - - - - - - -	State Protected
Sage grouse	*Centrocercus urophasianus*	- - - - - - - - -	State Protected
Mountain plover	*Charadrius montanus*	Proposed Threatened	State Protected
Black tern	*Chlidonias niger*	SOC	State Protected
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	SOC	State Protected
Yellow warbler	*Dendroica petechia*	- - - - - - - - -	State Protected
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	State Protected
Prairie falcon	*Falco mexicanus*	- - - - - - - - -	State Protected
Common yellowthroat	*Geothlypis trichas*	- - - - - - - - -	State Protected
Greater sandhill crane	*Grus canadensis tabida*	- - - - - - - - -	State Protected
Pinyon jay	*Gymnorhinus cyanocephalus*	- - - - - - - - -	State Protected
Yellow-breasted chat	*Icteria virens*	- - - - - - - - -	State Protected
Western least bittern	*Ixobrychus exilis hesperis*	SOC	State Protected
Loggerhead shrike	*Lanius ludovicianus*	SOC	State Protected
Lewis' woodpecker	*Melanerpes lewis*	- - - - - - - - -	State Protected
Long-billed curlew	*Numenius americanus*	- - - - - - - - -	State Protected

TABLE 2-3. Protected Species Potentially Occurring in Nye County, Nevada (Concluded)

Common Name	Scientific Name	Federal Status	State of Nevada Protected Status
Macgillivray's warbler	*Oporornis tolmiei*	- - - - - - - - -	State Protected
Mountain quail	*Oreortyx pictus*	- - - - - - - - -	State Protected
Flammulated owl	*Otus flammeolus*	- - - - - - - - -	State Protected
Osprey	*Pandion haliaetus*	- - - - - - - - -	State Protected
Phainopepla	*Phainopepla nitens*	- - - - - - - - -	State Protected
White-faced ibis	*Plegadis chihi*	SOC	State Protected
Vesper sparrow	*Pooecetes gramineus*	- - - - - - - - -	State Protected
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	State Protected
Red-naped sapsucker	*Sphyrapicus nuchalis*	- - - - - - - - -	State Protected
Crissal thrasher	*Toxostoma crissale*	- - - - - - - - -	State Protected
Orange-crowned warbler	*Vermivora celata*	- - - - - - - - -	State Protected
Lucy's warbler	*Vermivora luciae*	- - - - - - - - -	State Protected
Grey vireo	*Vireo vicinior*	- - - - - - - - -	State Protected

NOTES: SOC = Species of Concern

Historic Building Assessment

In 2004, DOE/NNSA/SSO initiated a consultation with the Nevada State Historic Preservation Office (SHPO) on the TTR site. The SHPO did not concur with the DOE determination of TTR's eligibility for the National Register of Historic Places as a historic district. At the SHPO's request, Sandia contracted with an external architectural historian to further evaluate the TTR buildings under National Register Criterion C. In 2009, a revised report on the buildings at TTR was submitted to SSO to support consultation with the Nevada SHPO.

2.1.14 Environmental Compliance Executive Orders (EO)

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 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 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 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, was issued in January 2007. EO 13423 sets goals in the areas of energy efficiency, acquisition, renewable energy, toxics reductions, recycling, sustainable buildings, electronics stewardship, fleets, and water conservation. EO 13423 also requires more widespread use of Environmental Management Systems (EMS) as the

framework in which to manage and continually improve these sustainable practices. EO 13423 incorporates the requirements of and cancels EOs 13101, 13123, 13134, 13148, and 13149, which were implemented through DOE Order 450.1 in 2007. DOE revised Order 450.1 to include the requirements of EO 13423 in June 2008. Anticipating this change, Sandia TTR personnel established new EMS objectives and targets starting in fiscal year (FY) 2008 to support upcoming requirements.

EO 13514, *Leadership in Environmental, Energy, and Economic Performance*, was issued in October 2009. EO 13514 establishes an integrated strategy towards sustainability to safeguard the health of our environment and make greenhouse gas emissions a priority for all federal agencies. EO 13514 sets goals in the areas of promoting electronics stewardship, pollution prevention, increased renewable energy, waste reduction, recycling, and fossil fuel usage reduction.

2.1.15 DOE Directives

DOE directives on the Management and Operating Contract (M&O) between Sandia and the DOE define the primary contractual obligations for operating SNL/NM. The DOE directives on the contract baseline that pertain to environmental protection and management are discussed in Chapter 1. Sandia met all the requirements stated in these DOE directives.

2.1.16 Quality Assurance

As outlined in detail in Section 8.0, Quality Assurance (QA), of the SNL/NM ASER, Sandia deploys at TTR and KTF responsibility and accountability for implementing and putting into action the QA Program elements specified in International Organization for Standardization (ISO) 9001-2000 (IOS 2008), the Contractor Requirements Document of DOE Order 414.1C, *Quality Assurance* (DOE 2005), and regulation 10 CFR 830, Subpart A, Quality Assurance, via policy statements, processes, and procedures; and executing the actions specified in those processes and procedures.

2.2 2010 Audits

There were no NDEP audits of SNL at TTR accomplished in 2010. A summary of 2010 environmental audits is presented in Table 2-4.

2.3 2010 Issues and Actions for TTR

Ongoing self-assessments of TTR continue to identify potential compliance issues and subsequent follow-up actions.

Federal Facility Agreement and Consent Order (FFACO) Compliance for ER Activities
An ongoing action started in 1996 is the FFACO with the State of Nevada. This agreement was implemented in May 1996 between the State of Nevada, DOE, and the U.S. Department of Defense (DoD) (DoD/DOE/State of Nevada 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, which are subject to the FFACO are:

- NNSS,
- Areas within TTR,
- Areas within the NTTR,

TABLE 2-4. Summary of Environmental Audits Performed at TTR During Calendar Year 2010

Type/Subject	Date	Audit Organization	Findings Summary
RCRA Compliance Evaluation Inspection	Scheduled for September 2010 but cancelled by NDEP	State of Nevada / NDEP / Bureau of Federal Facilities	Cancelled
TTR ES&H SME Self-Assessment Walk-Through	August 24, 2010 to August 26, 2010	2950	No environmental issues documented.

NOTES: RCRA = Resource Conservation and Recovery Act
NDEP = Nevada Division of Environmental Protection
TTR = Tonopah Test Range
SME = Subject Matter Expert
ES&H = Environment, Safety, and Health

- 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 Nevada 1996). The list of sites has been modified for consistency with NDEP requirements and grouped into Corrective Action Units (CAU), which are listed by Corrective Action Site (CAS) numbers. Each CAU/CAS is listed in the FFACO under Appendix II (Corrective Action Sites/Units, this section includes inactive CAU/CASs), Appendix III (Corrective Action Investigations/Corrective Actions, this section includes active CAU/CASs), and Appendix IV (Closed Corrective Action Units, this section lists CAU/CASs where corrective actions are complete). The FFACO is updated every six months. A listing of ER sites located at TTR is shown in Chapter 3, Table 3-1.

2.4 Environmental Permits

Environmental compliance permits for TTR include those for hazardous materials storage, potable water supply, RCRA, and Air Quality. The State of Nevada issues permits for these SNL activities directly to DOE/NNSA/SSO, and they are administered by Washington Group International (WGI) on behalf of Sandia. Sandia and WGI ensure that all permit conditions are met. Table 2-5 lists all permits and registrations in effect in 2010.

2.5 Occurrence Reporting

Under DOE Manual 231.1-2, an *occurrence* is defined as "one or more events or conditions that adversely affect, or may adversely affect, DOE (including NNSA) or contractor personnel, the public, property, the environment, or the DOE mission." Events or conditions meeting criteria thresholds identified in DOE Manual 231.1-2, or determined to be recurring through performance analysis, are considered occurrences. There are environmental releases that may not meet DOE Manual 231.1-2 reporting thresholds; however, they are still reportable to outside agencies. There were no reportable environmental occurrences in 2010.

TABLE 2-5. Summary of Permits at TTR During Calendar Year 2010

Permit Type and Location	Permit Number	Issue Date	Expiration Date	Comments
Air Quality Permits				
Class II Air Quality Operation Permit	AP8733-0680.02	Original issue date: July 23, 2006 Reissue Date: December 11, 2007	July 23, 2011	1- 12' X 8' Portable Screen Welding Shops Carpenter Shop Paint Shop Non-Permit Equipment List Generators (10 emission units) Boilers (2 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	NV-3014-12NTNC	August 6, 2010	September 30, 2011**	State of Nevada
Permit to Operate a Treatment Plant	NV-3014-TP11-12NTNC	September 14, 2010	September 30, 2011**	State of Nevada
Nevada State Fire Marshal (Hazardous Material)				
Hazardous Materials Permit	8848 FDID Number (13007)	February 26, 2010	February 28, 2011	State of Nevada
NPDES Construction Permits				
Backfilling Horse Pond	SNL/TTR NV 10031 and DOE NV 10032	June 9, 2009	February 16, 2010	State of Nevada

NOTES: *Generator ID number (not a permit number)
**The State of Nevada Bureau of Health Protection Services renews the permit for Well 6 (NV-3014-12NTNC) annually.
"Emission units" are sources such as generators and boilers.
NTNC = Non-Transient Non-Community
RCRA = Resource Conservation and Recovery Act
NPDES = National Pollutant Discharge Elimination System
SNL/NM = Sandia National Laboratories/New Mexico
NV = Nevada
FDID = Fire Department Identification

3.0 TTR Environmental Programs Information

The Environmental Restoration (ER) Project, the Waste Management Program, and the National Environmental Policy Act (NEPA) Program are some of the programs and activities the Tonopah Test Range (TTR) utilizes to comply with various federal and state regulations, and U.S. Department of Energy (DOE) directives. Presidential Executive Orders (EO) and DOE guidance documents are also used to establish program criteria. These are discussed in this chapter. Refer to Chapter 4 for information on other programs, including terrestrial surveillance, drinking water, wastewater, and air quality programs.

3.1 Environmental Restoration Project Activities

The ER Project at TTR was initiated in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. Responsibility for all TTR ER sites resides with DOE/National Nuclear Security Administration (NNSA)/Nevada Site Office (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) of 1996 (as amended February 2008) (DoD/DOE/State of Nevada 1996). The FFACO was negotiated between the State of Nevada, DOE Environmental Management, the U. S. Department of Defense (DoD), and DOE Legacy Management. The FFACO took effect on May 10, 1996 and accomplished the following:

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

The FFACO is also discussed in Section 2.3 of this report.

CAUs located at TTR are addressed by two ER sub-projects:

- **Industrial Sites Project** – Sites historically used to support nuclear testing and Sandia Corporation (Sandia) activities. Industrial sites include historic septic systems, landfills, sewage lagoons, depleted uranium sites, and ordnance testing sites.
- **Soil Sites Project** – Areas where nuclear testing has resulted in surface and/or shallow subsurface soil contamination. Soil sites include large area soil contamination from plutonium dispersal testing.

ER site contamination includes radiological constituents (e.g., depleted uranium and plutonium) and non-radiological constituents (e.g., munitions, solvents, pesticides, septic sludge, 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 (FFPAR) (E&E, 1989). Twelve additional potential CASs, not included in the PA, were also identified using the following methods:

- ER sites inventory processes,
- Ordnance removal activities,
- Geophysical surveys,
- Former worker interviews,
- Archive reviews,
- Site visits, and
- Aerial radiological and multi-spectral surveys (1993 – 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 Sites CAUs and CASs at TTR. The ER activities planned for these CASs range from "no activities currently planned" to "Nevada Division of Environmental Protection (NDEP)-approved closure." The list of CASs and general information presented in Table 3-1 is contained in Appendices II, III, and IV of the FFACO (DoD/DOE/State of Nevada 1996).

2010 ER Activities

ER activities in 2010 were focused on finishing the remediation activities for CAU 408 (Bomblet Target Area). No Resource Conservation and Recovery Act (RCRA) hazardous, Toxic Substances Control Act (TSCA) or mixed waste was disposed during ER activities in 2009 and 2010 as part of the CAU 408 remediation. In 2010, Low Level Radioactive Waste, Sanitary Waste, and Munitions Debris were disposed of as part of the CAU 408 remediation.

CAU 408 (Bomblet Target Area) field remediation activities were initiated in July 2009 by NNSA/NSO. CAU 408 closure activities included:

- Clearing bomblet target areas at seven discrete targets:
    - South Antelope Lake
    - Tomahawk Target 1
    - Tomahawk Target 2
    - Strategic Air Command Target 1
    - Strategic Air Command Target 2
    - Mid Target
    - Flight Line Target

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs 2010 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 Underground Storage Tank Site (TTR)		
03-02-003-0357	Underground Storage Tank, Gas	First Gas Station, Area 3
CAU 402 – *Closed* Area 3 Building 0353 Underground Storage Tank Site (TTR)		
03-02-001-0353	Underground Storage Tank, Diesel	Building 0353
CAU 403 – *Closed* Area 3 Second Gas Station Underground Storage Tank (TTR)		
03-02-004-0360	Underground Storage Tanks	Second Gas Station
CAU 404 – *Closed* Roller Coaster Lagoons and Trench (TTR)		
TA-03-001-TARC	Roller Coaster Lagoons	Northwest of Antelope Lake
TA-21-001-TARC	Roller Coaster North Disposal Trench	Northwest 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 Building 03-74 & Building 03-58 Underground Discharge Points (TTR)		
03-51-002-0374	Heavy Duty Shop UDP, Sumps	Building 0374
03-51-003-0358	UPS Building UDP	UPS Building, Area 3
CAU 407 – *Closed* Roller Coaster RadSafe Area (TTR)		
TA-23-001-TARC	Roller Coaster RadSafe Area	Northwest of Antelope Lake
CAU 408 – *Closed* 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	Area 3
TA-53-002-TAB2	Septic Sludge Disposal Pit	Area 3

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs 2010 Status (continued)

Industrial Sites CAUs/CASs		
CAS Number	**CAS Description**	**General Location**
CAU 410 – *Closed* Waste Disposal Trenches (TTR)		
03-19-001	Waste Disposal Site	Building 0385-T
09-21-001-TA09	Disposal Trenches	Area 9
TA-19-002-TAB2	Debris Mound	Bunker 2
TA-21-002-TAAL	Disposal Trench	South Antelope Lake
TA-21-003-TANL	Disposal Trench	NEDS Lake
CAU 423 – *Closed* Area 3 Underground Discharge Point, Building 0360 (TTR)		
03-02-002-0308	Underground Discharge Point	Building 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, 6 (TTR)		
03-05-002-SW02	Septic Waste System	Area 3
03-05-002-SW06	Septic Waste System	Area 3
CAU 428 – *Closed* Area 3 Septic Waste Systems 1, 5 (TTR)		
03-05-002-SW01	Septic Waste System	Area 3
03-05-002-SW05	Septic Waste System	Area 3
CAU 484 – *Closed* Surface Debris, Waste Sites, and Burn Area (TTR)		
RG-52-007-TAML	Davis Gun Penetrator Test	Test Range
TA-52-001-TANL	NEDS Detonation Area	NEDS Lake
TA-52-004-TAAL	Metal Particle Dispersion Test	Antelope Lake
TA-52-005-TAAL	Joint Test Assembly DU Sites	Antelope Lake
TA-52-006-TAPL	Depleted Uranium Site	Colimbo Detonation Area
TA-54-001-TANL	Contaminated Tank and Steel Structure	NEDS Lake

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs 2010 Status (concluded)

Industrial Sites CAUs/CASs		
CAS Number	**CAS Description**	**General Location**
CAU 490 – *Closed* Station 44 Burn Area (TTR)		
03-56-001-03BA	Fire Training Area	Area 3
03-58-001-03FN	Sandia Service Yard	Area 3
09-54-001-09L2	Gun Propellant Burn Area	Area 9
RG-56-001-RGBA	Station 44 Burn Area	Station 44
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 – *Closed* 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	Radar 24 Diesel Spill Site	Radar 24 Site
Soil Sites CAUs/CASs:		
CAU 411 – *Interim Closure* Double Tracks Plutonium Dispersion (Nellis)		
NAFR-23-01	Pu Contaminated Soil	Nellis Range 71
CAU 412 – *Interim Closure* Clean Slate I Plutonium Dispersion (TTR)		
TA-23-01CS	Pu Contaminated Soil	Tonopah Test Range
CAU 413 – *Remediation Phase* Clean Slate II Plutonium Dispersion (TTR)		
TA-23-02CS	Pu Contaminated Soil	Tonopah Test Range
CAU 414 – *Not Started* Clean Slate III Plutonium Dispersion (TTR)		
TA-23-03CS	Pu Contaminated Soil	Tonopah Test Range

SOURCE: FFACO, 1996 and ongoing updates

NOTES: CAS = Corrective Action Site
CAU = Corrective Action Unit
ER = Environmental Restoration
JTA = Joint Test Assembly
NEDS = Non-Explosive Destruction Site
NNSA = National Nuclear Security Administration
UPS = Uninterruptible Power Supply
NSO = Nevada Site Office
Pu = plutonium
TTR = Tonopah Test Range
UDP = underground discharge point
FFACO = Federal Facilities Agreement and Consent Order
DU = depleted uranium

- Identification and remediation of disposal pit:
  - Collection of verification samples
  - Removal of soil containing contaminants at concentrations above action levels

RCRA hazardous waste was identified in the form of unexploded ordnance and stored on-site at CAU 408 during the 2010 remediation activities pending treatment through detonation to render the items explosively inert.

During Calendar Year (CY) 2010, the remediation of CAU 408 was completed. The seven target areas were cleared of munitions to a depth of one foot. A buffer zone around the seven targets was also visually inspected for missed drops and identified munitions found on the surface were cleared from this area. The munitions were rendered inert and the resulting munitions debris was disposed along with sanitary waste and small amounts of depleted uranium. Field activities were completed in July of 2010. A Closure Report describing the remediation activities was developed and finalized after review. A copy of the final Closure Report was submitted by DOE/NNSA/NSO to NDEP on September 9, 2010 and approved by NDEP on September 20, 2010 with copies to the U.S. Air Force (USAF) and Sandia.

During the period from July 2009 through July 2010, the following items were removed during the remediation of CAU 408:

Waste Type	**Weight**
a. Sanitary Construction Debris	6,676 pounds (lb)
b. Munitions Debris (comprised of 2,903 MEC items)	34,232 lb
c. Depleted uranium (various sizes)	25 items found

During the period of July 2010 through November 2010, the following items were removed during the remediation of CAU 484:

Waste Type	**Weight**
a. Depleted uranium Impacted Soil	480,790 lb
b. Depleted uranium Items (fragmented depleted uranium)	1,000 pieces

The depleted uranium fragments were retrieved from 30 grids (100 meters by 100 meters) on Non-Explosive Destruction Site (NEDS) Lake, packaged into five each 55 gallon (gal) drums, and shipped to the Nevada National Security Site (NNSS) for disposal.

CAU 408 closure activities were completed in July 2010 and the project was considered closed in September with the approval of the closure report by NDEP on September 20, 2010.

3.2 Waste Management Programs

All waste generated at TTR, which excludes any waste generated by ER activities, is managed by Washington Group International (WGI) under the Waste Management Program. 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 shipped from TTR to approved facilities in 2010 was as follows:

Waste Type	**Weight**
RCRA hazardous waste	168 kilograms (kg) (370 lb)
Non-RCRA regulated	1,440 kg (3,167 lb)
Recycled material	9,758 kg (21,467 lb)
TSCA waste (Asbestos)	37 kg (82 lb)
Radioactive waste	0 kg (0 lb)

Sanitary landfill:

USAF Sanitary Landfill	24,164 kg (53,160 lb)

Construction debris:

USAF Construction Landfill	40,764 kg (89,680 lb)

Tires:

Phoenix Recycling Technologies	4,673 kg (10,280 lb)

TTR obtained a contract to recycle tires with Phoenix Recycling Technologies in 2010. All TTR tires can now be recycled with the exception of very large size tires (front end loader, etc.) which still must be disposed of in the Apex landfill.

Battery recycling:

Automotive Battery Recycling (NAPA)	2,104 kg (4,628 lb)

Scrap metal:

During 2010, Bentley's Auctions received under contract 67 pallets (three truckloads) of miscellaneous material as part of the DOE's Unneeded Materials and Chemicals (UMC) initiative. The loads consisted mostly of unneeded electrical, heating, ventilation, and air conditioning (HVAC), and plumbing supplies, including two non-polychlorinated biphenyl (PCB) reclosers and 19 non-PCB transformers.

Salvage Yard Cleanup:

Apex Landfill	23,273 kg (51,200 lb)

Hydrocarbon Contaminated Waste:

U.S. Ecology Landfill Beatty	0 kg (0 lb)

All regulated waste was shipped off-site to permitted treatment, storage, and disposal (TSD) facilities.

Waste Minimization Program

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

- Solvents,
- E-Waste -– computers, monitors, radios, Electronics, etc.,
- Fuels and oil,
- Tires,
- Antifreeze (on-site recycling unit),
- Lead acid batteries,

- Freon (on-site recovery unit),
- Fluorescent and sodium bulbs, and
- Mercury containing equipment.

Recyclables and used oil were sent for recycling or disposed of through the waste disposal contractor. Recycled or energy-recovered quantities shipped off-site in 2010 are presented in Table 3-2.

Radioactive Waste Management
There were no shipments of radioactive waste in 2010.

3.3 Spill Prevention Control and Countermeasures (SPCC) Plan

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

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

TABLE 3-2. Recycled or Energy-Recovered Quantities Shipped Off-Site During Calendar Year (CY) 2010

Categories of Waste Recycled or Energy-Recovered	Shipped (lb)	Shipped (kg)
NAPA Auto Batteries Recycled	4,628	2,104
Used Oil	1,278	581
Combustible Liquid, N.O.S.	31	14
Lead	116	53
Mercury	41	19
Batteries Wet Filled with Acid (Lead Acid)	268	122
Batteries Dry (Alkaline)	356	162
Electronic Equipment	3,500	1,591
Fluorescent Lights	339	154
Photographic Fixer	128	58
Non-PCB Ballasts	147	67
Welding Rod	352	160
Tires	10,280	4,673
TOTALS	**21,467**	**9,758**

NOTES: The lb or kg column weights are provided for convenience and indicate the same recycled material.
lb = pound
kg = kilogram
PCB = Polychlorinated Biphenyl
N.O.S. = Not Otherwise Specified

3.4 National Environmental Policy Act Program

NEPA Activities at TTR
At TTR, NEPA compliance is coordinated between personnel from TTR, Sandia National Laboratories, New Mexico (SNL/NM), and the DOE/NNSA, Sandia Site Office (SSO).

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

2010 NEPA Documentation
The SNL/NM NEPA Team completed six DOE NEPA checklists for TTR in 2010, which were transmitted to DOE/NNSA/SSO for review and determination.

As described in the July 24, 2009 Federal Register Notice of Intent (NOI), NNSA is preparing a new Site-Wide Environmental Impact Statement (SWEIS) for the continued operation of DOE/NNSA activities at NNSS and certain off-site locations, e.g., the Nevada Test and Training Range (NTTR), including activities at TTR (DOE/NNSA 2009). The new NNSS SWEIS will consider a No Action Alternative (NAA), which is to continue current operations through implementation of the 1996 ROD (DOE 1996) and subsequent decisions. Three action alternatives proposed for consideration in the SWEIS would be compared to the NAA. The three action alternatives would differ by either their type or level of ongoing operations, and may include proposals for new operations, or the reduction or elimination of certain operations. SSO, TTR personnel, and the SNL/NM NEPA Team supported ongoing NNSS SWEIS data calls for TTR in 2010.

3.5 Environmental Monitoring Performed By Outside Agencies

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

U.S. Environmental Protection Agency (EPA)
The EPA Environmental Monitoring Systems Laboratory in Las Vegas, Nevada monitored background radiation in the area of TTR as part of its Off-site Radiation Monitoring Reports Program (EPA 1999), which is now being conducted by Desert Research Institute (DRI).

DRI, University of Nevada System
The DRI trains and provides monitoring station managers 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.

The 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 (TLD). Two DRI portable monitoring stations are currently in use at TTR. Station 400 is located in the SNL Area 3 compound and Station 401 is located near Clean Slate 3. The DRI's Community Radiation Monitoring Program Annual Report is part of the NNSS Annual Site Environmental Report (ASER) (DOE 2010).

The DRI also performs other monitoring as requested by the DOE, such as archeological surveys. No archeological surveys were requested in 2010.

WGI

As part of its TTR support activities, WGI personnel perform environmental monitoring activities for DOE and/or SNL/NM when needed. This can include:

- Drinking water and wastewater sampling (details can be found in Section 4.3);
- 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 2010, SNL/NV* (SNL 2011) requires that an annual report be submitted from each DOE/NNSA site where facility sources contribute a public dose of over 0.1 millirems per year (mrem/yr). The NESHAP report must be submitted to 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 Extremely Hazardous Material Reporting Requirements – This is not currently required since extremely hazardous materials are not used during TTR routine operations.
- *Toxic Chemical Release Reporting Community Right-to-Know: Calendar Year 2010* (SNL 2011a) was submitted for lead released at the TTR firing range.

4.0 TTR Terrestrial, Ecological Surveillance, Air, and Water Quality

4.1 Terrestrial Surveillance

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

4.1.1 Program Objectives

The objectives of the Terrestrial Surveillance Program can be summarized by the following excerpts of requirements given in U.S. Department of Energy (DOE) Order 450.1A, *Environmental Protection Program* (DOE 2008):

- Collect and analyze samples to characterize environmental conditions and define increasing or decreasing trends,
- Establish background levels of pollutants to define baseline conditions (off-site sampling),
- Provide continuing assessment of pollution abatement programs,
- Identify and quantify new or existing environmental quality problems and their potential impacts, if any, and
- Verify compliance with applicable environmental laws and regulations and commitments made in National Environmental Policy Act (NEPA) documents such as Environmental Impact Statements (EIS), 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 450.1A, *Environmental Protection Program* (DOE 2008). Concentration limits for radionuclides and metals in terrestrial media are not well defined. However, the terrestrial surveillance coordinator does compare the results from on-site and perimeter locations to off-site results to determine what impact, if any, TTR operations have on the environment. In addition, sample results for metals in surface soils are compared to U.S. surface soil average concentrations that are published in *Trace Elements in Soils and Plants* (Kabata-Pendias 2000) or local/regional surface soil average concentrations that are published in *Elements in North American Soils* (Dragun and Chekiri 2005).

A summary report of metals in soils at TTR has been prepared and will serve as another point of reference. This report was Appendix B in the *Calendar Year (CY) 2006 Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii* (SNL 2007).

4.1.3 Statistical Analyses

Samples are generally collected from fixed locations to make useful 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. As the amount of data increases, the accuracy of the characterization increases.

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

In some instances, this qualitative inspection of the data is augmented by the graphical evaluation methodology as discussed in the metals-in-soil summary report (SNL 2007). This enables the visual identification of anomalies in the data that stand out from the data population for the entire site, or for just that location. This is particularly useful where insufficient data exists for trending, but comparison of new data to "expected values" is desired. In 2010, americium-241 at location S-51 continues to be identified as Priority-1 and will be investigated by additional sampling in 2011. In 2010, S-09 was identified as Priority-2 for americium-241 and an anamalous plutonium-239/240 increase. This will also be subject to additional sampling and investigation.

In 2000, Sandia National Laboratories, New Mexico (SNL/NM) personnel changed analytical laboratories for lower (better) detection capabilities for many of the metals and radiological analyses. As a result, a large number of false decreasing trends were noted for many of the parameters when the whole data set was analyzed. The analysis in 2010 utilized data from the same analytical laboratory for the eleven-year period.

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 SNL activities had a long-term or continued presence.

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

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

NOTES: Based on Statistical Analysis Prioritization Methodology (Shyr, Herrera, and Haaker 1998).
*While some sites may appear higher than off-site, there may not be a statistically significant difference.

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

- Off-site locations are selected to provide a measurement of environmental conditions unaffected by TTR activities. 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 and in areas near local population centers and along highways. Table 4-3 contains a list of the off-site sample locations and a map of these locations is shown in Appendix A, Figure A-1.
- Perimeter locations are selected to establish if contaminants are migrating either onto or off of TTR property. A list of perimeter sampling locations is shown in Table 4-4. A map of the perimeter sampling locations is shown in Appendix A, Figure A-2. All perimeter locations are in areas which Sandia Corporation (Sandia) does not control access.
- 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 Environmental Restoration (ER) sites). A list of on-site sampling locations is shown in Table 4-2. Maps of the on-site sampling locations are shown in Appendix A, Figures A-3 and A-4.

4.1.5 Radiological Parameters and Results

Soil is the only terrestrial medium sampled at TTR. There are no bodies of water other than the playa lakes – dry lake beds with only occasional standing water. 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 2010 analytical results can be found in Appendix B 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, 2010* (SNL 2011b).

Radiological parameters include gamma-emitting radionuclides, plutonium, and uranium and are described below:

- 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 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 and depleted uranium from past explosives testing.
- Plutonium – Due to past explosives testing, plutonium is present in some limited areas of TTR. One of the indicators of the presence of weapons–grade plutonium is radionuclide americium-241. Isotopic plutonium analysis is sometimes performed on any sample for which gamma spectroscopy identified americium-241 in concentrations greater than its minimum detectable activity (MDA).
- Uranium – Uranium occurs naturally in soils and may also be present as a pollutant in the environment due to past testing conducted at TTR. Total uranium analysis is used to measure all uranium isotopes present in a sample. A total uranium measurement may trigger an isotope-specific analysis to determine the possible source of uranium (i.e., natural, man-made, enriched, or depleted).

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

Location	Location Number	Sample Location	Soil Sampling	Replicate*	TLD
Range Operations Center	S-40	Waste Water Monitoring Station	X		
	S-41	"Danger Powerline Crossing" Sign	X		
	S-42	Main Road/Edward's Freeway	X		
	S-43	Southwest Corner of Sandia Corporation, TTR Operation Center	X		
	S-44	Northeast Corner of Sandia Corporation, TTR Operation Center	X		
	S-45	Storage Shelters 03-38 and 03-39	X		
	S-46	Sand Building	X		
	S-47	Generator Storage Area	X		
South Plume Area	S-48	North/South Mellan Airstrip - Antelope Tuff	X	X	
	S-49	North/South Mellan Airstrip - Southwest of S-48	X		
	S-50	North/South Mellan Airstrip - sign post	X		
	S-51	North/South Mellan Airstrip – Northeast of S-50	X		
	S-52	Northeast of Northwest/Southeast Mellan Airstrip	X		
Various On-Site	S-01	Antelope Lake Area Fence, Cultural Area Sign			X
	S-02	North/South Mellan Airstrip (TLD at South fence post)	X		X
	S-03	TLD at Clean Slate 2	X	X	X
	S-04	TLD at Clean Slate 3	X		X
	S-09	Roller Coaster Decon	X	X	X
	S-10	Brownes Road/Denton Freeway	X		X
	S-13	Area 3 between Building 100 and Caution Sign			X
	S-14	Area 3 CP Southwest side of fence			X
	S-15	Moody Avenue by Cattle Guard and Entrance to Chow Hall and Airport			X
	S-16	Area 9, near Well 7			X
	S-17	Main Lake South, near Neutron Bunkers			X
	S-38	Mellan Hill - Metal Scrap Pile	X		
	S-39	Mellan Hill - North	X		
	S-53	Main Road/Lake Road Southeast	X		

NOTES: TTR = Tonopah Test Range
TLD = Thermoluminescent Dosimeter
*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

Location	Location Number	Sample Location	Soil Sampling	Replicate*	TLD
Off-Site	C-19	Mining Museum, North Goldfield			X
	C-20	State Road 6 Rest Area	X		
	C-21	State Road 6/95 Ely Rest Area	X		X
	C-22	Rocket	X		X
	C-23	Alkali/Silver Peak Turnoff	X		
	C-24	Cattle Guard	X		
	C-25	Tonopah Rangers Station	X		
	C-26	Gabbs Pole Line Road	X		
	C-27	State Roads 6/376 Junction	X		
	C-28	Stone Cabin/Willow Creek	X		
	C-29	State Roads 6/375 Junction	X	X	
	C-30	State Road 375 Ranch Cattle Gate	X		
	C-31	Golden Arrow/Silver Bow	X		
	C-32	5 Miles South of Rocket	X		
	C-33	9 Miles North of Main Guard Gate	X		

NOTES: TTR = Tonopah Test Range
TLD = Thermoluminescent Dosimeter
*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

Location	Location Number	Sample Location	Soil Sampling	Replicate*	TLD
Perimeter	P-05	O&M Complex - Site 4 Entrance Gate			X
	P-06	Cedar Pass Road Guard Station	X		X
	P-07	On-Base Housing - South of Power Pole 55-11			X
	P-08	On-Base Housing (main guard gate/power pole CP17)	X		X
	P-11	Cactus Springs (TLD South of P-35)	X	X	X
	P-12	TLD at "U.S. Government Property" Sign	X		X
	P-34	O&M Complex - Owan Drive Post	X		
	P-35	Cactus Springs (North fence post)	X		
	P-36	On-Base Housing (Northeast fence line)	X		
	P-37	On-Base Housing (guard station)	X		

NOTES: TTR = Tonopah Test Range
TLD = Thermoluminescent Dosimeter
O&M = Operation and Maintenance
*In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.

- External gamma radiation exposure rates – Thermoluminescent dosimeters (TLD) 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 operations on those levels. The dosimeters are placed on aluminum poles, at a height of approximately one meter, and are exchanged and measured quarterly (January, April, July, and October) at 20 on-site, perimeter, and off-site locations.

Radiological Results

The results of the statistical analysis revealed that one on-site or perimeter location (S-51) was both higher than off-site and with an increasing trend (Priority-1) for americium-241. Overall summary statistics for all radiological results are presented in Table 4-5. The Priority-1 location (S-51), along with the associated summary statistics for 2010 is listed in Table 4-6. Americium-241 showed one on-site location (S-09) as Priority-2 (higher than off-site) as listed in Table 4-7. One on-site radiological analyte, americium-241, showed Priority-3 (increasing trend) at S-39 as listed in Table 4-8.

The respective radiological analytes are discussed in the following sections, which list the locations showing either Priority-1, Priority-2 or Priority-3.

Americium-241

In 2010, one on-site location (S-51) was identified as Priority-1 (higher than off-site and increasing trend). The first time this location had been identified as a Priority-1 was in 2009. The maximum result for this location was recorded in 2010 and was 6.51 picocuries per gram (pCi/g). The historical results can be seen in Figure 4-1. Location S-51 will undergo special additional sampling in 2011 to

TABLE 4-5. Summary Statistics for Soil Locations From Calendar Year (CY) 2000 - 2010 (all units in pCi/g unless otherwise noted)

Analyte	Class	Number of Samples	Average	Median	Std Dev	Minimum	Maximum
Americium-241	Perimeter	88	0.0158	0.0210	0.0580	-0.2370	0.121
	On-Site	230	0.2326	0.0417	0.8021	-0.2310	6.510
	Off-Site	154	0.0153	.0186	.0478	-0.2020	0.125
Cesium-137	Perimeter	88	.2082	.1660	.1572	0.0122	0.885
	On-Site	230	.2483	.2355	.1823	0.0000	0.886
	Off-Site	154	.2215	.1695	.1633	0.0000	0.930
Plutonium-238	Perimeter	17	.0042	.0028	.0076	-0.0056	0.028
	On-Site	81	0.1348	0.0081	0.9425	-0.0102	8.430
	Off-Site	34	0.00277	0.00094	0.0055	-0.0037	0.024
Plutonium-239/240	Perimeter	17	0.0207	0.0164	0.0170	0.00137	0.070
	On-Site	81	17.549	0.1530	133.8	-0.00816	1,200.00
	Off-Site	34	0.0142	0.01095	0.0132	-0.0011	0.054
Plutonium-242	On-Site	5	3.512	3.490	0.0319	3.49	3.56
Uranium	Perimeter	64	0.7134	0.6915	0.1774	0.483	1.49
	On-Site	196	0.7242	0.7080	0.1513	0.426	1.51
	Off-Site	112	0.7559	0.6970	0.2053	0.463	1.55
Uranium-235	Perimeter	88	0.0784	0.0789	0.0564	-0.059	0.25
	On-Site	234	0.0898	0.0826	0.0621	-0.045	0.39
	Off-Site	154	0.0822	0.0786	0.0596	-0.099	0.29
Uranium-238	Perimeter	88	1.1778	1.180	0.5473	0.0029	2.65
	On-Site	230	1.2185	1.130	0.5156	0.0324	3.13
	Off-Site	154	1.2228	1.125	0.5358	0.1360	2.96

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

TABLE 4-6. Summary Statistics for Soil Locations Noted as Priority-1
(all units in pCi/g unless otherwise noted)

Analyte	Location	Sample Size	2010 Result	Average	Median	Std Dev	Minimum	Maximum
Am-241	S-51	11	6.51	2.11	1.29	2.38	-0.01	6.51

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

TABLE 4-7. Summary Statistics for Soil Locations Noted as Priority-2
(all units in pCi/g unless otherwise noted)

Analyte	Location	Sample Size	2010 Result	Average	Median	Std Dev	Minimum	Maximum
Americium-241	S-09	11	3.47	177	1.15	1.28	0.47	3.58

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

TABLE 4-8. Summary Statistics for Soil Locations Noted as Priority-3
(all units in pCi/g unless otherwise noted)

Analyte	Location	Sample Size	2010 Result	Average	Median	Std Dev	Minimum	Maximum
Americium-241	S-39	11	0.33	0.088	0.074	0.098	-0.04	0.33

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

obtain a better understanding of the americium-241 and plutonium-239/240 at this location. One on-site location (S-09) was identified as Priority-2 (higher than off-site). S-09 is located near the Roller Coaster Decon site. The maximum result for this location was recorded in 2000 and is 3.58 pCi/g. No other on-site locations were identified as Priority-2 for Americium-241. No perimeter location was identified as Priority-2 or Priority-3 (increasing trend).

Plutonium-239/240

No on-site locations were identified as Priority-1 (higher than off-site and increasing trend) and no on-site locations were identified as Priority-2 (higher than off-site) for Plutonium 239/240. This year's results showed that the plutonium-239/240 result returned to "historical" levels at S-51, which confirms the "hot particle" theory suggested in the 2009 Annual Site Environmental Report (ASER). However, in 2010 a plutonium-239/240 anomaly for a single sample was observed at location S-09, similar to what occurred at S-51 in 2009 which justifies the need for additional sampling. Location S-09 is located near the Roller Coaster Decon site and S-51 is in "South Plume" near the Mellan Airstrip. The maximum result recorded at S-09 in 2010 was 1,200 pCi/g and the maximum recorded at S-51 was 130.0 pCi/g in 2009. The "Roller Coaster Decon" site is expected to have elevated readings. The historical results can be seen in Figure 4-2. No perimeter locations were identified as Priority-1, Priority-2 or Priority-3 (increasing trend).

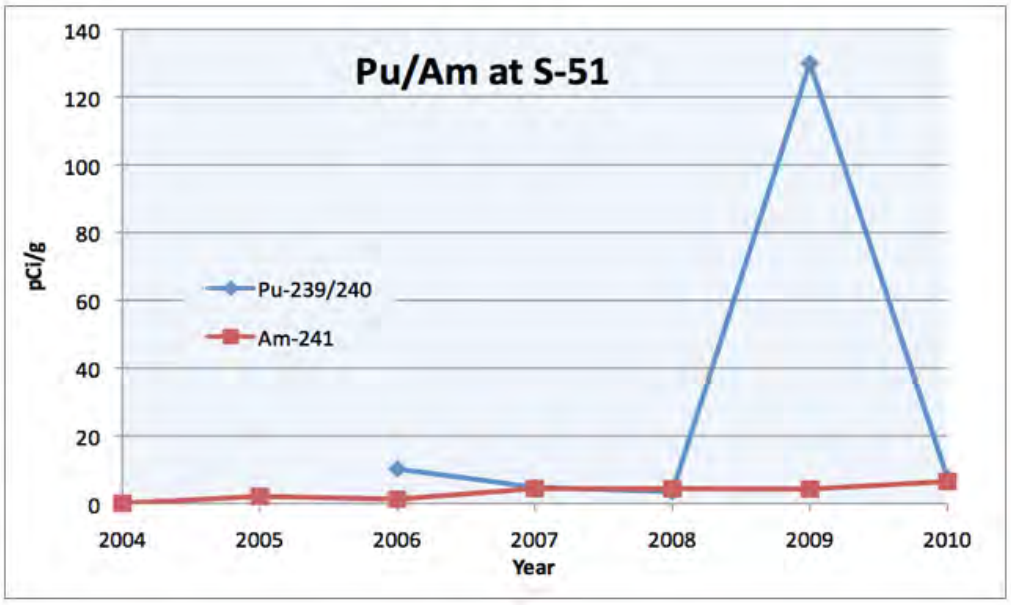

FIGURE 4-1. Historical Plutonium-239 and Americium-241 at S-51

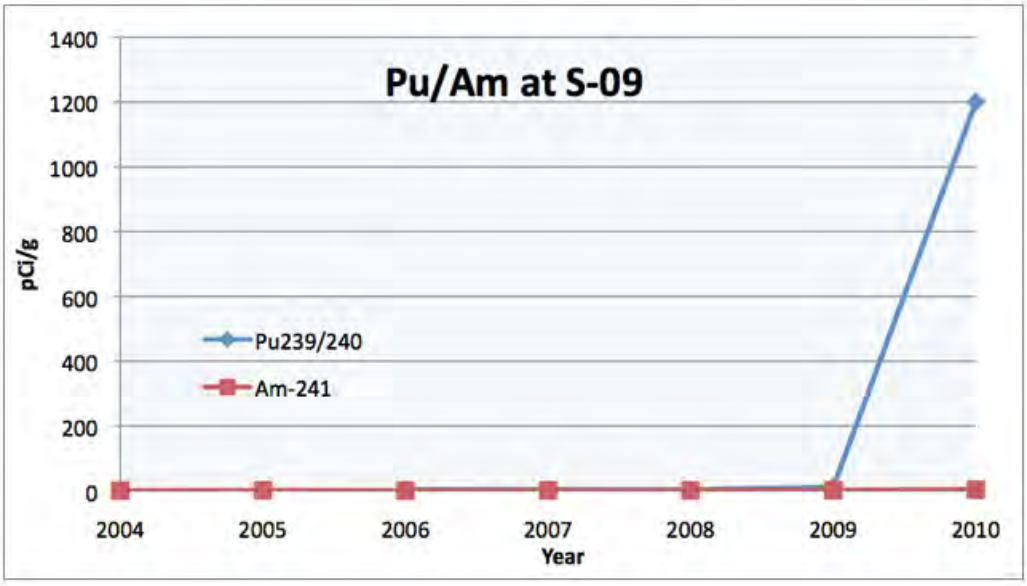

FIGURE 4-2. Historical Plutonium-239 and Americium-241 at S-09

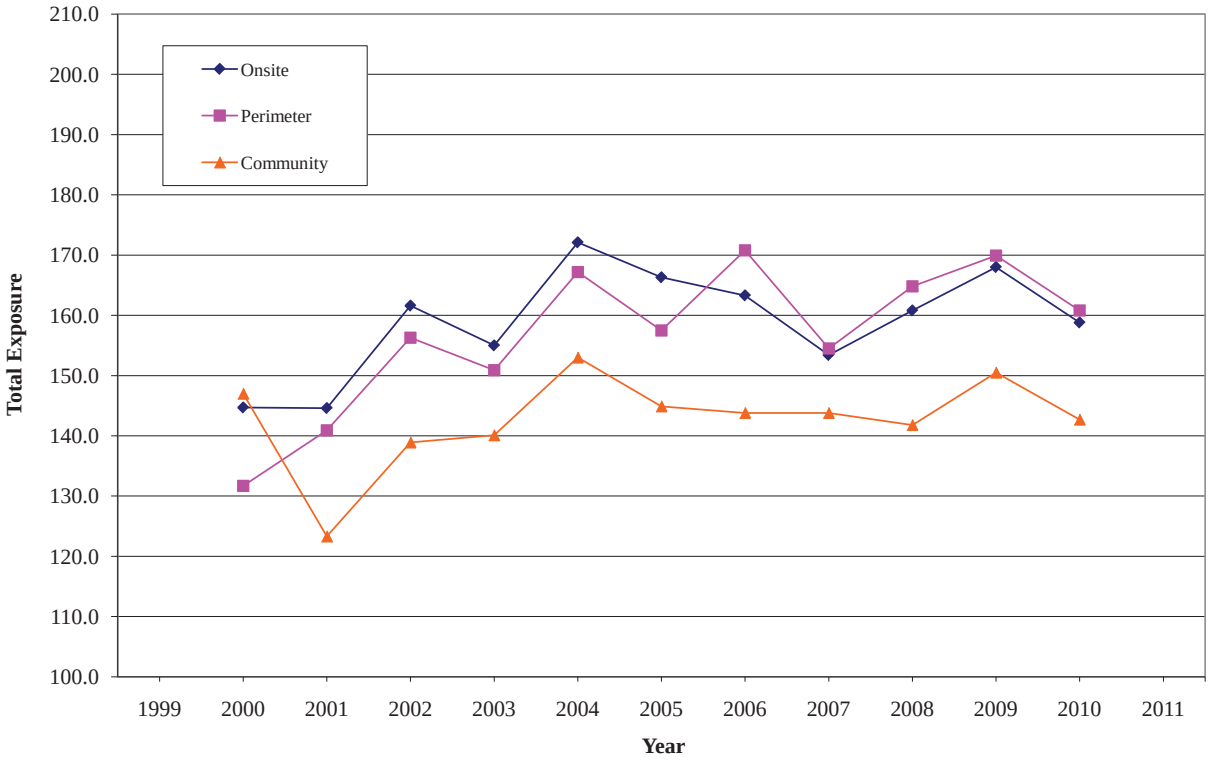

FIGURE 4-3. Tonopah Test Range TLD Exposure, 2000-2010

TLD Results

Sampling for 2010 was conducted from January 2010 through January 2011. When a TLD location has a missing quarter, the data is not included in the summary statistics (there were no missing TLDs in 2010). Summary statistics for the past ten years are shown in Table 4-9. On-site and perimeter locations were statistically different from off-site locations. Off-site locations are statistically lower than either on-site or perimeter locations. There is no remarkable difference between any of the annual groupings of the data. Figure 4-3 graphically portrays the TLD results from 2000 through 2010. TLD results and TLD measurements, by quarter and location type, for 2010 are shown in Appendix B of this report.

4.1.6 Non-Radiological Parameters and Results

In 2010, soils for 13 selected sentinel locations listed in Tables 4-2, 4-3 and 4-4 were analyzed for non-radiological constituents. Additionally, all historical non-radiological soil analyses were analyzed and reported in a summary report (SNL 2006). The only toxic analyte list (TAL) metal that exhibited a Priority-2 condition (higher than off-site) were locations S-09 and P-35 for cobalt and P-32 for copper. The mean value of 5.7 and 7.8, respectively, milligrams per kilogram (mg/kg) were well below the upper limit seen in Nevada soils and well below the U.S. Environmental Protection Agency (EPA) Region 9 Soil Screening Level (SSL) of 900 mg/kg (residential use) shown in Table 4-10. Copper at P-35 exhibited a Priority-2 condition at a mean value of 29.3 mg/kg, well below the EPA Region 9 SSL of 3,100 mg/kg. Copper at S-38 exhibited a Priority-3 condition at a mean value of 6.5 mg/kg, well below the EPA Region 9 SSL of 3,100 mg/kg.

TABLE 4-9. Summary Statistics for TLDs by Location Class, Calendar Year (CY) 2000 – 2010 (all units in mrem unless otherwise noted)

Location Class	Sample Size	Average	Median	Std Dev	Minimum	Maximum
On-site	100	158.7	158.2	14.6	132.4	228.8
Perimeter	55	156.3	156.6	17.7	100.0	216.0
Off-site (community)	31	142.2	144.8	15.2	105.1	163.2

NOTES: mrem = millirem
Std Dev = Standard Deviation
TLD = Thermoluminescent Dosimeter

TABLE 4-10. Various Reference Values for Metals in Soil (all units in mg/kg)

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

NOTES: ND = not detectable
N/A = not available
mg/kg = milligram per kilogram
NV = Nevada
EPA = U.S. Environmental Protection Agency
PRG = Protective Remediation Goal
U.S. = United States
(1) Dragun, James, A. Chiasson, *Elements in North American Soils*, 2005.
(2) EPA Region 9 Preliminary Remediation Goals (PRGs), U.S.E.P.A., October 2004.
(3) *Trace Elements in Soils and Plants*, 3rd Edition **(**Kabata-Pendias 2000).

TAL metals analyses are planned for additional locations every three to five years. The next planned routine sampling for both sentinel and surveillance locations will occur in 2013.

4.2 Water Monitoring

This section discusses the results for potable water, water conservation, wastewater effluent sampling, and storm water monitoring.

4.2.1 Production Well Monitoring

There are three active wells used by TTR: Production Well 6, Well 7, and the Roller Coaster Well. The most active are Production Well 6 and the Roller Coaster Well. Production Well 6 is a public water system (PWS) well that supplies drinking water to the TTR Main Compound in Area 3. Well 6 is the only well that has been sampled for contaminants. Outlying areas and buildings without water service use bottled water. The other wells are not used for potable purposes (construction and dust suppression only), and there are no regulatory sampling requirements.

All sampling is conducted in accordance with requirements set by the State of Nevada (State of Nevada 1997). Analytes are sampled at different intervals, as shown in Table 4-11. The Nevada Division of Environmental Protection (NDEP) currently provides Public Monitoring & Reporting Requirements for each PWS around May of each year.

Sampling parameters include (but are not limited to) total coliform, arsenic, nitrates, total trihalomethanes/haloacetic acids, copper & lead, phthalate, and secondary inorganic compounds (aluminum, color, copper [free], iron, magnesium, manganese, methylene blue active substances [MBAS]-foaming agent [surfactant], odor, potential hydrogen (pH), silver, total dissolved solids, and zinc).

TABLE 4-11. Routine Production Well Monitoring at TTR

Analyte	Sampling Frequency
Total Coliform	Monthly
Arsenic	Monthly
Total Trihalomethanes/Haloacetic Acids (5)	Annually
Di (2-Ethylhexyl) Phthalate (DEHP) ***also known as*** Bis(2-ethylhexyl) phthalate	Annually
Nitrate	Annually
IOCs Phase II, IOCs Phase V, Nitrite, Nitrate and Nitrite (Total) SOCs Phase II, SOCs Phase V, VOCs Phase I and II, VOCs Phase V	As required by NDEP, usually every 3 years
Lead/Copper	As required by NDEP, usually every 3 years
Dioxin	As required by NDEP, usually every 3 years
Secondary (13) Drinking Water Standards	As required by NDEP, usually every 3 years

NOTES: IOC = inorganic compounds
NDEP = Nevada Division of Environmental Protection
VOC = volatile organic compounds
SOC = synthetic organic compounds
TTR = Tonopah Test Range

The pH of the raw water is required to be between 6.5 and 7.0 on the pH scale for proper operation of the arsenic removal system.

Production Well Monitoring Results

There was one Drinking Water Public Notice issued to Area 3 personnel during 2010. In November of 2010 NDEP requested that TTR collect additional copper and lead samples from the PWS during the 2010 monitoring period. None of the required samples exceeded the 0.015 milligrams per liter (mg/L) or (15 parts per billion [ppb]) 90th percentile action level for lead, however in addition to the required samples we collected several samples from two old water coolers (connected to the PWS) located in building 03-57. A public notice was issued when one of the water cooler samples exceeded a lead level of 0.015 mg/L. The two water coolers were removed from this facility and bottled water coolers have replaced them.

In 2010, all sample results were below the maximum contaminant levels (MCL) established for the substances monitored. However, two of these substances did exceed the maximum contaminant level goals (MCLG) for disinfection by-products. MCLGs of zero are established for bromodichloromethane (0.88 micrograms per liter [µg/L] detected) and bromoform (3.0 µg/L detected). Total trihalomethanes and total haloacetic acid results are well below established MCLs. The State of Nevada NDEP continues to require annual monitoring of copper and lead until it is determined that lead levels are consistently maintained below a 90th percentile level of 0.015 mg/L. Di (2-Ethylhexyl) Phthalate was not detected in the 2010 sample. NDEP continues to require TTR to collect annual Di (2-Ethylhexyl) Phthalate samples as it has been periodically detected in past monitoring results.

The arsenic removal system has performed very well since coming back on-line with the carbon dioxide (pH adjustment) system in June of 2008. All arsenic samples collected during the year were "non-detect for arsenic."

During 2010, Well 6 produced 723,000 gallons (gal) of water that was chlorinated and sent to the elevated water storage tower. This equals an average monthly production of approximately 60,000 gals during 2010. Daily production during 2010 averaged approximately 2,000 gals.

During 2010 approximately 274,000 gals of water was treated to remove arsenic and sent to the drinking water distribution system. This equates to a monthly average of approximately 23,000 gals and a daily consumption rate of 750 gals.

A total of 423 pounds (lb) of carbon dioxide was used during the year for pH adjustment (35 lbs per month or 1.2 lbs per day on average).

During an intense snowstorm in April 2010 lightening struck the Elevated Storage Tank causing multiple control component failures including the red FAA Strobe Light to burn out. There are several burn marks on the painted surfaces of the exterior of the tank. One Solid State Control Relay at Well Six, one Solid State Control Relay at the Water Treatment Facility Control Panel, Two Digital Meters and their protection fuses in the Fire Alarm Interface Control Panel, were ruined. Impacts were short term and did not result in a loss of service. All impacted equipment has been repaired or replaced.

4.2.2 Water Conservation

The 1992 Water Conservation Plan for the TTR was updated in 2010 with the State Water Resources Division regulations requiring a water conservation plan for permitted water systems and major water users in Nevada (DOE 1992).

4.2.3 Sewage System and Septic Tank Monitoring

Wastewater discharges from TTR activities conducted at facilities in the Main Compound at Area 3 go to the United States Air Force (USAF) facultative sewage lagoon for treatment. As a best management practice, either SNL/NM or Washington Group International personnel take annual wastewater samples from Area 3 at the point where wastewater leaves TTR property and enters the USAF system.

The USAF holds the National Pollutant Discharge Elimination System (NPDES) permit for its wastewater discharges. The USAF takes quarterly samples from the headwater end of the lagoon. In the past, Sandia provided quarterly sampling results to 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. Therefore, Sandia 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 cyanide (cyanide-containing compounds are not used at TTR),
- pH,
- Total Suspended Solids (TSS),
- Phenolic Compounds (phenol containing compounds are not used at TTR),
- Chemical oxygen demand (COD),
- Volatile Organic Compounds (VOC),
- Semi-volatile Organic Compounds (SVOC),
- Metals (arsenic, cadmium, chromium, copper, nickel, silver, zinc, lead, selenium, and mercury),
- Total Petroleum Hydrocarbons (TPH),
- Oil and grease, and
- Tritium, gamma spectroscopy, gross alpha/beta.

All analytical results for wastewater sampled at Area 3 were within regulatory limits in 2010.

Septic Tank Systems

Septic tank systems are sampled as needed. There are five septic systems (36-01, 09-52, 24-01, Firing Range, and TTR Main Gate (Pt Able) Guard Station) located on-site which are owned by DOE/NNSA at TTR. These five 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 2010. All other remaining septic systems have been closed or are undergoing closure and are being addressed by the ER Project.

4.2.4 Storm Water Monitoring

Currently, Sandia 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 (AQC) at TTR is met by adherence to specific permit conditions and 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.

SNL operations at TTR do not involve activities that release radioactive emissions from either point sources (stacks and vents) or diffuse sources such as outdoor testing. However, diffuse radiological emissions are produced from the re-suspension of americium and plutonium present at the Clean Slate ER sites. Other ER sites with minor radiological contamination, such as depleted uranium, 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 millirems per year (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 sites 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 instituted continuous air monitoring at a 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:

Americium-241.....4.1 x 10-18 Ci/m^3
Plutonium-238.....1.6 x 10-18 Ci/m^3
Plutonium-239/240.....9.5 x 10-19 Ci/m^3

Although an annual calculated dose assessment is not required for the site, Sandia continues to produce an annual NESHAP report for TTR (SNL 2011). 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 4-12 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.

TABLE 4-12. 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)*	350 mrem/yr[1]

NOTES: *Dose calculated from continuous monitoring February 1996 to February 1997.
EDE = effective dose equivalent
MEI = maximally exposed individual
mrem/yr = millirem per year
mSv/yr = millisievert per year
TTR = Tonopah Test Range
[1] Natural background is estimated at 350 mrem/yr nationwide.
NESHAP = National Emission Standards for Hazardous Air Pollutants

4.4 Non-Radiological Air Emissions

TTR's Class II Air Quality Permit requires emission reports from significant non-radionuclide sources. At TTR, these sources include the portable screen and maintenance shop activities. Maintenance shop activities at TTR include the paint shop, welding shop and carpentry shops. In 2010, there were emissions from the portable screen and activities at the maintenance shop. The portable screen was operated for 40.5 hours during CY 2010, and contributed 0.002 tons of particulate matter (PM) emissions. The maintenance shop activities (painting, welding and woodworking) operated for a combined 355 hours or less during CY 2010 and contributed 0.09 tons of emissions (PM, hazardous air pollutants [HAPS] and VOC).

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5.0 2010 ASER for the Kauai Test Facility

Kauai Test Facility (KTF) is a government owned, contractor operated test range. Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, manages and operates KTF for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA). KTF currently operates as a rocket preparation, launching, and tracking facility for U.S. military agencies under the DOE/NNSA Work for Others program. The DOE/NNSA, Sandia Site Office (SSO) in Albuquerque, New Mexico administers the contract and oversees contractor operations at the site. KTF exists as a facility within the boundaries of the U.S. Department of Defense (DoD) Pacific Missile Range Facility (PMRF). 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 environmental protection and monitoring programs at KTF for Calendar Year (CY) 2010. This report was prepared in accordance with DOE Order 450.1A, *Environmental Protection Program* (DOE 2008) and DOE Manual 231.1A, *Environment, Safety, and Health Reporting* (DOE 2007).

5.1 Facilities and Operations

KTF has been an active rocket launching facility since 1962. The KTF and Remote Range Interfaces Department, under Sandia, manages and conducts rocket launching activities at KTF. The site has been used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering re-entry vehicles, and scientific studies of atmospheric and exoatmospheric phenomena, and currently supports Missile Defense Agency (MDA) programs. Nuclear devices have never been launched from KTF, only monitoring rockets associated with atmospheric testing.

The first facilities at KTF were constructed in the early 1960s to support the National Readiness Program. The most recent construction, completed in March 2005, extended the Missile Service Tower (MST) to support DOE and MDA. From 1992 to 2010 there have been 49 launches from KTF, and 22 launches from PMRF supported by KTF personnel.

The KTF launcher field was originally designed to accommodate 40 launch pads, but only 15 pads were constructed. Of these, 11 have had their launchers removed. Beyond the implementation of portions of the original plan, two additional launch pads were constructed: Pad 41 at Kokole Point and Pad 42 (the MST launch pad). The launcher field site has a number of permanent facilities used to support rocket operations. In addition to rocket launch pad sites, KTF facilities include missile and payload assembly areas, data acquisition and operations facilities, maintenance shops, and a trailer dock compound for administration and technical support personnel. Other features at KTF include Global Positioning System (GPS) and radar tracking, high-speed optics, and COMSEC support for DoD operations.

The administrative area of KTF, known as the Main Compound, and the Launch Field are located within fenced areas near the North Nohili access road in PMRF. Inside the compound, a number of trailers and structures are connected together with a network of concrete docks and covered walkways. The majority of these facilities are used during campaign operations to support customer and defense contractor personnel and technical staff from Sandia National Laboratories, New Mexico SNL/NM.

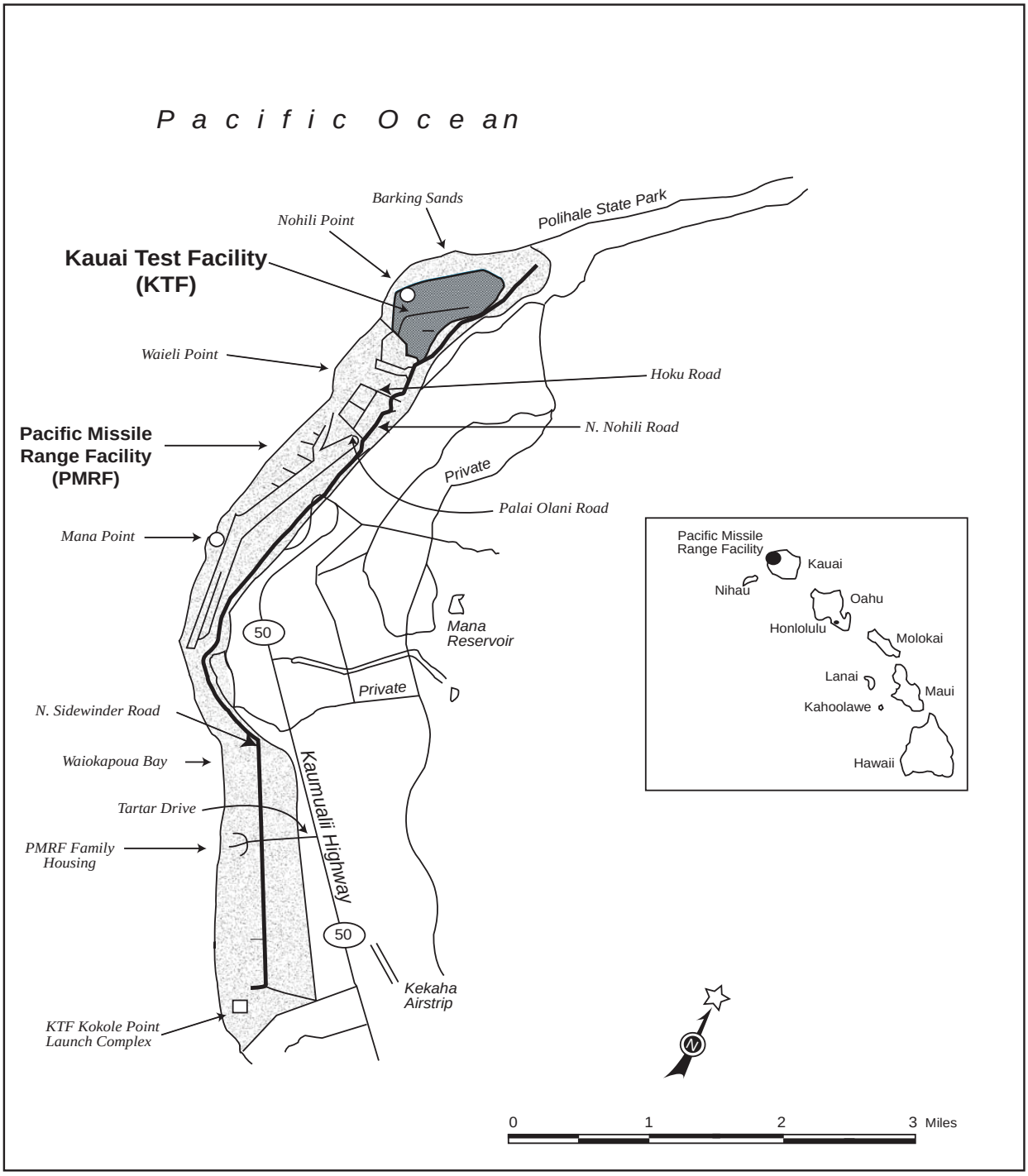

FIGURE 5-1. Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area (The Kauai Test Facility [KTF] is to the north, near Nohili Point)

During non-campaign operations, general maintenance continues and dehumidifiers remain in operation (to protect equipment). Additionally, there are a number of permanent buildings and shelters in the Main Compound and Launch Field, some of which are in use year round to support and maintain KTF facilities. Remote facilities at Mount Haleakala (Maui) and Kahili Peak (Kauai) are no longer used by Sandia, and are either closed or in the process of being closed.

5.2 2010 Rocket Launches

There were four rocket launches from KTF in 2010, and two scheduled launches were cancelled on launch day . The launches were covered by the KTF Environmental Assessment (EA), published in July 1992 (DOE 1992a) and the U.S. Navy, Hawaii Range Complex Environmental Impact Statement (DoD 2008):

- AEGIS BMD , JFTM-4, Events 1,2, October 6, 2010, (2 launches)
- AEGIS BMD, JFTM-4 Event 3, October 28, 2010
- AEGIS BMD, FTX-16, Event 2B, November 12, 2010
- AEGIS BMD, FTX-16 Event 1, November 4, 2010 (2 launches cancelled)

5.3 Demographics

There were 15 permanent on-site personnel at KTF in 2010. During campaign operations when rocket launches occur, an additional 15 to 300 persons temporarily worked at KTF. The closest population center to KTF is the town of Kekaha (population 3,300), which is eight miles from the site.

5.4 Compliance Summary

The list of regulations and statutes provides an overview of the compliance status for SNL operations at KTF in 2010 (Table 5-1). Table 5-2 lists the applicable permits in place at KTF.

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

The U.S. Environmental Protection Agency (EPA) designated ongoing oversight of 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)
The SARA Title III amended CERCLA requirements for reportable quantity (RQ) releases and chemical inventory 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 KTF under EPCRA or CERCLA in 2010. Table 5-3 lists SARA Title III reporting requirements.

TABLE 5-1. Major Environmental Regulations & Statutes Applicable to KTF

Regulation/Statute	Description	Where to go for more information
Clean Air Act (CAA) and CAA Amendments (CAAA)	Provides standards to protect the nation's air quality	*http://www.epa.gov/air/caa/*
Clean Water Act (CWA)	Provides general water quality standards to protect the nation's water sources and byways	*http://www.epa.gov/region09/water/*
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances	*http://www.epa.gov//lawsregs/laws/cercla.html*
Cultural Resources Acts	Includes various acts that protect archeological, historical, religious sites, and resources	*http://recreation.usgs.gov/laws_regs.html*
Endangered Species Act (ESA)	Provides special protection status for federally listed endangered or threatened species	*http://www.epa.gov//lawsregs/laws/esa.html*
Executive Orders (EO)	Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and encourages greening the government through leadership in Environmental Management	*http://www.archives.gov/federal-register/executive-orders/disposition.html*
Federal Facility Compliance Act (FFCA)	Directs federal agencies regarding environmental compliance	*http://www.hss.doe.gov/sesa/environment/policy/ffca.html*
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	Controls the distribution and use of various pesticides	*http://www.epa.gov//lawsregs/laws/fifra.html*
Migratory Bird Treaty Act (MBTA) of 1918	Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests	*http://www.fws.gov/migratorybirds/RegulationsPolicies/treatlaw.html#mbta*
National Emission Standards for Hazardous Air Pollutants (NESHAP)	Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA	*http://www.epa.gov/radiation/neshaps/*
National Environmental Policy Act (NEPA)	Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making	*http://nepa.energy.gov/*
Resource Conservation and Recovery Act (RCRA)	Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (UST)	*http://www.epa.gov//lawsregs/laws/rcra.html*
Safe Drinking Water Act (SDWA)	Enacts specific health standards for drinking water sources	*http://water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm*
Superfund Amendments and Reauthorization Act (SARA)	SARA, Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community	*http://www.epa.gov//lawsregs/laws/epcra.html*
Toxic Substance Control Act (TSCA)	Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCB)	*http://www.epa.gov/compliance/civil/tsca/index.html*

NOTES: KTF = Kauai Test Facility

TABLE 5-2. Permits in Place at KTF

Type	Permit Number	Date Issued	Expiration Date	Regulatory Agency
Non-covered Source Permit (NSP) (two stand-by diesel generators)	NSP 0429-01-N	March 3, 2009	March 2, 2014	State of Hawaii
Resource Conservation and Recovery Act (RCRA)	HI-0000-363309	Sept. 23, 1994	Not specified	EPA Region IX and Hawaii Dept. of Health
Underground Storage Tank (UST) (2,500)	Not applicable	Sept. 13, 1991	Indefinite	EPA Region IX and Hawaii Dept. of Health

NOTE: In 1999, there was a change in reporting fuel throughput from annual reporting to biannual reporting to the State of Hawaii.
KTF = Kauai Test Facility
EPA = U.S. Environmental Protection Agency
The Non-covered Source Permit update was issued on March 3, 2009 (Hawaii DOH 2009).

TABLE 5-3. 2010 SARA Title III (or EPCRA) Reporting Requirements Applicable to 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.
311-312	MSDSs/ Chemical Purchase Inventory Report	✓		There are two "Community Right-to-Know" reporting requirements: (a) the AQC 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 and provides the report to DOE/NNSA/SSO for distribution to the required entities; (b) the AQC Program provides MSDSs for each chemical entry on a Tier II form and provides the report to DOE/NNSA/SSO for distribution to the required entities.
313	Toxic Chemical Release Forms		✓	Sandia Corporation is below the reporting threshold in 2010 for producing a TRI Report for KTF operations.

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

Resource Conservation and Recovery Act (RCRA)
RCRA and the Hawaii Revised Statutes regulate the generation, transportation, treatment, storage, and disposal of hazardous chemical waste and non-hazardous solid wastes. Applicable regulations are listed in Chapter 6. Sandia generates some hazardous waste through normal operations at KTF; is classified as a "small quantity generator," and is subject to the applicable requirements.

Federal Facility Compliance Act (FFCA)
The FFCA requires federal facilities to comply with all federal, state, and local requirements for hazardous and solid waste, including full compliance with the restrictions and prohibitions on extended storage of wastes that do not meet the applicable hazardous waste treatment standards. Extended storage at DOE facilities is typically associated with mixed wastes (wastes that have hazardous and radioactive components) that have been generated on-site. SNL operations at KTF do not generate mixed waste and Sandia currently has no mixed waste stored on site, therefore these requirements are not applicable.

National Environmental Policy Act (NEPA)
NEPA requires federal agencies and other organizations that perform federally sponsored projects to consider environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these issues, and include this information in early project planning and decision making. Additionally, if a proposed action is determined to have environmentally "significant" impacts, the agency must prepare an EA or an environmental impact statement (EIS) before making an irretrievable commitment of resources or funding. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to choose a course of action with the least environmental impacts. Sandia coordinates NEPA compliance at KTF with DOE/NNSA/SSO.

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

Table 5-4 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 KTF are:

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

At KTF, cultural resources compliance is coordinated through the NEPA Program. Actions that could adversely affect cultural resources are initially analyzed in a NEPA review. It is DOE/NNSA's responsibility to ensure that impacts to cultural resources are assessed and appropriate actions taken to mitigate any impact.

TABLE 5-4. 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*	Endangered	Endangered
Kuawawaenohu	*Alsinidendron lychnoides*	Endangered	Endangered
Kuawawaenohu	*Alsinidendron viscosum*	Endangered	Endangered
Pa`iniu	*Astelia waialealae*	Endangered	Endangered
Ko`oko`olau	*Bidens amplectens*	Candidate	Candidate
Ko`oko`olau	*Bidens campylotheca pentamera*	Candidate	Candidate
Ko`oko`olau	*Bidens campylotheca waihoiensis*	Candidate	Candidate
Ko`oko`olau	*Bidens conjuncta*	Candidate	Candidate
Ko`oko`olau	*Bidens micrantha ctenophylla*	Candidate	Candidate
No common name	*Bonamia menziesii*	Endangered	Endangered
Olulu	*Brighamia insignis*	Endangered	Endangered
Uhiuhi	*Caesalpinia kavaiense*	Endangered	Endangered
Maui reedgrass	*Calamagrostis expansa*	Candidate	Candidate
Hillegrand's reedgrass	*Calamagrostis hillebrandii*	Candidate	Candidate
`Awikiwiki	*Canavalia napaliensis*	Endangered	Endangered
`Awikiwiki	*Canavalia pubescens*	Candidate	Candidate
Awiwi	*Centaurium sebaeoides*	Endangered	Endangered
`Akoko	*Chamaesyce eleanoriae*	Endangered	Endangered
No common name	*Chamaesyce halemanui*	Endangered	Endangered
`Akoko	*Chamaesyce remyi var. kauaiensis*	Endangered	Endangered
`Akoko	*Chamaesyce remyi var. remyi*	Endangered	Endangered
Papala	*Charpentiera densiflora*	Endangered	Endangered
Boyds maiden fern	*Christella boydiae*	Candidate	Candidate
Pauoa	*Ctenitis squamigera*	Endangered	Endangered
Haha	*Cyanea asarifolia*	Endangered	Endangered
Haha	*Cyanea asplenifolia*	Candidate	Candidate
Haha	*Cyanea calycina*	Candidate	Candidate
Haha	*Cyanea dolichopoda*	Endangered	Endangered
Haha	*Cyanea eleeleensis*	Endangered	Endangered
Haha	*Cyanea kolekoleensis*	Endangered	Endangered
Haha	*Cyanea kuhihewa*	Endangered	Endangered
Haha	*Cyanea kunthiana*	Candidate	Candidate
Haha	*Cyanea lanceolata*	Candidate	Candidate
Haha	*Cyanea obtusa*	Candidate	Candidate
Haha	*Cyanea recta*	Threatened	Threatened
Haha	*Cyanea remyi*	Endangered	Endangered
`aku	*Cyanea tritomantha*	Candidate	Candidate
Haha	*Cyanea undulata*	Endangered	Endangered
Pu`uka`a	*Cyperus trachysanthos*	Endangered	Endangered
Mapele	*Cyrtandra cyaneoides*	Endangered	Endangered
Ha`iwale	*Cyrtandra filipes*	Candidate	Candidate

TABLE 5-4. Threatened and Endangered Species Potentially Occurring on KTF (continued)

Common Name	Scientific Name	Federal Status	State Status
Ha`iwale	*Cyrtandra kaulantha*	Candidate	Candidate
Ha`iwale	*Cyrtandra limahuliensis*	Threatened	Threatened
Ha`iwale	*Cyrtandra oenobarba*	Endangered	Endangered
Ha`iwale	*Cyrtandra oxybapha*	Candidate	Candidate
Haiwale	*Cyrtandra paliku*	Endangered	Endangered
Ha`iwale	*Cyrtandra sessilis*	Candidate	Candidate
No common name	*Delissea rhytidosperma*	Endangered	Endangered
Oha	*Delissea rivularis*	Endangered	Endangered
No common name	*Delissea undulata*	Endangered	Endangered
Asplenium-leaved diellia	*Diellia erecta*	Endangered	Endangered
No common name	*Diellia mannii*	Endangered	Endangered
No common name	*Diellia pallida*	Endangered	Endangered
No common name	*Diplazium molokaiense*	Endangered	Endangered
No common name	*Doryopteris angelica*	Endangered	Endangered
No common name	*Doryopteris takeuchii*	Candidate	Candidate
Palapalai aumakua	*Dryopteris crinalis var. podosorus*	Endangered	Endangered
Na`ena`e	*Dubautia imbricata imbricata*	Endangered	Endangered
Naenae	*Dubautia kalalauensis*	Endangered	Endangered
Naenae	*Dubautia kenwoodii*	Endangered	Endangered
Na`ena`e	*Dubautia latifolia*	Endangered	Endangered
Na`ena`e	*Dubautia pauciflorula*	Endangered	Endangered
Na`ena`e	*Dubautia plantaginea magnifolia*	Endangered	Endangered
Na`ena`e	*Dubautia waialealae*	Endangered	Endangered
`Akoko	*Euphorbia haeleeleana*	Endangered	Endangered
Heau	*Exocarpos luteolus*	Endangered	Endangered
No common name	*Festuca hawaiiensis*	Candidate	Candidate
Mehamehame	*Flueggea neowawraea*	Endangered	Endangered
Nanu	*Gardenia remyi*	Candidate	Candidate
Nohoanu	*Geranium hanaense*	Candidate	Candidate
Nohoanu	*Geranium hillebrandii*	Candidate	Candidate
Nohoanu	*Geranium kauaiense*	Endangered	Endangered
No common name	*Gouania meyenii*	Endangered	Endangered
Honohono	*Haplostachys haplostachya*	Endangered	Endangered
Awiwi	*Hedyotis cookiana*	Endangered	Endangered
Kampua`a	*Hedyotis fluviatilis*	Candidate	Candidate
Na Pali beach hedyotis	*Hedyotis st.-johnii*	Endangered	Endangered
No common name	*Hesperomannia lydgatei*	Endangered	Endangered
Kauai hau kuahiwi	*Hibiscadelphus distans*	Endangered	Endangered
Hau kuahiwi	*Hibiscadelphus woodii*	Endangered	Endangered
Clay's hibiscus	*Hibiscus clayi*	Endangered	Endangered
Koki`o ke`oke`o	*Hibiscus waimeae ssp. hannerae*	Endangered	Endangered
Wawae`iole	*Huperzia (=Phlegmariurus) stemmermanniae*	Candidate	Candidate
Wawae`iole	*Huperzia mannii*	Endangered	Endangered
Hilo ischaemum	*Ischaemum byrone*	Endangered	Endangered
Aupaka	*Isodendrion laurifolium*	Endangered	Endangered
Aupaka	*Isodendrion longifolium*	Threatened	Threatened

TABLE 5-4. Threatened and Endangered Species Potentially Occurring on KTF (continued)

Common Name	Scientific Name	Federal Status	State Status
`Ohe	*Joinvillea ascendens ascendens*	Candidate	Candidate
No common name	*Keysseria (=Lagenifera) erici*	Endangered	Endangered
No common name	*Keysseria (=Lagenifera) helenae*	Endangered	Endangered
Koki`o	*Kokia kauaiensis*	Endangered	Endangered
Hulumoa	*Korthalsella degeneri*	Candidate	Candidate
Kamakahala	*Labordia helleri*	Endangered	Endangered
Kamakahala	*Labordia lydgatei*	Endangered	Endangered
Kamakahala	*Labordia pumila*	Endangered	Endangered
Kamakahala	*Labordia tinifolia var. wahiawaensis*	Endangered	Endangered
Nehe	*Lipochaeta fauriei*	Endangered	Endangered
Nehe	*Lipochaeta micrantha*	Endangered	Endangered
No common name	*Lobelia niihauensis*	Endangered	Endangered
Wawae`iole	*Lycopodium (=Phlegmariurus) nutans*	Endangered	Endangered
lehua makanoe	*Lysimachia daphnoides*	Endangered	Endangered
No common name	*Lysimachia filifolia*	Endangered	Endangered
No common name	*Lysimachia iniki*	Endangered	Endangered
No common name	*Lysimachia pendens*	Endangered	Endangered
No common name	*Lysimachia scopulensis*	Endangered	Endangered
No common name	*Lysimachia venosa*	Endangered	Endangered
No common name	*Mariscus pennatiformis*	Endangered	Endangered
Alani	*Melicope christophersenii*	Candidate	Candidate
Alani	*Melicope degeneri*	Endangered	Endangered
Alani	*Melicope haupuensis*	Endangered	Endangered
Alani	*Melicope hiiakae*	Candidate	Candidate
Alani	*Melicope knudsenii*	Endangered	Endangered
Alani	*Melicope makahae*	Candidate	Candidate
Alani	*Melicope pallida*	Endangered	Endangered
Alani	*Melicope paniculata*	Endangered	Endangered
Alani	*Melicope puberula*	Endangered	Endangered
Alani	*Melicope quadrangularis*	Endangered	Endangered
Maui fern	*Microlepia strigosa var. mauiensis*	Candidate	Candidate
No common name	*Munroidendron racemosum*	Endangered	Endangered
Kolea	*Myrsine fosbergii*	Candidate	Candidate
Kolea	*Myrsine knudsenii*	Endangered	Endangered
Kolea	*Myrsine linearifolia*	Threatened	Threatened
Kolea	*Myrsine mezii*	Endangered	Endangered
Kolea	*Myrsine vaccinioides*	Candidate	Candidate
`Aiea	*Nothocestrum latifolium*	Candidate	Candidate
`Aiea	*Nothocestrum peltatum*	Endangered	Endangered
Holei	*Ochrosia haleakalae*	Candidate	Candidate
Lau `ehu	*Panicum niihauense*	Endangered	Endangered
`Ala `ala wai nui	*Peperomia subpetiolata*	Candidate	Candidate
Makou	*Peucedanum sandwicense*	Threatened	Threatened
No common name	*Phyllostegia bracteata*	Candidate	Candidate
No common name	*Phyllostegia floribunda*	Candidate	Candidate
No common name	*Phyllostegia knudsenii*	Endangered	Endangered

TABLE 5-4. Threatened and Endangered Species Potentially Occurring on KTF (continued)

Common Name	Scientific Name	Federal Status	State Status
No common name	*Phyllostegia renovans*	Endangered	Endangered
No common name	*Phyllostegia waimeae*	Endangered	Endangered
No common name	*Phyllostegia wawrana*	Endangered	Endangered
Ho`awa	*Pittosporum napaliense*	Endangered	Endangered
No common name	*Platanthera holochila*	Endangered	Endangered
No common name	*Platydesma cornuta cornuta*	Candidate	Candidate
No common name	*Platydesma cornuta decurrens*	Candidate	Candidate
No common name	*Platydesma remyi*	Candidate	Candidate
Pilo kea lau li`i	*Platydesma rostrata*	Endangered	Endangered
Hala pepe	*Pleomele fernaldii*	Candidate	Candidate
Hala pepe	*Pleomele forbesii*	Candidate	Candidate
Mann's bluegrass	*Poa mannii*	Endangered	Endangered
Hawaiian bluegrass	*Poa sandvicensis*	Endangered	Endangered
No common name	*Poa siphonoglossa*	Endangered	Endangered
lo`ulu (=Na`ena`e)	*Pritchardia hardyi*	Endangered	Endangered
Lo`ulu	*Pritchardia napaliensis*	Endangered	Endangered
Lo`ulu	*Pritchardia viscosa*	Endangered	Endangered
`Ena`ena	*Pseudognaphalium (=Gnaphalium) sandwicensium var. molokaiense*	Candidate	Candidate
Kopiko	*Psychotria grandiflora*	Endangered	Endangered
Oahu wild coffee (=kopiko)	*Psychotria hexandra ssp. oahuensis var. oahuensis*	Candidate	Candidate
Kopiko	*Psychotria hobdyi*	Endangered	Endangered
Kaulu	*Pteralyxia kauaiensis*	Endangered	Endangered
Kaulu	*Pteralyxia macrocarpa*	Candidate	Candidate
Makou	*Ranunculus hawaiensis*	Candidate	Candidate
Makou	*Ranunculus mauiensis*	Candidate	Candidate
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 attenuata*	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
Ma`oli`oli	*Schiedea pubescens*	Candidate	Candidate
No common name	*Schiedea salicaria*	Candidate	Candidate
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
`Anunu	*Sicyos macrophyllus*	Candidate	Candidate
No common name	*Silene lanceolata*	Endangered	Endangered
Popolo ku mai	*Solanum incompletum*	Endangered	Endangered
Popolo	*Solanum nelsonii*	Candidate	Candidate
`Aiakeakua, popolo	*Solanum sandwicense*	Endangered	Endangered

TABLE 5-4. Threatened and Endangered Species Potentially Occurring on KTF (continued)

Common Name	Scientific Name	Federal Status	State Status
No common name	*Spermolepis hawaiiensis*	Endangered	Endangered
No common name	*Stenogyne campanulata*	Endangered	Endangered
No common name	*Stenogyne cranwelliae*	Candidate	Candidate
No common name	*Stenogyne kealiae*	Endangered	Endangered
No common name	*Tetraplasandra bisattenuata*	Endangered	Endangered
No common name	*Tetraplasandra flynnii*	Endangered	Endangered
No common name	*Viola helenae*	Endangered	Endangered
Nani wai`ale`ale	*Viola kauaiensis var. wahiawaensis*	Endangered	Endangered
Dwarf iliau	*Wilkesia hobdyi*	Endangered	Endangered
No common name	*Xylosma crenatum*	Endangered	Endangered
A`e	*Zanthoxylum hawaiiense*	Endangered	Endangered
A`e	*Zanthoxylum oahuense*	Candidate	Candidate
ANIMALS			
Mammals			
Hawaiian hoary bat	Lasiurus cinereus semotus	Endangered	Endangered
Birds			
Hawaiian duck	Anas wyvilliana	Endangered	Endangered
Hawaiian goose	Branta (=Nesochen) sandvicensis	Endangered	Endangered
Arctic peregrine falcon	Falco peregrinus tundrius	Recovery	Recovery
Hawaiian coot	Fulica americana alai	Endangered	Endangered
Hawaiian common moorhen	Gallinula chloropus sandvicensis	Endangered	Endangered
Nukupu`u (honeycreeper)	Hemignathus lucidus	Endangered	Endangered
Kauai akialoa (honeycreeper)	Hemignathus procerus	Endangered	Endangered
Hawaiian stilt	Himantopus mexicanus knudseni	Endangered	Endangered
Akekee	Loxops caeruleirostris	Endangered	Endangered
Kauai `o`o duck	Moho braccatus	Endangered	Endangered
Large Kauai thrush	Myadestes myadestinus	Endangered	Endangered
Small Kauai (honeycreeper)	Myadestes palmeri	Endangered	Endangered
Band-rumped storm-petrel	Oceanodroma castro	Candidate	Candidate
Akikiki	Oreomystis bairdi	Endangered	Endangered
`O`u (honeycreeper)	Psittirostra psittacea	Endangered	Endangered
Hawaiian dark-rumped petrel	Pterodroma phaeopygia sandwichensis	Endangered	Endangered
Newell's Townsend's shearwater	Puffinus auricularis newelli	Threatened	Threatened
Reptiles			
Green sea turtle	Chelonia mydas	Threatened	Threatened
Hawksbill sea turtle	Eretmochelys imbricata	Endangered	Endangered
Snails			
Newcomb's snail	Erinna newcombi	Threatened	Threatened
Newcomb's tree snail	Newcombia cumingi	Candidate	Candidate
Lanai tree snail	Partulina semicarinata	Candidate	Candidate
Lanai tree snail	Partulina variabilis	Candidate	Candidate
Arachnids			
Kauai cave wolf or pe'e pe'e maka 'ole spider	Adelocosa anops	Endangered	Endangered

TABLE 5-4. Threatened and Endangered Species Potentially Occurring on KTF (concluded)

Common Name	Scientific Name	Federal Status	State Status
Insects			
Hawaiian picture-wing fly	Drosophila digressa	Candidate	Candidate
Pomace fly (no common name)	Drosophila musaphila	Endangered	Endangered
Hawaiian picture-wing fly	Drosophila sharpi	Endangered	Endangered
Crimson Hawaiian damselfly	Megalagrion leptodemus	Candidate	Candidate
Blackline Hawaiian damselfly	Megalagrion nigrohamatum nigrolineatum	Candidate	Candidate
Oceanic Hawaiian damselfly	Megalagrion oceanicum	Candidate	Candidate
Pacific Hawaiian damselfly	Megalagrion pacificum	Endangered	Endangered
Orangeblack Hawaiian damselfly	Megalagrion xanthomelas	Candidate	Candidate
Wekiu bug	Nysius wekiuicola	Candidate	Candidate
Crustaceans			
Anchialine pool shrimp	Metabetaeus lohena	Candidate	Candidate
Anchialine pool shrimp	Palaemonella burnsi	Candidate	Candidate
Anchialine pool shrimp	Procaris hawaiana	Candidate	Candidate
Kauai cave amphipod	Spelaeorchestia koloana	Endangered	Endangered
Anchialine pool shrimp	Vetericaris chaceorum	Candidate	Candidate

NOTES: KTF = Kauai Test Facility

Migratory Bird Treaty Act (MBTA) of 1918

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

Environmental Compliance Executive Orders (EO)

The primary EOs related to environmental compliance at KTF are as follows (for additional information on these EOs see Section 2.1.14):

- EO 11988, *Floodplain Management*, as amended.
- EO 11990, *Protection of Wetlands*, as amended.
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended.
- EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, as amended.
- EO 13514, *Leadership in Environmental, Energy, and Economic Performance*

DOE directives applicable to KTF can be found in Chapter 6 of this report.

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 KTF that require federal air permits or compliance with the New Source Performance Standards (NSPS), Prevention of Significant Deterioration (PSD), or 40 Code of Federal Regulations (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 KTF, or by DoD for PMRF. However, the two electrical generators at KTF are permitted for operation by the State of Hawaii under a "Noncovered Source Permit (NSP)" (Hawaii DOH 2009).

Rocket launches are mobile sources and do not require any reporting of RQ releases.

Clean Water Act (CWA)
There were no compliance issues with respect to any state or federal water pollution regulations in 2010.

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.

Oil Storage – There is one underground storage tank (UST) at KTF, which is owned by the DOE. There is also one 10,000 gallons (gal) aboveground fuel tank inside the Main Compound. Sandia cooperates with the U.S. Navy's (USN) spill control guidelines contained in the *Spill Prevention Control and Countermeasures Plan*, *Pacific Missile Range Facility* (NAVFAC 2008).

Safe Drinking Water Act (SDWA)
The SDWA does not apply directly to Sandia activities at KTF because all drinking water is supplied by the Pacific Missile Range Facility drinking water system 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 KTF site have been tested and are free of PCBs. A comprehensive asbestos survey was conducted by the SNL/NM Asbestos Management Team in July 2008. A total of 202 lbs of ACMs were identified site-wide.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
FIFRA controls the distribution and application of pesticides including herbicides, insecticides, and rodenticides. All pesticide use at KTF follows EPA requirements.

Releases and Occurrences
There were no reportable occurrences at KTF in 2010.

5.5 Environmental Program Activities

This section describes three environmental programs:

- NEPA,
- ER Project, and
- the Spill Prevention Program.

NEPA Program Activities at KTF
The DOE completed a comprehensive site-wide EA for KTF operations in 1992 (DOE 1992a), which resulted in a Finding of No Significant Impact (FONSI), issued on July 17, 1992. This EA provided NEPA documentation covering all rocket launching activities at KTF.

2010 NEPA Documentation
The SNL/NM NEPA Team completed one DOE NEPA checklist for KTF in 2010, which was transmitted to DOE/NNSA/SSO for review and determination.

ER Project Activities
There are no ER sites at KTF. The three ER sites identified in 1995 were given a Site Evaluation Accomplished (SEA) determination by EPA on September 30, 1996. This confirmed that 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 KTF.

5.6 Environmental Surveillance and Monitoring Activities

Wastewater Monitoring
SNL activities at KTF produce only sanitary sewage, which is directed into nine wastewater systems—three DOE/NNSA owned septic tanks and six French drains, four with pumping systems located in the Launch Operations Building (LOB) parking lot, the paved drive west of the office complex, the paved lot west of the garage, the drive west of the shops, and two on the parking lot east of the office complex—in accordance with Hawaii Underground Injection Control regulations (HAR Title 11, Chapter 23). The two older septic tanks for the LOB and the Missile Assembly Building (MAB) do not require permits for the State of Hawaii. However, the septic systems are periodically pumped by licensed, state-certified contractors and inspected by state officials. No state inspections were conducted during 2010. 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 KTF. As a best management practice (BMP), KTF personnel have periodically performed sampling. Historically no contaminants have been identified above the reporting limits from these past sampling events. During CY 2010, no sampling of septic tanks was conducted at KTF.

Air Emission Monitoring
Based on effluent air monitoring results of the STARS Flight Test Unit 1 (FTU-1) in February 1993 (SNL 1993) and the CDX rocket launch in the summer of 1992 (SNL 1992), it was determined that rocket launches at 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 KTF that differs in emission substance from the STARS rocket, or air emission requirements change, future monitoring may be considered.

As required by the State of Hawaii, the 2010 Monitoring Report (air emissions) was submitted to the State of Hawaii in February 2011 (SNL 2011d). The required $500 annual fee was submitted for CY 2011 as required. Sandia was in compliance with all air quality regulations in 2010.

A Semi-Annual Air Monitoring Report for the first half of 2010 was submitted to the State of Hawaii in July 2010. For the period of January 1, 2010 through June 30, 2010, the total fuel usage from activities that was reported to the State of Hawaii was 16,585 gals of diesel fuel. The highest total hours of operation for the permitted generators in a rolling 6-month period during the first half of CY 2010 was 1,760 hours. An Annual Air Monitoring Report for CY 2010 was submitted to the State of Hawaii in February 2011. For the period of January 1, 2010 through December 31, 2010, the total fuel usage from activities that was reported to the State of Hawaii was 20,900 gals of diesel fuel. The highest total hours of operation for the permitted generators in a rolling 12-month period for CY 2010 was 1,806 hours.

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 KTF. Climatic information representative of KTF is obtained from PMRF, and severe weather notifications are automatically issued by the PMRF Emergency Operations Center to all KTF resident personnel.

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.

5.7 Terrestrial Surveillance

Since sampling at KTF only occurs every five years (last conducted during July 2007), there was no sampling in 2010.

However, a summary report of the entire database for Toxic Analyte List (TAL) metals was prepared to document the current baseline concentrations at the KTF site (SNL 2008).

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6.0 TTR & KTF References

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

40 CFR 280 *Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks*

40 CFR 355 *Emergency Planning and Notification*

40 CFR 370 *Hazardous Chemical Reporting: Community Right-to-Know*

ACTS & STATUTES

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- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. §9601) (Amended by SARA)
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- Quiet Communities Act of 1978 (42 U.S.C. §4901 et seq.)
- Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C. §6901 et seq.)
- Safe Drinking Water Act (SDWA) (42 U.S.C. §300f)
- Superfund Amendments and Reauthorization Act (SARA) of 1986 (see CERCLA)
- Toxic Substances Control Act (TSCA) of 1976 (15 U.S.C. §2601 et seq)

STATE OF HAWAII ENVIRONMENTAL REGULATIONS

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

STATE OF NEVADA ENVIRONMENTAL REGULATIONS

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

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

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"	• Recyclables, 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 534.500, "Underground Water and Wells"	• Drilling, operation, and abandonment of wells

NOTES: TTR = Tonopah Test Range
*This regulation provides protection to endangered, threatened, and sensitive species.
**Two wild horse units encompass areas within the Nellis Air Force Range:
"Unit 252: That portion of Nye County and those portions of the Nellis Air Force Range as authorized by the United States Department of Defense."
"Unit 253: That portion of Nye County including those portions of the Nellis Air Force Range as authorized by the United States Department of Defense and the Nevada Test Site as authorized by the United States Department of Energy." (NAC 504.210, "General Designation of Management Areas and Units")

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7.0 Glossary

A

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

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

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

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

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

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

B

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

Best Management Practice (BMP) – The preferred methods and practices for managing operations.

C

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

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

Coliform Organism – Microorganisms found in the intestinal tract of humans and animals. Their presence in water indicates fecal pollution and potentially adverse contamination by pathogens.

D

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

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

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

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

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

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

E

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

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

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

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

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

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

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

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

F

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

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

G

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

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

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

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

H

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

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

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

I

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

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

M

Maximally Exposed Individual (MEI) – The location of a member of the public which receives or has the potential to receive the maximum radiological dose from air emissions of a National Emissions Standards for Hazardous Air Pollutants (NESHAP) radionuclide source. The dose estimates are based on realistic, yet conservative input parameters.

Mixed Waste – Radioactive waste that contains both source material, special nuclear material, or by-product material subject to the Atomic Energy Act of 1954, as amended; and a hazardous component subject to the Resource Conservation and Recovery Act (RCRA), as amended.

N

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

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

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

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

P

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

Plutonium – A radioactive metallic element chemically similar to uranium.

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

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

R

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

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

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

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

S

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

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

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

T

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

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

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

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

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

U

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

Uranium – A heavy silvery-white metallic element, radioactive and toxic, easily oxidized, and having 14 known isotopes of which U 238 is the most abundant in nature. The element occurs in several minerals, including uraninite and carnotite, from which it is extracted and processed for use in research, nuclear fuels, and nuclear weapons.

V

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

W

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

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

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APPENDIX A

2010
TTR SAMPLING LOCATION
MAPS

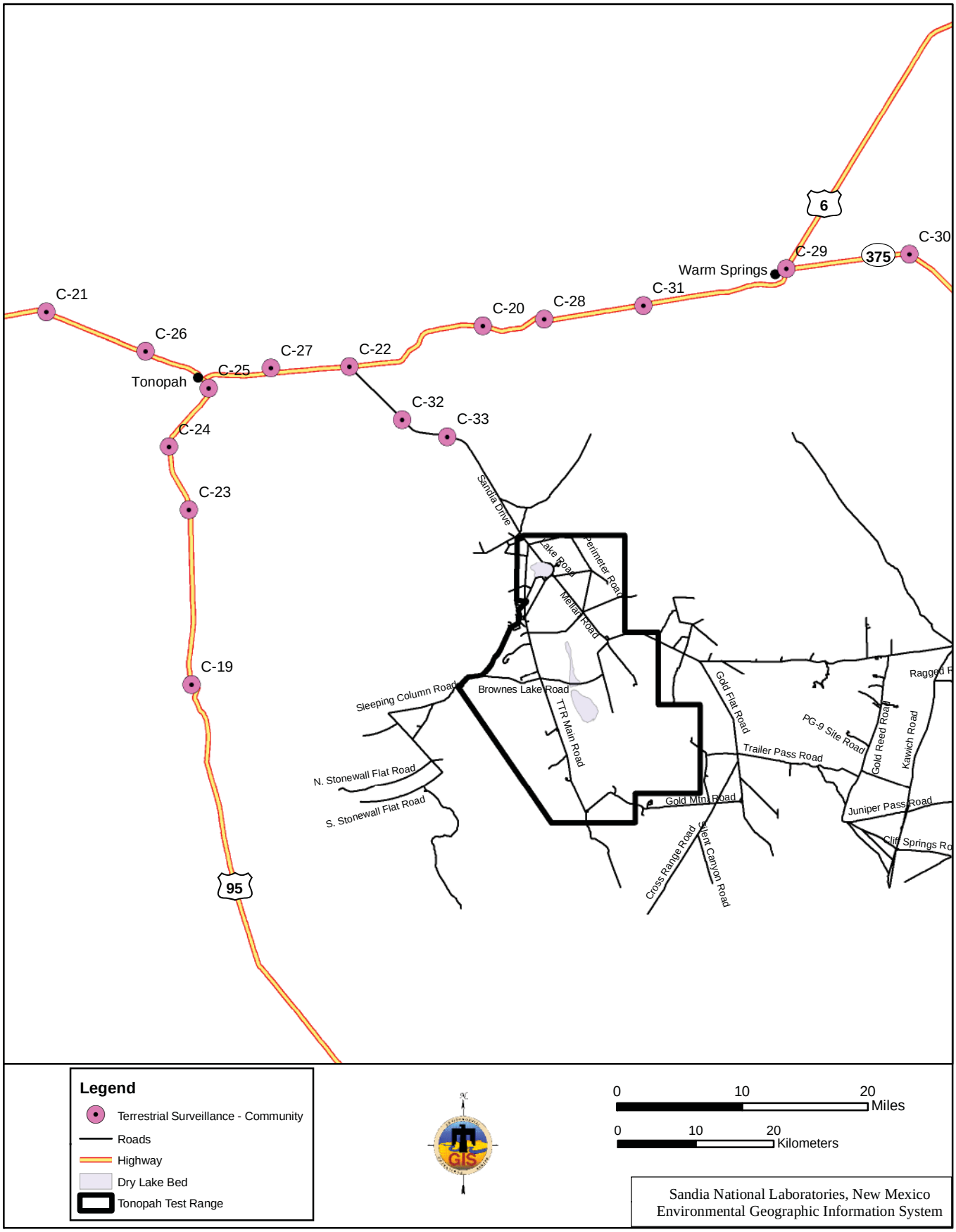

FIGURE A-1. Off-site Soil Sampling Locations

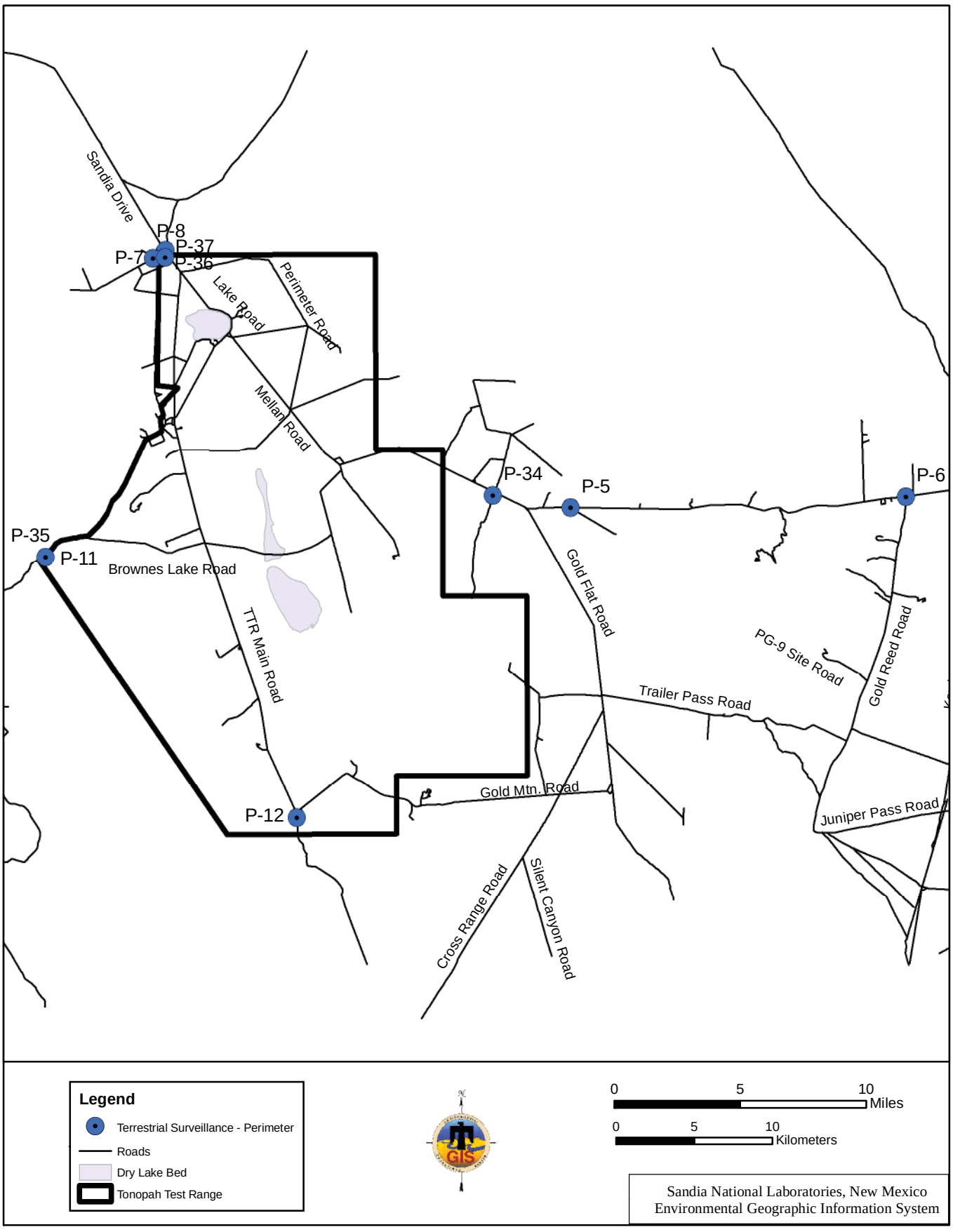

FIGURE A-2. Perimeter Soil Sampling Locations

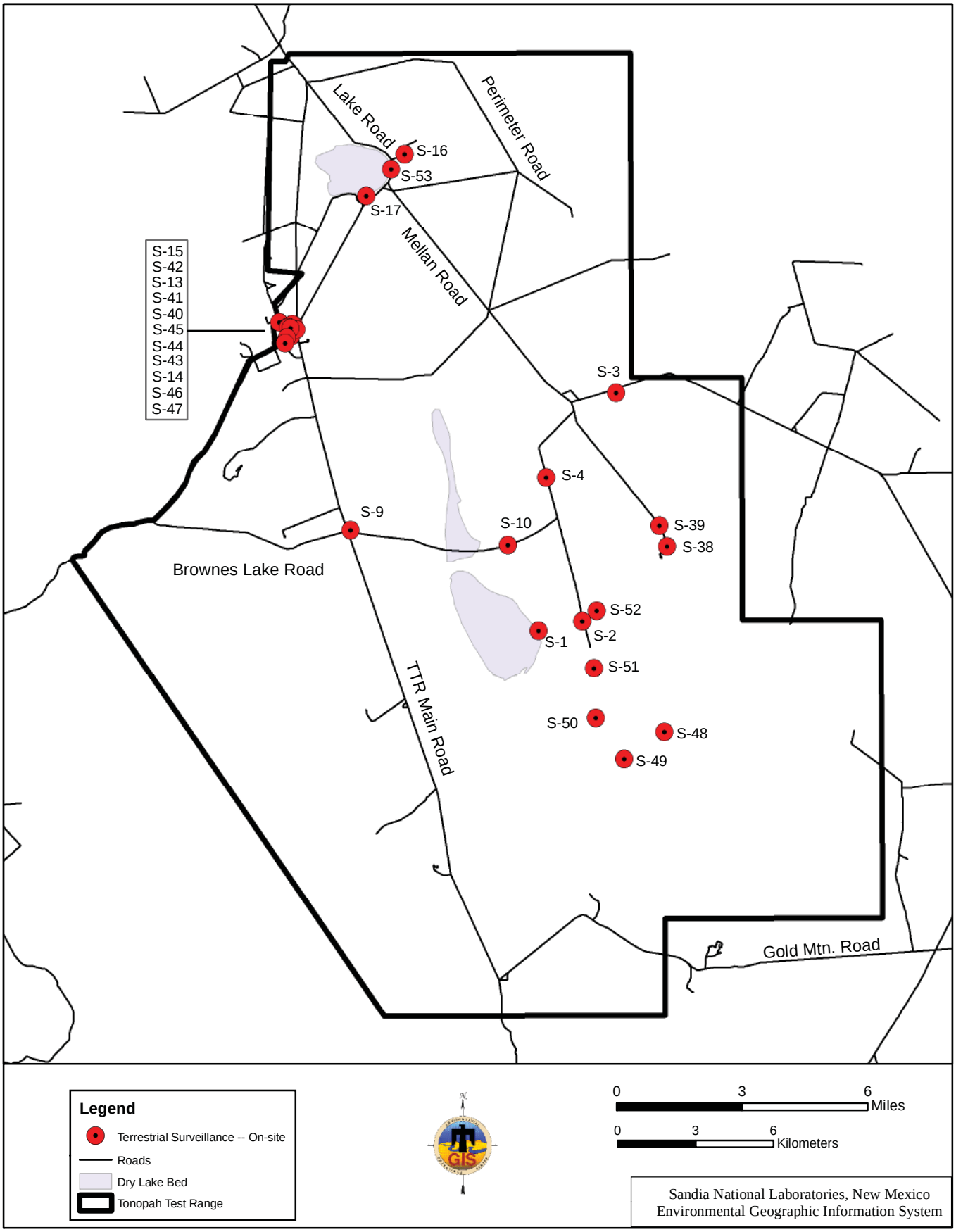

FIGURE A-3. On-Site Soil Sampling Locations

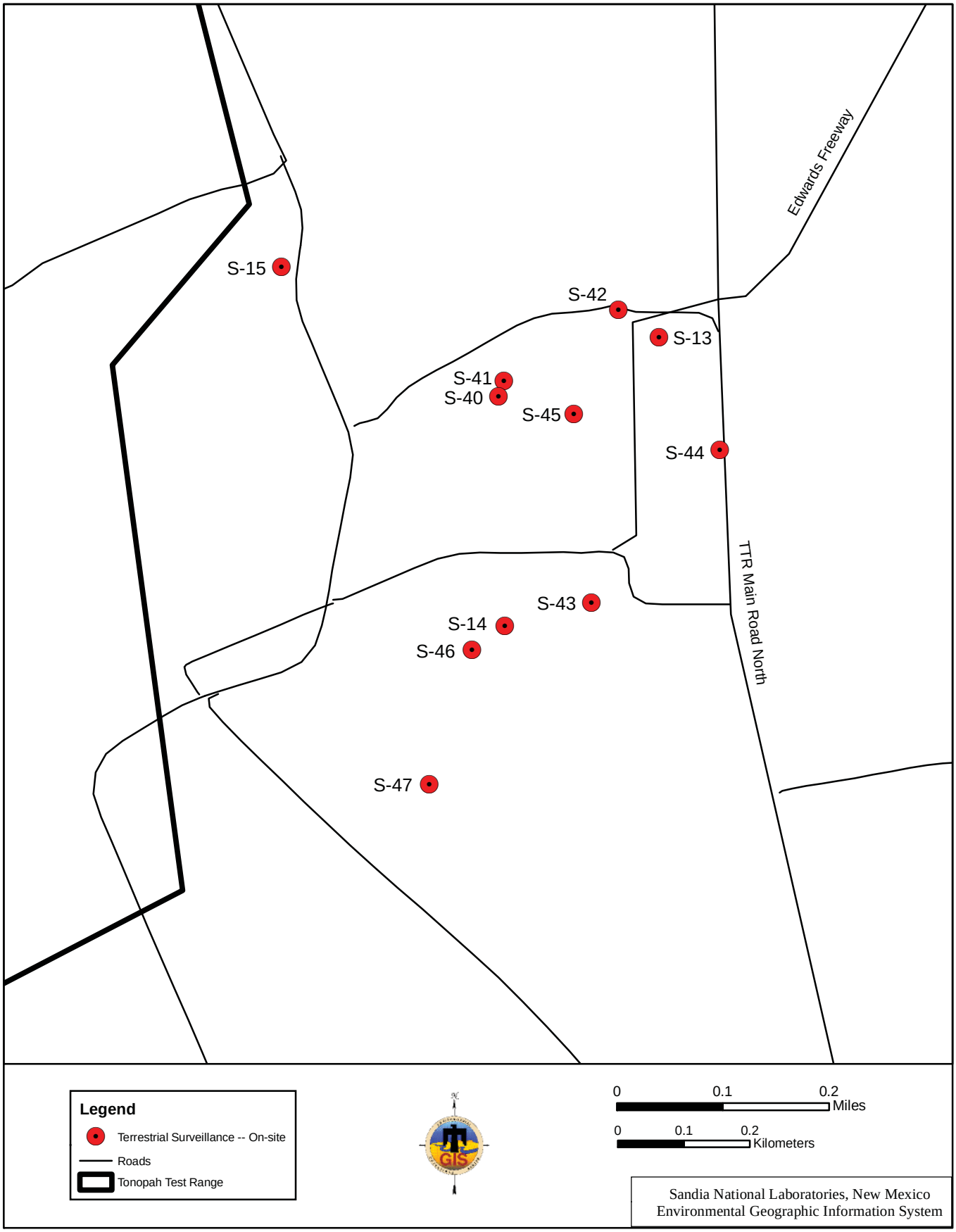

FIGURE A-4. Soil Sampling Locations in the Range Operations Center and Compound (On-Site)

APPENDIX B

2010 TTR TERRESTRIAL SURVEILLANCE RESULTS

TABLE B-1. Radiological Results for Off-Site Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
C-20	Americium-241	pCi/g	0.0193	0.0184	0.0146	0.0293	U
C-20	Cesium-137	pCi/g	0.23	0.0366	0.0119	0.0238	
C-20	Uranium-235	pCi/g	0.039	0.0645	0.053	0.106	U
C-20	Uranium-238	pCi/g	0.939	0.329	0.145	0.289	
C-21	Americium-241	pCi/g	0.00841	0.0137	0.0111	0.0222	U
C-21	Cesium-137	pCi/g	0.141	0.0257	0.00921	0.0184	
C-21	Uranium-235	pCi/g	0.0415	0.0527	0.0403	0.0805	U
C-21	Uranium-238	pCi/g	0.866	0.277	0.11	0.219	
C-22	Americium-241	pCi/g	-0.0229	0.0608	0.053	0.106	U
C-22	Cesium-137	pCi/g	0.0755	0.0219	0.0132	0.0263	
C-22	Uranium-235	pCi/g	0.0462	0.0763	0.0635	0.127	U
C-22	Uranium-238	pCi/g	0.942	0.679	0.435	0.869	
C-23	Americium-241	pCi/g	0.112	0.0547	0.046	0.113	U
C-23	Cesium-137	pCi/g	0.15	0.0189	0.00957	0.0191	
C-23	Uranium-235	pCi/g	0.00117	0.079	0.0598	0.12	U
C-23	Uranium-238	pCi/g	0.841	0.636	0.385	0.769	
C-24	Americium-241	pCi/g	0.0394	0.0766	0.0644	0.129	U
C-24	Cesium-137	pCi/g	0.317	0.0336	0.0103	0.0207	
C-24	Uranium-235	pCi/g	0.0958	0.0737	0.0578	0.115	U
C-24	Uranium-238	pCi/g	2.01	1.01	0.496	0.992	
C-25	Americium-241	pCi/g	0.0308	0.0243	0.0199	0.0397	U
C-25	Cesium-137	pCi/g	0.097	0.0234	0.0156	0.0312	
C-25	Uranium-235	pCi/g	0.101	0.107	0.0635	0.127	U
C-25	Uranium-238	pCi/g	1.72	0.591	0.196	0.392	
C-26	Americium-241	pCi/g	0.0823	0.0562	0.0502	0.1	U
C-26	Cesium-137	pCi/g	0.657	0.0605	0.0101	0.0201	
C-26	Uranium-235	pCi/g	0.0159	0.0798	0.0582	0.116	U
C-26	Uranium-238	pCi/g	1.02	0.765	0.391	0.781	
C-27	Americium-241	pCi/g	-0.00545	0.0679	0.0581	0.116	U
C-27	Cesium-137	pCi/g	0.444	0.0449	0.0097	0.0194	
C-27	Uranium-235	pCi/g	0.0188	0.0577	0.0518	0.104	U
C-27	Uranium-238	pCi/g	1.56	0.822	0.45	0.9	

TABLE B-1. Radiological Results for Off-Site Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
C-28	Americium-241	pCi/g	0.0421	0.0367	0.032	0.0639	U
C-28	Cesium-137	pCi/g	0.157	0.025	0.0117	0.0234	
C-28	Uranium-235	pCi/g	0.054	0.0721	0.0588	0.118	U
C-28	Uranium-238	pCi/g	0.708	0.53	0.287	0.575	
C-29	Americium-241	pCi/g	0.019	0.0659	0.0628	0.126	U
C-29	Cesium-137	pCi/g	0.127	0.0258	0.013	0.0259	
C-29	Uranium-235	pCi/g	0.0957	0.0989	0.0755	0.151	U
C-29	Uranium-238	pCi/g	0.984	0.747	0.584	1.17	U
C-30	Americium-241	pCi/g	0.044	0.0428	0.0374	0.0748	U
C-30	Cesium-137	pCi/g	0.148	0.0224	0.00941	0.0188	
C-30	Uranium-235	pCi/g	0.0816	0.069	0.0503	0.1	U
C-30	Uranium-238	pCi/g	0.687	0.492	0.321	0.641	
C-31	Americium-241	pCi/g	0.00538	0.0759	0.07	0.14	U
C-31	Cesium-137	pCi/g	0.167	0.0236	0.0118	0.0237	
C-31	Uranium-235	pCi/g	0.048	0.0883	0.0735	0.147	U
C-31	Uranium-238	pCi/g	0.136	0.687	0.59	1.18	U
C-32	Americium-241	pCi/g	0.0589	0.0634	0.0529	0.106	U
C-32	Cesium-137	pCi/g	0.125	0.0257	0.0135	0.027	
C-32	Uranium-235	pCi/g	0.0576	0.0846	0.0687	0.137	U
C-32	Uranium-238	pCi/g	1.03	0.773	0.441	0.881	
C-33	Americium-241	pCi/g	0.0248	0.0406	0.0383	0.0766	U
C-33	Cesium-137	pCi/g	0.0625	0.0156	0.00958	0.0191	
C-33	Uranium-235	pCi/g	0.095	0.09	0.0575	0.115	U
C-33	Uranium-238	pCi/g	0.523	0.456	0.365	0.73	U

NOTES:

MDA = minimum detectable amount
pCi/g = picocurie per gram
TTR= Tonopah Test Range
U = The analyte was analyzed for, but not detected above the MDA.

TABLE B-2. Radiological Results for Perimeter Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
P-06	Americium-241	pCi/g	0.0233	0.0174	0.0145	0.0291	U
P-06	Cesium-137	pCi/g	0.311	0.0399	0.0118	0.0235	
P-06	Uranium-238	pCi/g	1.28	0.338	0.147	0.294	
P-08	Americium-241	pCi/g	0.0252	0.0305	0.0265	0.053	U
P-08	Cesium-137	pCi/g	0.0582	0.0133	0.00916	0.0183	
P-08	Uranium-235	pCi/g	-0.00665	0.0619	0.0482	0.0964	U
P-08	Uranium-238	pCi/g	0.944	0.473	0.236	0.472	
P-11	Americium-241	pCi/g	0.0445	0.0237	0.0198	0.0445	U
P-11	Cesium-137	pCi/g	0.119	0.0275	0.0137	0.0273	
P-11	Uranium-235	pCi/g	0.0444	0.085	0.0658	0.131	U
P-11	Uranium-238	pCi/g	1.27	0.475	0.2	0.399	
P-12	Americium-241	pCi/g	0.0521	0.0566	0.0467	0.0934	U
P-12	Cesium-137	pCi/g	0.275	0.0328	0.0112	0.0224	
P-12	Uranium-235	pCi/g	0.0958	0.0943	0.0606	0.121	U
P-12	Uranium-238	pCi/g	1.33	0.723	0.401	0.802	
P-34	Americium-241	pCi/g	0.0563	0.0505	0.0431	0.0862	U
P-34	Cesium-137	pCi/g	0.374	0.0392	0.0105	0.0211	
P-34	Uranium-235	pCi/g	0.0384	0.0737	0.0575	0.115	U
P-34	Uranium-238	pCi/g	1.44	0.66	0.368	0.736	
P-35	Americium-241	pCi/g	0.0122	0.0481	0.0388	0.0776	U
P-35	Cesium-137	pCi/g	0.472	0.0459	0.00927	0.0185	
P-35	Uranium-235	pCi/g	0.0861	0.0854	0.0521	0.104	U
P-35	Uranium-238	pCi/g	1.08	0.638	0.328	0.655	
P-36	Americium-241	pCi/g	-0.00423	0.0681	0.0592	0.118	U
P-36	Cesium-137	pCi/g	0.0919	0.0182	0.0109	0.0217	
P-36	Uranium-235	pCi/g	-0.0524	0.0753	0.0623	0.125	U
P-36	Uranium-238	pCi/g	1.11	0.87	0.482	0.964	
P-37	Americium-241	pCi/g	0.0796	0.0411	0.0325	0.0796	U
P-37	Cesium-137	pCi/g	0.0123	0.013	0.00992	0.0198	U
P-37	Uranium-235	pCi/g	0.0818	0.059	0.0524	0.105	U
P-37	Uranium-238	pCi/g	0.402	0.419	0.289	0.577	U

NOTES:

MDA = minimum detectable amount

pCi/g = picocurie per gram

TTR= Tonopah Test Range

U = The analyte was analyzed for, but not detected above the MDA.

TABLE B-3. Radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-48	Americium-241	pCi/g	0.0562	0.0715	0.0666	0.133	U
S-48	Cesium-137	pCi/g	0.468	0.0469	0.0108	0.0216	
S-48	Uranium-235	pCi/g	0.0808	0.0666	0.058	0.116	U
S-48	Uranium-238	pCi/g	0.784	0.658	0.536	1.07	U
S-49	Americium-241	pCi/g	0.828	0.0915	0.0193	0.0387	
S-49	Cesium-137	pCi/g	0.415	0.0456	0.0138	0.0276	
S-49	Plutonium-238	pCi/g	0.0249	0.0132	0.00669	0.0176	
S-49	Plutonium-239/240	pCi/g	0.585	0.0872	0.00801	0.0202	
S-49	Uranium-235	pCi/g	0.118	0.11	0.0613	0.123	U
S-49	Uranium-238	pCi/g	1.3	0.446	0.2	0.4	
S-50	Americium-241	pCi/g	0.0765	0.0494	0.037	0.074	
S-50	Cesium-137	pCi/g	0.434	0.0508	0.00992	0.0198	
S-50	Plutonium-238	pCi/g	0.00543	0.00655	0.00584	0.0154	U
S-50	Plutonium-239/240	pCi/g	0.08	0.0221	0.007	0.0177	
S-50	Uranium-235	pCi/g	0.053	0.0807	0.0597	0.119	U
S-50	Uranium-238	pCi/g	1	0.619	0.336	0.671	
S-51	Americium-241	pCi/g	0.6	0.109	0.059	0.118	
S-51	Americium-241	pCi/g	1.34	0.271	0.112	0.224	
S-51	Americium-241	pCi/g	3.11	0.326	0.079	0.158	
S-51	Americium-241	pCi/g	6.51	0.635	0.0573	0.115	
S-51	Cesium-137	pCi/g	0.291	0.0351	0.0125	0.0249	
S-51	Cesium-137	pCi/g	0.359	0.0403	0.0118	0.0236	
S-51	Cesium-137	pCi/g	0.385	0.0477	0.0159	0.0318	
S-51	Cesium-137	pCi/g	0.671	0.0644	0.0126	0.0252	
S-51	Plutonium-238	pCi/g	0.0255	0.0118	0.00577	0.0152	
S-51	Plutonium-238	pCi/g	0.0283	0.0142	0.0076	0.02	
S-51	Plutonium-238	pCi/g	0.0396	0.0175	0.0081	0.0213	
S-51	Plutonium-238	pCi/g	0.0617	0.0229	0.00856	0.0225	
S-51	Plutonium-239/240	pCi/g	1.1	0.154	0.00971	0.0245	
S-51	Plutonium-239/240	pCi/g	1.24	0.166	0.0091	0.023	
S-51	Plutonium-239/240	pCi/g	1.73	0.206	0.00691	0.0175	
S-51	Plutonium-239/240	pCi/g	7.58	0.906	0.0103	0.0259	

TABLE B-3. Radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-51	Uranium-235	pCi/g	-0.0705	0.132	0.0884	0.177	U
S-51	Uranium-235	pCi/g	0.0154	0.0934	0.0674	0.135	U
S-51	Uranium-235	pCi/g	0.0752	0.0801	0.0629	0.126	U
S-51	Uranium-235	pCi/g	0.0893	0.0761	0.0593	0.118	U
S-51	Uranium-238	pCi/g	-0.177	1.27	0.838	1.68	U
S-51	Uranium-238	pCi/g	0.52	0.667	0.483	0.966	U
S-51	Uranium-238	pCi/g	1.18	0.672	0.392	0.783	
S-51	Uranium-238	pCi/g	1.45	0.975	0.58	1.16	
S-52	Americium-241	pCi/g	0.0393	0.0732	0.0633	0.127	U
S-52	Cesium-137	pCi/g	0.107	0.0187	0.0102	0.0203	
S-52	Uranium-235	pCi/g	0.0528	0.066	0.0537	0.107	U
S-52	Uranium-238	pCi/g	0.901	0.841	0.479	0.957	U

NOTES:

MDA = minimum detectable amount
pCi/g = picocurie per gram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected above the MDA.

TABLE B-4. Radiological Results for Range Operations Center On-Site Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-40	Americium-241	pCi/g	0.0129	0.0157	0.0126	0.0252	U
S-40	Cesium-137	pCi/g	0.0849	0.0214	0.0098	0.0196	
S-40	Uranium-235	pCi/g	0.0464	0.0596	0.0461	0.0921	U
S-40	Uranium-238	pCi/g	1.17	0.324	0.125	0.25	
S-41	Americium-241	pCi/g	0.119	0.0604	0.0505	0.119	U
S-41	Cesium-137	pCi/g	0.0368	0.0145	0.0102	0.0205	
S-41	Uranium-235	pCi/g	0.0737	0.0855	0.066	0.132	U
S-41	Uranium-238	pCi/g	0.999	0.693	0.427	0.853	
S-42	Americium-241	pCi/g	0.0294	0.0588	0.05	0.1	U
S-42	Cesium-137	pCi/g	0.256	0.0306	0.0114	0.0227	
S-42	Uranium-235	pCi/g	0.177	0.0902	0.0575	0.115	
S-42	Uranium-238	pCi/g	0.977	0.647	0.413	0.825	
S-43	Americium-241	pCi/g	0.112	0.0677	0.0576	0.115	U
S-43	Cesium-137	pCi/g	0.0346	0.0243	0.0162	0.0323	
S-43	Uranium-235	pCi/g	0.103	0.106	0.0934	0.187	U
S-43	Uranium-238	pCi/g	1.13	0.783	0.495	0.989	
S-44	Americium-241	pCi/g	0.066	0.0767	0.0661	0.132	U
S-44	Cesium-137	pCi/g	0.0488	0.0263	0.0171	0.0341	
S-44	Uranium-235	pCi/g	0.00961	0.0991	0.0886	0.177	U
S-44	Uranium-238	pCi/g	0.882	0.85	0.571	1.14	U
S-45	Americium-241	pCi/g	0.0669	0.0731	0.0586	0.117	U
S-45	Cesium-137	pCi/g	0.0129	0.0204	0.0182	0.0364	U
S-45	Uranium-235	pCi/g	0.00682	0.115	0.0995	0.199	U
S-45	Uranium-238	pCi/g	2.14	0.901	0.512	1.02	
S-46	Americium-241	pCi/g	0.0453	0.021	0.0175	0.0453	U
S-46	Cesium-137	pCi/g	0.0292	0.0192	0.0111	0.0221	
S-46	Uranium-235	pCi/g	0.0973	0.0772	0.0562	0.112	U
S-46	Uranium-238	pCi/g	1.2	0.346	0.179	0.357	
S-47	Americium-241	pCi/g	0.0257	0.0521	0.0507	0.101	U

TABLE B-4. Radiological Results for Range Operations Center On-Site Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-47	Cesium-137	pCi/g	0.0982	0.0255	0.0112	0.0223	
S-47	Uranium-235	pCi/g	0.0264	0.0821	0.0597	0.119	U
S-47	Uranium-238	pCi/g	0.622	0.574	0.464	0.927	U

NOTES:

MDA = minimum detectable amount
pCi/g = picocurie per gram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected above the MDA.

TABLE B-5. Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-02	Americium-241	pCi/g	0.129	0.0667	0.0545	0.13	U
S-02	Cesium-137	pCi/g	0.257	0.0328	0.0124	0.0248	
S-02	Uranium-235	pCi/g	-0.012	0.0938	0.0674	0.135	U
S-02	Uranium-238	pCi/g	0.961	0.723	0.445	0.889	
S-03	Americium-241	pCi/g	0.117	0.0438	0.0303	0.0606	
S-03	Cesium-137	pCi/g	0.372	0.042	0.00894	0.0179	
S-03	Plutonium-238	pCi/g	0.0207	0.021	0.0127	0.0334	U
S-03	Plutonium-239/240	pCi/g	1.13	0.167	0.0152	0.0384	
S-03	Uranium-235	pCi/g	0.0959	0.0828	0.0514	0.103	U
S-03	Uranium-238	pCi/g	1.38	0.525	0.279	0.558	
S-04	Americium-241	pCi/g	0.0659	0.0215	0.0177	0.0659	U
S-04	Cesium-137	pCi/g	0.273	0.0353	0.0121	0.0242	
S-04	Uranium-235	pCi/g	0.1	0.0684	0.0561	0.112	U
S-04	Uranium-238	pCi/g	0.889	0.327	0.178	0.355	
S-09	Americium-241	pCi/g	3.47	0.349	0.062	0.124	
S-09	Cesium-137	pCi/g	0.116	0.0231	0.0113	0.0226	
S-09	Plutonium-238	pCi/g	8.43	1.89	0.162	0.454	
S-09	Plutonium-239/240	pCi/g	1200	204	0.195	0.519	
S-09	Uranium-235	pCi/g	0.0947	0.0749	0.0627	0.125	U
S-09	Uranium-238	pCi/g	1.05	0.708	0.553	1.11	U
S-10	Americium-241	pCi/g	0.0257	0.0598	0.0511	0.102	U
S-10	Cesium-137	pCi/g	0.109	0.0216	0.0127	0.0253	
S-10	Uranium-235	pCi/g	0.0191	0.0788	0.0601	0.12	U
S-10	Uranium-238	pCi/g	1.49	0.711	0.413	0.825	
S-38	Americium-241	pCi/g	0.0306	0.0573	0.0506	0.101	U
S-38	Cesium-137	pCi/g	0.149	0.0238	0.0112	0.0224	
S-38	Uranium-235	pCi/g	0.0547	0.0817	0.0597	0.119	U
S-38	Uranium-238	pCi/g	0.815	0.829	0.408	0.815	U
S-39	Americium-241	pCi/g	0.33	0.0487	0.0191	0.0381	
S-39	Cesium-137	pCi/g	0.563	0.06	0.0137	0.0273	
S-39	Plutonium-238	pCi/g	0.00952	0.00989	0.00682	0.0179	U
S-39	Plutonium-239/240	pCi/g	0.973	0.131	0.00818	0.0206	

TABLE B-5. Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-39	Uranium-235	pCi/g	0.1	0.0766	0.0661	0.132	U
S-39	Uranium-238	pCi/g	1.12	0.372	0.201	0.401	
S-53	Americium-241	pCi/g	-0.137	0.103	0.0946	0.189	U
S-53	Cesium-137	pCi/g	0.208	0.0315	0.0152	0.0303	
S-53	Uranium-235	pCi/g	0.125	0.0991	0.0818	0.164	U
S-53	Uranium-238	pCi/g	0.232	0.878	0.758	1.51	U

NOTES:

MDA = minimum detectable amount
pCi/g = picocurie per gram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected above the MDA.

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
C-29	Americium-241	pCi/g	088869-001	0.019	0.0659	0.0628	0.126	U
C-29	Americium-241	pCi/g	088869-002	0.0731	0.0755	0.0635	0.127	U
C-29	Americium-241	pCi/g	088869-003	0.116	0.105	0.0857	0.171	U
	Americium-241 Average			**0.07**				
	Americium-241 StdDev			**0.05**				
	Americium-241 Min			**0.02**				
	Americium-241 Max			**0.12**				
	CV%			**70**				
C-29	Cesium-137	pCi/g	088869-001	0.127	0.0258	0.013	0.0259	
C-29	Cesium-137	pCi/g	088869-002	0.188	0.0278	0.0128	0.0255	
C-29	Cesium-137	pCi/g	088869-003	0.0526	0.0215	0.0114	0.0227	
	Cesium-137 Average			**0.12**				
	Cesium-137 StdDev			**0.07**				
	Cesium-137 Min			**0.05**				
	Cesium-137 Max			**0.19**				
	CV%			**55**				
C-29	Uranium-235	pCi/g	088869-001	0.0957	0.0989	0.0755	0.151	U
C-29	Uranium-235	pCi/g	088869-002	0.129	0.121	0.0749	0.15	U
C-29	Uranium-235	pCi/g	088869-003	0.0345	0.0987	0.0741	0.148	U
	Uranium-235 Average			**0.09**				
	Uranium-235 StdDev			**0.05**				
	Uranium-235 Min			**0.03**				
	Uranium-235 Max			**0.13**				
	CV%			**55**				
C-29	Uranium-238	pCi/g	088869-001	0.984	0.747	0.584	1.17	U
C-29	Uranium-238	pCi/g	088869-002	1.01	0.826	0.515	1.03	U
C-29	Uranium-238	pCi/g	088869-003	1.54	1.03	0.645	1.29	
	Uranium-238 Average			**1.18**				
	Uranium-238 StdDev			**0.31**				
	Uranium-238 Min			**0.98**				
	Uranium-238 Max			**1.54**				
	CV%			**27**				
P-11	Americium-241	pCi/g	088893-001	0.0445	0.0237	0.0198	0.0445	U

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
P-11	Americium-241	pCi/g	088893-002	0.052	0.0571	0.0491	0.098	U
P-11	Americium-241	pCi/g	088893-003	0.0787	0.0517	0.0444	0.0888	U
	Americium-241 Average			**0.06**				
	Americium-241 StdDev			**0.02**				
	Americium-241 Min			**0.04**				
	Americium-241 Max			**0.08**				
	CV%			**31**				
P-11	Cesium-137	pCi/g	088893-001	0.119	0.0275	0.0137	0.0273	
P-11	Cesium-137	pCi/g	088893-002	0.136	0.0188	0.00827	0.0165	
P-11	Cesium-137	pCi/g	088893-003	0.187	0.0252	0.00991	0.0198	
	Cesium-137 Average			**0.15**				
	Cesium-137 StdDev			**0.04**				
	Cesium-137 Min			**0.12**				
	Cesium-137 Max			**0.19**				
	CV%			**24**				
P-11	Uranium-235	pCi/g	088893-001	0.0444	0.085	0.0658	0.131	U
P-11	Uranium-235	pCi/g	088893-002	0.0641	0.0678	0.0514	0.103	U
	Uranium-235 Average			**0.05**				
	Uranium-235 StdDev			**0.01**				
	Uranium-235 Min			**0.04**				
	Uranium-235 Max			**0.06**				
	CV%			**26**				
P-11	Uranium-238	pCi/g	088893-001	1.27	0.475	0.2	0.399	
P-11	Uranium-238	pCi/g	088893-002	1.2	0.83	0.399	0.798	
P-11	Uranium-238	pCi/g	088893-003	1.01	0.637	0.379	0.757	
	Uranium-238 Average			**1.16**				
	Uranium-238 StdDev			**0.13**				
	Uranium-238 Min			**1.01**				
	Uranium-238 Max			**1.27**				
	CV%			**12**				
S-03	Americium-241	pCi/g	088880-001	0.117	0.0438	0.0303	0.0606	
S-03	Americium-241	pCi/g	088880-002	0.118	0.0484	0.0363	0.0726	
S-03	Americium-241	pCi/g	088880-003	0.145	0.0838	0.06	0.12	

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Americium-241 Average			**0.13**				
	Americium-241 StdDev			**0.02**				
	Americium-241 Min			**0.12**				
	Americium-241 Max			**0.15**				
	CV%			**13**				
S-03	Cesium-137	pCi/g	088880-001	0.372	0.042	0.00894	0.0179	
S-03	Cesium-137	pCi/g	088880-002	0.287	0.0386	0.00848	0.0169	
S-03	Cesium-137	pCi/g	088880-003	0.318	0.0353	0.0108	0.0215	
	Cesium-137 Average			**0.33**				
	Cesium-137 StdDev			**0.04**				
	Cesium-137 Min			**0.29**				
	Cesium-137 Max			**0.37**				
	CV%			**13**				
S-03	Plutonium-238	pCi/g	088880-R01	0.0207	0.021	0.0127	0.0334	U
S-03	Plutonium-238	pCi/g	088880-R02	0.0209	0.0227	0.0128	0.0337	U
S-03	Plutonium-238	pCi/g	088880-R03	0.0539	0.0205	0.00681	0.0179	
	Plutonium-238 Average			**0.03**				
	Plutonium-238 StdDev			**0.02**				
	Plutonium-238 Min			**0.02**				
	Plutonium-238 Max			**0.05**				
	CV%			**60**				
S-03	Plutonium-239/240	pCi/g	088880-R01	1.13	0.167	0.0152	0.0384	
S-03	Plutonium-239/240	pCi/g	088880-R02	0.875	0.141	0.0154	0.0388	
S-03	Plutonium-239/240	pCi/g	088880-R03	5.03	0.576	0.00816	0.0206	
	Plutonium-239/240 Average			**2.35**				
	Plutonium-239/240 StdDev			**2.33**				
	Plutonium-239/240 Min			**0.88**				
	Plutonium-239/240 Max			**5.03**				
	CV%			**99**				
S-03	Uranium-235	pCi/g	088880-001	0.0959	0.0828	0.0514	0.103	U
S-03	Uranium-235	pCi/g	088880-002	0.0573	0.0724	0.056	0.112	U
S-03	Uranium-235	pCi/g	088880-003	0.0632	0.0791	0.0636	0.127	U
	Uranium-235 Average			**0.07**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Uranium-235 StdDev			**0.02**				
	Uranium-235 Min			**0.06**				
	Uranium-235 Max			**0.10**				
	CV%			**29**				
S-03	Uranium-238	pCi/g	088880-001	1.38	0.525	0.279	0.558	
S-03	Uranium-238	pCi/g	088880-002	1.28	0.586	0.324	0.647	
S-03	Uranium-238	pCi/g	088880-003	1.45	0.841	0.486	0.972	
	Uranium-238 Average			**1.37**				
	Uranium-238 StdDev			**0.09**				
	Uranium-238 Min			**1.28**				
	Uranium-238 Max			**1.45**				
	CV%			**6**				
S-09	Americium-241	pCi/g	088877-001	3.47	0.349	0.062	0.124	
S-09	Americium-241	pCi/g	088877-002	2.22	0.19	0.0338	0.0675	
S-09	Americium-241	pCi/g	088877-003	2.59	0.269	0.0526	0.105	
	Americium-241 Average			**2.76**				
	Americium-241 StdDev			**0.64**				
	Americium-241 Min			**2.22**				
	Americium-241 Max			**3.47**				
	CV%			**23**				
S-09	Cesium-137	pCi/g	088877-001	0.116	0.0231	0.0113	0.0226	
S-09	Cesium-137	pCi/g	088877-002	0.125	0.0229	0.00906	0.0181	
S-09	Cesium-137	pCi/g	088877-003	0.152	0.0188	0.00774	0.0155	
	Cesium-137 Average			**0.13**				
	Cesium-137 StdDev			**0.02**				
	Cesium-137 Min			**0.12**				
	Cesium-137 Max			**0.15**				
	CV%			**14**				
S-09	Plutonium-238	pCi/g	088877-R01	8.43	1.89	0.162	0.454	
S-09	Plutonium-238	pCi/g	088877-R02	0.0701	0.0364	0.0112	0.0293	
S-09	Plutonium-238	pCi/g	088877-R03	0.298	0.136	0.0463	0.13	
	Plutonium-238 Average			**2.93**				
	Plutonium-238 StdDev			**4.76**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Plutonium-238 Min			**0.07**				
	Plutonium-238 Max			**8.43**				
	CV%			**162**				
S-09	Plutonium-239/240	pCi/g	088877-R01	1200	204	0.195	0.519	
S-09	Plutonium-239/240	pCi/g	088877-R02	6.65	0.759	0.0134	0.0338	
S-09	Plutonium-239/240	pCi/g	088877-R03	35.8	6.41	0.0555	0.148	
	Plutonium-239/240 Average			**414.15**				
	Plutonium-239/240 StdDev			**680.72**				
	Plutonium-239/240 Min			**6.65**				
	Plutonium-239/240 Max			**1200.00**				
	CV%			**164**				
S-09	Uranium-235	pCi/g	088877-001	0.0947	0.0749	0.0627	0.125	U
S-09	Uranium-235	pCi/g	088877-002	0.081	0.0822	0.0491	0.0981	U
S-09	Uranium-235	pCi/g	088877-003	0.0792	0.082	0.0505	0.101	U
	Uranium-235 Average			**0.08**				
	Uranium-235 StdDev			**0.01**				
	Uranium-235 Min			**0.08**				
	Uranium-235 Max			**0.09**				
	CV%			**10**				
S-09	Uranium-238	pCi/g	088877-001	1.05	0.708	0.553	1.11	U
S-09	Uranium-238	pCi/g	088877-002	1.34	0.569	0.269	0.538	
S-09	Uranium-238	pCi/g	088877-003	1.2	0.627	0.4	0.799	
	Uranium-238 Average			**1.20**				
	Uranium-238 StdDev			**0.15**				
	Uranium-238 Min			**1.05**				
	Uranium-238 Max			**1.34**				
	CV%			**12**				
S-48	Americium-241	pCi/g	088886-001	0.0562	0.0715	0.0666	0.133	U
S-48	Americium-241	pCi/g	088886-002	0.0324	0.0511	0.043	0.086	U
S-48	Americium-241	pCi/g	088886-003	0.125	0.0439	0.0349	0.125	U
	Americium-241 Average			**0.07**				
	Americium-241 StdDev			**0.05**				
	Americium-241 Min			**0.03**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Americium-241 Max			**0.13**				
	CV%			**68**				
S-48	Cesium-137	pCi/g	088886-001	0.468	0.0469	0.0108	0.0216	
S-48	Cesium-137	pCi/g	088886-002	0.488	0.0488	0.0103	0.0205	
S-48	Cesium-137	pCi/g	088886-003	0.432	0.0471	0.00926	0.0185	
	Cesium-137 Average			**0.46**				
	Cesium-137 StdDev			**0.03**				
	Cesium-137 Min			**0.43**				
	Cesium-137 Max			**0.49**				
	CV%			**6**				
S-48	Uranium-235	pCi/g	088886-001	0.0808	0.0666	0.058	0.116	U
S-48	Uranium-235	pCi/g	088886-002	0.0106	0.0763	0.0592	0.118	U
S-48	Uranium-235	pCi/g	088886-003	0.142	0.0741	0.0539	0.108	
	Uranium-235 Average			**0.08**				
	Uranium-235 StdDev			**0.07**				
	Uranium-235 Min			**0.01**				
	Uranium-235 Max			**0.14**				
	CV%			**85**				
S-48	Uranium-238	pCi/g	088886-001	0.784	0.658	0.536	1.07	U
S-48	Uranium-238	pCi/g	088886-002	1.12	0.604	0.368	0.735	
S-48	Uranium-238	pCi/g	088886-003	0.759	0.487	0.302	0.603	
	Uranium-238 Average			**0.89**				
	Uranium-238 StdDev			**0.20**				
	Uranium-238 Min			**0.76**				
	Uranium-238 Max			**1.12**				
	CV%			**23**				
S-51	Americium-241	pCi/g	088889-001	6.51	0.635	0.0573	0.115	
S-51	Americium-241	pCi/g	088889-002	5.85	0.58	0.0747	0.149	
S-51	Americium-241	pCi/g	088889-003	5.15	0.404	0.0366	0.0732	
S-51	Americium-241	pCi/g	088889-004	1.34	0.271	0.112	0.224	
S-51	Americium-241	pCi/g	088889-005	0.6	0.109	0.059	0.118	
S-51	Americium-241	pCi/g	088889-006	3.11	0.326	0.079	0.158	
	Americium-241 Average			**3.76**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Americium-241 StdDev			**2.45**				
	Americium-241 Min			**0.60**				
	Americium-241 Max			**6.51**				
	CV%			**65**				
S-51	Cesium-137	pCi/g	088889-001	0.291	0.0351	0.0125	0.0249	
S-51	Cesium-137	pCi/g	088889-002	0.336	0.0338	0.0107	0.0214	
S-51	Cesium-137	pCi/g	088889-003	0.524	0.0544	0.00912	0.0182	
S-51	Cesium-137	pCi/g	088889-004	0.385	0.0477	0.0159	0.0318	
S-51	Cesium-137	pCi/g	088889-005	0.671	0.0644	0.0126	0.0252	
S-51	Cesium-137	pCi/g	088889-006	0.359	0.0403	0.0118	0.0236	
	Cesium-137 Average			**0.43**				
	Cesium-137 StdDev			**0.14**				
	Cesium-137 Min			**0.29**				
	Cesium-137 Max			**0.67**				
	CV%			**33**				
S-51	Plutonium-238	pCi/g	088889-R01	0.0617	0.0229	0.00856	0.0225	
S-51	Plutonium-238	pCi/g	088889-R02	0.0113	0.0165	0.00697	0.0183	U
S-51	Plutonium-238	pCi/g	088889-R03	0.0623	0.0225	0.00609	0.016	
S-51	Plutonium-238	pCi/g	088889-R04	0.0255	0.0118	0.00577	0.0152	
S-51	Plutonium-238	pCi/g	088889-R05	0.0283	0.0142	0.0076	0.02	
S-51	Plutonium-238	pCi/g	088889-R06	0.0396	0.0175	0.0081	0.0213	
	Plutonium-238 Average			**0.04**				
	Plutonium-238 StdDev			**0.02**				
	Plutonium-238 Min			**0.01**				
	Plutonium-238 Max			**0.06**				
	CV%			**54**				
S-51	Plutonium-239/240	pCi/g	088889-R01	7.58	0.906	0.0103	0.0259	
S-51	Plutonium-239/240	pCi/g	088889-R02	1.29	0.169	0.00835	0.0211	
S-51	Plutonium-239/240	pCi/g	088889-R03	4.63	0.521	0.00729	0.0184	
S-51	Plutonium-239/240	pCi/g	088889-R04	1.73	0.206	0.00691	0.0175	
S-51	Plutonium-239/240	pCi/g	088889-R05	1.24	0.166	0.0091	0.023	
S-51	Plutonium-239/240	pCi/g	088889-R06	1.1	0.154	0.00971	0.0245	
	Plutonium-239/240 Average			**2.93**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Plutonium-239/240 StdDev			**2.64**				
	Plutonium-239/240 Min			**1.10**				
	Plutonium-239/240 Max			**7.58**				
	CV%			**90**				
S-51	Uranium-235	pCi/g	088889-001	0.0893	0.0761	0.0593	0.118	U
S-51	Uranium-235	pCi/g	088889-002	0.104	0.0902	0.0648	0.13	U
S-51	Uranium-235	pCi/g	088889-003	0.047	0.0596	0.0484	0.0968	U
S-51	Uranium-235	pCi/g	088889-004	-0.0705	0.132	0.0884	0.177	U
S-51	Uranium-235	pCi/g	088889-005	0.0154	0.0934	0.0674	0.135	U
S-51	Uranium-235	pCi/g	088889-006	0.0752	0.0801	0.0629	0.126	U
	Uranium-235 Average			**0.04**				
	Uranium-235 StdDev			**0.06**				
	Uranium-235 Min			**-0.07**				
	Uranium-235 Max			**0.10**				
	CV%			**148**				
S-51	Uranium-238	pCi/g	088889-001	1.18	0.672	0.392	0.783	
S-51	Uranium-238	pCi/g	088889-002	0.123	0.738	0.544	1.09	U
S-51	Uranium-238	pCi/g	088889-003	0.908	0.432	0.258	0.516	
S-51	Uranium-238	pCi/g	088889-004	-0.177	1.27	0.838	1.68	U
S-51	Uranium-238	pCi/g	088889-005	0.52	0.667	0.483	0.966	U
S-51	Uranium-238	pCi/g	088889-006	1.45	0.975	0.58	1.16	
	Uranium-238 Average			**0.67**				
	Uranium-238 StdDev			**0.63**				
	Uranium-238 Min			**-0.18**				
	Uranium-238 Max			**1.45**				
	CV%			**94**				

NOTES:

CV = coefficient of variation. Only meaningful if data contains non-zero values.
MDA = minimum detectable amount.
pCi/g = picocurie per gram

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	U = The analyte was analyzed for, but not detected above the MDA.							

Table B-7. TLD Measurements by Quarter and Location Class for Calendar Year 2010

Location Class	Location Number	1st Quarter (80 Days) Exposure (mR)	Error	2nd Quarter (89 Days) Exposure (mR)	Error	3rd Quarter (98 Days) Exposure (mR)	Error	4th Quarter (90 Days) Exposure (mR)	Error
On-Site	S-01	38.7	1.3	39.8	0.8	35.0	1.7	44.1	0.9
On-Site	S-02	38.5	2.1	40.1	1.2	39.9	4.8	44.1	1.5
On-Site	S-03	44.6	1.5	39.1	0.7	39.0	3.2	45.1	2.4
On-Site	S-04	46.8	3.2	36.3	1.8	36.1	1.6	46.8	1.1
On-Site	S-09	36.7	3.5	40.8	0.8	33.0	1.5	39.7	1.4
On-Site	S-10	40.2	1.0	38.4	2.4	35.3	2.8	45.4	2.0
On-Site	S-13	41.7	1.2	36.5	0.9	34.7	2.4	42.7	0.9
On-Site	S-14	37.6	1.0	39.0	1.1	33.8	2.2	40.5	0.9
On-Site	S-15	41.5	2.0	37.8	1.9	36.3	2.6	43.4	0.9
On-Site	S-16	42.8	1.2	38.2	2.4	35.8	2.2	43.3	2.1
On-Site	S-17	39.1	3.2	38.4	0.7	35.7	2.4	44.0	0.9
Perimeter	P-05	41.7	3.6	38.9	0.7	42.0	2.6	43.9	0.9
Perimeter	P-06	41.3	1.0	40.2	0.8	36.3	1.9	44.1	0.9
Perimeter	P-07	37.9	1.0	38.1	3.4	31.6	1.6	40.4	1.0
Perimeter	P-08	39.2	1.5	35.3	0.7	33.3	2.4	39.6	1.5
Perimeter	P-11	44.7	2.0	44.1	1.1	40.9	1.8	50.3	1.2
Perimeter	P-12	39.0	1.2	n/a	n/a	37.2	2.1	46.0	0.9
Community	C-19	31.3	1.0	31.4	1.4	26.6	1.6	32.5	1.0
Community	C-21	38.2	1.3	38.3	2.2	34.9	2.9	42.3	1.2
Community	C-22	38.0	1.2	36.5	0.9	37.4	2.2	40.7	1.1

NOTES:

mR = Milliroentgen (10-3 roentgen); uR = microroentgen (10-6 roentgen)

n/a = Dosimeter was not returned to dosimetry lab.

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-48	Aluminum	mg/kg	10100		14.8	49.3
S-48	Antimony	mg/kg	0.3	U	0.3	0.909
S-48	Arsenic	mg/kg	2.57		0.197	0.986
S-48	Barium	mg/kg	186		0.493	1.97
S-48	Beryllium	mg/kg	0.595		0.0986	0.493
S-48	Cadmium	mg/kg	0.427		0.0197	0.197
S-48	Calcium	mg/kg	4330		32.5	98.6
S-48	Chromium	mg/kg	6.24		0.986	2.96
S-48	Cobalt	mg/kg	3.95		0.296	0.986
S-48	Copper	mg/kg	7.5		0.325	0.986
S-48	Iron	mg/kg	9540		24.7	98.6
S-48	Lead	mg/kg	10.7		0.0986	0.394
S-48	Magnesium	mg/kg	3890		7.4	24.7
S-48	Manganese	mg/kg	394		0.986	4.93
S-48	Nickel	mg/kg	6.21		0.493	1.97
S-48	Potassium	mg/kg	4330		78.9	296
S-48	Selenium	mg/kg	0.493	U	0.493	0.986
S-48	Silver	mg/kg	0.112	J	0.0909	0.455
S-48	Sodium	mg/kg	338		78.9	247
S-48	Thallium	mg/kg	0.159	J	0.0592	0.197
S-48	Uranium	mg/kg	0.479		0.0124	0.0376
S-48	Vanadium	mg/kg	12.6		0.376	1.88
S-48	Zinc	mg/kg	38.6		1.97	9.86
S-49	Aluminum	mg/kg	10500		14	46.7
S-49	Antimony	mg/kg	1.61	U	1.61	4.87
S-49	Arsenic	mg/kg	3.11		0.187	0.935
S-49	Barium	mg/kg	220		0.467	1.87
S-49	Beryllium	mg/kg	0.644		0.0935	0.467
S-49	Cadmium	mg/kg	0.445		0.0187	0.187
S-49	Calcium	mg/kg	6680		30.8	93.5
S-49	Chromium	mg/kg	5.97		0.935	2.8
S-49	Cobalt	mg/kg	3.93		0.28	0.935
S-49	Copper	mg/kg	7.41		0.308	0.935
S-49	Iron	mg/kg	9510		23.4	93.5
S-49	Lead	mg/kg	11.4		0.0935	0.374
S-49	Magnesium	mg/kg	4600		7.01	23.4
S-49	Manganese	mg/kg	505		0.935	4.67
S-49	Nickel	mg/kg	6.33		0.467	1.87
S-49	Potassium	mg/kg	6660		74.8	280
S-49	Selenium	mg/kg	0.467	U	0.467	0.935
S-49	Silver	mg/kg	0.268	J	0.0975	0.487
S-49	Sodium	mg/kg	771		74.8	234
S-49	Thallium	mg/kg	0.146	J	0.0561	0.187
S-49	Uranium	mg/kg	0.593		0.0126	0.0383
S-49	Vanadium	mg/kg	11.7		0.383	1.92
S-49	Zinc	mg/kg	43.4		1.87	9.35
S-50	Aluminum	mg/kg	11100		14.9	49.5
S-50	Antimony	mg/kg	1.63	U	1.63	4.93
S-50	Arsenic	mg/kg	3.27		0.198	0.99

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-50	Barium	mg/kg	216		0.495	1.98
S-50	Beryllium	mg/kg	0.607		0.099	0.495
S-50	Cadmium	mg/kg	0.458		0.0198	0.198
S-50	Calcium	mg/kg	5140		32.7	99
S-50	Chromium	mg/kg	6.84		0.99	2.97
S-50	Cobalt	mg/kg	4.85		0.297	0.99
S-50	Copper	mg/kg	8.68		0.327	0.99
S-50	Iron	mg/kg	10900		24.8	99
S-50	Lead	mg/kg	21.6		0.099	0.396
S-50	Magnesium	mg/kg	4460		7.43	24.8
S-50	Manganese	mg/kg	587		0.99	4.95
S-50	Nickel	mg/kg	6.85		0.495	1.98
S-50	Potassium	mg/kg	5240		79.2	297
S-50	Selenium	mg/kg	0.495	U	0.495	0.99
S-50	Silver	mg/kg	0.14	J	0.0986	0.493
S-50	Sodium	mg/kg	745		79.2	248
S-50	Thallium	mg/kg	0.186	J	0.0594	0.198
S-50	Uranium	mg/kg	0.546		0.0122	0.0371
S-50	Vanadium	mg/kg	12.1		0.371	1.86
S-50	Zinc	mg/kg	53.7		1.98	9.9
S-51	Aluminum	mg/kg	13000		14.4	48
S-51	Aluminum	mg/kg	9110		14.6	48.5
S-51	Aluminum	mg/kg	21900		14	46.6
S-51	Aluminum	mg/kg	7400		14.6	48.8
S-51	Antimony	mg/kg	1.62	U	1.62	4.91
S-51	Antimony	mg/kg	0.307	U	0.307	0.929
S-51	Antimony	mg/kg	1.59	U	1.59	4.83
S-51	Antimony	mg/kg	0.308	U	0.308	0.933
S-51	Arsenic	mg/kg	5.08		0.192	0.96
S-51	Arsenic	mg/kg	3.6		0.194	0.971
S-51	Arsenic	mg/kg	5.56		0.187	0.933
S-51	Arsenic	mg/kg	2.64		0.195	0.977
S-51	Barium	mg/kg	221		0.466	1.87
S-51	Barium	mg/kg	202		0.48	1.92
S-51	Barium	mg/kg	161		0.488	1.95
S-51	Barium	mg/kg	174		0.485	1.94
S-51	Beryllium	mg/kg	0.547		0.0971	0.485
S-51	Beryllium	mg/kg	0.765		0.096	0.48
S-51	Beryllium	mg/kg	0.465	J	0.0977	0.488
S-51	Beryllium	mg/kg	1.27		0.0933	0.466
S-51	Cadmium	mg/kg	0.476		0.0194	0.194
S-51	Cadmium	mg/kg	0.319		0.0195	0.195
S-51	Cadmium	mg/kg	0.559		0.0192	0.192
S-51	Cadmium	mg/kg	0.745		0.0187	0.187
S-51	Calcium	mg/kg	13000		30.8	93.3
S-51	Calcium	mg/kg	5010		32	97.1
S-51	Calcium	mg/kg	11500		31.7	96
S-51	Calcium	mg/kg	4070		32.2	97.7
S-51	Chromium	mg/kg	14.8		0.933	2.8

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-51	Chromium	mg/kg	9.44		0.96	2.88
S-51	Chromium	mg/kg	6.45		0.971	2.91
S-51	Chromium	mg/kg	4.71		0.977	2.93
S-51	Cobalt	mg/kg	7.67		0.28	0.933
S-51	Cobalt	mg/kg	5.83		0.288	0.96
S-51	Cobalt	mg/kg	3.45		0.293	0.977
S-51	Cobalt	mg/kg	4.28		0.291	0.971
S-51	Copper	mg/kg	5.98		0.322	0.977
S-51	Copper	mg/kg	11.8		0.317	0.96
S-51	Copper	mg/kg	7.57		0.32	0.971
S-51	Copper	mg/kg	18.4		0.308	0.933
S-51	Iron	mg/kg	7260		24.4	97.7
S-51	Iron	mg/kg	8990		24.3	97.1
S-51	Iron	mg/kg	12800		24	96
S-51	Iron	mg/kg	19500		23.3	93.3
S-51	Lead	mg/kg	13.5		0.096	0.384
S-51	Lead	mg/kg	11		0.0977	0.391
S-51	Lead	mg/kg	15.3		0.0933	0.373
S-51	Lead	mg/kg	12.3		0.0971	0.388
S-51	Magnesium	mg/kg	3160		7.32	24.4
S-51	Magnesium	mg/kg	12400		7	23.3
S-51	Magnesium	mg/kg	7100		7.2	24
S-51	Magnesium	mg/kg	3970		7.28	24.3
S-51	Manganese	mg/kg	554		0.971	4.85
S-51	Manganese	mg/kg	747		0.933	4.66
S-51	Manganese	mg/kg	662		0.96	4.8
S-51	Manganese	mg/kg	496		0.977	4.88
S-51	Nickel	mg/kg	9.93		0.48	1.92
S-51	Nickel	mg/kg	7.15		0.485	1.94
S-51	Nickel	mg/kg	15.9		0.466	1.87
S-51	Nickel	mg/kg	4.94		0.488	1.95
S-51	Potassium	mg/kg	3110		78.1	293
S-51	Potassium	mg/kg	4120		77.7	291
S-51	Potassium	mg/kg	9390		74.6	280
S-51	Potassium	mg/kg	5920		76.8	288
S-51	Selenium	mg/kg	0.48	U	0.48	0.96
S-51	Selenium	mg/kg	0.488	U	0.488	0.977
S-51	Selenium	mg/kg	0.466	U	0.466	0.933
S-51	Selenium	mg/kg	0.485	U	0.485	0.971
S-51	Silver	mg/kg	0.216	J	0.0929	0.465
S-51	Silver	mg/kg	0.376	J	0.0982	0.491
S-51	Silver	mg/kg	0.23	J	0.0933	0.466
S-51	Silver	mg/kg	0.505		0.0965	0.483
S-51	Sodium	mg/kg	290		77.7	243
S-51	Sodium	mg/kg	231	J	78.1	244
S-51	Sodium	mg/kg	554		76.8	240
S-51	Sodium	mg/kg	707		74.6	233
S-51	Thallium	mg/kg	0.21		0.0576	0.192
S-51	Thallium	mg/kg	0.36		0.056	0.187

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-51	Thallium	mg/kg	0.153	J	0.0583	0.194
S-51	Thallium	mg/kg	0.122	J	0.0586	0.195
S-51	Uranium	mg/kg	0.572		0.0122	0.037
S-51	Uranium	mg/kg	0.596		0.0131	0.0398
S-51	Uranium	mg/kg	0.747		0.0126	0.0382
S-51	Uranium	mg/kg	0.736		0.0123	0.0373
S-51	Vanadium	mg/kg	19.1		0.382	1.91
S-51	Vanadium	mg/kg	13.8		0.373	1.87
S-51	Vanadium	mg/kg	8.46		0.37	1.85
S-51	Vanadium	mg/kg	11		0.398	1.99
S-51	Zinc	mg/kg	60		1.92	9.6
S-51	Zinc	mg/kg	36.5		1.94	9.71
S-51	Zinc	mg/kg	33.2		1.95	9.77
S-51	Zinc	mg/kg	88.3		1.87	9.33
S-52	Aluminum	mg/kg	6070		14.8	49.2
S-52	Antimony	mg/kg	0.319	U	0.319	0.967
S-52	Arsenic	mg/kg	3.82		0.197	0.984
S-52	Barium	mg/kg	88.8		0.492	1.97
S-52	Beryllium	mg/kg	0.394	J	0.0984	0.492
S-52	Cadmium	mg/kg	0.289		0.0197	0.197
S-52	Calcium	mg/kg	2030		32.5	98.4
S-52	Chromium	mg/kg	4.06		0.984	2.95
S-52	Cobalt	mg/kg	2.51		0.295	0.984
S-52	Copper	mg/kg	4.69		0.325	0.984
S-52	Iron	mg/kg	6720		24.6	98.4
S-52	Lead	mg/kg	7.08		0.0984	0.394
S-52	Magnesium	mg/kg	2280		7.38	24.6
S-52	Manganese	mg/kg	305		0.984	4.92
S-52	Nickel	mg/kg	3.75		0.492	1.97
S-52	Potassium	mg/kg	2280		78.7	295
S-52	Selenium	mg/kg	0.492	U	0.492	0.984
S-52	Silver	mg/kg	0.0967	U	0.0967	0.484
S-52	Sodium	mg/kg	145	J	78.7	246
S-52	Thallium	mg/kg	0.0963	J	0.0591	0.197
S-52	Uranium	mg/kg	0.729		0.0132	0.0399
S-52	Vanadium	mg/kg	7.53		0.399	2
S-52	Zinc	mg/kg	26.8		1.97	9.84

NOTES:

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

MDL = Method detection limit.

mg/kg = milligram per kilogram

PQL = Practical quantitation limit.

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

TABLE B-9. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-02	Aluminum	mg/kg	9730		2.93	9.77
S-02	Antimony	mg/kg	0.325	U	0.325	0.986
S-02	Arsenic	mg/kg	4.45		0.195	0.977
S-02	Barium	mg/kg	98.5		0.0977	0.391
S-02	Beryllium	mg/kg	0.539		0.0195	0.0977
S-02	Cadmium	mg/kg	0.18	J	0.0195	0.195
S-02	Calcium	mg/kg	2880		6.45	19.5
S-02	Chromium	mg/kg	4.38		0.195	0.586
S-02	Cobalt	mg/kg	2.69		0.0586	0.195
S-02	Copper	mg/kg	4.51		0.0645	0.195
S-02	Iron	mg/kg	7990		4.88	19.5
S-02	Lead	mg/kg	8.18		0.0977	0.391
S-02	Magnesium	mg/kg	2740		1.46	4.88
S-02	Manganese	mg/kg	358		9.77	48.8
S-02	Nickel	mg/kg	4.58		0.0977	0.391
S-02	Potassium	mg/kg	3490		15.6	58.6
S-02	Selenium	mg/kg	0.488	U	0.488	0.977
S-02	Silver	mg/kg	0.0986	U	0.0986	0.493
S-02	Sodium	mg/kg	140		15.6	48.8
S-02	Thallium	mg/kg	0.132	J	0.0586	0.195
S-02	Uranium	mg/kg	1.03		0.0129	0.0391
S-02	Vanadium	mg/kg	10.9		0.391	1.95
S-02	Zinc	mg/kg	29		0.391	1.95
S-03	Aluminum	mg/kg	6520		2.71	9.04
S-03	Antimony	mg/kg	0.327	U	0.327	0.992
S-03	Arsenic	mg/kg	2.98		0.181	0.904
S-03	Barium	mg/kg	84.7		0.0904	0.362
S-03	Beryllium	mg/kg	0.375		0.0196	0.098
S-03	Cadmium	mg/kg	0.208		0.0196	0.196
S-03	Calcium	mg/kg	2080		6.47	19.6
S-03	Chromium	mg/kg	4.06		0.196	0.588
S-03	Cobalt	mg/kg	2.57		0.0588	0.196
S-03	Copper	mg/kg	4.85		0.0647	0.196
S-03	Iron	mg/kg	6590		4.52	18.1
S-03	Lead	mg/kg	8.54		0.098	0.392
S-03	Magnesium	mg/kg	2540		1.47	4.9
S-03	Manganese	mg/kg	350		9.04	45.2
S-03	Nickel	mg/kg	3.8		0.098	0.392
S-03	Potassium	mg/kg	2390		14.5	54.2
S-03	Selenium	mg/kg	0.49	U	0.49	0.98
S-03	Silver	mg/kg	0.0992	U	0.0992	0.496
S-03	Sodium	mg/kg	201		14.5	45.2
S-03	Thallium	mg/kg	0.0998	J	0.0588	0.196
S-03	Uranium	mg/kg	0.771		0.0119	0.0362
S-03	Vanadium	mg/kg	10.6		0.392	1.96
S-03	Zinc	mg/kg	22.9		0.392	1.96
S-04	Aluminum	mg/kg	6240		2.97	9.9
S-04	Antimony	mg/kg	0.32	U	0.32	0.969
S-04	Arsenic	mg/kg	2.31		0.198	0.99

TABLE B-9. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-04	Barium	mg/kg	80.6		0.099	0.396
S-04	Beryllium	mg/kg	0.375		0.0195	0.0977
S-04	Cadmium	mg/kg	0.216		0.0195	0.195
S-04	Calcium	mg/kg	2550		6.45	19.5
S-04	Chromium	mg/kg	2.8		0.195	0.586
S-04	Cobalt	mg/kg	1.85		0.0586	0.195
S-04	Copper	mg/kg	4.06		0.0645	0.195
S-04	Iron	mg/kg	5770		4.95	19.8
S-04	Lead	mg/kg	6.26		0.0977	0.391
S-04	Magnesium	mg/kg	2250		1.46	4.88
S-04	Manganese	mg/kg	380		9.9	49.5
S-04	Nickel	mg/kg	2.84		0.0977	0.391
S-04	Potassium	mg/kg	2370		15.8	59.4
S-04	Selenium	mg/kg	0.488	U	0.488	0.977
S-04	Silver	mg/kg	0.111	J	0.0969	0.484
S-04	Sodium	mg/kg	155		15.8	49.5
S-04	Thallium	mg/kg	0.0865	J	0.0586	0.195
S-04	Uranium	mg/kg	0.664		0.0131	0.0396
S-04	Vanadium	mg/kg	8.07		0.391	1.95
S-04	Zinc	mg/kg	21.9		0.391	1.95
S-09	Aluminum	mg/kg	11700		14.3	47.8
S-09	Antimony	mg/kg	0.319	U	0.319	0.965
S-09	Arsenic	mg/kg	4.55		0.191	0.956
S-09	Barium	mg/kg	119		0.0956	0.382
S-09	Beryllium	mg/kg	0.548		0.0193	0.0967
S-09	Cadmium	mg/kg	0.197		0.0193	0.193
S-09	Calcium	mg/kg	5050		6.38	19.3
S-09	Chromium	mg/kg	5.82		0.193	0.58
S-09	Cobalt	mg/kg	4.88		0.058	0.193
S-09	Copper	mg/kg	6.49		0.0638	0.193
S-09	Iron	mg/kg	14800		23.9	95.6
S-09	Lead	mg/kg	11.9		0.0967	0.387
S-09	Magnesium	mg/kg	4330		1.45	4.84
S-09	Manganese	mg/kg	450		9.56	47.8
S-09	Nickel	mg/kg	5.63		0.0967	0.387
S-09	Potassium	mg/kg	3950		15.3	57.4
S-09	Selenium	mg/kg	0.484	U	0.484	0.967
S-09	Silver	mg/kg	0.0965	U	0.0965	0.483
S-09	Sodium	mg/kg	198		15.3	47.8
S-09	Thallium	mg/kg	0.168	J	0.058	0.193
S-09	Uranium	mg/kg	0.786		0.0126	0.0382
S-09	Vanadium	mg/kg	15.8		0.387	1.93
S-09	Zinc	mg/kg	34.3		0.387	1.93
S-10	Aluminum	mg/kg	7560		2.71	9.03
S-10	Antimony	mg/kg	0.307	U	0.307	0.929
S-10	Arsenic	mg/kg	3.5		0.181	0.903
S-10	Barium	mg/kg	92.1		0.0903	0.361
S-10	Beryllium	mg/kg	0.472		0.019	0.0951
S-10	Cadmium	mg/kg	0.218		0.019	0.19

TABLE B-9. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-10	Calcium	mg/kg	3810		6.27	19
S-10	Chromium	mg/kg	4.13		0.19	0.57
S-10	Cobalt	mg/kg	2.67		0.057	0.19
S-10	Copper	mg/kg	5.32		0.0627	0.19
S-10	Iron	mg/kg	7080		4.51	18.1
S-10	Lead	mg/kg	7.82		0.0951	0.38
S-10	Magnesium	mg/kg	3060		1.43	4.75
S-10	Manganese	mg/kg	404		9.03	45.1
S-10	Nickel	mg/kg	3.98		0.0951	0.38
S-10	Potassium	mg/kg	3220		14.4	54.2
S-10	Selenium	mg/kg	0.475	U	0.475	0.951
S-10	Silver	mg/kg	0.0929	U	0.0929	0.465
S-10	Sodium	mg/kg	262		14.4	45.1
S-10	Thallium	mg/kg	0.132	J	0.057	0.19
S-10	Uranium	mg/kg	0.701		0.0119	0.0361
S-10	Vanadium	mg/kg	11		0.38	1.9
S-10	Zinc	mg/kg	28		0.38	1.9
S-38	Aluminum	mg/kg	13200		14.9	49.8
S-38	Antimony	mg/kg	0.387	J	0.324	0.98
S-38	Arsenic	mg/kg	4.72		0.199	0.996
S-38	Barium	mg/kg	112		0.498	1.99
S-38	Beryllium	mg/kg	0.851		0.0996	0.498
S-38	Cadmium	mg/kg	0.383		0.0199	0.199
S-38	Calcium	mg/kg	19200		32.9	99.6
S-38	Chromium	mg/kg	8.01		0.996	2.99
S-38	Cobalt	mg/kg	3.75		0.299	0.996
S-38	Copper	mg/kg	7.9		0.329	0.996
S-38	Iron	mg/kg	11200		24.9	99.6
S-38	Lead	mg/kg	9.44		0.0996	0.398
S-38	Magnesium	mg/kg	5470		7.47	24.9
S-38	Manganese	mg/kg	228		0.996	4.98
S-38	Nickel	mg/kg	7.93		0.498	1.99
S-38	Potassium	mg/kg	4200		79.7	299
S-38	Selenium	mg/kg	0.498	U	0.498	0.996
S-38	Silver	mg/kg	0.705		0.098	0.49
S-38	Sodium	mg/kg	275		79.7	249
S-38	Thallium	mg/kg	0.233		0.0598	0.199
S-38	Uranium	mg/kg	0.661		0.0128	0.0389
S-38	Vanadium	mg/kg	11.1		0.389	1.95
S-38	Zinc	mg/kg	43.8		1.99	9.96
S-39	Aluminum	mg/kg	6470		2.84	9.45
S-39	Antimony	mg/kg	0.329	U	0.329	0.998
S-39	Arsenic	mg/kg	3.75		0.189	0.945
S-39	Barium	mg/kg	109		0.0945	0.378
S-39	Beryllium	mg/kg	0.478		0.0197	0.0984
S-39	Cadmium	mg/kg	0.304		0.0197	0.197
S-39	Calcium	mg/kg	3840		6.5	19.7
S-39	Chromium	mg/kg	4.65		0.197	0.591
S-39	Cobalt	mg/kg	3.26		0.0591	0.197

TABLE B-9. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2010

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-39	Copper	mg/kg	5.99		0.065	0.197
S-39	Iron	mg/kg	6570		4.73	18.9
S-39	Lead	mg/kg	10		0.0984	0.394
S-39	Magnesium	mg/kg	3440		1.48	4.92
S-39	Manganese	mg/kg	621		9.45	47.3
S-39	Nickel	mg/kg	4.92		0.0984	0.394
S-39	Potassium	mg/kg	2860		15.1	56.7
S-39	Selenium	mg/kg	0.492	U	0.492	0.984
S-39	Silver	mg/kg	0.105	J	0.0998	0.499
S-39	Sodium	mg/kg	254		15.1	47.3
S-39	Thallium	mg/kg	0.136	J	0.0591	0.197
S-39	Uranium	mg/kg	0.734		0.0125	0.0378
S-39	Vanadium	mg/kg	12.2		0.394	1.97
S-39	Zinc	mg/kg	29.6		0.394	1.97
S-53	Aluminum	mg/kg	4680		2.96	9.86
S-53	Antimony	mg/kg	0.32	U	0.32	0.971
S-53	Arsenic	mg/kg	3.05		0.197	0.986
S-53	Barium	mg/kg	122		0.0986	0.394
S-53	Beryllium	mg/kg	0.285		0.0196	0.0982
S-53	Cadmium	mg/kg	0.133	J	0.0196	0.196
S-53	Calcium	mg/kg	5360		6.48	19.6
S-53	Chromium	mg/kg	2.37		0.196	0.589
S-53	Cobalt	mg/kg	1.52		0.0589	0.196
S-53	Copper	mg/kg	3.6		0.0648	0.196
S-53	Iron	mg/kg	4730		4.93	19.7
S-53	Lead	mg/kg	4.92		0.0982	0.393
S-53	Magnesium	mg/kg	2110		1.47	4.91
S-53	Manganese	mg/kg	185		1.97	9.86
S-53	Nickel	mg/kg	2.31		0.0982	0.393
S-53	Potassium	mg/kg	2760		15.8	59.2
S-53	Selenium	mg/kg	0.491	U	0.491	0.982
S-53	Silver	mg/kg	0.26	J	0.0971	0.485
S-53	Sodium	mg/kg	311		15.8	49.3
S-53	Thallium	mg/kg	0.109	J	0.0589	0.196
S-53	Uranium	mg/kg	0.572		0.013	0.0394
S-53	Vanadium	mg/kg	8.37		0.393	1.96
S-53	Zinc	mg/kg	14.4		0.393	1.96

NOTES:

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

MDL = Method detection limit.

mg/kg = milligram per kilogram

PQL = Practical quantitation limit.

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

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Aluminum	088880-001	mg/kg	6520		2.71	9.04
S-03	Aluminum	088880-002	mg/kg	6760		2.78	9.28
S-03	Aluminum	088880-003	mg/kg	6410		2.8	9.33
	Aluminum Average			**6563.33**			
	Aluminum StdDev			**178.98**			
	CV%			**94.82**			
S-03	Antimony	088880-001	mg/kg	0.327	U	0.327	0.992
S-03	Antimony	088880-002	mg/kg	0.314	U	0.314	0.952
S-03	Antimony	088880-003	mg/kg	0.325	U	0.325	0.984
	Antimony Average			**0.32**			
	Antimony StdDev			**0.01**			
	CV%			**103.50**			
S-03	Arsenic	088880-001	mg/kg	2.98		0.181	0.904
S-03	Arsenic	088880-002	mg/kg	4.16		0.186	0.928
S-03	Arsenic	088880-003	mg/kg	4.37		0.187	0.933
	Arsenic Average			**3.84**			
	Arsenic StdDev			**0.75**			
	CV%			**105.05**			
S-03	Barium	088880-001	mg/kg	84.7		0.0904	0.362
S-03	Barium	088880-002	mg/kg	80.8		0.0928	0.371
S-03	Barium	088880-003	mg/kg	78		0.0933	0.373
	Barium Average			**81.17**			
	Barium StdDev			**3.37**			
	CV%			**96.53**			
S-03	Beryllium	088880-001	mg/kg	0.375		0.0196	0.098
S-03	Beryllium	088880-002	mg/kg	0.353		0.0184	0.0921
S-03	Beryllium	088880-003	mg/kg	0.362		0.0193	0.0965
	Beryllium Average			**0.36**			
	Beryllium StdDev			**0.01**			
	CV%			**102.55**			
S-03	Cadmium	088880-001	mg/kg	0.208		0.0196	0.196
S-03	Cadmium	088880-002	mg/kg	0.183	J	0.0184	0.184

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Cadmium	088880-003	mg/kg	0.211		0.0193	0.193
	Cadmium Average			**0.20**			
	Cadmium StdDev			**0.02**			
	CV%			**115.30**			
S-03	Calcium	088880-001	mg/kg	2080		6.47	19.6
S-03	Calcium	088880-002	mg/kg	1810		6.08	18.4
S-03	Calcium	088880-003	mg/kg	2120		6.37	19.3
	Calcium Average			**2003.33**			
	Calcium StdDev			**168.62**			
	CV%			**117.13**			
S-03	Chromium	088880-001	mg/kg	4.06		0.196	0.588
S-03	Chromium	088880-002	mg/kg	3.72		0.184	0.552
S-03	Chromium	088880-003	mg/kg	4.2		0.193	0.579
	Chromium Average			**3.99**			
	Chromium StdDev			**0.25**			
	CV%			**112.90**			
S-03	Cobalt	088880-001	mg/kg	2.57		0.0588	0.196
S-03	Cobalt	088880-002	mg/kg	2.39		0.0552	0.184
S-03	Cobalt	088880-003	mg/kg	2.63		0.0579	0.193
	Cobalt Average			**2.53**			
	Cobalt StdDev			**0.12**			
	CV%			**110.04**			
S-03	Copper	088880-001	mg/kg	4.85		0.0647	0.196
S-03	Copper	088880-002	mg/kg	4.49		0.0608	0.184
S-03	Copper	088880-003	mg/kg	4.98		0.0637	0.193
	Copper Average			**4.77**			
	Copper StdDev			**0.25**			
	CV%			**110.91**			
S-03	Iron	088880-001	mg/kg	6590		4.52	18.1
S-03	Iron	088880-002	mg/kg	6840		4.64	18.6
S-03	Iron	088880-003	mg/kg	6900		4.66	18.7
	Iron Average			**6776.67**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
	Iron StdDev			**164.42**			
	CV%			**100.88**			
S-03	Lead	088880-001	mg/kg	8.54		0.098	0.392
S-03	Lead	088880-002	mg/kg	7.82		0.0921	0.368
S-03	Lead	088880-003	mg/kg	8.44		0.0965	0.386
	Lead Average			**8.27**			
	Lead StdDev			**0.39**			
	CV%			**107.93**			
S-03	Magnesium	088880-001	mg/kg	2540		1.47	4.9
S-03	Magnesium	088880-002	mg/kg	2370		1.38	4.6
S-03	Magnesium	088880-003	mg/kg	2590		1.45	4.83
	Magnesium Average			**2500.00**			
	Magnesium StdDev			**115.33**			
	CV%			**109.28**			
S-03	Manganese	088880-001	mg/kg	350		9.04	45.2
S-03	Manganese	088880-002	mg/kg	360		9.28	46.4
S-03	Manganese	088880-003	mg/kg	348		9.33	46.6
	Manganese Average			**352.67**			
	Manganese StdDev			**6.43**			
	CV%			**96.67**			
S-03	Nickel	088880-001	mg/kg	3.8		0.098	0.392
S-03	Nickel	088880-002	mg/kg	3.48		0.0921	0.368
S-03	Nickel	088880-003	mg/kg	3.97		0.0965	0.386
	Nickel Average			**3.75**			
	Nickel StdDev			**0.25**			
	CV%			**114.08**			
S-03	Potassium	088880-001	mg/kg	2390		14.5	54.2
S-03	Potassium	088880-002	mg/kg	2570		14.8	55.7
S-03	Potassium	088880-003	mg/kg	2470		14.9	56
	Potassium Average			**2476.67**			
	Potassium StdDev			**90.18**			
	CV%			**96.11**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Selenium	088880-001	mg/kg	0.49	U	0.49	0.98
S-03	Selenium	088880-002	mg/kg	0.46	U	0.46	0.921
S-03	Selenium	088880-003	mg/kg	0.483	U	0.483	0.965
	Selenium Average			**0.48**			
	Selenium StdDev			**0.02**			
	CV%			**105.00**			
S-03	Silver	088880-001	mg/kg	0.0992	U	0.0992	0.496
S-03	Silver	088880-002	mg/kg	0.0952	U	0.0952	0.476
S-03	Silver	088880-003	mg/kg	0.0984	U	0.0984	0.492
	Silver Average			**0.10**			
	Silver StdDev			**0.00**			
	CV%			**103.36**			
S-03	Sodium	088880-001	mg/kg	201		14.5	45.2
S-03	Sodium	088880-002	mg/kg	205		14.8	46.4
S-03	Sodium	088880-003	mg/kg	231		14.9	46.6
	Sodium Average			**212.33**			
	Sodium StdDev			**16.29**			
	CV%			**112.68**			
S-03	Thallium	088880-001	mg/kg	0.0998	J	0.0588	0.196
S-03	Thallium	088880-002	mg/kg	0.0952	J	0.0552	0.184
S-03	Thallium	088880-003	mg/kg	0.102	J	0.0579	0.193
	Thallium Average			**0.10**			
	Thallium StdDev			**0.00**			
	CV%			**107.14**			
S-03	Uranium	088880-001	mg/kg	0.771		0.0119	0.0362
S-03	Uranium	088880-002	mg/kg	0.77		0.0122	0.0371
S-03	Uranium	088880-003	mg/kg	0.831		0.0123	0.0373
	Uranium Average			**0.79**			
	Uranium StdDev			**0.03**			
	CV%			**107.92**			
S-03	Vanadium	088880-001	mg/kg	10.6		0.392	1.96
S-03	Vanadium	088880-002	mg/kg	9.68		0.368	1.84

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Vanadium	088880-003	mg/kg	10.8		0.386	1.93
	Vanadium Average			**10.36**			
	Vanadium StdDev			**0.60**			
	CV%			**111.57**			
S-03	Zinc	088880-001	mg/kg	22.9		0.392	1.96
S-03	Zinc	088880-002	mg/kg	22.1		0.368	1.84
S-03	Zinc	088880-003	mg/kg	23.2		0.386	1.93
	Zinc Average			**22.73**			
	Zinc StdDev			**0.57**			
	CV%			**104.98**			
S-09	Aluminum	088877-001	mg/kg	11700		14.3	47.8
S-09	Aluminum	088877-002	mg/kg	10900		14.1	46.9
S-09	Aluminum	088877-003	mg/kg	10900		14.9	49.6
	Aluminum Average			**11166.67**			
	Aluminum StdDev			**461.88**			
	CV%			**100.00**			
S-09	Antimony	088877-001	mg/kg	0.319	U	0.319	0.965
S-09	Antimony	088877-002	mg/kg	0.314	U	0.314	0.952
S-09	Antimony	088877-003	mg/kg	0.319	U	0.319	0.967
	Antimony Average			**0.32**			
	Antimony StdDev			**0.00**			
	CV%			**101.59**			
S-09	Arsenic	088877-001	mg/kg	4.55		0.191	0.956
S-09	Arsenic	088877-002	mg/kg	3.63		0.188	0.938
S-09	Arsenic	088877-003	mg/kg	4.11		0.198	0.992
	Arsenic Average			**4.10**			
	Arsenic StdDev			**0.46**			
	CV%			**113.22**			
S-09	Barium	088877-001	mg/kg	119		0.0956	0.382
S-09	Barium	088877-002	mg/kg	121		0.0938	0.375
S-09	Barium	088877-003	mg/kg	118		0.0992	0.397
	Barium Average			**119.33**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
	Barium StdDev			**1.53**			
	CV%			**97.52**			
S-09	Beryllium	088877-001	mg/kg	0.548		0.0193	0.0967
S-09	Beryllium	088877-002	mg/kg	0.58		0.0198	0.099
S-09	Beryllium	088877-003	mg/kg	0.606		0.0187	0.0936
	Beryllium Average			**0.58**			
	Beryllium StdDev			**0.03**			
	CV%			**104.48**			
S-09	Cadmium	088877-001	mg/kg	0.197		0.0193	0.193
S-09	Cadmium	088877-002	mg/kg	0.198	J	0.0198	0.198
S-09	Cadmium	088877-003	mg/kg	0.237		0.0187	0.187
	Cadmium Average			**0.21**			
	Cadmium StdDev			**0.02**			
	CV%			**119.70**			
S-09	Calcium	088877-001	mg/kg	5050		6.38	19.3
S-09	Calcium	088877-002	mg/kg	8550		6.53	19.8
S-09	Calcium	088877-003	mg/kg	6000		6.18	18.7
	Calcium Average			**6533.33**			
	Calcium StdDev			**1809.93**			
	CV%			**70.18**			
S-09	Chromium	088877-001	mg/kg	5.82		0.193	0.58
S-09	Chromium	088877-002	mg/kg	5.39		0.198	0.594
S-09	Chromium	088877-003	mg/kg	6.43		0.187	0.562
	Chromium Average			**5.88**			
	Chromium StdDev			**0.52**			
	CV%			**119.29**			
S-09	Cobalt	088877-001	mg/kg	4.88		0.058	0.193
S-09	Cobalt	088877-002	mg/kg	4.98		0.0594	0.198
S-09	Cobalt	088877-003	mg/kg	5.16		0.0562	0.187
	Cobalt Average			**5.01**			
	Cobalt StdDev			**0.14**			
	CV%			**103.61**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-09	Copper	088877-001	mg/kg	6.49		0.0638	0.193
S-09	Copper	088877-002	mg/kg	6.69		0.0653	0.198
S-09	Copper	088877-003	mg/kg	7.03		0.0618	0.187
	Copper Average			**6.74**			
	Copper StdDev			**0.27**			
	CV%			**105.08**			
S-09	Iron	088877-001	mg/kg	14800		23.9	95.6
S-09	Iron	088877-002	mg/kg	13000		23.5	93.8
S-09	Iron	088877-003	mg/kg	13600		24.8	99.2
	Iron Average			**13800.00**			
	Iron StdDev			**916.52**			
	CV%			**104.62**			
S-09	Lead	088877-001	mg/kg	11.9		0.0967	0.387
S-09	Lead	088877-002	mg/kg	12.6		0.099	0.396
S-09	Lead	088877-003	mg/kg	11		0.0936	0.375
	Lead Average			**11.83**			
	Lead StdDev			**0.80**			
	CV%			**87.30**			
S-09	Magnesium	088877-001	mg/kg	4330		1.45	4.84
S-09	Magnesium	088877-002	mg/kg	4400		1.49	4.95
S-09	Magnesium	088877-003	mg/kg	4660		1.4	4.68
	Magnesium Average			**4463.33**			
	Magnesium StdDev			**173.88**			
	CV%			**105.91**			
S-09	Manganese	088877-001	mg/kg	450		9.56	47.8
S-09	Manganese	088877-002	mg/kg	616		9.38	46.9
S-09	Manganese	088877-003	mg/kg	594		9.92	49.6
	Manganese Average			**553.33**			
	Manganese StdDev			**90.16**			
	CV%			**96.43**			
S-09	Nickel	088877-001	mg/kg	5.63		0.0967	0.387
S-09	Nickel	088877-002	mg/kg	5.63		0.099	0.396

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-09	Nickel	088877-003	mg/kg	6.07		0.0936	0.375
	Nickel Average			**5.78**			
	Nickel StdDev			**0.25**			
	CV%			**107.82**			
S-09	Potassium	088877-001	mg/kg	3950		15.3	57.4
S-09	Potassium	088877-002	mg/kg	3470		15	56.3
S-09	Potassium	088877-003	mg/kg	3370		15.9	59.5
	Potassium Average			**3596.67**			
	Potassium StdDev			**310.05**			
	CV%			**97.12**			
S-09	Selenium	088877-001	mg/kg	0.484	U	0.484	0.967
S-09	Selenium	088877-002	mg/kg	0.495	U	0.495	0.99
S-09	Selenium	088877-003	mg/kg	0.468	U	0.468	0.936
	Selenium Average			**0.48**			
	Selenium StdDev			**0.01**			
	CV%			**94.55**			
S-09	Silver	088877-001	mg/kg	0.0965	U	0.0965	0.483
S-09	Silver	088877-002	mg/kg	0.198	J	0.0952	0.476
S-09	Silver	088877-003	mg/kg	0.241	J	0.0967	0.484
	Silver Average			**0.18**			
	Silver StdDev			**0.07**			
	CV%			**121.72**			
S-09	Sodium	088877-001	mg/kg	198		15.3	47.8
S-09	Sodium	088877-002	mg/kg	194		15	46.9
S-09	Sodium	088877-003	mg/kg	173		15.9	49.6
	Sodium Average			**188.33**			
	Sodium StdDev			**13.43**			
	CV%			**89.18**			
S-09	Thallium	088877-001	mg/kg	0.168	J	0.058	0.193
S-09	Thallium	088877-002	mg/kg	0.157	J	0.0594	0.198
S-09	Thallium	088877-003	mg/kg	0.229		0.0562	0.187
	Thallium Average			**0.18**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2010

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
	Thallium StdDev			**0.04**			
	CV%			**145.86**			
S-09	Uranium	088877-001	mg/kg	0.786		0.0126	0.0382
S-09	Uranium	088877-002	mg/kg	0.805		0.0124	0.0375
S-09	Uranium	088877-003	mg/kg	0.675		0.0131	0.0397
	Uranium Average			**0.76**			
	Uranium StdDev			**0.07**			
	CV%			**83.85**			
S-09	Vanadium	088877-001	mg/kg	15.8		0.387	1.93
S-09	Vanadium	088877-002	mg/kg	16.8		0.396	1.98
S-09	Vanadium	088877-003	mg/kg	16.9		0.375	1.87
	Vanadium Average			**16.50**			
	Vanadium StdDev			**0.61**			
	CV%			**100.60**			
S-09	Zinc	088877-001	mg/kg	34.3		0.387	1.93
S-09	Zinc	088877-002	mg/kg	36.8		0.396	1.98
S-09	Zinc	088877-003	mg/kg	39.5		0.375	1.87
	Zinc Average			**36.87**			
	Zinc StdDev			**2.60**			
	CV%			**107.34**			

NOTES:

CV = coefficient of variation
J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.
MDL = Method detection limit.
mg/kg = milligram per kilogram
PQL = Practical quantitation limit.
Std Dev = standard deviation
U = The analyte was analyzed for, but not detected. For organic and inorganic analytes the result is less than the effective MDL concentration.