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2011 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

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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Calendar Year 2011
Annual Site Environmental Report for
Tonopah Test Range, Nevada & Kauai Test Facility, Hawaii

PRODUCED BY:
Sandia National Laboratories
P.O. Box 5800
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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) 2011. 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 231.1B, *Environment, Safety, and Health Reporting* (DOE 2011a).

Calendar Year 2011 Annual Site Environmental Report
Sandia National Laboratories, Tonopah Test Range, Nevada &
Kauai Test Facility, Hawaii
Final Approval date: August 2012

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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
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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	ACM	Asbestos-Containing Material
	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
	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
	COMSEC	communications security
	CRD	Contractor Requirements Document
	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.
	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	FAA	Federal Aviation Administration
	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
	FTU-1	Flight Test Unit 1

G	GOES	Geostationary Operational Environmental Satellite
	GPS	Global Positioning System
H	HAPS	hazardous air pollutants
	HAR	Hawaii Administrative Rules
	HQ	Headquarters
I	ISMS	Integrated Safety Management System
	ISO	International Organization for Standardization
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
	MBAS	methylene blue active substances
	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
	MOA	Memorandum of Agreement
	MSDS	Material Safety Data Sheet
	MST	Missile Service Tower
N	NAAQS	National Ambient Air Quality Standards
	NAC	Nevada Administrative Code
	NAEG	Nevada Applied Ecology Group
	NAFB	U.S. Nellis Air Force Base (Range Complex)
	NDEP	Nevada Division of Environmental Protection
	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
	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 of Hydrogen

	PIC	pressured ion chamber
	PMRF	Pacific Missile Range Facility
	PMS	portable monitoring station
	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
	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
	SNL	Sandia National Laboratories
	SNL/NM	Sandia National Laboratories, New Mexico
	SNL/TTR	Sandia National Laboratories, Tonopah Test Range
	SPCC	Spill Prevention, Control, and Countermeasures
	SSL	Soil Screening Level
	SSO	Sandia Site Office
	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
	TRU	Transuranic waste
	TSCA	Toxic Substances Control Act
	TSD	treatment, storage, and disposal
	TSS	total suspended solids
	TTR	Tonopah Test Range
U	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

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

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 231.1B, *Environment, Safety, and Health Reporting* (DOE 2011a),
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001),
- DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2011c), and
- DOE Manual 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003).

This ASER summarizes data from environmental protection and monitoring programs at TTR and KTF for Calendar Year (CY) 2011. It also covers Sandia's compliance with environmental statutes, regulations, 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 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 in 2011.

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 2011 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.

The Nevada Division of Environmental Protection (NDEP) conducted an audit of TTR's Hazardous Waste Management activities in 2011 and had only positive comments with no findings or recommendations.

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. ER activities in 2011 were very limited with no field activities conducted.

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 2011, soil samples were collected from 15 off-site, 10 perimeter, and 27 on-site locations.

In 2011, 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 is consistent with the "hot particle" theory suggested in the 2009 ASER. The 2009 higher than normal plutonium-239/240 result returned to "historical" levels in 2010 and 2011, which confirms the "hot particle" theory suggested in 2009. Plutonium 239/240 exhibited an anomalous spike at location S-09 in 2010 near the "Roller Coaster Decon" area. Accordingly, in 2011, a transect was sampled at 100, 200 and 300 yards upwind and downwind, respectively, of location S-09. These samples demonstrated that there is no significant migration from location S-09.

Non-radiological monitoring of toxic analyte list (TAL) metals for soil samples was conducted at 13 on-site sentinel locations, which identified only one anomalous condition. The only TAL metal that exhibited a Priority-2 condition (higher than off-site) was location S-09 for cobalt. Cobalt is not a potential contaminant of concern at TTR and is assumed to represent natural background at this location. 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 2011.

The public water system (PWS) at TTR is permitted by the 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 System. The well water is routinely sampled and analyzed per the requirements of the NDEP to demonstrate conformance with primary drinking water standards.

A Sanitary Survey of the TTR PWS was conducted in 2011 by NDEP. Most comments were favorable, and there were no findings identified during the survey; however, during the inspection of the Well 6 pump house, the inspector made a comment that the Construction Pond located approximately 120 feet to the north of the Well 6 pump house seemed too close and might be considered a source of potential contamination. Nevada Administrative Code (NAC) 445A.66865 Water Wells Location, Section 2(b) states: "Except as otherwise justified by an engineer and approved by the health authority, no water well may be located: Within 150 feet of a wastewater force main, wastewater lift station, septic tank or absorption field, or any other source of pollution or contamination." The pond was removed in February 2012.

In 2011, all well sample results were below the maximum contaminant levels (MCL) established for the substances monitored. However, the "trigger" level of 0.5 parts per billion (ppb) for ethylbenzene and total xylene were exceeded in 2011. The exceedance of the "trigger" level for these substances means that additional quarterly samples are required in order to demonstrate that the sample results are reliably and consistently below the MCL. Although the sample results exceeded the "trigger" level, they were below the enforceable MCL and the non-enforceable Maximum Contaminant Level Goals (MCLG) for these substances.

TTR has a NDEP permitted treatment system for arsenic removal (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 of hydrogen [pH] adjustment) system in June of 2008. All samples collected during the year were from 1 ppb to 2 ppb for arsenic, the MCL regulatory limit is set at 10 ppb.

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 millirems 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.

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 four DOE NEPA checklists for TTR that were transmitted to the DOE/NNSA/SSO for review and determination in 2011.

The DOE/NNSA has begun preparing a new Site-Wide Environmental Impact Statement (SWEIS) for the continued operation of activities at the Nevada National Security Site (NNSS) and certain off-site locations (e.g., the Nevada Test and Training Range [NTTR]). During CY 2011, DOE personnel held public meetings and reviews of the SWEIS for TTR. Personnel from the DOE/NNSA/SSO, TTR, and the SNL/NM NEPA Team supported ongoing NNSS SWEIS data calls for TTR.

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 was one reportable occurrence at KTF in 2011 which was an EPA Warning Letter for an unlabeled drum.

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
- Waste Management.

NEPA

At KTF, NEPA compliance is coordinated between personnel from KTF, SNL/NM, and the DOE/NNSA/SSO. The SNL/NM NEPA Team completed one DOE NEPA checklist for KTF that was transmitted to the DOE/NNSA/SSO for review and determination in 2011.

In CY 2011, personnel from Sandia began working on the Environmental Baseline Survey for divestiture of the Mount Haleakala, Hawaii facility. Sandia staff is assisting the DOE to return the facility located on the peak of Mount Haleakala on the island of Maui back to the Federal Aviation Administration (FAA). The facility has been a Sandia National Laboratories facility since 1962 for telemetry operations to provide high-altitude tracking for tests conducted from KTF.

Water Quality Monitoring

In 2011, 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 2011. 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 2011. The State of Hawaii requires an Annual and Semi-Annual Monitoring Report for air emissions. The Semi-Annual report for the first half of CY 2011 was submitted to the State of Hawaii in July 2011. The CY 2011 Annual Monitoring Report for air emissions was submitted to the State of Hawaii in February 2012.

For the period of January 1, 2011 through June 30, 2011, the total fuel usage from activities that was reported to the State of Hawaii was 17,397 gallons (gal) 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 2011 was 2,308 hours. For the period of January 1, 2011 through December 31, 2011, the total fuel usage from activities that was reported to the State of Hawaii was 21,238 gal of diesel fuel. The highest total hours of operation for the permitted generators in a rolling 12-month period for CY 2011 was 2,610 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 2011.

Waste Management

Sandia generates some hazardous waste through normal operations at KTF and is classified as a "small quantity generator," There was one reportable occurrence at KTF in 2011 which was an EPA Warning Letter for an unlabeled drum.

Photo of Mormom Tea at Antelope Peak

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Chapter 1 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). TTR is owned by DOE/NNSA and overseen by the DOE/NNSA, Sandia Site Office (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 231.1B, *Environment, Safety, and Health Reporting* (DOE 2011a),
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001),
- DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2011c), and
- DOE Manual 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003).

This ASER summarizes data from environmental protection and monitoring programs at TTR during Calendar Year (CY) 2011. 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 231.1B, *Environment, Safety, and Health Reporting*, 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 231.1B. 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, U.S. Department of Defense (DoD) test units. Sandia National Laboratories, Tonopah Test Range (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.

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).

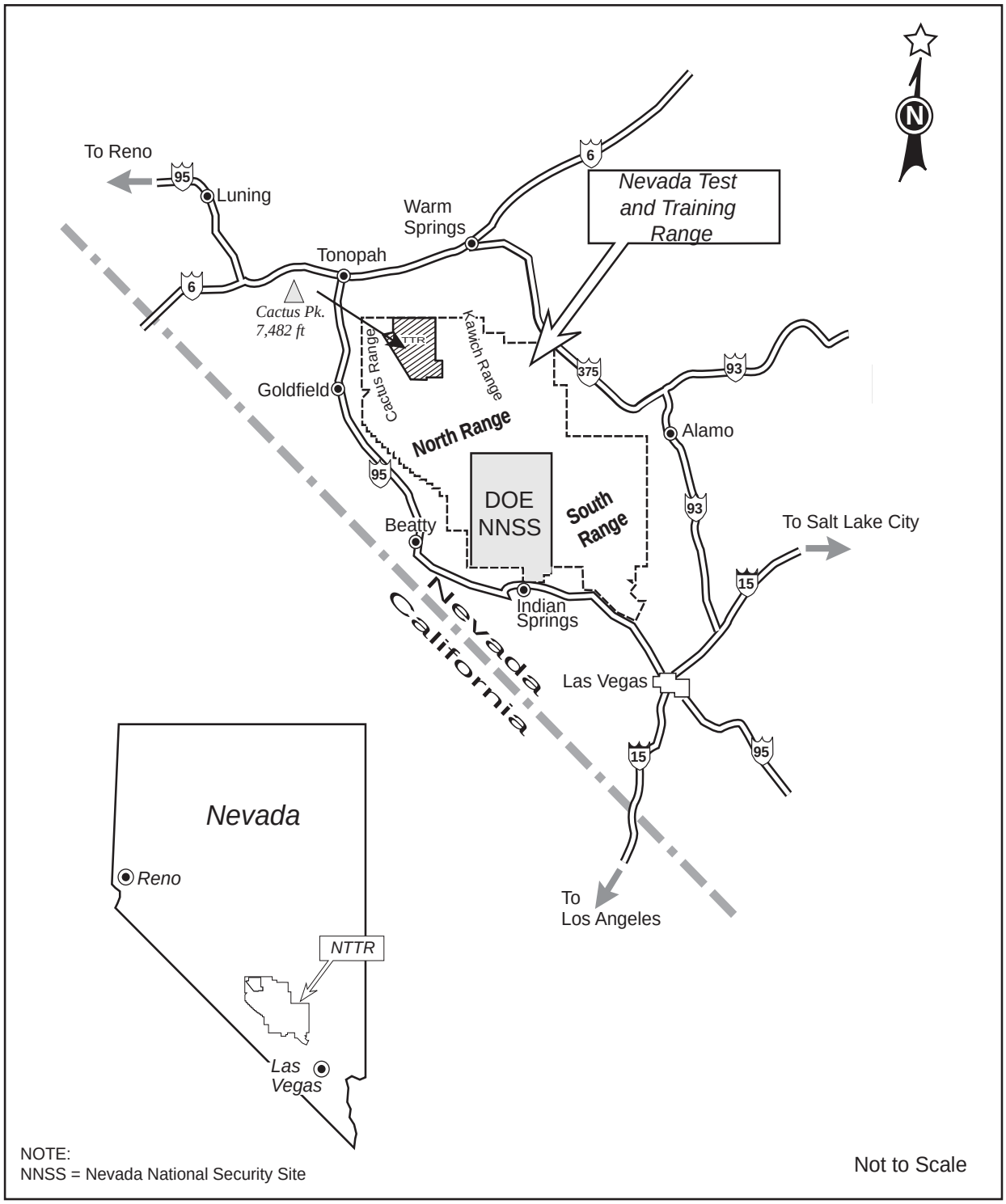

FIGURE 1-1. Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada.

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

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 in 2000. 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 remnant 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. The static water level at the main water supply well for Area 3 (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 (°C) 104 degrees Fahrenheit (°F) in summer, with lows approaching -30 °C (-22 °F) in winter. July and August are the hottest months with highs generally between 32 °C to 37 °C (90s °F) during the day and dropping to between 10 °C and 15 °C (50s °F) at night. January conditions vary from highs of 5 °C to 10 °C (40s °F) to lows -7 °C to -11 °C (teens °F). An eight year climatology developed from data taken in the 1960s identified the record high of 38.8 °C (102 °F) with a record low of -31 °C (24 °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

Ecologically, TTR is part of the Central Basin and Range Level III ecoregion as classified by the U. S. Environmental Protection Agency (EPA). TTR contains four further discrete, Level IV, ecoregions within its boundaries. Vegetation and each of the Level IV ecoregions on TTR are described below.

- The Lahontan and Tonopah Playas ecoregion occurs at the lowest elevations of TTR. Little to no vegetation grows in this highly alkaline playa ecoregion. At TTR four-wing saltbush (*Atriplex canescens*) grows along the playa edges.
- The surrounding low lying non-playa areas that compose the majority of TTR lands are part of the Tonopah Basin ecoregion. This ecoregion on TTR is dominated by shrubs such as winterfat (*Krascheninnikovia lanata*), shadscale (*Atriplex confertifolia*), spiny hopsage (*Grayia spinosa)* and budsage (*Artemisia spinescens*) as well as lesser quantities of longspine horsebrush,

four-wing saltbush, sagebrush (*Artemesia tridentata*) littleleaf horsebrush (*Tetradymia glabrata*), and snakeweed (*Gutierrezia sarothrae*) shrubs. Indian ricegrass (*Achnatherum hymenoides*) and galleta (*Pleuraphis jamesii*) are common grasses found throughout this ecoregion on TTR.

- The Tonopah Sagebrush Foothills ecoregion occurs in the higher elevation mountains on the west side of TTR. Dwarf sagebrush (*Artemisia arbuscula*) is the dominant plant species at the higher elevations of this ecoregion on TTR. Nevada jointfir (*Ephedra nevadensis*) grows along the drainages at all elevations and is a more dominant shrub at lower elevations of this ecoregions on TTR, along with spiny greasebush (*Glossopetalon spinescens*), spiny hopsage, and budsage shrubs. Joshua tree (*Yucca brevifolia*) and juniper (*Juniperus species*) grow in the transition zone at the base of the mountains.

Wildlife

Wild horses are protected in Nevada and their populations are monitored and managed. Though wild horses compete with livestock and wildlife for limited forage, their presence is tolerated because they are associated with regional national heritage. 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 2011).

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).

Horned larks (*Eremophilia alpestris*) are prevalent throughout the Tonopah Basin ecoregion on TTR. Other common breeding bird species in this ecoregion include yellow warbler (*Dendroica petechia*), brewer's sparrow (*Spizella breweri*), and black-throated sparrow (*Amphispiza bilineata*). Birds commonly found in association with water sources at TTR in this ecoregion include Bullock's oriole (*Icterus bullockii*), common yellowthroat (*Geothlypis trichas*), and mourning dove (*enaida macroura*), Wilson's warbler (*Cardellina pusilla*). The common raven (*Corvus corax*) is a common year-round resident.

Chukar (*Alectoris chukar*), rock wren (*Salpinctes obsoletus*), and Northern mockingbird (*Mimus polyglottos)* are bird species found in association with the higher elevation Tonopah Sagebrush Foothills ecoregion.

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 effects 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.

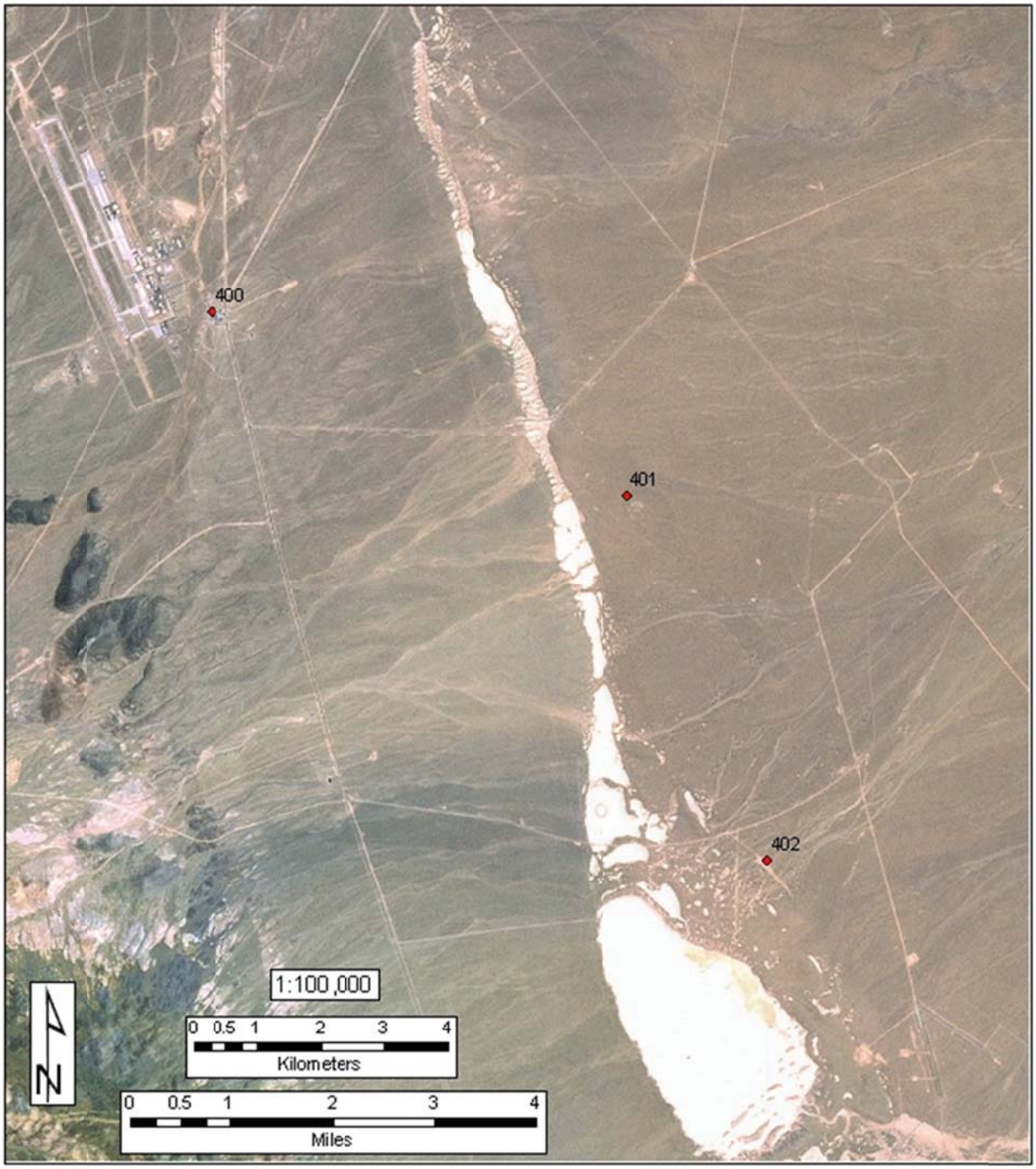

FIGURE 1-2. Soils project monitoring stations at Tonopah Test Range are located at the Range Operations Center (Station 400), Clean Slate 1 (Station 402), and Clean Slate 3 (Station 401).

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.

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 2011, at the request of DOE/NNSA/NSO, the DRI maintained two portable environmental monitoring stations (both installed in 2008) and installed a third station 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 any of the Soil Sub-Project Corrective Action Units (CAU) associated with Operation Roller Coaster on 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 (suspended)
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: NTTR = Nevada Test and Training Range
TTR = Tonopah Test Range
Source: *Sampling and Analysis Plan for Clean Slate 1*, September 1996 (IT 1996)

One station is located in the general vicinity of the Range Operations Center (ROC), the second station is located on the north edge of Clean Slate 3, and the newest station is located on the north edge of Clean Slate 1. 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. The station at Clean Slate 1 is located on the north perimeter of the soil CAU. Both stations at Clean Slate 3 and Clean Slate 1 measure 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 Climate Center (WRCC) for management and incorporation into a TTR-specific database. The stations at ROC and Clean Slate 3 have been in continuous operations since July 2008; the station installed at Clean Slate 1 became operational in August 2011.

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, which manages TTR for the DOE/NNSA. In addition, Station 400 was located where line power was available to operate the instruments. The second and third stations, Station 401 (Solar Powered Air Samplers) and Station 402 (Meteorological Towers), consist of two components: 1) the air sampler, and 2) the auxiliary meteorological tower. Station 401 is located along the fenced perimeter of the north end of Clean Slate 3. Station 402 is located along the fenced perimeter of the north end of Clean Slate 1. Their locations were initially 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; however, on-site wind direction measurements have since confirmed their locations. 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.

All three stations are equipped with continuous low volume air samplers (flow rate of approximately 0.05663 cubic meters 2 cubic feet 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 14 ft trailer. The station is located approximately 91.44 meters (m) [100 yards (yd)] south-southwest of the ROC. The station configuration as currently deployed is shown in Figure 1-3. 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 are 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, as well as performing data quality checks on the WRCC database. 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

FIGURE 1-3. Station 400 is located near the Tonopah Test Range Operations Center.

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 29, 2010 and December 28, 2011, 26 air particulate filter samples were collected and analyzed by gamma spectroscopy and for gross alpha/beta activity. Except for the two samples collected on March 9 and March 23, only naturally occurring radionuclides were identified and measured on these samples; beryllium-7 and lead-210 have been the most commonly identified natural radionuclides. The samples collected on March 9 and March 23 showed the detection of cesium-134 and cesium-137 as well as elevated gross beta results. Their presence is a direct result of the release of airborne radionuclides during the Fukushima Nuclear Power plant accident in Japan. Similar results were found in off-site samples from the DRI CEMP. No other anthropogenic gamma emitting radionuclides such as cobalt-60 or americium-241 have been detected. The mean annual gross alpha activity from all samples (Table 1-2) was 2.57×10^{-15} microcuries per milliliter (µCi/mL), with a maximum of 6.04×10^{-15} µCi/mL, a minimum of 0.51×10^{-15} µCi/mL, and a standard deviation of 1.26×10^{-15} µCi/mL. The mean annual gross beta activity from all samples (Table 1-3) was 2.18×10^{-14} µCi/mL, with a maximum of 4.40×10^{-14} µCi/mL, a minimum of 0.60×10^{-14} µCi/mL, and a standard deviation of 0.96×10^{-14} µCi/mL.

TABLE 1-2. Gross Alpha Results for TTR Sampling Stations in 2011

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	2.57	1.26	0.51	6.04
401	26	1.74	0.86	0.70	3.72
402	9	2.65	0.98	1.30	4.15

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

TABLE 1-3. Gross Beta Results for TTR Sampling Stations in 2011

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	2.18	0.98	0.60	4.40
401	26	0.94	0.35	0.50	1.83
402	9	1.44	0.27	1.06	1.82

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

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. The station is located on the north end of Clean Slate 3. Sensors include an anemometer, a temperature/relative humidity probe, PIC, and a DustTrak™. Data from these sensors are collected and stored on a Campbell Scientific™ data logger and are then transmitted through a 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, as well as performing data quality checks on the WRCC database. 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 capabilities allow the air sampler to maintain a near constant flow rate. An internal totalizer is used to collect and store airflow data. A saltation sensor was installed at Station 401 in August 2001. This instrument will measure sand and particle movement by aeolian transport close to the ground surface. Saltation is a wind-driven process and is an important mechanism for transport of soil material in desert environments. DRI will monitor for frequency of saltation events as a function of wind speed and wind direction at Station 401. 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. The configurations of the solar powered air sampler and the portable meteorological station are shown in Figures 1-4 and 1-5.

FIGURE 1-4. Station 401 includes two solar powered air particulate samplers mounted on a trailer for mobility and is positioned on the north fence of Clean Slate 3.

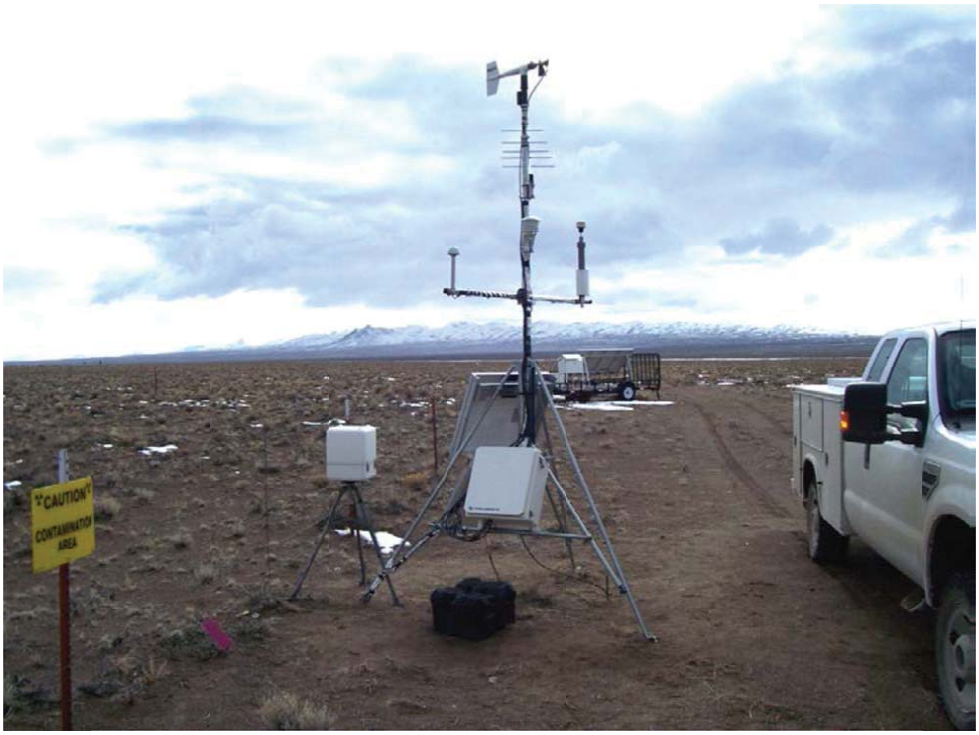

FIGURE 1-5. The Station 401 portable meteorological tower and instrumentation are located on the fence on the north side of Clean Slate 3.

Station 401: Air Sampling Results

Air samples are collected every two weeks from Station 401 and delivered to the Radiological Services Laboratory at the University of Nevada, in Las Vegas, Nevada on a quarterly basis for batch processing. Between December 29, 2010 and December 28, 2011, 26 air particulate filter samples were collected and analyzed by gamma spectroscopy and for gross alpha/beta activity. Except for samples collected March 9 and March 23, only naturally occurring beryllium-7 and lead-210 have been detected. The samples collected on March 9 and March 23 showed the detection of cesium-134 and cesium-137 as well as elevated gross beta results. Their presence is a direct result of the release of airborne radionuclides during the Fukushima Nuclear Power plant accident in Japan. Similar results were found in off-site samples from the DRI CEMP. No other anthropogenic gamma emitting radionuclides such as cobalt-60 or americium-241 have been detected. The mean annual gross alpha activity (Table 1-2) from all samples was 1.74×10^{-15} µCi/mL, with a maximum of 3.12×10^{-15} µCi/mL, a minimum of 0.70×10^{-15} µCi/mL, and a standard deviation of 0.86×10^{-15} µCi/mL. The mean annual gross beta activity from all samples (Table 1-3) was 0.94×10^{-14} µCi/mL, with a maximum of 1.83×10^{-14} µCi/mL, a minimum of 0.50×10^{-14} µCi/mL, and a standard deviation of 0.35×10^{-14} µCi/mL.

Station 402: Clean Slate 1

In May 2011, DRI established Station 402, and installed a portable meteorological tower with an anemometer, a temperature/relative humidity probe, and a DustTrak™ as well as a GOES satellite transmitter. During August 2011, DRI installed a solar powered air sampler (sampler and solar panels) mounted on a trailer and a PIC was installed during September 2011. Internal airflow monitoring and self-adjustment 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. DRI installed a saltation monitoring station at Station 402 in August of 2011. This instrument will measure sand and particle movement by aeolian transport close to the ground surface. Saltation is a wind-driven process and is an important mechanism for transport of soil material in desert environments. DRI will monitor for frequency of saltation events as a function of wind speed and wind direction at Station 402. Collection of bi-weekly air samples from Station 402 began in August 2011. The samples were delivered to the Radiological Services Laboratory at the University of Nevada, in Las Vegas, Nevada every four to six weeks for batch processing. Between August 2011 and December 2011, a total of nine samples were collected. Solar panels, with battery assist, provide power for the air sampler and the meteorological station. The configurations of the solar powered air sampler and the portable meteorological station are shown in Figure 1-6.

Station 402: Air Sampling Results

Air samples are collected every two weeks from station 402 and delivered to the Radiological Services Laboratory at the University of Nevada, in Las Vegas, Nevada on a quarterly basis for batch processing. Between August 23 and December 28, 2011, a total of nine air particulate samples were collected and analyzed by gamma spectroscopy and for gross alpha/beta activity. Only naturally occurring beryllium-7 and lead-210 have been detected. No anthropogenic gamma emitting radionuclides such as cobalt-60 or americium-241 have been detected. The mean gross alpha activity from all samples (Table 1-2) was 2.65×10^{-15} µCi/mL, with a maximum of 4.15×10^{-15} µCi/mL, a minimum of 1.30×10^{-15} µCi/mL, and a standard deviation of 0.98×10^{-15} µCi/mL. The mean gross beta activity from all samples (Table 1-3) was 1.44×10^{-14} µCi/mL, with a maximum of 1.82×10^{-14} µCi/mL, a minimum of 1.06×10^{-14} µCi/mL, and a standard deviation of 0.27×10^{-14} µCi/mL.

FIGURE 1-6. Station 402 consists of a trailer mounted solar powered air sampler and a portable meteorological tower located on the north fenceline at Clean Slate 1.

Station 400 and 401 Air Particulate Migration

At Station 400 (ROC), wind speed was observed to be 15 mph or less about 92 percent of the time; no wind speeds were measured in excess of 35 mph. Slightly higher wind speeds were observed at Station 401 (Clean Slate 3) where winds of 15 mph or less were observed 88 percent of the time and a small fraction of the time the wind speed exceeded 35 mph. Figures 1-7 and 1-8, where average PM_{10} concentrations for 5-mph wind speed intervals are plotted against the mid-point of the intervals, show that PM_{10} concentrations increase exponentially as wind speed increases at both Stations 400 and 401. Below 15 mph the PM_{10} concentration is less than 10 micrograms per cubic meter ($\mu g/m^3$); this suggests that little or no soil migration is occurring at the low wind speeds.

Wind speed and associated PM_{10} concentrations observed during a 48-hour wind event recorded during April 2011 at Station 401 (Clean Slate 3) are illustrated in Figure 1-9. (Instantaneous wind speeds are averaged for 10-minute intervals and recorded; maximum hourly wind speed is the highest speed recorded for a 10-minute period during an hour and the average hourly wind speed is the calculated from the six 10-minute intervals recorded during an hour.) During the event illustrated in Figure 1-10, average hourly wind speed was above 10 mph most of the time. The maximum hourly wind speed recorded reached almost 45 mph; the maximum hourly wind speeds generally exceeded 15 mph. The PM_{10} peaked at a concentration greater than 200 $\mu g/m^3$ at about eight hours on April 29 in association with the recorded maximum hourly wind speed of almost 45 mph and the highest average hourly wind speed of about 30 mph. Other peaks in the observed PM_{10} concentration were also associated with occasions when both the maximum hourly and average hourly wind speeds peaked. Overall, even with average hourly wind speeds above 15 mph, the PM_{10} concentrations were near 10 $\mu g/m^3$. This event illustrates the importance of high wind speed on PM_{10} concentration and soil migration.

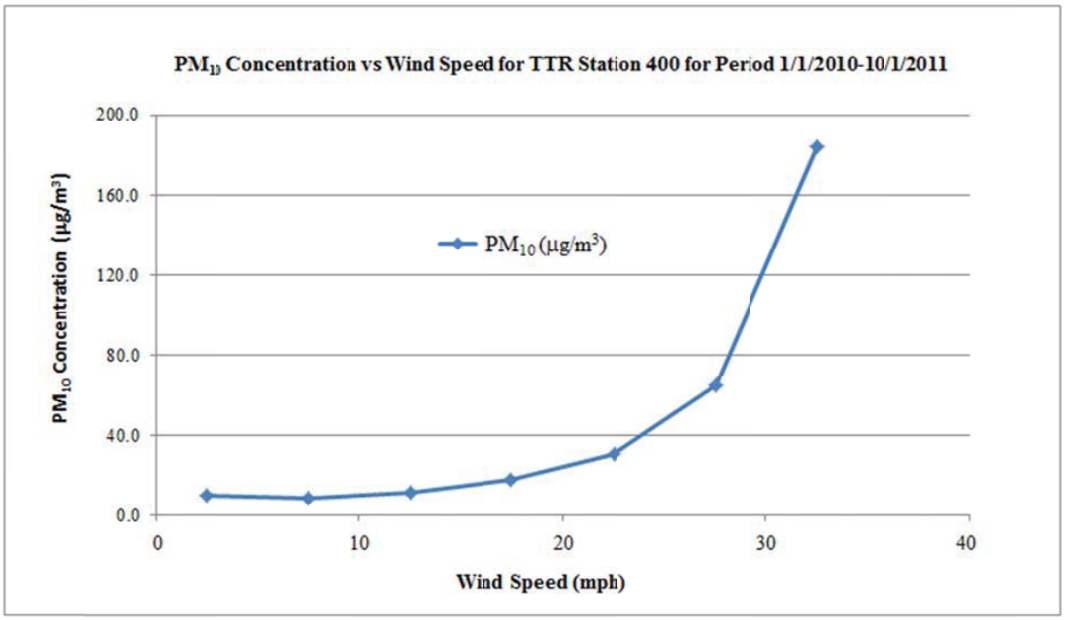

FIGURE 1-7. Wind speed and PM_{10} trend for Station 400 for January 1, 2010 through October 1, 2011

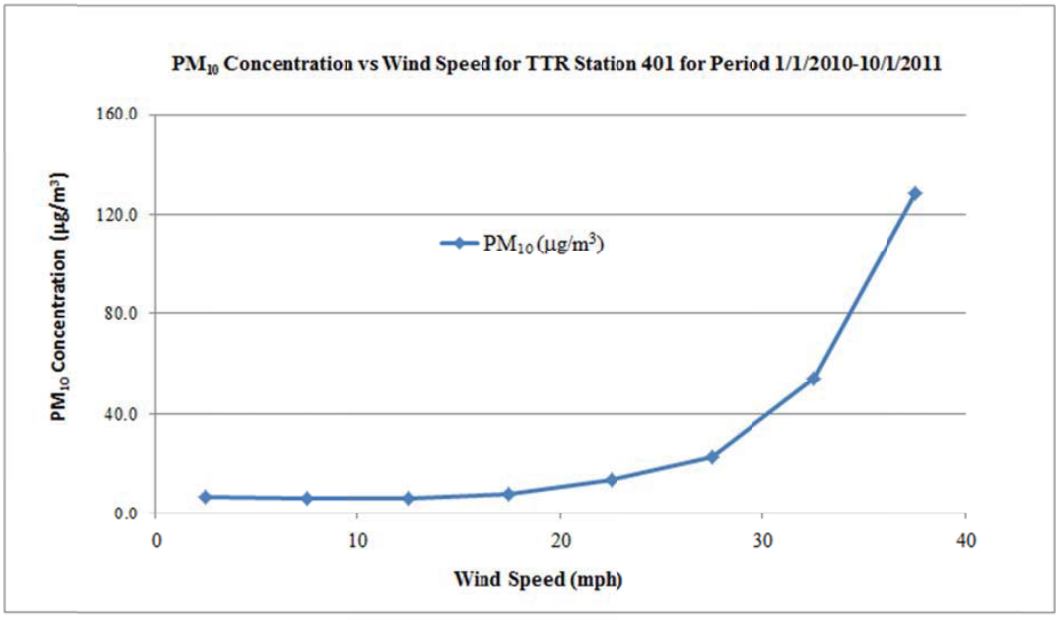

FIGURE 1-8. Wind speed and PM_{10} trend for Station 401 for January 1, 2010 through October 1, 2011

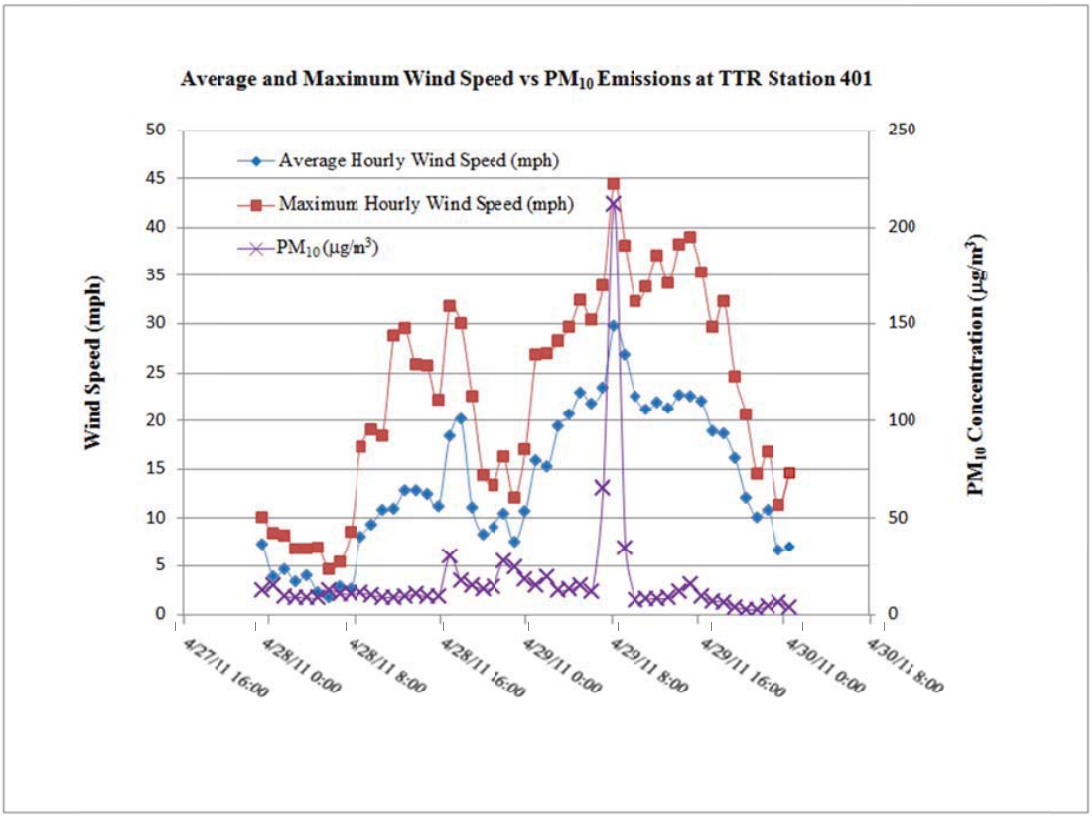

FIGURE 1-9. The relationship between wind and PM_{10} concentration is illustrated in this wind event for Station 401 for April 2011

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 and can be accessed via the web at http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?nvcttr. Data for Station 400 can be found at http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?nvctcs and Station 401 at http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?nvctc1. 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) as a function of time.

Chapter 2 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 2011 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

The Comprehensive Environmental Response, Compensation, and Liability Act (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 2012). 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 2011. Table 2-2 lists SARA Title III reporting requirements.

2.1.2 Emergency Planning and Community Right-to-Know Act

SARA Title III (also known as the Emergency Planning and Community Right-to-Know Act [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 129.3 lb of non-recovered lead in 2011. This information was reported in the *Calendar Year 2011 Chemical Inventory Report* (SNL 2012e). The management of the TTR Firing Range has changed from DOE to U.S. Air Force (USAF). The reporting of the non-recovered lead will be done by USAF starting in Calendar Year (CY) 2012.

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://www.epa.gov/greenkit/cultural.htm*
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://www.epa.gov/compliance/nepa/*
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/superfund/policy/sara.htm*
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/lawsregs/laws/tsca.html*

NOTES: TTR = Tonopah Test Range

TABLE 2-2. 2011 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 2011.
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 2012a).
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 2011, a report was submitted for lead (SNL 2012c).

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

2.1.3 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (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 2011, 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 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

The Federal Facility Compliance Act (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 TTR operations do not generate mixed waste and Sandia currently has no mixed waste stored on-site, these requirements are not applicable to Sandia National Laboratories (SNL) operations at TTR.

2.1.5 Clean Air Act and CAA Amendments of 1990

The Clean Air Act (CAA) and CAA Amendments 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 2011.

National Emission Standards for Hazardous Air Pollutants (NESHAP) Compliance

The EPA retains compliance authority for all radionuclide air releases, which are regulated by NESHAP and implemented under 40 CFR 61, Subpart H. The Clean Slate sites, as discussed in Chapter 1, have been the only source of radionuclide air emissions at TTR. Continuous air monitoring was conducted from February 22, 1996 to February 25, 1997 (SNL 1997). The TTR Airport was determined to be the location of the maximally exposed individual (MEI). The result of 0.024 millirems per year (mrem/yr) was below the threshold of 0.1 mrem/yr, for which continuous air monitoring would be required, and approximately 400 times less than the EPA standard of 10 mrem/yr. The *NESHAP Annual Report for CY 2011, SNL/NV* (SNL 2012) 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 lagoons. The USAF operates these lagoons under a National Pollution Discharge Elimination System (NPDES) permit issued by the NDEP. Sandia also maintains one inactive and five active septic tank systems in remote areas at TTR, which are used only for domestic sanitary sewage collection. Additional information can be found in Section 4.2.3 of this report.

Storm Water

The issuance of a 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).

2.1.7 Safe Drinking Water Act

Sandia meets standards for drinking water as defined in the Safe Drinking Water Act (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 issued by the NDEP (one for the PWS and one for the arsenic treatment system). 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

Compliance with the Toxic Substances Control Act (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. Asbestos containing materials at TTR have been identified in a comprehensive 1993 Asbestos Site Survey all of which has been scanned and is available on the

TTR server. It is updated periodically when new information (sample results, abatement activities, etc.) is available. All asbestos related activities are conducted in accordance with applicable regulatory requirements.

2.1.9 Federal Insecticide, Fungicide, and Rodenticide Act

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 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) in 2011.

2.1.10 National Environmental Policy Act

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

The Endangered Species Act (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

The Migratory Bird Treaty Act (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.

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*	SOC	Endangered
Halfring milkvetch	*Astragalus mohavensis var hemigyrus*	SOC	State Protected
Clokey eggvetch	*Astragalus oophorus* var. *clokeyanus*	SOC	- - - - - - - - -
Ash Meadows milkvetch	*Astragalus phoenix*	Threatened	Endangered
Spring-loving centaury	*Centaurium namophilum*	Threatened	Endangered
Armored hedgehog cactus	*Echinocereus engelmannii var. armatus*	- - - - - - - - -	State Protected
Ash Meadows sunray	*Enceliopsis nudicaulis* var. *corrugata*	Threatened	Endangered
Sunnyside green gentian	*Frasera gypsicola*	- - - - - - - - -	Endangered
Ash Meadows gumplant	*Grindelia fraxinopratensis*	Threatened	Endangered
Sand cholla	*Grusonia pulchella*	- - - - - - - - -	State Protected
Ash Meadows mousetails	*Ivesia kingii* var. *eremica*	Threatened	Endangered
Ash Meadows blazingstar	*Mentzelia leucophylla*	Threatened	Endangered
Amargosa niterwort	*Nitrophila mohavensis*	Endangered	Endangered
Williams combleaf	*Polyctenium williamsiae*	- - - - - - - - -	Endangered
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	- - - - - - - - -
FISHES			
White River desert sucker	*Catostomus clarkii 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
Hot Creek Valley tui chub	*Gila bicolor* ssp. 5	SOC	State Protected
Little Fish Lake Valley tui chub	*Gila bicolor* ssp. 6	- - - - - - - - -	State Protected
Railroad Valley tui chub	*Gila bicolor* ssp. 7	SOC	State Protected
Big Smoky Valley tui chub	*Gila bicolor* ssp. 8	SOC	State Protected
White River spinedace	*Lepidomeda albivallis*	Endangered	State Protected
Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	Threatened	State Protected
Big Smoky Valley speckled dace	*Rhinichthys osculus lariversi*	- - - - - - - - -	State Protected
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*	Endangered	State Protected
Monitor Valley speckled dace	*Rhinichthys osculus* ssp. 5	SOC	State Protected
Oasis Valley speckled dace	*Rhinichthys osculus* ssp. 6	SOC	State Protected

See notes at end of table.

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	*Anaxyrus nelsoni*	- - - - - - - - -	State Protected
Columbia spotted frog (Great Basin pop)	*Rana luteiventris* pop. 3	Candidate	State Protected
REPTILES			
Desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	Threatened	State Protected
Banded gila monster	*Heloderma suspectum cinctum*	- - - - - - - - -	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
Pale kangaroo mouse	*Microdipodops pallidus*	- - - - - - - - -	State Protected
Ash Meadows montane vole	*Microtus montanus nevadensis*	- - - - - - - - -	State Protected
Fringed myotis	*Myotis thysanodes*	- - - - - - - - -	State Protected
American pika	*Ochotona princeps*	- - - - - - - - -	State Protected
Brazilian free-tailed bat	*Tadarida brasiliensis*	- - - - - - - - -	State Protected
BIRDS			
Northern goshawk	*Accipiter gentilis*	SOC	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
Western snowy plover	*Charadrius alexandrinus nivosus*	- - - - - - - - -	State Protected
Mountain plover	*Charadrius montanus*	Proposed Threatened	State Protected
Black tern	*Chlidonias niger*	SOC	State Protected
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate	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

See notes at end of table.

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

Common Name	Scientific Name	Federal Status	State of Nevada Protected Status
Long-billed curlew	*Numenius americanus*	- - - - - - - - -	State Protected
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

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 2011, Sandia's operations generated no impact on cultural resources. The written report mitigating the impact of the 2010 remodel of Building 03-56 is still in preparation.

Historic Building Assessment

In 2004, DOE/NNSA/SSO initiated a consultation with the Nevada State Historic Preservation Office (SHPO) on the TTR site. The Nevada 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 Nevada 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 the DOE/NNSA/SSO to support consultation with the Nevada SHPO. In 2011, DOE/NNSA/SSO completed consultation with the Nevada SHPO, reaching an agreement on the proposed Sandia TTR Historic District, including everything in the site as originally proposed with the addition of Building 09-22. The DOE/NNSA/SSO also agreed to provide samples of the mitigating documentation created to preserve the Sandia TTR Historic District via recordation. The Nevada SHPO will review the sample documentation in 2012; once that is completed, the DOE/NNSA/SSO and the Nevada SHPO will sign a Memorandum of Agreement (MOA) regarding the historic district and future mitigative efforts at the site.

In 2011, staff at TTR began scanning building drawings to support the collection of mitigative documentation for any future negative impacts to the historic district. TTR staff also took additional large-format and digital images of Building 09-22 after it was added to the SNL/TTR Historic District upon Nevada SHPO's direction.

2.1.14 Environmental Compliance Executive Orders

Executive Order (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.

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 (M&O) Contract between Sandia and the DOE define the primary contractual obligations for operating SNL/NM. Sandia met all the requirements stated in these DOE directives.

2.1.16 Quality Assurance

As outlined in detail in Section 7.0, Quality Assurance (QA), of the SNL/NM Annual Site Environmental Report (ASER), Sandia deploys at TTR and Kauai Test Facility (KTF) responsibility and accountability for implementing and putting into action the QA Program elements specified in International Organization for Standardization (ISO) 9001-2000 (ISO 2008), the Contractor

Requirements Document (CRD) of DOE Order 414.1D, *Quality Assurance* (DOE 2011b), 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 2011 Audits

NDEP conducted a PWS Vulnerability Assessment in July 2011, a PWS Sanitary Survey in September 2011, a RCRA Compliance Evaluation Inspection in October 2011. SNL conducted an Environmental Programs & Assurance Evaluation in December 2011. There were no findings or violations noted as a result of the NDEP inspections. During the SNL Environmental Programs & Assurance Evaluation in December there was one minor finding of portable fuel tanks (diesel, gasoline) that contained fuel that did not have an inspection record and one observation of a date missing on a weekly TTR Less Than 180-Day Hazardous Waste Accumulation Facility Inspection Form. A summary of 2011 environmental audits is presented in Table 2-4.

2.3 2011 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 Environmental Restoration (ER) sites for which DOE has assumed responsibility, which are subject to the FFACO are:

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

A summary of DOE/NNSA's ER sites in Nevada can be found in the FFACO report (DoD/DOE/State of 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.

TABLE 2-4. Summary of Environmental Audits Performed at TTR During Calendar Year 2011

Type/Subject	Date	Audit Organization	Findings Summary
PWS Vulnerability Assessment	July 27, 2011	State of Nevada / NDEP / Bureau of Safe Drinking Water	Verified records, tagged the well, no comments.
PWS Sanitary Survey	September 20, 2011	State of Nevada / NDEP / Bureau of Safe Drinking Water	Verified records, certification requirements, contact information, discussed groundwater rule, and visited PWS systems and components. There were no findings or violations noted. There was discussion about a pond next to ground water source well. There is a requirement that there can be no source of potential contamination to the well within 150 feet of the well. The pond is located approximately 120 feet to the north of the well pump house. It is currently dry and surrounded by a fence, so the only source of potential contamination is from waste from small mammals
RCRA Compliance Evaluation Inspection	October 19, 2011	State of Nevada / NDEP / Bureau of Federal Facilities	No findings or observations, they were pleased with the TTR Waste Management operation.
Environmental Programs & Assurance Evaluation	December 13, 2011 to December 14, 2011	4143	1 minor finding of Portable fuel tanks (diesel, gasoline) that contained fuel did not have an inspection record and 1 observation of a date missing on a weekly TTR Less Than 180-Day Hazardous Waste Accumulation Facility Inspection Form

NOTES: NDEP = Nevada Division of Environmental Protection
PWS = Public Water System
RCRA = Resource Conservation and Recovery Act
TTR = Tonopah Test Range

2.4 Environmental Permits

Environmental compliance permits for TTR include those for hazardous materials storage, public water supply, RCRA, and air quality. The State of Nevada issues permits for these Sandia TTR 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 2011.

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 2011.

TABLE 2-5. Summary of Permits at TTR During Calendar Year 2011

Permit Type and Location	Permit Number	Issue Date	Expiration Date	Comments
Air Quality Permits				
Class II Air Quality Operation Permit	AP 8733-0680.03	08/05/2011	08/04/2016	Portable Screen Welding Operation Carpenter Area Paint Booth Generators (9 systems) 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	20965 FDID Number (13007)	March 3, 2012	February 28, 2013	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.
AP=Air Permit
FDID = Fire Department Identification
ID=Identification
NTNC = Non-Transient Non-Community
NV = Nevada
TTR = Tonopah Test Range

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Chapter 3 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).

2011 ER Activities

ER activities in 2011 were very limited. No field activities were conducted other than site visits to plan for investigations at the Double Tracks and Clean Slates 1, 2, and 3 sites. The work performed in 2010 on the remediation of CAUs 408 and 484 was completed in 2010.

TABLE 3-1. DOE/NNSA/NSO ER Operations TTR CAUs and CASs 2011 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

See notes at end of table.

TABLE 3-1. DOE/NNSA/NSO ER Operations TTR CAUs and CASs 2011 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

See notes at end of table.

TABLE 3-1. DOE/NNSA/NSO ER Operations TTR CAUs and CASs 2011 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, as amended (DOD/DOE/State of NV 1996)

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

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, Resource Conservation and Recovery Act (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 2011 was as follows:

Waste Type	Weight
RCRA hazardous waste	792 kilograms (kg) (1,742 pounds [lb])
Non-RCRA regulated	4,194 kg (9,227 lb)
Recycled material	8,627 kg (18,979 lb)
Toxic Substances Control Act (TSCA) waste (Asbestos)	270 kg (594 lb)
Radioactive waste	0 kg (0 lb)
Sanitary landfill:	
U.S. Air Force (USAF) Sanitary Landfill	12,518 kg (27,540 lb)
Construction debris:	
USAF Construction Landfill	53,009 kg (116,620 lb)
Tires:	
Phoenix Recycling Technologies	0 kg (0 lb)
Battery recycling:	
Battery Recycling	501 kg (1,101 lb)
Apex Landfill:	
Tires too large for recycling were disposed of at this landfill	2,236 kg (4,919 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 2011 are presented in Table 3-2.

Radioactive Waste Management

There were no shipments of radioactive waste in 2011.

3.3 Spill Prevention Control and Countermeasures 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 two mobile refuelers (a truck and a mobile trailer), seven aboveground storage tanks (AST), one bulk storage area (BSA), and one transformer storage area that are covered by the Spill Prevention Control and Countermeasures (SPCC) Plan at TTR. During 2011, an effort was made to replace non-certified fuel storage tanks (ASTs and mobile refuelers) with certified tanks. TTR also obtained

TABLE 3-2. Recycled or Energy-Recovered Quantities Shipped Off-Site During Calendar Year 2011

Categories of Waste Recycled or Energy-Recovered	Shipped (lb)	Shipped (kg)
NAPA Auto Batteries Recycled	0	0
Used Oil	12,309	5,595
Combustible Liquid, N.O.S.	0	0
Lead	42	19
Mercury	33	15
Batteries Wet Filled with Acid (Lead Acid)	811	369
Batteries Dry (Alkaline)	290	132
Electronic Equipment	5,432	2,469
Fluorescent Lights	475	216
Photographic Fixer	0	0
Non-PCB Ballasts	636	289
Welding Rod	0	0
Tires	0	0
TOTALS	**20,028**	**9,104**

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

several additional floating wall containment systems to be used with mobile generators or other fuel systems at remote locations. Enough certified ASTs were obtained during 2011 to replace all of the aging "Bickerstaff" type uncertified tanks. These tanks will be installed sometime in 2012. Both truck and trailer mobile refueling platforms were replaced with certified tank units in 2011 and are currently in use. Also in 2011, four ASTs and 1 BSA were removed.

3.4 National Environmental Policy Act Program

National Environmental Policy Act (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 NNSA has begun 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]). During Calendar Year (CY) 2011, DOE personnel held public meetings and reviews of the SWEIS for TTR.

2011 NEPA Documentation

The SNL/NM NEPA Team completed four DOE NEPA checklists for TTR that were transmitted to the DOE/NNSA/SSO for review and determination in 2011. Personnel from DOE/NNSA/SSO, TTR, and the SNL/NM NEPA Team supported ongoing NNSS SWEIS data calls for TTR.

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). There are now three DRI portable monitoring stations in use at TTR. Station 400 is located near the TTR Range Operations Center (ROC), Station 401 is located near Clean Slate 3, and the newest Station (402) is located near Clean Slate 1. The DRI's Community Radiation Monitoring Program Annual Report is part of the NNSS Annual Site Environmental Report (ASER) (DOE 2011).

The DRI also performs other monitoring as requested by the DOE, such as archeological surveys. No archeological surveys were requested in 2011.

WGI

As part of its TTR support activities, WGI personnel perform environmental monitoring activities for DOE and/or Sandia when necessary. 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 three release reporting documents must be submitted to external regulatory agencies if releases exceed applicable threshold quantities (TQ):

- *NESHAP Annual Report for CY 2011, SNL/NV* (SNL 2012) 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 2011* (SNL 2012a) was submitted for lead released at the TTR firing range.

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Chapter 4 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:

- 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 to address the requirements of U.S. Department of Energy (DOE) Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2011c), and to satisfy Sandia Corporation (Sandia) Environmental Management System (EMS) Program standards, which adopt the requirements of International Organization for Standardization (ISO) 14001 (ISO 2004). Reporting is done in accordance with DOE Order 231.1B, *Environment, Safety and Health Reporting* (DOE 2011a). 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 2011, americium-241 at location S-51 continues to be identified as Priority-1 consistent with the "hot particle" theory suggested in the 2009 Annual Site Environmental Report. In 2011, S-09 continues to be identified as Priority-2 for americium-241.

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 2011 utilized data from the same analytical laboratory for the twelve-year period.

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.

4.1.4 Sampling Locations

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

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

- On-site locations are near areas of known contamination, potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate (such as in the vicinity of Environmental Restoration (ER) Project 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.
- 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 does not control access.

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 2011 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, 2011* (SNL 2012b).

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.

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

TABLE 4-3. 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: *In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.
TLD = Thermoluminescent Dosimeter
TTR = Tonopah Test Range

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

- 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).

- 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 (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 2011 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. There were no locations that exhibited Priority-3 characteristics in 2011.

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 2011, 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 with a value of 4.27 picocuries per gram (pCi/g) and subsequently 6.51 pCi/g in 2010). The maximum result for this location in 2011 was 5.07 pCi/g. These results can be expected with the "hot-particle" nature of americium-241 environmental distribution, especially at the edge of the plume. The historical results can be seen in Figure 4-1. In 2011, one on-site location S-09 was identified as Priority-2. The value at S-09 was 2.18 pCi/g and the maximum recorded value at this location was 2.18 pCi/g in 2011. The historical results can be seen in Figure 4-2. In addition, a transect was sampled at 100, 200 and 300 yards upwind, and downwind, respectively, of S-09. The results were 0.024, 0.029 and 0.07 pCi/g for 100, 200 and 300 upwind, respectively and 0.052, 0.11 and 0.10 pCi/g for 100, 200 and 300 yards downwind, respectively. These samples demonstrate that there is no significant migration from S-09. These points are shown in Figure 4-3. Since no significant conclusions can be drawn from these special sampling efforts, no further "special sampling" at locations S-09 and S-51 is planned for the immediate future, unless indicated by significant changes in routine samples collected at these locations.

There were no locations that exhibited Priority-3 characteristics.

TABLE 4-5. Summary Statistics for TTR Radiological Analytes From Calendar Year (CY) 2000 - 2011 (all units in pCi/g unless otherwise noted)

Analyte	Class	Number of Samples	Average	Median	Std Dev	Minimum	Maximum
Americium-241	Perimeter	96	0.0148	0.0214	0.0612	-0.2370	0.133
	On-Site	251	0.2467	0.0453	0.837	-0.2310	6.510
	Off-Site	168	0.0171	0.0208	0.0478	-0.2020	0.125
Cesium-137	Perimeter	96	0.2071	0.1615	0.1550	0.0122	0.885
	On-Site	262	0.2526	0.2370	0.1944	0.0000	1.490
	Off-Site	168	0.2183	0.1695	0.1620	0.0000	0.930
Plutonium-238	Perimeter	17	0.0042	0.0028	0.0076	-0.0056	0.028
	On-Site	86	0.1307	0.0095	0.9146	-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	86	17.0534	0.2770	129.9	-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 (mg/kg)	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	96	0.0782	0.0765	0.0570	-0.059	0.25
	On-Site	262	0.0878	0.0808	0.0608	-0.045	0.39
	Off-Site	168	0.0823	0.0764	0.0582	-0.099	0.29
Uranium-238	Perimeter	96	1.1813	1.180	0.5300	0.0029	2.65
	On-Site	262	1.2402	1.170	0.5038	0.0324	3.13
	Off-Site	168	1.2268	1.140	0.5198	0.1360	2.96

NOTES: mg/kg = milligrams per kilogram
pCi/g = picocurie per gram
Std Dev = Standard Deviation
TTR = Tonopah Test Range

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 is consistent with "historical" slightly elevated levels at S-51. 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 justified the need for additional sampling in 2011. Location S-09 is located near the Roller Coaster Decon site and S-51 is in "South Plume" near the Mellan Airstrip. The recorded value collected at S-09 in 2011 was 35.4 pCi/g and the recorded value collected at S-51 was 4.57 pCi/g in 2011. Both locations are expected to have elevated readings. The historical results can be seen in Figures 4-1 and 4-2. There were no locations that exhibited Priority-3 characteristics in 2011. Since no significant conclusions can be drawn from these special sampling efforts, no further "special sampling" at locations S-09 and S-51 is planned for the immediate future, unless indicated by significant changes in routine samples collected at these locations.

TLD Results

Sampling for 2011 was conducted from January 2011 through January 2012. When a TLD location has a missing quarter, the data is not included in the summary statistics (there were no missing TLDs in 2011). Summary statistics for the past twelve years are shown in Table 4-8. On-site and perimeter locations were statistically different from off-site locations. Off-site locations are statistically lower than either on-site or perimeter locations. There is no remarkable difference between any of the annual groupings of the data. Figure 4-4 graphically portrays the TLD results from 2000 through 2011. TLD results and TLD measurements, by quarter and location type, for 2011 are shown in Appendix B of this report.

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

Analyte	Location	Sample Size	2011 Result	Average	Median	Std Dev	Minimum	Maximum
Americium-241	S-51	12	5.07	2.35	1.70	2.42	-0.01	6.51

NOTES: pCi/g = picocurie per gram
Std Dev = Standard Deviation
TTR = Tonopah Test Range

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

Analyte	Location	Sample Size	2011 Result	Average	Median	Std Dev	Minimum	Maximum
Americium-241	S-09	12	2.18	1.80	1.39	1.23	0.47	3.58

NOTES: pCi/g = picocurie per gram
Std Dev = Standard Deviation
TTR = Tonopah Test Range

TABLE 4-8. Summary Statistics for TTR TLDs by Location Class, 2000 – 2011 (all units in mrem)

Location Class	Sample Size	Average	Median	Std Dev	Minimum	Maximum
On-Site	122	159.5	158.7	13.7	132.4	228.8
Perimeter	66	157.6	157.8	17.1	100.0	216.0
Off-Site (community)	35	143.0	149.0	15.6	105.1	163.2

NOTES: mrem = millirem
Std Dev = Standard Deviation
TLD = Thermoluminescent Dosimeter
TTR = Tonopah Test Range

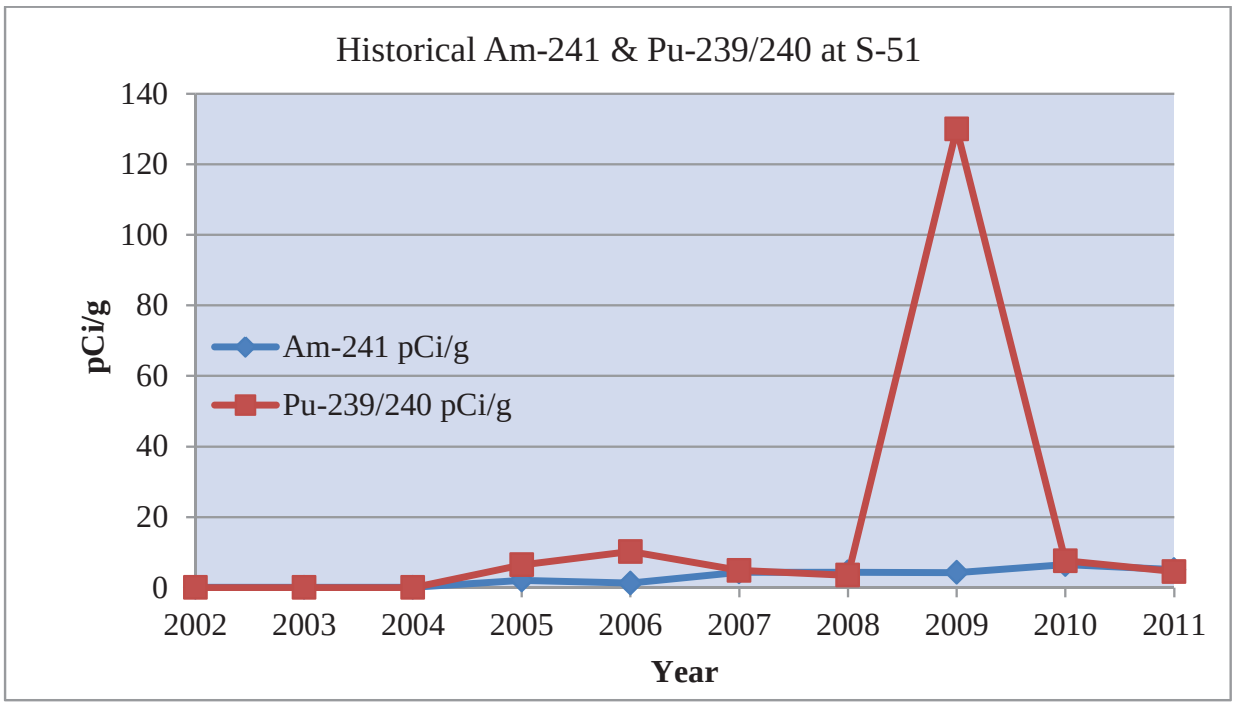

FIGURE 4-1. Historical Plutonium-239 and Americium-241 at TTR S-51

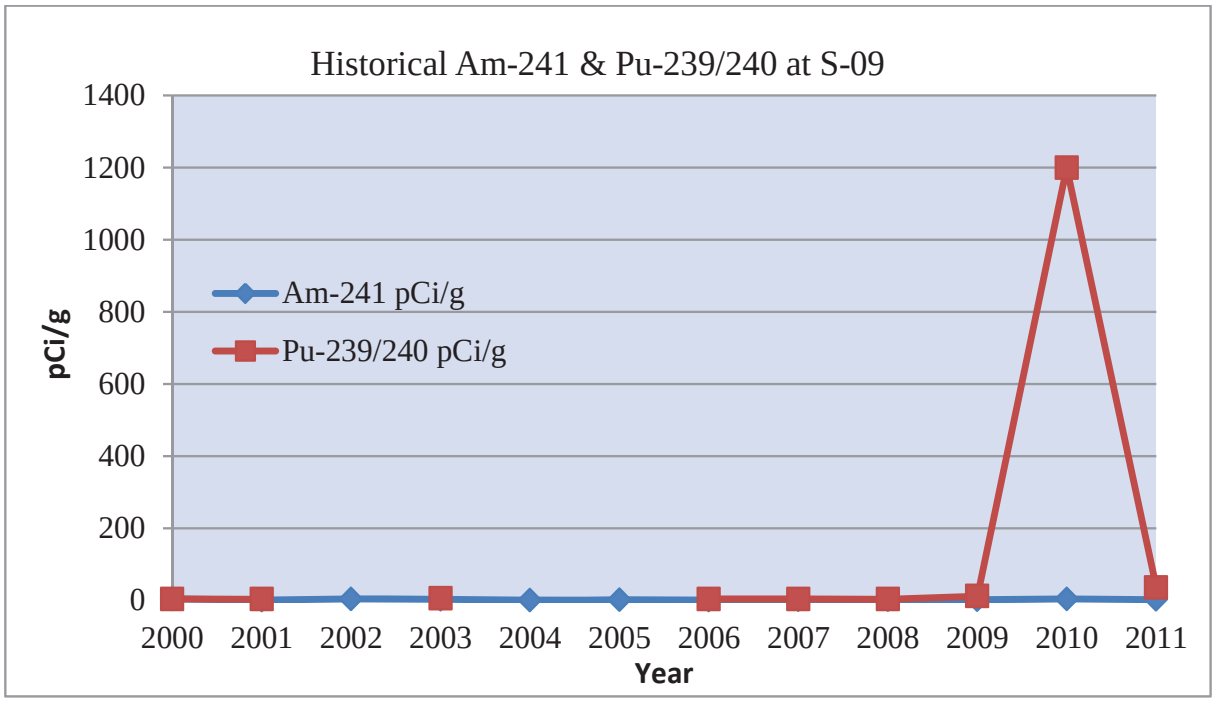

FIGURE 4-2. Historical Plutonium-239 and Americium-241 at TTR S-09

FIGURE 4-3. Transect Samplng at TTR S-09

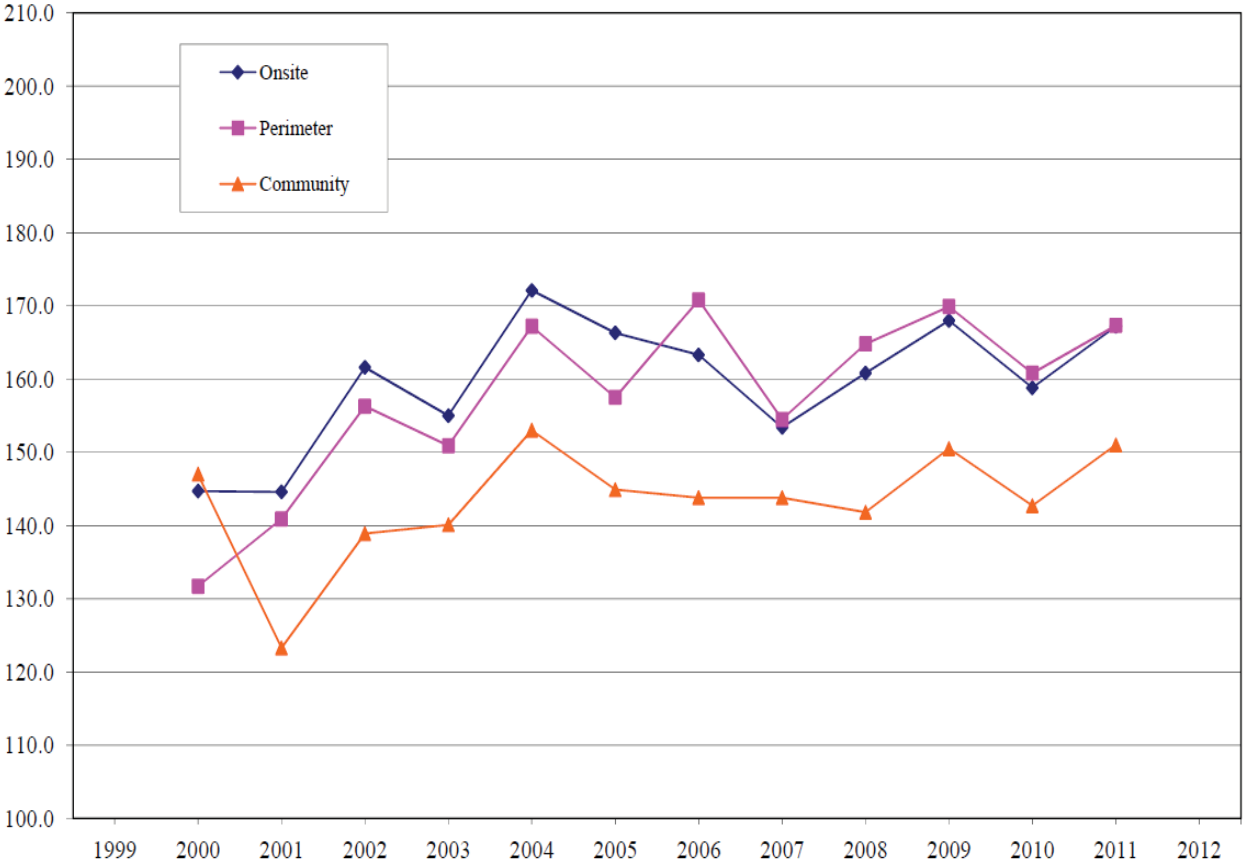

FIGURE 4-4. Tonopah Test Range TLD Exposure, 2000-2011

4.1.6 Non-Radiological Parameters and Results

In 2011, 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) was location S-09 for cobalt (see Table 4-9). The mean value of 5.7 milligrams per kilogram (mg/kg) is 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. Cobalt is not a potential contaminant of concern at TTR and is assumed to represent natural background at this location. There were no Priority-1 or Priority-3 metals noted at any other of the sampled locations.

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 for them.

All PWS drinking water sampling is conducted in accordance with requirements set by the State of Nevada (NDEP 2011). Analytes are sampled at different intervals, as shown in Table 4-11. The Nevada Division of Environmental Protection (NDEP) currently provides Public Monitoring and Reporting Requirements for each PWS around May of each year.

The State maintains information on the TTR/SNL PWS including; water system details, sample schedules, sample results, and any violation/enforcement actions at the following location:

https://ndwis.ndep.nv.gov/DWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=296666&tinwsys_st_code=NV&wsnumber=NV0003014

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

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

TABLE 4-9. Summary Statistics for Soil Locations Noted as Priority-2 (all units in mg/kg unless otherwise noted).

Analyte	Location	Sample Size	2011 Result	Average	Median	Std Dev	Minimum	Maximum
Cobalt	S-09	6	5.46	5.68	5.72	0.53	4.88	6.26

NOTES: mg/kg = milligram per kilogram
Std Dev = Standard Deviation

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

	NV Background Soil Concentrations[1]		EPA Region 9 PRGs (Soil Screening Levels[2])		U.S. Background 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: (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).
EPA = U.S. Environmental Protection Agency
mg/kg = milligram per kilogram
N/A = not available
ND = not detectable
NV = Nevada
PRG = Protective Remediation Goal

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	Quarterly in 2012 (usually 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
SOC = synthetic organic compounds
TTR = Tonopah Test Range
VOC = volatile organic compounds

Production Well Monitoring Results

There were no Drinking Water Public Notices issued to Area 3 personnel during 2011.

In 2011, all sample results were below the maximum contaminant levels (MCL) established for the substances monitored. However, the State database flagged the regulated volatile organic compound (VOC) chemicals (ethylbenzene and total xylene) from the 2011 sampling round as slightly exceeding the Safe Drinking Water Act (SDWA) Phase II Monitoring "trigger"/detection limit of 0.0005 milligrams per liter (mg/L) or 0.5 parts per billion (ppb). Both Substances were at least several hundred times below their respective MCLs and Maximum Contaminant Level Goals (MCLG). For example, total xylene was detected at 19 ppb and the MCL/MCLG is 10,000 ppb and ethylbenzene was detected at 2.5 ppb and the MCL/MCLG is 700 ppb. However, anytime regulated VOCs are detected above the state detection limit of 0.5 ppb additional monitoring is required. When this "trigger" is exceeded in groundwater systems, such as at TTR, it requires a minimum of two quarters of monitoring (beginning in the subsequent quarter after detection). The state has required two quarterly samples of these compounds beginning in the first quarter of 2012, and then if the results are reliably and consistently below the MCL, TTR will be placed back on a three year monitoring schedule for VOCs.

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 between 1 to 2 ppb for arsenic. The MCL for arsenic in drinking water is 10 ppb.

During 2011, Well 6 produced 652,000 gallons (gal) of water that was chlorinated and sent to the elevated water storage tower. This equals an average monthly production of approximately 54,000 gal during 2011. Daily production during 2011 averaged approximately 2,000 gal.

During 2011, approximately 297,000 gal of water was treated to remove arsenic and sent to the drinking water distribution system. This equates to a monthly average of approximately 25,000 gal and a daily consumption rate of 825 gal.

A total of 294 pounds (lb) of carbon dioxide was used during the year for pH adjustment (25 lb per month or 0.8 lb per day on average).

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). The plan must be updated every five years, so the next revision is due in 2015.

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 U.S. Air Force (USAF) facultative sewage lagoon for treatment. As a best management practice (BMP), either SNL/NM or Washington Group International (WGI) 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 samples from the headwater end of the lagoon. In the past, Sandia provided quarterly sampling results to the USAF for inclusion into their USAF Discharge Monitoring Report (DMR); however, the NPDES permit was modified in 1997 and no longer stipulates the requirement of quarterly data from Sandia. Therefore, Sandia now only provides annual wastewater sampling results to the USAF in the Annual Site Environmental Report (ASER) as Appendix C – "Wastewater Sampling Results". These systems are periodically sampled as a BMP and do not require sampling by the NDEP. During Calendar Year (CY) 2011 there were no excursions or violations of concentration limits. Twenty-four 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),
- VOCs,
- 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.

The analytical results for wastewater sampled at Area 3 are contained in Appendix C.

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 [Point Able Guard Station]) located on-site which are owned by DOE/National Nuclear Security Administration (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 2011. 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 Code of Federal Regulations (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 2012). 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.

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, various generators and maintenance shop activities. Maintenance shop activities at TTR include the paint shop, welding shop and carpentry shops. In 2011, there were emissions from the portable screen and activities at the maintenance shop. The generators that were added to the permit have not yet been installed. The portable screen was operated for 69.5 hours during CY 2011, and contributed 0.004 tons of particulate matter (PM) emissions. The maintenance shop activities (painting, welding and woodworking) operated for a combined 316.8 hours or less during CY 2011 and contributed 0.14 tons of emissions (PM, hazardous air pollutants [HAPS] and VOCs).

TABLE 4-12. Calculated Dose Assessment Results for On-Site Receptor at TTR

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.
[1] Natural background is estimated at 350 mrem/yr nationwide.
EDE = effective dose equivalent
MEI = maximally exposed individual
mrem/yr = millirem per year
mSv/yr = millisievert per year
NESHAP = National Emission Standards for Hazardous Air Pollutants
TTR = Tonopah Test Range

Chapter 5 2011 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) 2011. This report was prepared in accordance with DOE Order 231.1B, *Environment, Safety, and Health Reporting* (DOE 2011a).

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 2011 there have been 52 launches from KTF, 1 launch from the Kokole Point site and 27 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 communications security (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). During non-campaign operations, general maintenance continues and dehumidifiers remain in

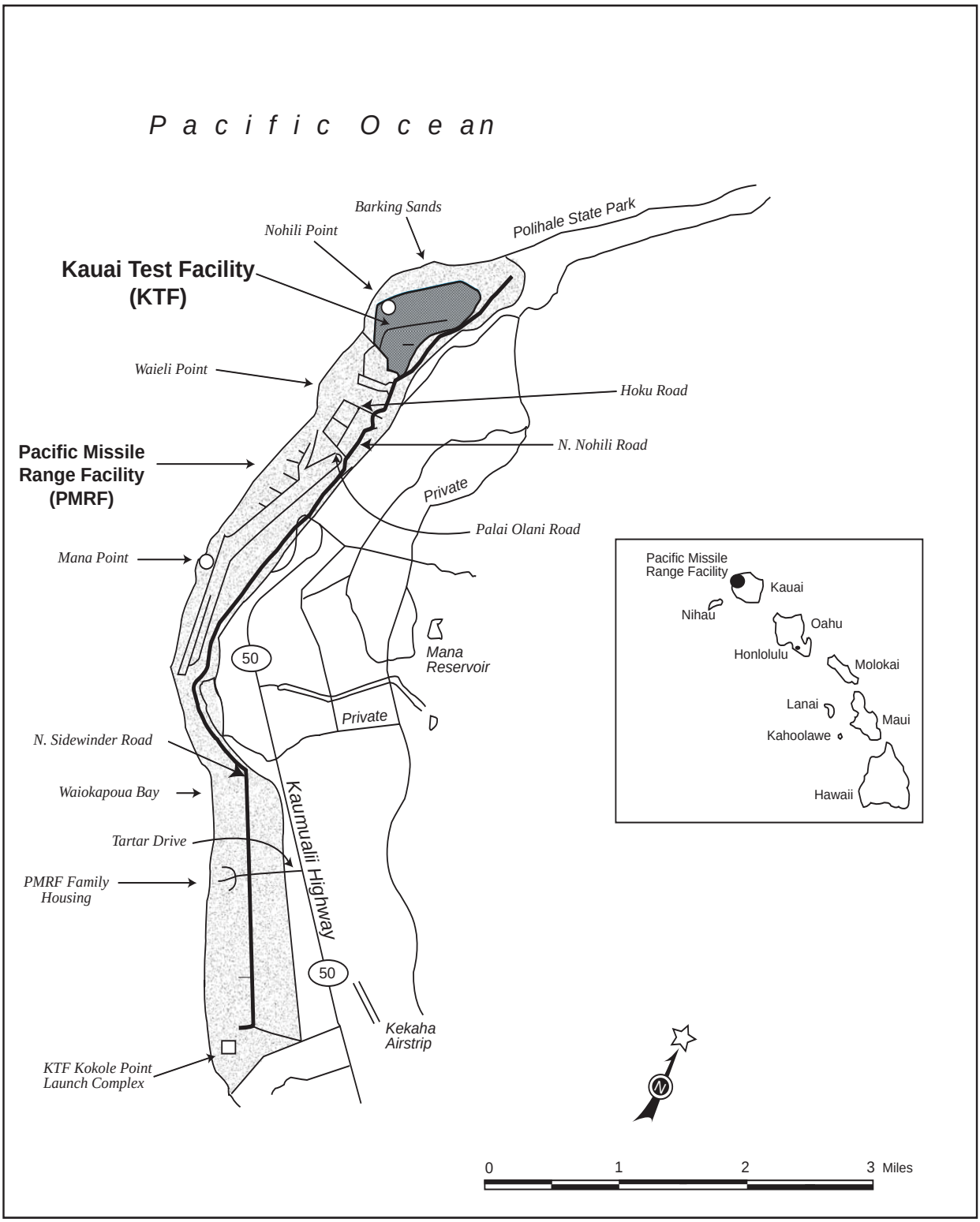

FIGURE 5-1. Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area (The Kauai Test Facility [KTF] is to the north, near Nohili Point)

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 2011 Rocket Launches

There were four rocket launches from KTF in 2011. 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, FTX-16E1, March 15, 2011
- AEGIS BMD, FTM-16E2, September 1, 2011
- SMDC AHW, November 16, 2011
- AEGIS BMD, FTX-16E3, December 15, 2011

5.3 Demographics

There were 16 permanent on-site personnel at KTF in 2011. During campaign operations when rocket launches occur, up to an additional 178 people temporarily worked at KTF. The closest population center to KTF are the towns of Kekaha and Waimea (Census 2010 population 5,561), which are eight and ten miles southeast from the site, respectively.

5.4 Compliance Summary

The list of regulations and statutes provides an overview of the compliance status for Sandia National Laboratories (SNL) operations at KTF in 2011 (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 2011. 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://www.epa.gov/greenkit/cultural.htm
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://www.epa.gov/compliance/nepa/
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/superfund/policy/sara.htm
Toxic Substance Control Act (TSCA)	Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCB)	http://www.epa.gov/lawsregs/laws/tsca.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.
The Non-covered Source Permit update was issued on March 3, 2009 (Hawaii DOH 2009).
EPA = U.S. Environmental Protection Agency
KTF = Kauai Test Facility

TABLE 5-3. 2011 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 2011 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. At KTF, NEPA compliance is coordinated between personnel from KTF, SNL/NM, and the DOE/NNSA/SSO.

In CY 2011, personnel from Sandia began working on the Environmental Baseline Survey for divestiture of the Mount Haleakala, Hawaii facility. Sandia staff is assisting the DOE to return the facility located on the peak of Mount Haleakala on the island of Maui back to the Federal Aviation Administration. The Facility has been a SNL Facility since 1962 for telemetry operations to provide high-altitude tracking for tests conducted from the Kauai Test Facility.

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.

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

Common Name	Scientific Name	Federal Status	State Status
PLANTS			
Ferns and Allies			
Pendant kihi fern	Adenophorus periens	Endangered	Endangered
Pauoa	Ctenitis squamigera	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
Palapalai aumakua	Dryopteris crinalis var. podosorus	Endangered	Endangered
Wawae`iole	Huperzia mannii	Endangered	Endangered
Wawae`iole	Lycopodium (=Phlegmariurus) nutans	Endangered	Endangered
Flowering Plants			
Liliwai	Acaena exigua	Endangered	Endangered
No common name	Achyranthes mutica	Endangered	Endangered
Mahoe	Alectryon macrococcus	Endangered	Endangered
Kuawawaenohu	Alsinidendron lychnoides	Endangered	Endangered
No common name	Alsinidendron viscosum	Endangered	Endangered
Pa`iniu	Astelia waialealae	Endangered	Endangered
No common name	Bonamia menziesii	Endangered	Endangered
Olulu	Brighamia insignis	Endangered	Endangered
Uhiuhi	Caesalpinia kavaiense	Endangered	Endangered
`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
Haha	Cyanea asarifolia	Endangered	Endangered
Haha	Cyanea dolichopoda	Endangered	Endangered
Haha	Cyanea eleeleensis	Endangered	Endangered
Haha	Cyanea kolekoleensis	Endangered	Endangered
Haha	Cyanea kuhihewa	Endangered	Endangered
Haha	Cyanea recta	Threatened	Threatened
Haha	Cyanea remyi	Endangered	Endangered
Haha	Cyanea undulata	Endangered	Endangered
Pu`uka`a	Cyperus trachysanthos	Endangered	Endangered
Mapele	Cyrtandra cyaneoides	Endangered	Endangered
Ha`iwale	Cyrtandra limahuliensis	Threatened	Threatened
Ha`iwale	Cyrtandra oenobarba	Endangered	Endangered
Haiwale	Cyrtandra paliku	Endangered	Endangered
No common name	Delissea rhytidosperma	Endangered	Endangered
Oha	Delissea rivularis	Endangered	Endangered
No common name	Delissea undulata	Endangered	Endangered
Na`ena`e	Dubautia imbricata imbricata	Endangered	Endangered

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

Common Name	Scientific Name	Federal Status	State Status
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
Mehamehame	Flueggea neowawraea	Endangered	Endangered
Nanu	Gardenia remyi	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
Hilo ischaemum	Ischaemum byrone	Endangered	Endangered
Aupaka	Isodendrion laurifolium	Endangered	Endangered
Aupaka	Isodendrion longifolium	Threatened	Threatened
`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
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
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 degeneri	Endangered	Endangered
Alani	Melicope haupuensis	Endangered	Endangered
Alani	Melicope knudsenii	Endangered	Endangered
Alani	Melicope pallida	Endangered	Endangered
Alani	Melicope paniculata	Endangered	Endangered

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

Common Name	Scientific Name	Federal Status	State Status
Alani	Melicope puberula	Endangered	Endangered
Alani	Melicope quadrangularis	Endangered	Endangered
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
`Aiea	Nothocestrum latifolium	Candidate	Candidate
`Aiea	Nothocestrum peltatum	Endangered	Endangered
Lau `ehu	Panicum niihauense	Endangered	Endangered
Makou	Peucedanum sandwicense	Threatened	Threatened
No common name	Phyllostegia knudsenii	Endangered	Endangered
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
Pilo kea lau li`i	Platydesma rostrata	Endangered	Endangered
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
Kopiko	Psychotria grandiflora	Endangered	Endangered
Kopiko	Psychotria hobdyi	Endangered	Endangered
Kaulu	Pteralyxia kauaiensis	Endangered	Endangered
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
No common name	Schiedea spergulina var. leiopoda	Endangered	Endangered
No common name	Schiedea spergulina var. spergulina	Threatened	Threatened
Laulihilihi	Schiedea stellarioides	Endangered	Endangered
Ohai	Sesbania tomentosa	Endangered	Endangered
No common name	Silene lanceolata	Endangered	Endangered
Popolo ku mai	Solanum incompletum	Endangered	Endangered
Popolo	Solanum nelsonii	Candidate	Candidate
`Aiakeakua, popolo	Solanum sandwicense	Endangered	Endangered
No common name	Spermolepis hawaiiensis	Endangered	Endangered
No common name	Stenogyne campanulata	Endangered	Endangered

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

Common Name	Scientific Name	Federal Status	State Status
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
ANIMALS			
Mammals			
Hawaiian hoary bat	Lasiurus cinereus semotus	Endangered	Endangered
Birds			
Hawaiian (=koloa) Duck	Anas wyvilliana	Endangered	Endangered
Hawaiian goose	Branta (=Nesochen) sandvicensis	Endangered	Endangered
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 (honeyeater)	Moho braccatus	Endangered	Endangered
Large Kauai (=kamao) thrush	Myadestes myadestinus	Endangered	Endangered
Small Kauai (=puaiohi) thrush	Myadestes palmeri	Endangered	Endangered
Band-rumped storm-petrel	Oceanodroma castro	Candidate	Candidate
Akikiki	Oreomystis bairdi	Endangered	Endangered
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
Leatherback sea turtle	Dermochelys coriacea	Endangered	Endangered
Hawksbill sea turtle	Eretmochelys imbricata	Endangered	Endangered
Snails			
Newcomb's snail	Erinna newcombi	Threatened	Threatened
Arachnids			
Kauai cave wolf or pe'e pe'e maka 'ole spider	Adelocosa anops	Endangered	Endangered
Insects			
Pomace fly (no common name)	Drosophila musaphila	Endangered	Endangered
Hawaiian picture-wing fly	Drosophila sharpi	Endangered	Endangered
Pacific Hawaiian damselfly	Megalagrion pacificum	Endangered	Endangered
Crustaceans			
Kauai cave amphipod	Spelaeorchestia koloana	Endangered	Endangered

NOTES: KTF = Kauai Test Facility

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 checklist review. It is DOE/NNSA's responsibility to ensure that impacts to cultural resources are assessed and appropriate actions taken to mitigate any impact.

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, *Federal 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 CAA Amendments 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 reportable quantity releases.

Clean Water Act (CWA)

There were no compliance issues with respect to any state or federal water pollution regulations in 2011.

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 PMRF drinking water system or is purchased from commercial suppliers.

Toxic Substances Control Act (TSCA)

TSCA regulates the distribution of polychlorinated biphenyls (PCB) 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 110 pounds (lb) of Asbestos-Containing Materials (ACM) were identified at KTF and 91 lb were identified at the Mount Haleakala site on Maui.

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 was one reportable occurrence at KTF in 2011, which was an EPA Warning Letter for an unlabeled drum.

5.5 Environmental Program Activities

This section describes three environmental programs:

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

NEPA Program Activities at KTF

In CY 2011, personnel from Sandia began assisting on the Environmental Baseline Survey for divestiture of the Mount Haleakala, Hawaii facility. Sandia staff is working through the DOE to return the facility located on the peak of Mount Haleakala on the island of Maui back to the Federal Aviation Administration. The Facility has been in use by Sandia personnel since 1962 for telemetry operations to provide high-altitude tracking for tests conducted from the Kauai Test Facility.

2011 NEPA Documentation

The SNL/NM NEPA Team completed one DOE NEPA checklist for KTF that was transmitted to the DOE/NNSA/SSO for review and determination in 2011.

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 three DOE/NNSA owned septic tanks and stormwater runoff is directed into three French drains and four area drains 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 three 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) were registered with the State of Hawaii in 1988, and a newer septic tank for the main office compound was registered in 2004. The septic systems are periodically pumped by licensed, state-certified contractors and inspected by state officials. No state inspections were conducted during 2011. 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 2011, 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 2011 Annual Monitoring Report for air emissions was submitted to the State of Hawaii in February 2012 (SNL 2012d). The required $500 annual fee was submitted for CY 2011 as required. Sandia was in compliance with all air quality regulations in 2011.

A Semi-Annual Air Monitoring Report for the first half of 2011 was submitted to the State of Hawaii in July 2011. For the period of January 1, 2011 through June 30, 2011, the total fuel usage from activities that was reported to the State of Hawaii was 17,397 gal 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 2011 was 2,308 hours. An Annual Air Monitoring Report for CY 2011 was submitted to the State of Hawaii in February 2012. For the period of January 1, 2011 through December 31, 2011, the total fuel usage from activities that was reported to the State of Hawaii was 21,238 gal of diesel fuel. The highest total hours of operation for the permitted generators in a rolling 12-month period for CY 2011 was 2,610 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 2011.

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).

Chapter

6 TTR & KTF References

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10 CFR 830 *Nuclear Safety Management*

40 CFR 61 *National Emission Standards for Hazardous Air Pollutants (NESHAP)*

40 CFR 110 *Discharge of Oil*

40 CFR 112 *Oil Pollution Prevention*

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

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

40 CFR 355 *Emergency Planning and Notification*

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

ACTS & STATUTES

American Indian Religious Freedom Act (AIRFA) of 1978 (42 U.S.C. §1996)

Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. §470aa)

Clean Air Act (CAA) and CAA Amendments of 1990 (42 U.S.C. §7401)

Clean Water Act (CWA) of 1977 (The Federal Water Pollution Control Act) (33 U.S.C. §1251)

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. §9601) (Amended by SARA)

Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 U.S.C. §11001 et seq.) (Also known as SARA Title III)

Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.)

Federal Facility Compliance Act (FFCA) of 1992 (42 U.S.C. §6961)

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. §136)

Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. §703 et seq.)

National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. §4321)

National Historic Preservation Act of 1966, as amended (16 U.S.C. §470 et seq.)

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 444.976, "Solid Waste Disposal"	• Disposal of construction debris • Disposal of routine non-hazardous solid wastes • Disposal of septic sludge • Disposal of hazardous waste • PCB • Asbestos
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 • Water conservation plan
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 459, *Hazardous Materials*	
NAC 459.9921 to 459.999, "Storage Tanks"	• Spill reporting
Chapter 477, *State Fire Marshall*	
NAC 459.9921 to 459.999, "Permit to Store Hazardous Material"	• Hazardous material storage
Chapter 534, *Underground Water and Wells*	
NAC 534.010 to 534.500, "Underground Water and Wells"	• Drilling, construction, operation, and plugging (abandonment) of wells and boreholes

NOTES: TTR = Tonopah Test Range
PCB = polychlorinated biphenols

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Chapter 7 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.

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 National Ambient Air Quality Standards (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

2011 TTR SAMPLING LOCATION MAPS

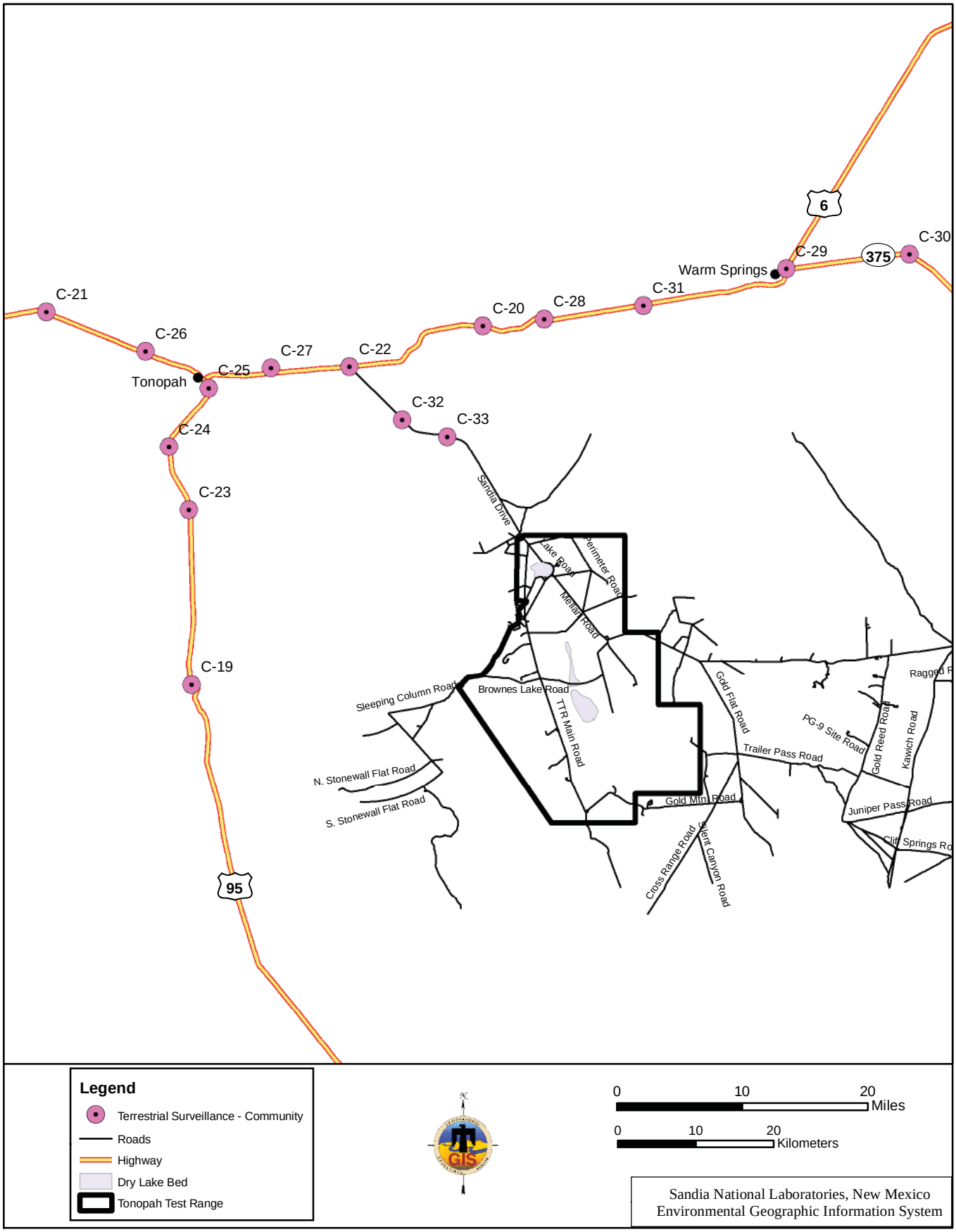

FIGURE A-1. Off-site Soil Sampling Locations

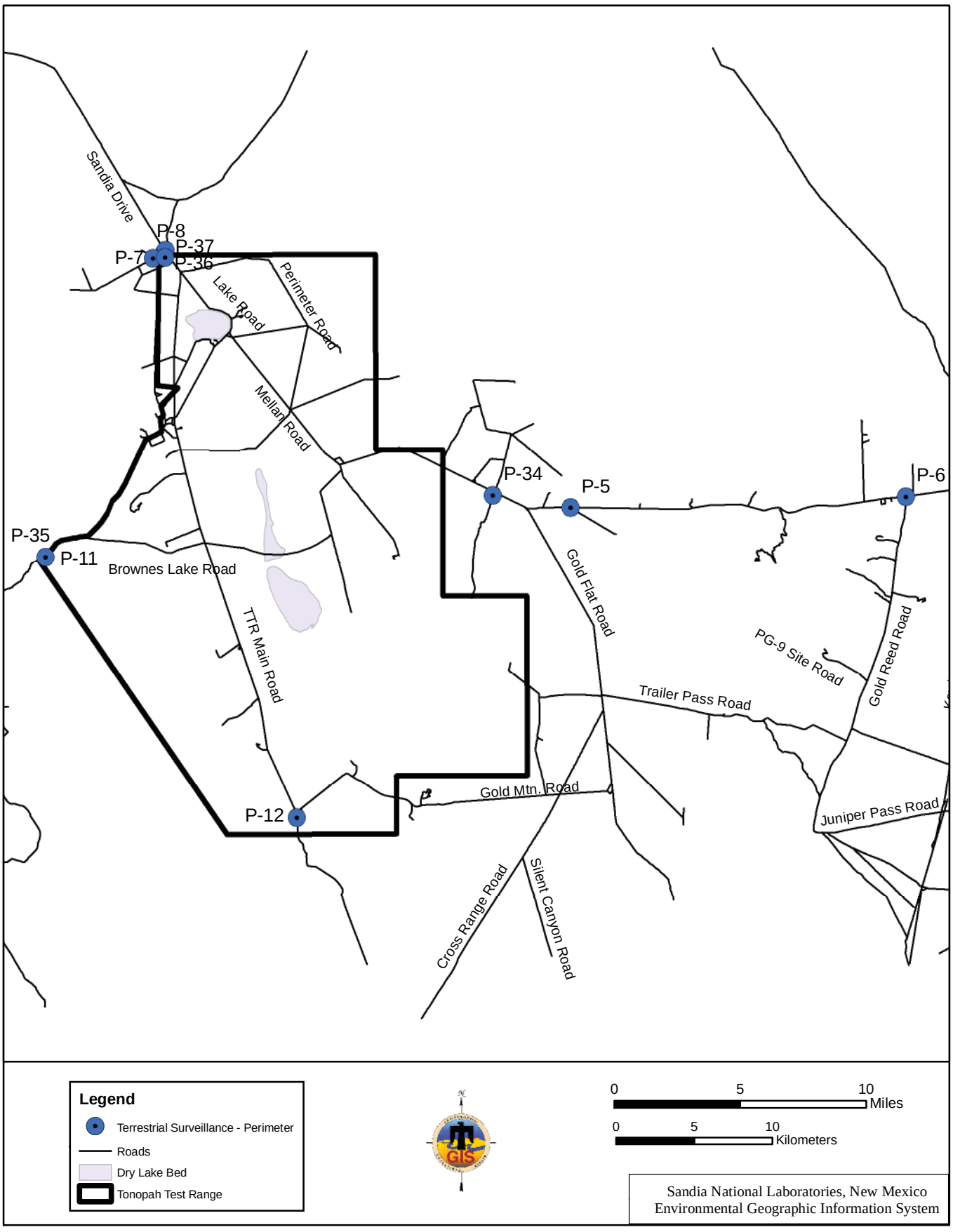

FIGURE A-2. Perimeter Soil Sampling Locations

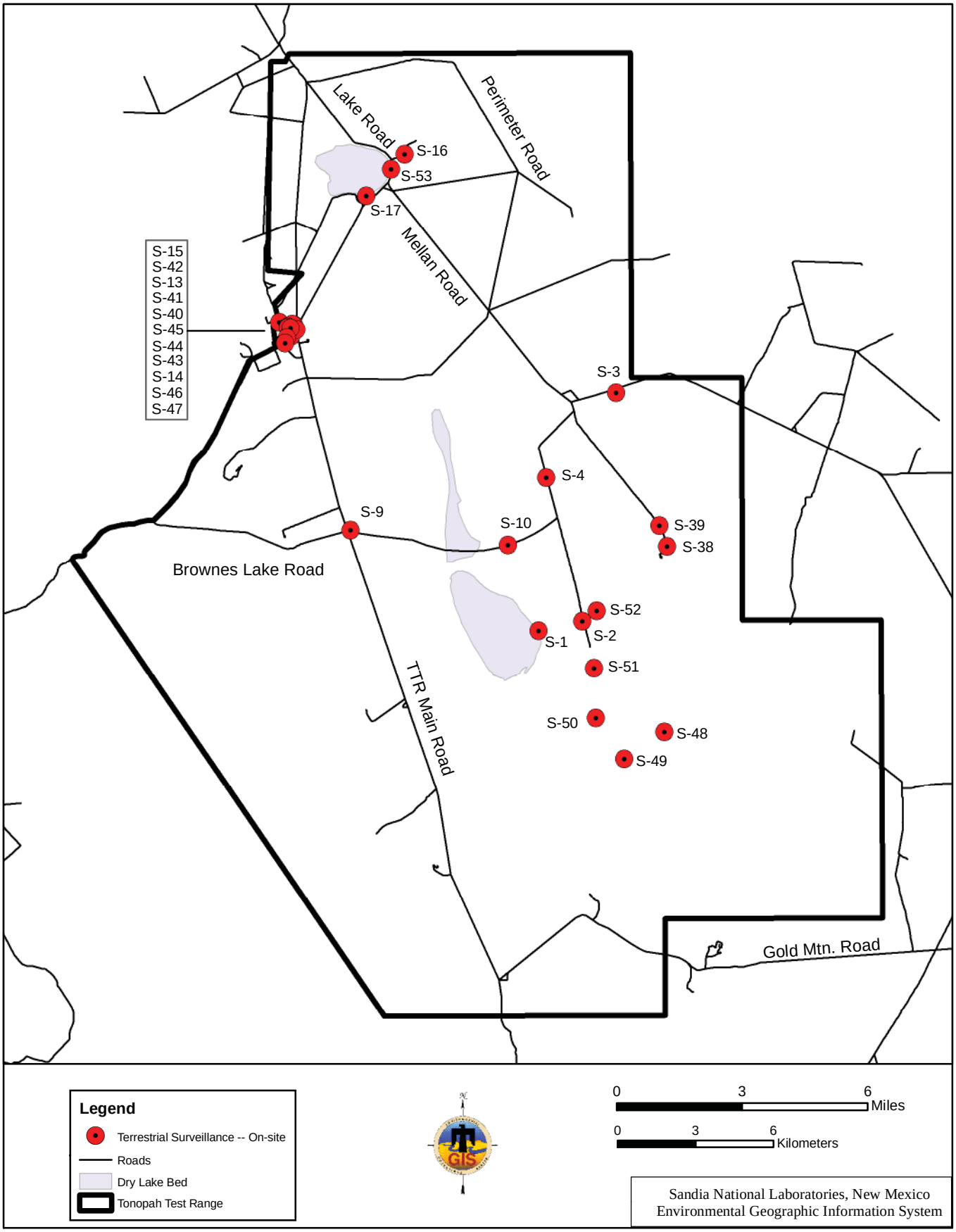

FIGURE A-3. On-Site Soil Sampling Locations

APPENDIX B

2011 TTR TERRESTRIAL SURVEILLANCE RESULTS

TABLE B-1. Radiological Results for Off-Site Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
C-20	Americium-241	pCi/g	0.0252	0.0352	0.0275	0.0549	U
C-20	Cesium-137	pCi/g	0.171	0.0231	0.00931	0.0186	
C-20	Uranium-235	pCi/g	0.0921	0.0897	0.0503	0.101	U
C-20	Uranium-238	pCi/g	1.24	0.547	0.249	0.498	
C-21	Americium-241	pCi/g	0.0477	0.0399	0.028	0.0559	U
C-21	Cesium-137	pCi/g	0.213	0.0254	0.00826	0.0165	
C-21	Uranium-235	pCi/g	0.0848	0.0948	0.0455	0.091	U
C-21	Uranium-238	pCi/g	1.11	0.611	0.244	0.488	
C-22	Americium-241	pCi/g	0.0942	0.0656	0.0422	0.0943	U
C-22	Cesium-137	pCi/g	0.0535	0.0171	0.00974	0.0195	
C-22	Uranium-235	pCi/g	0.0986	0.0735	0.0594	0.119	U
C-22	Uranium-238	pCi/g	1.1	0.745	0.355	0.709	
C-23	Americium-241	pCi/g	0.0266	0.0482	0.0379	0.0758	U
C-23	Cesium-137	pCi/g	0.0708	0.0279	0.0135	0.0269	
C-23	Uranium-238	pCi/g	1.33	0.808	0.337	0.674	
C-24	Americium-241	pCi/g	0.0134	0.0213	0.0155	0.0309	U
C-24	Cesium-137	pCi/g	0.257	0.0305	0.0106	0.0211	
C-24	Uranium-235	pCi/g	0.0719	0.107	0.0486	0.0971	U
C-24	Uranium-238	pCi/g	1.36	0.477	0.149	0.297	
C-25	Americium-241	pCi/g	0.0894	0.0611	0.0388	0.0894	U
C-25	Cesium-137	pCi/g	0.0265	0.0131	0.00944	0.0189	
C-25	Uranium-235	pCi/g	0.0964	0.0988	0.0528	0.106	U
C-25	Uranium-238	pCi/g	1.54	0.673	0.328	0.655	
C-26	Americium-241	pCi/g	0.0182	0.0494	0.0393	0.0785	U
C-26	Cesium-137	pCi/g	0.611	0.0582	0.012	0.0239	
C-26	Uranium-235	pCi/g	0.0672	0.126	0.0663	0.132	U
C-26	Uranium-238	pCi/g	1.61	0.984	0.353	0.705	
C-27	Americium-241	pCi/g	0.0358	0.0441	0.0339	0.0677	U
C-27	Cesium-137	pCi/g	0.357	0.0474	0.0115	0.0229	
C-27	Uranium-235	pCi/g	0.036	0.0801	0.0661	0.132	U
C-27	Uranium-238	pCi/g	1.76	0.727	0.309	0.618	
C-28	Americium-241	pCi/g	0.0405	0.0365	0.0264	0.0528	U
C-28	Cesium-137	pCi/g	0.146	0.0323	0.0157	0.0313	
C-28	Uranium-235	pCi/g	0.0647	0.0948	0.0723	0.145	U
C-28	Uranium-238	pCi/g	0.747	0.726	0.25	0.5	
C-29	Americium-241	pCi/g	0.0229	0.0873	0.0709	0.142	U
C-29	Cesium-137	pCi/g	0.17	0.0287	0.0143	0.0285	
C-29	Uranium-235	pCi/g	0.177	0.133	0.081	0.162	

TABLE B-1. Radiological Results for Off-Site Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
C-29	Uranium-238	pCi/g	1.53	1.29	0.591	1.18	
C-30	Americium-241	pCi/g	0.0416	0.0286	0.0183	0.0416	U
C-30	Cesium-137	pCi/g	0.198	0.0308	0.013	0.0259	
C-30	Uranium-235	pCi/g	0.0389	0.123	0.0577	0.115	U
C-30	Uranium-238	pCi/g	1.44	0.584	0.178	0.356	
C-31	Americium-241	pCi/g	0.036	0.0507	0.0392	0.0783	U
C-31	Cesium-137	pCi/g	0.113	0.0303	0.0143	0.0285	
C-31	Uranium-235	pCi/g	0.047	0.0822	0.0636	0.127	U
C-31	Uranium-238	pCi/g	1.2	0.743	0.339	0.678	
C-32	Americium-241	pCi/g	0.0201	0.0544	0.0459	0.0917	U
C-32	Cesium-137	pCi/g	0.109	0.0168	0.00813	0.0163	
C-32	Uranium-235	pCi/g	0.0428	0.0863	0.0458	0.0916	U
C-33	Americium-241	pCi/g	-0.00615	0.0242	0.0174	0.0349	U
C-33	Cesium-137	pCi/g	0.063	0.0228	0.0132	0.0264	
C-33	Uranium-235	pCi/g	0.0903	0.103	0.0539	0.108	U
C-33	Uranium-238	pCi/g	1.07	0.476	0.173	0.346	

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, 2011

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
P-06	Americium-241	pCi/g	-0.122	0.141	0.117	0.234	U
P-06	Cesium-137	pCi/g	0.139	0.0376	0.0153	0.0306	
P-06	Uranium-235	pCi/g	-0.00376	0.11	0.092	0.184	U
P-06	Uranium-238	pCi/g	0.996	1.16	0.912	1.82	U
P-08	Americium-241	pCi/g	0.0372	0.0385	0.029	0.0579	U
P-08	Cesium-137	pCi/g	0.107	0.0202	0.00857	0.0171	
P-08	Uranium-235	pCi/g	0.0698	0.0982	0.0436	0.0872	U
P-08	Uranium-238	pCi/g	0.927	0.668	0.249	0.498	
P-11	Americium-241	pCi/g	0.0513	0.0567	0.0437	0.0873	U
P-11	Cesium-137	pCi/g	0.151	0.0233	0.0108	0.0216	
P-11	Uranium-235	pCi/g	0.0404	0.102	0.0626	0.125	U
P-11	Uranium-238	pCi/g	1.41	0.967	0.368	0.735	
P-12	Americium-241	pCi/g	-0.00332	0.0649	0.0556	0.111	U
P-12	Cesium-137	pCi/g	0.213	0.0272	0.0105	0.0209	
P-12	Uranium-235	pCi/g	0.135	0.115	0.0577	0.115	
P-12	Uranium-238	pCi/g	1.55	1.2	0.449	0.897	
P-34	Americium-241	pCi/g	0.133	0.114	0.0816	0.163	U
P-34	Cesium-137	pCi/g	0.326	0.0414	0.0145	0.0289	
P-34	Uranium-238	pCi/g	1.04	1.4	0.629	1.26	U
P-35	Americium-241	pCi/g	0.0353	0.0269	0.017	0.0354	U
P-35	Cesium-137	pCi/g	0.469	0.0572	0.0147	0.0293	
P-35	Uranium-235	pCi/g	0.0721	0.0666	0.0585	0.117	U
P-35	Uranium-238	pCi/g	1.49	0.46	0.163	0.325	
P-36	Americium-241	pCi/g	0.0397	0.0584	0.048	0.0959	U
P-36	Cesium-137	pCi/g	0.133	0.0242	0.0109	0.0218	
P-36	Uranium-235	pCi/g	0.0408	0.103	0.0561	0.112	U
P-36	Uranium-238	pCi/g	1.54	1.06	0.392	0.783	
P-37	Americium-241	pCi/g	-0.147	0.117	0.0873	0.175	U
P-37	Cesium-137	pCi/g	0.0273	0.0183	0.0121	0.0273	U
P-37	Uranium-235	pCi/g	0.0868	0.088	0.0709	0.142	U
P-37	Uranium-238	pCi/g	0.797	0.891	0.679	1.36	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, 2011

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-48	Americium-241	pCi/g	-0.0143	0.0814	0.0681	0.136	U
S-48	Cesium-137	pCi/g	0.447	0.0473	0.0125	0.0249	
S-48	Uranium-235	pCi/g	-0.0206	0.0942	0.0712	0.142	U
S-48	Uranium-238	pCi/g	1.71	1.39	0.551	1.1	
S-49	Americium-241	pCi/g	0.211	0.0908	0.0476	0.0951	
S-49	Cesium-137	pCi/g	0.368	0.0411	0.0116	0.0233	
S-49	Plutonium-238	pCi/g	0.0279	0.0435	0.0688	0.156	U
S-49	Uranium-235	pCi/g	0.0909	0.0936	0.072	0.144	U
S-49	Uranium-238	pCi/g	1.26	0.935	0.418	0.835	
S-50	Americium-241	pCi/g	0.0898	0.0579	0.0347	0.0898	U
S-50	Cesium-137	pCi/g	0.389	0.0423	0.00997	0.0199	
S-50	Uranium-235	pCi/g	0.00927	0.0776	0.0639	0.128	U
S-50	Uranium-238	pCi/g	1.05	0.622	0.308	0.616	
S-51	Americium-241	pCi/g	6.56	0.589	0.0212	0.0425	
S-51	Cesium-137	pCi/g	0.406	0.0521	0.0131	0.0262	
S-51	Plutonium-238	pCi/g	0.338	0.183	0.196	0.446	U
S-51	Uranium-235	pCi/g	0.07	0.0694	0.0594	0.119	U
S-51	Uranium-238	pCi/g	1.3	0.43	0.168	0.336	
S-52	Americium-241	pCi/g	0.185	0.0654	0.0208	0.0416	
S-52	Cesium-137	pCi/g	0.238	0.0407	0.0145	0.029	
S-52	Plutonium-238	pCi/g	0.0119	0.0156	0.0196	0.0445	U
S-52	Uranium-235	pCi/g	0.0496	0.133	0.0661	0.132	U
S-52	Uranium-238	pCi/g	1.63	0.554	0.2	0.4	

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, 2011

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-40	Americium-241	pCi/g	0.0343	0.0525	0.0399	0.0797	U
S-40	Cesium-137	pCi/g	0.159	0.0245	0.0106	0.0213	
S-40	Uranium-235	pCi/g	0.0115	0.099	0.0568	0.114	U
S-40	Uranium-238	pCi/g	1.22	0.755	0.347	0.694	
S-41	Americium-241	pCi/g	0.0484	0.0336	0.0209	0.0484	U
S-41	Cesium-137	pCi/g	0.0685	0.0239	0.0149	0.0297	
S-41	Uranium-235	pCi/g	0.144	0.143	0.0656	0.131	
S-41	Uranium-238	pCi/g	1.6	0.664	0.208	0.415	
S-42	Americium-241	pCi/g	0.0464	0.0316	0.0186	0.0464	U
S-42	Cesium-137	pCi/g	0.256	0.0345	0.0135	0.027	
S-42	Uranium-235	pCi/g	0.134	0.102	0.0597	0.119	
S-42	Uranium-238	pCi/g	1.34	0.483	0.184	0.368	
S-43	Americium-241	pCi/g	0.0438	0.0711	0.0574	0.115	U
S-43	Cesium-137	pCi/g	0.0186	0.0238	0.0115	0.023	U
S-43	Uranium-235	pCi/g	0.0297	0.102	0.0609	0.122	U
S-43	Uranium-238	pCi/g	1.63	1.24	0.462	0.923	
S-44	Americium-241	pCi/g	0.0228	0.0384	0.0309	0.0617	U
S-44	Cesium-137	pCi/g	0.0659	0.0228	0.0114	0.0228	
S-44	Uranium-235	pCi/g	0.139	0.122	0.0536	0.107	
S-44	Uranium-238	pCi/g	1	0.686	0.276	0.551	
S-45	Americium-241	pCi/g	0.0638	0.0647	0.0423	0.0846	U
S-45	Cesium-137	pCi/g	0.0168	0.0186	0.0126	0.0252	U
S-45	Uranium-235	pCi/g	0.0813	0.0904	0.0689	0.138	U
S-45	Uranium-238	pCi/g	1.65	0.821	0.372	0.743	
S-46	Americium-241	pCi/g	0.063	0.0717	0.0558	0.111	U
S-46	Cesium-137	pCi/g	0.0725	0.0192	0.00989	0.0198	
S-46	Uranium-235	pCi/g	0.0321	0.107	0.0571	0.114	U
S-47	Americium-241	pCi/g	0.0806	0.0852	0.0646	0.129	U
S-47	Cesium-137	pCi/g	0.103	0.0248	0.0115	0.023	
S-47	Uranium-235	pCi/g	0.0357	0.0649	0.0568	0.113	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, 2011

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-02	Americium-241	pCi/g	0.00427	0.08	0.068	0.136	U
S-02	Cesium-137	pCi/g	0.461	0.0494	0.015	0.03	
S-02	Uranium-235	pCi/g	0.0743	0.142	0.07	0.14	U
S-02	Uranium-238	pCi/g	0.737	1.32	0.539	1.08	U
S-03	Americium-241	pCi/g	0.0111	0.0948	0.08	0.16	U
S-03	Cesium-137	pCi/g	0.206	0.039	0.0126	0.0252	
S-03	Uranium-235	pCi/g	0.1	0.0842	0.0696	0.139	U
S-03	Uranium-238	pCi/g	1.08	1.21	0.611	1.22	U
S-04	Americium-241	pCi/g	0.0448	0.0587	0.0462	0.0924	U
S-04	Cesium-137	pCi/g	0.35	0.0426	0.0124	0.0249	
S-04	Uranium-235	pCi/g	0.0787	0.115	0.0641	0.128	U
S-04	Uranium-238	pCi/g	1.02	0.858	0.388	0.776	
S-09	Americium-241	pCi/g	0.0967	0.0733	0.0523	0.105	U
S-09	Americium-241	pCi/g	0.0293	0.024	0.0166	0.0333	U
S-09	Americium-241	pCi/g	0.109	0.123	0.097	0.194	U
S-09	Americium-241	pCi/g	0.0731	0.11	0.085	0.17	U
S-09	Americium-241	pCi/g	0.024	0.0261	0.0195	0.0389	U
S-09	Americium-241	pCi/g	0.052	0.0377	0.0242	0.052	U
S-09	Americium-241	pCi/g	2.18	0.189	0.0418	0.0835	
S-09	Cesium-137	pCi/g	0.17	0.029	0.0126	0.0251	
S-09	Cesium-137	pCi/g	0.374	0.0442	0.014	0.028	
S-09	Cesium-137	pCi/g	0.164	0.0382	0.0128	0.0256	
S-09	Cesium-137	pCi/g	0.463	0.0438	0.00859	0.0172	
S-09	Cesium-137	pCi/g	0.267	0.0331	0.0125	0.0249	
S-09	Cesium-137	pCi/g	0.16	0.0335	0.0162	0.0323	
S-09	Cesium-137	pCi/g	0.107	0.0267	0.0136	0.0271	
S-09	Plutonium-238	pCi/g	0.2	0.068	0.0493	0.112	
S-09	Uranium-235	pCi/g	-0.0357	0.109	0.0776	0.155	U
S-09	Uranium-235	pCi/g	0.0459	0.0619	0.0573	0.115	U
S-09	Uranium-235	pCi/g	0.146	0.121	0.069	0.138	
S-09	Uranium-235	pCi/g	0.0461	0.109	0.0536	0.107	U
S-09	Uranium-235	pCi/g	0.0688	0.153	0.0769	0.154	U
S-09	Uranium-235	pCi/g	-0.02	0.0908	0.0747	0.149	U
S-09	Uranium-235	pCi/g	0.182	0.108	0.0647	0.129	
S-09	Uranium-238	pCi/g	1.44	0.461	0.163	0.327	
S-09	Uranium-238	pCi/g	1.24	0.516	0.199	0.397	
S-09	Uranium-238	pCi/g	0.745	1.25	0.662	1.32	U
S-09	Uranium-238	pCi/g	2.22	1.47	0.741	1.48	
S-09	Uranium-238	pCi/g	1.99	0.756	0.362	0.724	

TABLE B-5. Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
S-09	Uranium-238	pCi/g	1.76	0.741	0.242	0.484	
S-09	Uranium-238	pCi/g	1.4	1.02	0.414	0.828	
S-10	Americium-241	pCi/g	0.0997	0.0939	0.0672	0.134	U
S-10	Cesium-137	pCi/g	0.114	0.0257	0.0146	0.0291	
S-10	Uranium-235	pCi/g	0.0514	0.111	0.0878	0.176	U
S-10	Uranium-238	pCi/g	2.06	1.11	0.557	1.11	
S-38	Americium-241	pCi/g	0.0463	0.0517	0.0381	0.0762	U
S-38	Cesium-137	pCi/g	0.119	0.0235	0.012	0.0241	
S-38	Uranium-235	pCi/g	0.0997	0.109	0.0553	0.111	U
S-38	Uranium-238	pCi/g	0.943	0.805	0.333	0.666	
S-39	Americium-241	pCi/g	0.0763	0.0443	0.0252	0.0503	
S-39	Cesium-137	pCi/g	0.342	0.0463	0.0165	0.033	
S-39	Plutonium-238	pCi/g	0.0313	0.0171	0.0162	0.0369	U
S-39	Uranium-235	pCi/g	0.0787	0.17	0.0822	0.164	U
S-39	Uranium-238	pCi/g	1.58	0.739	0.26	0.52	
S-53	Americium-241	pCi/g	0.000795	0.0467	0.0381	0.0761	U
S-53	Cesium-137	pCi/g	0.407	0.0399	0.00901	0.018	
S-53	Uranium-235	pCi/g	0.13	0.111	0.0484	0.0968	
S-53	Uranium-238	pCi/g	1.27	0.843	0.325	0.649	

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, 2011

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
C-29	Americium-241	pCi/g	090065-001	0.0229	0.0873	0.0709	0.142	U
C-29	Americium-241	pCi/g	090066-001	0.014	0.049	0.0399	0.0797	U
C-29	Americium-241	pCi/g	090067-001	0.0256	0.026	0.0183	0.0366	U
	Americium-241 Average			**0.02**				
	Americium-241 StdDev			**0.01**				
	CV%			**29.14**				
	Americium-241 Min			**0.01**				
	Americium-241 Max			**0.03**				
C-29	Cesium-137	pCi/g	090065-001	0.17	0.0287	0.0143	0.0285	
C-29	Cesium-137	pCi/g	090066-001	0.186	0.0303	0.0131	0.0261	
C-29	Cesium-137	pCi/g	090067-001	0.169	0.0267	0.0119	0.0238	
	Cesium-137 Average			**0.18**				
	Cesium-137 StdDev			**0.01**				
	CV%			**5.45**				
	Cesium-137 Min			**0.17**				
	Cesium-137 Max			**0.19**				
C-29	Uranium-235	pCi/g	090065-001	0.177	0.133	0.081	0.162	
C-29	Uranium-235	pCi/g	090066-001	0.0839	0.121	0.0712	0.142	U
C-29	Uranium-235	pCi/g	090067-001	0.242	0.12	0.0619	0.124	
	Uranium-235 Average			**0.17**				
	Uranium-235 StdDev			**0.08**				
	CV%			**47.40**				
	Uranium-235 Min			**0.08**				
	Uranium-235 Max			**0.24**				
C-29	Uranium-238	pCi/g	090065-001	1.53	1.29	0.591	1.18	
C-29	Uranium-238	pCi/g	090066-001	1.51	0.745	0.362	0.723	
C-29	Uranium-238	pCi/g	090067-001	1.27	0.455	0.186	0.372	
	Uranium-238 Average			**1.44**				
	Uranium-238 StdDev			**0.14**				
	CV%			**10.07**				
	Uranium-238 Min			**1.27**				
	Uranium-238 Max			**1.53**				
P-11	Americium-241	pCi/g	090664-001	0.0513	0.0567	0.0437	0.0873	U
P-11	Americium-241	pCi/g	090665-001	-0.0433	0.0827	0.0651	0.13	U
P-11	Americium-241	pCi/g	090666-001	0.0118	0.0277	0.021	0.0421	U
	Americium-241 Average			**0.01**				
	Americium-241 StdDev			**0.05**				
	CV%			**719.91**				
	Americium-241 Min			**-0.04**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Americium-241 Max			**0.05**				
P-11	**Cesium-137**	pCi/g	090664-001	**0.15**	0.0233	0.0108	0.0216	
P-11	Cesium-137	pCi/g	090665-001	0.0841	0.0272	0.0157	0.0314	
P-11	Cesium-137	pCi/g	090666-001	0.0827	0.0316	0.0151	0.0301	
	Cesium-137 Average			**0.11**				
	Cesium-137 StdDev			**0.04**				
	CV%			**36.85**				
	Cesium-137 Min			**0.08**				
	Cesium-137 Max			**0.15**				
P-11	Uranium-235	pCi/g	090664-001	0.0404	0.102	0.0626	0.125	U
P-11	Uranium-235	pCi/g	090665-001	0.0855	0.0892	0.0772	0.154	U
P-11	Uranium-235	pCi/g	090666-001	0.156	0.143	0.0641	0.128	
	Uranium-235 Average			**0.09**				
	Uranium-235 StdDev			**0.06**				
	CV%			**62.00**				
	Uranium-235 Min			**0.04**				
	Uranium-235 Max			**0.16**				
P-11	Uranium-238	pCi/g	090664-001	1.41	0.967	0.368	0.735	
P-11	Uranium-238	pCi/g	090665-001	2.3	1.24	0.538	1.07	
P-11	Uranium-238	pCi/g	090666-001	1.9	0.625	0.206	0.411	
	Uranium-238 Average			**1.87**				
	Uranium-238 StdDev			**0.45**				
	CV%			**23.84**				
	Uranium-238 Min			**1.41**				
	Uranium-238 Max			**2.30**				
S-03	Americium-241	pCi/g	090080-001	0.0111	0.0948	0.08	0.16	U
S-03	Americium-241	pCi/g	090081-001	0.164	0.0448	0.021	0.0419	
S-03	Americium-241	pCi/g	090082-001	0.0536	0.0481	0.0364	0.0728	U
	Americium-241 Average			**0.08**				
	Americium-241 StdDev			**0.08**				
	CV%			**103.53**				
	Americium-241 Min			**0.01**				
	Americium-241 Max			**0.16**				
S-03	Cesium-137	pCi/g	090080-001	0.206	0.039	0.0126	0.0252	
S-03	Cesium-137	pCi/g	090081-001	0.197	0.0343	0.0142	0.0283	
S-03	Cesium-137	pCi/g	090082-001	0.191	0.0317	0.0123	0.0245	
	Cesium-137 Average			**0.20**				
	Cesium-137 StdDev			**0.01**				
	CV%			**3.81**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Cesium-137 Min			**0.19**				
	Cesium-137 Max			**0.21**				
S-03	Uranium-235	pCi/g	090080-001	0.1	0.0842	0.0696	0.139	U
S-03	Uranium-235	pCi/g	090081-001	0.287	0.141	0.0661	0.132	
S-03	Uranium-235	pCi/g	090082-001	0.0534	0.076	0.0644	0.129	U
	Uranium-235 Average			**0.15**				
	Uranium-235 StdDev			**0.12**				
	CV%			**84.22**				
	Uranium-235 Min			**0.05**				
	Uranium-235 Max			**0.29**				
S-03	Uranium-238	pCi/g	090080-001	1.08	1.21	0.611	1.22	U
S-03	Uranium-238	pCi/g	090081-001	1.84	0.558	0.203	0.406	
S-03	Uranium-238	pCi/g	090082-001	1.42	0.727	0.317	0.635	
	Uranium-238 Average			**1.45**				
	Uranium-238 StdDev			**0.38**				
	CV%			**26.32**				
	Uranium-238 Min			**1.08**				
	Uranium-238 Max			**1.84**				
S-09	Americium-241	pCi/g	090075-001	2.18	0.189	0.0418	0.0835	
S-09	Americium-241	pCi/g	090076-001	3.23	0.296	0.0207	0.0413	
S-09	Americium-241	pCi/g	090077-001	1.66	0.164	0.0417	0.0834	
	Americium-241 Average			**2.36**				
	Americium-241 StdDev			**0.80**				
	CV%			**33.94**				
	Americium-241 Min			**1.66**				
	Americium-241 Max			**3.23**				
S-09	Cesium-137	pCi/g	090075-001	0.107	0.0267	0.0136	0.0271	
S-09	Cesium-137	pCi/g	090076-001	0.144	0.0374	0.0147	0.0293	
S-09	Cesium-137	pCi/g	090077-001	0.171	0.0398	0.0136	0.0272	
	Cesium-137 Average			**0.14**				
	Cesium-137 StdDev			**0.03**				
	CV%			**22.84**				
	Cesium-137 Min			**0.11**				
	Cesium-137 Max			**0.17**				
S-09	Plutonium-238	pCi/g	090075-R01	0.2	0.068	0.0493	0.112	
S-09	Plutonium-238	pCi/g	090076-R01	0.129	0.0415	0.0303	0.0689	
S-09	Plutonium-238	pCi/g	090077-R01	0.119	0.124	0.196	0.446	U
	Plutonium-238 Average			**0.15**				
	Plutonium-238 StdDev			**0.04**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	CV%			**29.57**				
	Plutonium-238 Min			**0.12**				
	Plutonium-238 Max			**0.20**				
S-09	Uranium-235	pCi/g	090075-001	0.146	0.121	0.069	0.138	
S-09	Uranium-235	pCi/g	090076-001	0.074	0.111	0.059	0.118	U
S-09	Uranium-235	pCi/g	090077-001	0.0614	0.111	0.063	0.126	U
	Uranium-235 Average			**0.09**				
	Uranium-235 StdDev			**0.05**				
	CV%			**48.66**				
	Uranium-235 Min			**0.06**				
	Uranium-235 Max			**0.15**				
S-09	Uranium-238	pCi/g	090075-001	1.99	0.756	0.362	0.724	
S-09	Uranium-238	pCi/g	090076-001	1.36	0.44	0.181	0.362	
S-09	Uranium-238	pCi/g	090077-001	1.41	0.725	0.382	0.764	
	Uranium-238 Average			**1.59**				
	Uranium-238 StdDev			**0.35**				
	CV%			**22.07**				
	Uranium-238 Min			**1.36**				
	Uranium-238 Max			**1.99**				
S-48	Americium-241	pCi/g	090088-001	-0.0143	0.0814	0.0681	0.136	U
S-48	Americium-241	pCi/g	090089-001	0.0201	0.0294	0.0216	0.0432	U
S-48	Americium-241	pCi/g	090090-001	0.0675	0.0658	0.0498	0.0994	U
	Americium-241 Average			**0.02**				
	Americium-241 StdDev			**0.04**				
	CV%			**168.10**				
	Americium-241 Min			**-0.01**				
	Americium-241 Max			**0.07**				
S-48	Cesium-137	pCi/g	090088-001	0.447	0.0473	0.0125	0.0249	
S-48	Cesium-137	pCi/g	090089-001	0.347	0.0444	0.0156	0.0311	
S-48	Cesium-137	pCi/g	090090-001	0.291	0.0374	0.0122	0.0243	
	Cesium-137 Average			**0.36**				
	Cesium-137 StdDev			**0.08**				
	CV%			**21.85**				
	Cesium-137 Min			**0.29**				
	Cesium-137 Max			**0.45**				
S-48	Uranium-235	pCi/g	090088-001	-0.0206	0.0942	0.0712	0.142	U
S-48	Uranium-235	pCi/g	090089-001	0.0342	0.117	0.0665	0.133	U
S-48	Uranium-235	pCi/g	090090-001	0.0147	0.0767	0.07	0.14	U
	Uranium-235 Average			**0.01**				

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Uranium-235 StdDev			**0.03**				
	CV%			**294.46**				
	Uranium-235 Min			**-0.02**				
	Uranium-235 Max			**0.03**				
S-48	Uranium-238	pCi/g	090088-001	1.71	1.39	0.551	1.1	
S-48	Uranium-238	pCi/g	090089-001	1.5	0.593	0.209	0.418	
S-48	Uranium-238	pCi/g	090090-001	0.544	0.923	0.429	0.858	U
	Uranium-238 Average			**1.25**				
	Uranium-238 StdDev			**0.62**				
	CV%			**49.67**				
	Uranium-238 Min			**0.54**				
	Uranium-238 Max			**1.71**				
S-51	Americium-241	pCi/g	090093-001	6.56	0.589	0.0212	0.0425	
S-51	Americium-241	pCi/g	090094-001	0.0477	0.0521	0.0381	0.0762	U
S-51	Americium-241	pCi/g	090095-001	39	3.35	0.142	0.284	
S-51	Americium-241	pCi/g	090096-001	5.34	0.45	0.0536	0.107	
S-51	Americium-241	pCi/g	090659-001	2.29	0.195	0.0255	0.0509	
S-51	Americium-241	pCi/g	090660-001	5.07	0.428	0.0512	0.102	
	Americium-241 Average			**9.72**				
	Americium-241 StdDev			**14.54**				
	CV%			**149.61**				
	Americium-241 Min			**0.05**				
	Americium-241 Max			**39.00**				
S-51	Cesium-137	pCi/g	090093-001	0.406	0.0521	0.0131	0.0262	
S-51	Cesium-137	pCi/g	090094-001	0.0335	0.0271	0.0135	0.027	
S-51	Cesium-137	pCi/g	090095-001	1.49	0.142	0.0147	0.0294	
S-51	Cesium-137	pCi/g	090096-001	0.569	0.0621	0.0138	0.0276	
S-51	Cesium-137	pCi/g	090659-001	0.313	0.0403	0.0145	0.029	
S-51	Cesium-137	pCi/g	090660-001	0.354	0.0441	0.0156	0.0311	
	Cesium-137 Average			**0.53**				
	Cesium-137 StdDev			**0.50**				
	CV%			**95.26**				
	Cesium-137 Min			**0.03**				
	Cesium-137 Max			**1.49**				
S-51	Plutonium-238	pCi/g	090093-R01	0.338	0.183	0.196	0.446	U
S-51	Plutonium-238	pCi/g	090095-R01	2.19	0.467	0.184	0.419	
S-51	Plutonium-238	pCi/g	090096-R01	0.0443	0.087	0.146	0.331	U
S-51	Plutonium-238	pCi/g	090659-R01	0.488	0.1	0.0356	0.081	
S-51	Plutonium-238	pCi/g	090660-R01	0.0441	0.0326	0.0362	0.0823	U

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Sample ID	Activity and/or Concentration	Two Sigma Error	Decision Level	MDA	Lab Data Qualifiers
	Plutonium-238 Average			**0.62**				
	Plutonium-238 StdDev			**0.90**				
	CV%			**144.62**				
	Plutonium-238 Min			**0.04**				
	Plutonium-238 Max			**2.19**				
S-51	Uranium-235	pCi/g	090093-001	0.07	0.0694	0.0594	0.119	U
S-51	Uranium-235	pCi/g	090094-001	0.17	0.0802	0.0704	0.141	
S-51	Uranium-235	pCi/g	090095-001	0.157	0.116	0.0903	0.181	U
S-51	Uranium-235	pCi/g	090096-001	0.0367	0.112	0.0665	0.133	U
S-51	Uranium-235	pCi/g	090659-001	0.0942	0.141	0.0649	0.13	U
S-51	Uranium-235	pCi/g	090660-001	0.0284	0.0867	0.0731	0.146	U
	Uranium-235 Average			**0.09**				
	Uranium-235 StdDev			**0.06**				
	CV%			**64.53**				
	Uranium-235 Min			**0.03**				
	Uranium-235 Max			**0.17**				
S-51	Uranium-238	pCi/g	090093-001	1.3	0.43	0.168	0.336	
S-51	Uranium-238	pCi/g	090094-001	1.55	0.763	0.344	0.688	
S-51	Uranium-238	pCi/g	090095-001	1.45	0.965	0.643	1.28	
S-51	Uranium-238	pCi/g	090096-001	1.19	0.766	0.388	0.775	
S-51	Uranium-238	pCi/g	090659-001	2.11	0.724	0.246	0.493	
S-51	Uranium-238	pCi/g	090660-001	1.4	1.09	0.379	0.758	
	Uranium-238 Average			**1.50**				
	Uranium-238 StdDev			**0.32**				
	CV%			**21.57**				
	Uranium-238 Min			**1.19**				
	Uranium-238 Max			**2.11**				

NOTES: **CV = coefficient of variation. Only meaningful if data contains non-zero values.**
MDA = minimum detectable amount.
n/a = Not Applicable
pCi/g = picocurie per gram
U = The analyte was analyzed for, but not detected above the MDA.

Table B-7. TLD Measurements at TTR by Quarter and Location Class for Calendar Year 2011

		1st Quarter (91 Days)		2nd Quarter (92 Days)		3rd Quarter (92 Days)		4th Quarter (84 Days)	
Location Class	Location Number	Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error
On-Site	S-01	52.3	7.6	43.8	0.9	36.0	1.6	39.9	3.1
On-Site	S-02	50.1	1.0	44.4	3.4	37.3	0.5	40.0	2.7
On-Site	S-03	49.9	0.5	44.3	3.4	36.4	0.6	38.5	1.3
On-Site	S-04	52.1	1.1	47.0	2.6	36.3	0.8	41.4	0.9
On-Site	S-09	44.6	0.5	40.2	3.1	33.3	0.4	36.8	1.5
On-Site	S-10	53.8	7.4	43.6	3.7	39.4	0.9	39.0	3.0
On-Site	S-13	47.9	2.0	41.5	2.9	36.0	0.4	37.9	2.4
On-Site	S-14	45.4	0.8	40.1	2.5	33.3	0.5	35.7	0.8
On-Site	S-15	49.5	0.9	43.6	3.2	36.6	1.0	38.3	2.0
On-Site	S-16	48.3	0.8	43.0	4.5	35.6	0.4	39.1	3.3
On-Site	S-17	48.3	0.5	44.5	4.1	35.8	1.9	38.6	1.6
Perimeter	P-05	48.1	0.5	45.9	2.7	35.6	0.5	38.1	3.8
Perimeter	P-06	48.7	1.0	43.8	2.7	36.5	0.4	38.3	1.1
Perimeter	P-07	44.9	1.0	40.3	4.0	32.9	1.5	35.2	1.0
Perimeter	P-08	44.9	1.1	44.9	2.3	32.0	0.4	37.3	0.7
Perimeter	P-11	54.3	1.2	48.8	3.8	40.4	1.4	43.7	1.5
Perimeter	P-12	49.5	1.8	44.1	2.0	37.3	1.1	38.5	1.5
Community	C-19	41.7	6.6	34.2	3.9	28.5	0.5	30.0	0.7
Community	C-21	47.4	1.0	42.4	2.3	36.8	1.7	37.9	0.8
Community	C-22	45.2	0.7	40.1	2.9	34.2	1.2	34.6	2.2

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, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-48	Aluminum	mg/kg	13100		13.3	44.2
S-48	Antimony	mg/kg	0.322	U	0.322	0.977
S-48	Arsenic	mg/kg	2.56		0.177	0.885
S-48	Barium	mg/kg	224		0.442	1.77
S-48	Beryllium	mg/kg	0.448		0.0177	0.0885
S-48	Cadmium	mg/kg	0.31		0.0177	0.177
S-48	Calcium	mg/kg	8330		5.84	17.7
S-48	Chromium	mg/kg	6.12		0.177	0.531
S-48	Cobalt	mg/kg	3.62		0.0531	0.177
S-48	Copper	mg/kg	6.98		0.0584	0.177
S-48	Iron	mg/kg	10500		29.2	88.5
S-48	Lead	mg/kg	10.3		0.0885	0.354
S-48	Magnesium	mg/kg	3740		1.77	5.31
S-48	Manganese	mg/kg	406		0.885	4.42
S-48	Nickel	mg/kg	5.74		0.0885	0.354
S-48	Potassium	mg/kg	4390		14.2	53.1
S-48	Selenium	mg/kg	0.292	U	0.292	0.885
S-48	Silver	mg/kg	0.0977	U	0.0977	0.488
S-48	Sodium	mg/kg	454		14.2	44.2
S-48	Thallium	mg/kg	0.144	J	0.0531	0.354
S-48	Uranium	mg/kg	0.605		0.0117	0.0354
S-48	Vanadium	mg/kg	24.7		0.0977	0.488
S-48	Zinc	mg/kg	36		1.77	8.85
S-49	Aluminum	mg/kg	14500		14.5	48.2
S-49	Antimony	mg/kg	0.297	U	0.297	0.899
S-49	Arsenic	mg/kg	3.25		0.193	0.963
S-49	Barium	mg/kg	223		0.482	1.93
S-49	Beryllium	mg/kg	0.527		0.0193	0.0963
S-49	Cadmium	mg/kg	0.373		0.0193	0.193
S-49	Calcium	mg/kg	6250		6.36	19.3
S-49	Chromium	mg/kg	6.77		0.193	0.578
S-49	Cobalt	mg/kg	3.79		0.0578	0.193
S-49	Copper	mg/kg	8.1		0.0636	0.193
S-49	Iron	mg/kg	11100		31.8	96.3
S-49	Lead	mg/kg	11.9		0.0963	0.385
S-49	Magnesium	mg/kg	4550		1.93	5.78
S-49	Manganese	mg/kg	487		0.963	4.82
S-49	Nickel	mg/kg	6.56		0.0963	0.385
S-49	Potassium	mg/kg	5830		15.4	57.8

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-49	Selenium	mg/kg	0.318	U	0.318	0.963
S-49	Silver	mg/kg	0.0899	U	0.0899	0.45
S-49	Sodium	mg/kg	686		15.4	48.2
S-49	Thallium	mg/kg	0.168	J	0.0578	0.385
S-49	Uranium	mg/kg	0.762		0.0127	0.0385
S-49	Vanadium	mg/kg	21.1		0.0899	0.45
S-49	Zinc	mg/kg	42.6		1.93	9.63
S-50	Aluminum	mg/kg	11700		13.9	46.5
S-50	Antimony	mg/kg	0.319	U	0.319	0.965
S-50	Arsenic	mg/kg	3.25		0.186	0.929
S-50	Barium	mg/kg	157		0.0929	0.372
S-50	Beryllium	mg/kg	0.439		0.0186	0.0929
S-50	Cadmium	mg/kg	0.307		0.0186	0.186
S-50	Calcium	mg/kg	4410		6.13	18.6
S-50	Chromium	mg/kg	6.19		0.186	0.558
S-50	Cobalt	mg/kg	3.46		0.0558	0.186
S-50	Copper	mg/kg	6.83		0.0613	0.186
S-50	Iron	mg/kg	10600		30.7	92.9
S-50	Lead	mg/kg	9.7		0.0929	0.372
S-50	Magnesium	mg/kg	3680		1.86	5.58
S-50	Manganese	mg/kg	387		0.929	4.65
S-50	Nickel	mg/kg	5.7		0.0929	0.372
S-50	Potassium	mg/kg	4760		14.9	55.8
S-50	Selenium	mg/kg	0.307	U	0.307	0.929
S-50	Silver	mg/kg	0.0965	U	0.0965	0.483
S-50	Sodium	mg/kg	710		14.9	46.5
S-50	Thallium	mg/kg	0.137	J	0.0558	0.372
S-50	Uranium	mg/kg	0.635		0.0123	0.0372
S-50	Vanadium	mg/kg	29.2		0.0965	0.483
S-50	Zinc	mg/kg	38.3		1.86	9.29
S-51	Aluminum	mg/kg	11000		14.3	47.8
S-51	Antimony	mg/kg	0.675	J	0.308	0.935
S-51	Arsenic	mg/kg	3.36		0.191	0.956
S-51	Barium	mg/kg	197		0.478	1.91
S-51	Beryllium	mg/kg	0.434		0.0191	0.0956
S-51	Cadmium	mg/kg	0.315		0.0191	0.191
S-51	Calcium	mg/kg	4880		6.31	19.1
S-51	Chromium	mg/kg	5.48		0.191	0.574
S-51	Cobalt	mg/kg	3.75		0.0574	0.191

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-51	Copper	mg/kg	6.41		0.0631	0.191
S-51	Iron	mg/kg	7920		6.31	19.1
S-51	Lead	mg/kg	11.5		0.0956	0.382
S-51	Magnesium	mg/kg	3420		1.91	5.74
S-51	Manganese	mg/kg	553		0.956	4.78
S-51	Nickel	mg/kg	5.42		0.0956	0.382
S-51	Potassium	mg/kg	4280		15.3	57.4
S-51	Selenium	mg/kg	0.315	U	0.315	0.956
S-51	Silver	mg/kg	0.0935	U	0.0935	0.467
S-51	Sodium	mg/kg	317		15.3	47.8
S-51	Thallium	mg/kg	0.131	J	0.0574	0.382
S-51	Uranium	mg/kg	0.969		0.0126	0.0382
S-51	Vanadium	mg/kg	17.4		0.0935	0.467
S-51	Zinc	mg/kg	32.2		1.91	9.56
S-52	Aluminum	mg/kg	7440		2.92	9.75
S-52	Antimony	mg/kg	0.324	U	0.324	0.98
S-52	Arsenic	mg/kg	3.56		0.195	0.975
S-52	Barium	mg/kg	81.2		0.0975	0.39
S-52	Beryllium	mg/kg	0.348		0.0195	0.0975
S-52	Cadmium	mg/kg	0.281		0.0195	0.195
S-52	Calcium	mg/kg	1980		6.43	19.5
S-52	Chromium	mg/kg	3.89		0.195	0.585
S-52	Cobalt	mg/kg	2.38		0.0585	0.195
S-52	Copper	mg/kg	4.18		0.0643	0.195
S-52	Iron	mg/kg	6160		6.43	19.5
S-52	Lead	mg/kg	7.3		0.0975	0.39
S-52	Magnesium	mg/kg	2120		1.95	5.85
S-52	Manganese	mg/kg	279		0.975	4.87
S-52	Nickel	mg/kg	3.44		0.0975	0.39
S-52	Potassium	mg/kg	2510		15.6	58.5
S-52	Selenium	mg/kg	0.322	U	0.322	0.975
S-52	Silver	mg/kg	0.098	U	0.098	0.49
S-52	Sodium	mg/kg	193		15.6	48.7
S-52	Thallium	mg/kg	0.094	J	0.0585	0.39
S-52	Uranium	mg/kg	0.893		0.0129	0.039
S-52	Vanadium	mg/kg	11.6		0.098	0.49
S-52	Zinc	mg/kg	29.2		0.39	1.95

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)

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 Various On-Site Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-02	Aluminum	mg/kg	10800		12.9	42.9
S-02	Antimony	mg/kg	0.295	U	0.295	0.894
S-02	Arsenic	mg/kg	4.27		0.172	0.858
S-02	Barium	mg/kg	86.8		0.0858	0.343
S-02	Beryllium	mg/kg	0.474		0.0172	0.0858
S-02	Cadmium	mg/kg	0.187		0.0172	0.172
S-02	Calcium	mg/kg	2360		5.66	17.2
S-02	Chromium	mg/kg	4.55		0.172	0.515
S-02	Cobalt	mg/kg	2.37		0.0515	0.172
S-02	Copper	mg/kg	4.37		0.0566	0.172
S-02	Iron	mg/kg	6980		5.66	17.2
S-02	Lead	mg/kg	8.52		0.0858	0.343
S-02	Magnesium	mg/kg	2500		1.72	5.15
S-02	Manganese	mg/kg	258		0.858	4.29
S-02	Nickel	mg/kg	4.5		0.0858	0.343
S-02	Potassium	mg/kg	2950		13.7	51.5
S-02	Selenium	mg/kg	0.283	U	0.283	0.858
S-02	Silver	mg/kg	0.0894	U	0.0894	0.447
S-02	Sodium	mg/kg	142		13.7	42.9
S-02	Thallium	mg/kg	0.135	J	0.0515	0.343
S-02	Uranium	mg/kg	0.819		0.0113	0.0343
S-02	Vanadium	mg/kg	16		0.0894	0.447
S-02	Zinc	mg/kg	31		1.72	8.58
S-03	Aluminum	mg/kg	9200		2.79	9.31
S-03	Antimony	mg/kg	0.302	U	0.302	0.914
S-03	Arsenic	mg/kg	6.34		0.186	0.931
S-03	Barium	mg/kg	103		0.0931	0.372
S-03	Beryllium	mg/kg	0.377		0.0186	0.0931
S-03	Cadmium	mg/kg	0.211		0.0186	0.186
S-03	Calcium	mg/kg	2640		6.15	18.6
S-03	Chromium	mg/kg	4.7		0.186	0.559
S-03	Cobalt	mg/kg	2.9		0.0559	0.186
S-03	Copper	mg/kg	5.11		0.0615	0.186
S-03	Iron	mg/kg	7970		6.15	18.6
S-03	Lead	mg/kg	7.66		0.0931	0.372
S-03	Magnesium	mg/kg	2580		1.86	5.59
S-03	Manganese	mg/kg	312		0.931	4.66
S-03	Nickel	mg/kg	4.12		0.0931	0.372
S-03	Potassium	mg/kg	2680		14.9	55.9

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Selenium	mg/kg	0.307	U	0.307	0.931
S-03	Silver	mg/kg	0.0914	U	0.0914	0.457
S-03	Sodium	mg/kg	329		14.9	46.6
S-03	Thallium	mg/kg	0.109	J	0.0559	0.372
S-03	Uranium	mg/kg	0.861		0.0123	0.0372
S-03	Vanadium	mg/kg	13.9		0.0914	0.457
S-03	Zinc	mg/kg	29		1.86	9.31
S-04	Aluminum	mg/kg	8110		2.86	9.54
S-04	Antimony	mg/kg	0.301	U	0.301	0.911
S-04	Arsenic	mg/kg	3.74		0.191	0.954
S-04	Barium	mg/kg	107		0.0954	0.382
S-04	Beryllium	mg/kg	0.409		0.0191	0.0954
S-04	Cadmium	mg/kg	0.265		0.0191	0.191
S-04	Calcium	mg/kg	2600		6.3	19.1
S-04	Chromium	mg/kg	4.72		0.191	0.573
S-04	Cobalt	mg/kg	2.77		0.0573	0.191
S-04	Copper	mg/kg	5.31		0.063	0.191
S-04	Iron	mg/kg	7550		6.3	19.1
S-04	Lead	mg/kg	7.94		0.0954	0.382
S-04	Magnesium	mg/kg	2780		1.91	5.73
S-04	Manganese	mg/kg	395		0.954	4.77
S-04	Nickel	mg/kg	4.09		0.0954	0.382
S-04	Potassium	mg/kg	2900		15.3	57.3
S-04	Selenium	mg/kg	0.315	U	0.315	0.954
S-04	Silver	mg/kg	0.0911	U	0.0911	0.455
S-04	Sodium	mg/kg	260		15.3	47.7
S-04	Thallium	mg/kg	0.123	J	0.0573	0.382
S-04	Uranium	mg/kg	0.762		0.0126	0.0382
S-04	Vanadium	mg/kg	15.7		0.0911	0.455
S-04	Zinc	mg/kg	30.7		1.91	9.54
S-09	Aluminum	mg/kg	14800		12.9	42.9
S-09	Antimony	mg/kg	0.282	U	0.282	0.853
S-09	Arsenic	mg/kg	3.95		0.172	0.858
S-09	Barium	mg/kg	154		0.0858	0.343
S-09	Beryllium	mg/kg	0.569		0.0172	0.0858
S-09	Cadmium	mg/kg	0.218		0.0172	0.172
S-09	Calcium	mg/kg	6650		5.66	17.2
S-09	Chromium	mg/kg	7.25		0.172	0.515
S-09	Cobalt	mg/kg	5.46		0.0515	0.172

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-09	Copper	mg/kg	7.53		0.0566	0.172
S-09	Iron	mg/kg	15300		28.3	85.8
S-09	Lead	mg/kg	11.8		0.0858	0.343
S-09	Magnesium	mg/kg	4380		1.72	5.15
S-09	Manganese	mg/kg	385		0.858	4.29
S-09	Nickel	mg/kg	6.22		0.0858	0.343
S-09	Potassium	mg/kg	3990		13.7	51.5
S-09	Selenium	mg/kg	0.283	U	0.283	0.858
S-09	Silver	mg/kg	0.0853	U	0.0853	0.427
S-09	Sodium	mg/kg	213		13.7	42.9
S-09	Thallium	mg/kg	0.188	J	0.0515	0.343
S-09	Uranium	mg/kg	0.756		0.0113	0.0343
S-09	Vanadium	mg/kg	23.5		0.0853	0.427
S-09	Zinc	mg/kg	43.5		1.72	8.58
S-10	Aluminum	mg/kg	8970		2.98	9.94
S-10	Antimony	mg/kg	0.327	U	0.327	0.992
S-10	Arsenic	mg/kg	3.04		0.199	0.994
S-10	Barium	mg/kg	108		0.0994	0.398
S-10	Beryllium	mg/kg	0.472		0.0199	0.0994
S-10	Cadmium	mg/kg	0.246		0.0199	0.199
S-10	Calcium	mg/kg	4700		6.56	19.9
S-10	Chromium	mg/kg	5.31		0.199	0.596
S-10	Cobalt	mg/kg	2.93		0.0596	0.199
S-10	Copper	mg/kg	6.1		0.0656	0.199
S-10	Iron	mg/kg	7950		6.56	19.9
S-10	Lead	mg/kg	7.43		0.0994	0.398
S-10	Magnesium	mg/kg	3270		1.99	5.96
S-10	Manganese	mg/kg	354		0.994	4.97
S-10	Nickel	mg/kg	4.69		0.0994	0.398
S-10	Potassium	mg/kg	3980		15.9	59.6
S-10	Selenium	mg/kg	0.328	U	0.328	0.994
S-10	Silver	mg/kg	0.0992	U	0.0992	0.496
S-10	Sodium	mg/kg	374		15.9	49.7
S-10	Thallium	mg/kg	0.149	J	0.0596	0.398
S-10	Uranium	mg/kg	0.739		0.0131	0.0398
S-10	Vanadium	mg/kg	14.6		0.0992	0.496
S-10	Zinc	mg/kg	33.2		1.99	9.94
S-38	Aluminum	mg/kg	17200		14	46.6
S-38	Antimony	mg/kg	0.317	U	0.317	0.962

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-38	Arsenic	mg/kg	4.79		0.187	0.933
S-38	Barium	mg/kg	119		0.0933	0.373
S-38	Beryllium	mg/kg	0.645		0.0187	0.0933
S-38	Cadmium	mg/kg	0.296		0.0187	0.187
S-38	Calcium	mg/kg	21800		30.8	93.3
S-38	Chromium	mg/kg	8.09		0.187	0.56
S-38	Cobalt	mg/kg	3.4		0.056	0.187
S-38	Copper	mg/kg	6.95		0.0616	0.187
S-38	Iron	mg/kg	12000		30.8	93.3
S-38	Lead	mg/kg	9.6		0.0933	0.373
S-38	Magnesium	mg/kg	4780		1.87	5.6
S-38	Manganese	mg/kg	227		0.933	4.66
S-38	Nickel	mg/kg	7.38		0.0933	0.373
S-38	Potassium	mg/kg	4590		14.9	56
S-38	Selenium	mg/kg	0.308	U	0.308	0.933
S-38	Silver	mg/kg	0.0962	U	0.0962	0.481
S-38	Sodium	mg/kg	366		14.9	46.6
S-38	Thallium	mg/kg	0.228	J	0.056	0.373
S-38	Uranium	mg/kg	0.863		0.0123	0.0373
S-38	Vanadium	mg/kg	18.9		0.0962	0.481
S-38	Zinc	mg/kg	38.7		1.87	9.33
S-39	Aluminum	mg/kg	7900		2.94	9.8
S-39	Antimony	mg/kg	0.32	U	0.32	0.969
S-39	Arsenic	mg/kg	4.22		0.196	0.98
S-39	Barium	mg/kg	131		0.098	0.392
S-39	Beryllium	mg/kg	0.412		0.0196	0.098
S-39	Cadmium	mg/kg	0.261		0.0196	0.196
S-39	Calcium	mg/kg	3880		6.47	19.6
S-39	Chromium	mg/kg	5.56		0.196	0.588
S-39	Cobalt	mg/kg	3.19		0.0588	0.196
S-39	Copper	mg/kg	6.12		0.0647	0.196
S-39	Iron	mg/kg	7900		6.47	19.6
S-39	Lead	mg/kg	9.08		0.098	0.392
S-39	Magnesium	mg/kg	3060		1.96	5.88
S-39	Manganese	mg/kg	517		0.98	4.9
S-39	Nickel	mg/kg	4.95		0.098	0.392
S-39	Potassium	mg/kg	2830		15.7	58.8
S-39	Selenium	mg/kg	0.324	U	0.324	0.98
S-39	Silver	mg/kg	0.0969	U	0.0969	0.484

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2011

Location	Analyte	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-39	Sodium	mg/kg	254		15.7	49
S-39	Thallium	mg/kg	0.13	J	0.0588	0.392
S-39	Uranium	mg/kg	0.993		0.0129	0.0392
S-39	Vanadium	mg/kg	23.9		0.0969	0.484
S-39	Zinc	mg/kg	33		1.96	9.8
S-53	Aluminum	mg/kg	4810		2.9	9.67
S-53	Antimony	mg/kg	0.301	U	0.301	0.912
S-53	Arsenic	mg/kg	2.76		0.193	0.967
S-53	Barium	mg/kg	161		0.0967	0.387
S-53	Beryllium	mg/kg	0.262		0.0193	0.0967
S-53	Cadmium	mg/kg	0.149	J	0.0193	0.193
S-53	Calcium	mg/kg	7180		6.38	19.3
S-53	Chromium	mg/kg	2.87		0.193	0.58
S-53	Cobalt	mg/kg	1.58		0.058	0.193
S-53	Copper	mg/kg	3.6		0.0638	0.193
S-53	Iron	mg/kg	4960		6.38	19.3
S-53	Lead	mg/kg	6.18		0.0967	0.387
S-53	Magnesium	mg/kg	1850		1.93	5.8
S-53	Manganese	mg/kg	158		0.193	0.967
S-53	Nickel	mg/kg	2.43		0.0967	0.387
S-53	Potassium	mg/kg	2440		15.5	58
S-53	Selenium	mg/kg	0.319	U	0.319	0.967
S-53	Silver	mg/kg	0.0912	U	0.0912	0.456
S-53	Sodium	mg/kg	278		15.5	48.4
S-53	Thallium	mg/kg	0.0816	J	0.058	0.387
S-53	Uranium	mg/kg	0.676		0.0128	0.0387
S-53	Vanadium	mg/kg	10.3		0.0912	0.456
S-53	Zinc	mg/kg	14.2		0.387	1.93

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, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Aluminum	090080-002	mg/kg	9200		2.79	9.31
S-03	Aluminum	090081-002	mg/kg	7870		2.77	9.23
S-03	Aluminum	090082-002	mg/kg	8870		2.8	9.33
	Aluminum Average			**8646.67**			
	Aluminum StdDev			**692.56**			
	CV%			**8.01**			
S-03	Antimony	090080-002	mg/kg	0.302	U	0.302	0.914
S-03	Antimony	090081-002	mg/kg	0.301	U	0.301	0.911
S-03	Antimony	090082-002	mg/kg	0.327	U	0.327	0.992
	Antimony Average			**0.31**			
	Antimony StdDev			**0.01**			
	CV%			**4.75**			
S-03	Arsenic	090080-002	mg/kg	6.34		0.186	0.931
S-03	Arsenic	090081-002	mg/kg	3.44		0.185	0.923
S-03	Arsenic	090082-002	mg/kg	3.85		0.187	0.933
	Arsenic Average			**4.54**			
	Arsenic StdDev			**1.57**			
	CV%			**34.54**			
S-03	Barium	090080-002	mg/kg	103		0.0931	0.372
S-03	Barium	090081-002	mg/kg	99.2		0.0923	0.369
S-03	Barium	090082-002	mg/kg	95.2		0.0933	0.373
	Barium Average			**99.13**			
	Barium StdDev			**3.90**			
	CV%			**3.93**			
S-03	Beryllium	090080-002	mg/kg	0.377		0.0186	0.0931
S-03	Beryllium	090081-002	mg/kg	0.39		0.0185	0.0923
S-03	Beryllium	090082-002	mg/kg	0.415		0.0187	0.0933
	Beryllium Average			**0.39**			
	Beryllium StdDev			**0.02**			
	CV%			**4.90**			
S-03	Cadmium	090080-002	mg/kg	0.211		0.0186	0.186
S-03	Cadmium	090081-002	mg/kg	0.208		0.0185	0.185
S-03	Cadmium	090082-002	mg/kg	0.23		0.0187	0.187
	Cadmium Average			**0.22**			
	Cadmium StdDev			**0.01**			
	CV%			**5.51**			
S-03	Calcium	090080-002	mg/kg	2640		6.15	18.6
S-03	Calcium	090081-002	mg/kg	2300		6.09	18.5
S-03	Calcium	090082-002	mg/kg	2460		6.16	18.7

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
	Calcium Average			**2466.67**			
	Calcium StdDev			**170.10**			
	CV%			**6.90**			
S-03	Chromium	090080-002	mg/kg	4.7		0.186	0.559
S-03	Chromium	090081-002	mg/kg	4.71		0.185	0.554
S-03	Chromium	090082-002	mg/kg	5.46		0.187	0.56
	Chromium Average			**4.96**			
	Chromium StdDev			**0.44**			
	CV%			**8.79**			
S-03	Cobalt	090080-002	mg/kg	2.9		0.0559	0.186
S-03	Cobalt	090081-002	mg/kg	2.78		0.0554	0.185
S-03	Cobalt	090082-002	mg/kg	2.76		0.056	0.187
	Cobalt Average			**2.81**			
	Cobalt StdDev			**0.08**			
	CV%			**2.69**			
S-03	Copper	090080-002	mg/kg	5.11		0.0615	0.186
S-03	Copper	090081-002	mg/kg	5		0.0609	0.185
S-03	Copper	090082-002	mg/kg	5.65		0.0616	0.187
	Copper Average			**5.25**			
	Copper StdDev			**0.35**			
	CV%			**6.62**			
S-03	Iron	090080-002	mg/kg	7970		6.15	18.6
S-03	Iron	090081-002	mg/kg	7540		6.09	18.5
S-03	Iron	090082-002	mg/kg	8110		6.16	18.7
	Iron Average			**7873.33**			
	Iron StdDev			**297.04**			
	CV%			**3.77**			
S-03	Lead	090080-002	mg/kg	7.66		0.0931	0.372
S-03	Lead	090081-002	mg/kg	8.2		0.0923	0.369
S-03	Lead	090082-002	mg/kg	7.64		0.0933	0.373
	Lead Average			**7.83**			
	Lead StdDev			**0.32**			
	CV%			**4.06**			
S-03	Magnesium	090080-002	mg/kg	2580		1.86	5.59
S-03	Magnesium	090081-002	mg/kg	2380		1.85	5.54
S-03	Magnesium	090082-002	mg/kg	2720		1.87	5.6
	Magnesium Average			**2560.00**			
	Magnesium StdDev			**170.88**			
	CV%			**6.68**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Manganese	090080-002	mg/kg	312		0.931	4.66
S-03	Manganese	090081-002	mg/kg	342		0.923	4.61
S-03	Manganese	090082-002	mg/kg	298		0.933	4.66
	Manganese Average			**317.33**			
	Manganese StdDev			**22.48**			
	CV%			**7.08**			
S-03	Nickel	090080-002	mg/kg	4.12		0.0931	0.372
S-03	Nickel	090081-002	mg/kg	4.13		0.0923	0.369
S-03	Nickel	090082-002	mg/kg	4.64		0.0933	0.373
	Nickel Average			**4.30**			
	Nickel StdDev			**0.30**			
	CV%			**6.92**			
S-03	Potassium	090080-002	mg/kg	2680		14.9	55.9
S-03	Potassium	090081-002	mg/kg	2670		14.8	55.4
S-03	Potassium	090082-002	mg/kg	2880		14.9	56
	Potassium Average			**2743.33**			
	Potassium StdDev			**118.46**			
	CV%			**4.32**			
S-03	Selenium	090080-002	mg/kg	0.307	U	0.307	0.931
S-03	Selenium	090081-002	mg/kg	0.304	U	0.304	0.923
S-03	Selenium	090082-002	mg/kg	0.308	U	0.308	0.933
	Selenium Average			**0.31**			
	Selenium StdDev			**0.00**			
	CV%			**0.68**			
S-03	Silver	090080-002	mg/kg	0.0914	U	0.0914	0.457
S-03	Silver	090081-002	mg/kg	0.0911	U	0.0911	0.455
S-03	Silver	090082-002	mg/kg	0.0992	U	0.0992	0.496
	Silver Average			**0.09**			
	Silver StdDev			**0.00**			
	CV%			**4.89**			
S-03	Sodium	090080-002	mg/kg	329		14.9	46.6
S-03	Sodium	090081-002	mg/kg	201		14.8	46.1
S-03	Sodium	090082-002	mg/kg	249		14.9	46.6
	Sodium Average			**259.67**			
	Sodium StdDev			**64.66**			
	CV%			**24.90**			
S-03	Thallium	090080-002	mg/kg	0.109	J	0.0559	0.372
S-03	Thallium	090081-002	mg/kg	0.115	J	0.0554	0.369
S-03	Thallium	090082-002	mg/kg	0.125	J	0.056	0.373

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
	Thallium Average			**0.12**			
	Thallium StdDev			**0.01**			
	CV%			**6.95**			
S-03	Uranium	090080-002	mg/kg	0.861		0.0123	0.0372
S-03	Uranium	090081-002	mg/kg	0.867		0.0122	0.0369
S-03	Uranium	090082-002	mg/kg	0.918		0.0123	0.0373
	Uranium Average			**0.88**			
	Uranium StdDev			**0.03**			
	CV%			**3.55**			
S-03	Vanadium	090080-002	mg/kg	13.9		0.0914	0.457
S-03	Vanadium	090081-002	mg/kg	14		0.0911	0.455
S-03	Vanadium	090082-002	mg/kg	15		0.0992	0.496
	Vanadium Average			**14.30**			
	Vanadium StdDev			**0.61**			
	CV%			**4.25**			
S-03	Zinc	090080-002	mg/kg	29		1.86	9.31
S-03	Zinc	090081-002	mg/kg	28.1		1.85	9.23
S-03	Zinc	090082-002	mg/kg	29.6		1.87	9.33
	Zinc Average			**28.90**			
	Zinc StdDev			**0.75**			
	CV%			**2.61**			
S-09	Aluminum	090075-002	mg/kg	14800		12.9	42.9
S-09	Aluminum	090076-002	mg/kg	13400		14.5	48.2
S-09	Aluminum	090077-002	mg/kg	15500		14.6	48.5
	Aluminum Average			**14566.67**			
	Aluminum StdDev			**1069.27**			
	CV%			**7.34**			
S-09	Antimony	090075-002	mg/kg	0.282	U	0.282	0.853
S-09	Antimony	090076-002	mg/kg	0.31	U	0.31	0.938
S-09	Antimony	090077-002	mg/kg	0.313	U	0.313	0.947
	Antimony Average			**0.30**			
	Antimony StdDev			**0.02**			
	CV%			**5.67**			
S-09	Arsenic	090075-002	mg/kg	3.95		0.172	0.858
S-09	Arsenic	090076-002	mg/kg	3.8		0.193	0.963
S-09	Arsenic	090077-002	mg/kg	3.97		0.194	0.971
	Arsenic Average			**3.91**			
	Arsenic StdDev			**0.09**			
	CV%			**2.38**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-09	Barium	090075-002	mg/kg	154		0.0858	0.343
S-09	Barium	090076-002	mg/kg	148		0.0963	0.385
S-09	Barium	090077-002	mg/kg	137		0.0971	0.388
	Barium Average			**146.33**			
	Barium StdDev			**8.62**			
	CV%			**5.89**			
S-09	Beryllium	090075-002	mg/kg	0.569		0.0172	0.0858
S-09	Beryllium	090076-002	mg/kg	0.523		0.0193	0.0963
S-09	Beryllium	090077-002	mg/kg	0.554		0.0194	0.0971
	Beryllium Average			**0.55**			
	Beryllium StdDev			**0.02**			
	CV%			**4.28**			
S-09	Cadmium	090075-002	mg/kg	0.218		0.0172	0.172
S-09	Cadmium	090076-002	mg/kg	0.218		0.0193	0.193
S-09	Cadmium	090077-002	mg/kg	0.234		0.0194	0.194
	Cadmium Average			**0.22**			
	Cadmium StdDev			**0.01**			
	CV%			**4.14**			
S-09	Calcium	090075-002	mg/kg	6650		5.66	17.2
S-09	Calcium	090076-002	mg/kg	6840		6.36	19.3
S-09	Calcium	090077-002	mg/kg	6840		6.41	19.4
	Calcium Average			**6776.67**			
	Calcium StdDev			**109.70**			
	CV%			**1.62**			
S-09	Chromium	090075-002	mg/kg	7.25		0.172	0.515
S-09	Chromium	090076-002	mg/kg	8.14		0.193	0.578
S-09	Chromium	090077-002	mg/kg	7.87		0.194	0.583
	Chromium Average			**7.75**			
	Chromium StdDev			**0.46**			
	CV%			**5.89**			
S-09	Cobalt	090075-002	mg/kg	5.46		0.0515	0.172
S-09	Cobalt	090076-002	mg/kg	5.23		0.0578	0.193
S-09	Cobalt	090077-002	mg/kg	5.41		0.0583	0.194
	Cobalt Average			**5.37**			
	Cobalt StdDev			**0.12**			
	CV%			**2.25**			
S-09	Copper	090075-002	mg/kg	7.53		0.0566	0.172
S-09	Copper	090076-002	mg/kg	7.48		0.0636	0.193
S-09	Copper	090077-002	mg/kg	7.64		0.0641	0.194

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
	Copper Average			**7.55**			
	Copper StdDev			**0.08**			
	CV%			**1.08**			
S-09	Iron	090075-002	mg/kg	15300		28.3	85.8
S-09	Iron	090076-002	mg/kg	14200		31.8	96.3
S-09	Iron	090077-002	mg/kg	14500		32	97.1
	Iron Average			**14666.67**			
	Iron StdDev			**568.62**			
	CV%			**3.88**			
S-09	Lead	090075-002	mg/kg	11.8		0.0858	0.343
S-09	Lead	090076-002	mg/kg	12.3		0.0963	0.385
S-09	Lead	090077-002	mg/kg	12.5		0.0971	0.388
	Lead Average			**12.20**			
	Lead StdDev			**0.36**			
	CV%			**2.96**			
S-09	Magnesium	090075-002	mg/kg	4380		1.72	5.15
S-09	Magnesium	090076-002	mg/kg	4360		1.93	5.78
S-09	Magnesium	090077-002	mg/kg	4650		1.94	5.83
	Magnesium Average			**4463.33**			
	Magnesium StdDev			**161.97**			
	CV%			**3.63**			
S-09	Manganese	090075-002	mg/kg	385		0.858	4.29
S-09	Manganese	090076-002	mg/kg	344		0.963	4.82
S-09	Manganese	090077-002	mg/kg	363		0.971	4.85
	Manganese Average			**364.00**			
	Manganese StdDev			**20.52**			
	CV%			**5.64**			
S-09	Nickel	090077-002	mg/kg	6.53		0.0971	0.388
	Nickel StdDev			**6.53**			
	CV%			**#DIV/0!**			
	Potassium			**#DIV/0!**			
S-09	Potassium	090075-002	mg/kg	3990		13.7	51.5
S-09	Potassium	090076-002	mg/kg	4090		15.4	57.8
S-09		090077-002	mg/kg	4230		15.5	58.3
	Potassium Average			**4103.33**			
	Potassium StdDev			**120.55**			
	CV%			**2.94**			
S-09	Selenium	090075-002	mg/kg	0.283	U	0.283	0.858
S-09	Selenium	090076-002	mg/kg	0.318	U	0.318	0.963

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-09	Selenium	090077-002	mg/kg	0.32	U	0.32	0.971
	Selenium Average			**0.31**			
	Selenium StdDev			**0.02**			
	CV%			**6.78**			
S-09	Silver	090075-002	mg/kg	0.0853	U	0.0853	0.427
S-09	Silver	090076-002	mg/kg	0.0938	U	0.0938	0.469
S-09	Silver	090077-002	mg/kg	0.0947	U	0.0947	0.473
	Silver Average			**0.09**			
	Silver StdDev			**0.01**			
	CV%			**5.68**			
S-09	Sodium	090075-002	mg/kg	213		13.7	42.9
S-09	Sodium	090076-002	mg/kg	296		15.4	48.2
S-09	Sodium	090077-002	mg/kg	215		15.5	48.5
	Sodium Average			**241.33**			
	Sodium StdDev			**47.35**			
	CV%			**19.62**			
S-09	Thallium	090075-002	mg/kg	0.188	J	0.0515	0.343
S-09	Thallium	090076-002	mg/kg	0.17	J	0.0578	0.385
S-09	Thallium	090077-002	mg/kg	0.185	J	0.0583	0.388
	Thallium Average			**0.18**			
	Thallium StdDev			**0.01**			
	CV%			**5.33**			
S-09	Uranium	090075-002	mg/kg	0.756		0.0113	0.0343
S-09	Uranium	090076-002	mg/kg	1.39		0.0127	0.0385
S-09	Uranium	090077-002	mg/kg	0.745		0.0128	0.0388
	Uranium Average			**0.96**			
	Uranium StdDev			**0.37**			
	CV%			**38.32**			
S-09	Vanadium	090075-002	mg/kg	23.5		0.0853	0.427
S-09	Vanadium	090076-002	mg/kg	24.9		0.0938	0.469
S-09	Vanadium	090077-002	mg/kg	23		0.0947	0.473
	Vanadium Average			**23.80**			
	Vanadium StdDev			**0.98**			
	CV%			**4.14**			
S-09	Zinc	090075-002	mg/kg	43.5		1.72	8.58
S-09	Zinc	090076-002	mg/kg	40.5		1.93	9.63
S-09	Zinc	090077-002	mg/kg	43.3		1.94	9.71
	Zinc Average			**42.43**			
	Zinc StdDev			**1.68**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
	CV%			**3.95**			
S-48	Aluminum	090088-002	mg/kg	13100		13.3	44.2
S-48	Aluminum	090089-002	mg/kg	14300		13.8	46
S-48	Aluminum	090090-002	mg/kg	13500		14.8	49.2
	Aluminum Average			**13633.33**			
	Aluminum StdDev			**611.01**			
	CV%			**4.48**			
S-48	Antimony	090088-002	mg/kg	0.322	U	0.322	0.977
S-48	Antimony	090089-002	mg/kg	0.317	U	0.317	0.962
S-48	Antimony	090090-002	mg/kg	0.303	U	0.303	0.919
	Antimony Average			**0.31**			
	Antimony StdDev			**0.01**			
	CV%			**3.14**			
S-48	Arsenic	090088-002	mg/kg	2.56		0.177	0.885
S-48	Arsenic	090089-002	mg/kg	2.63		0.184	0.921
S-48	Arsenic	090090-002	mg/kg	2.7		0.197	0.984
	Arsenic Average			**2.63**			
	Arsenic StdDev			**0.07**			
	CV%			**2.66**			
S-48	Barium	090088-002	mg/kg	224		0.442	1.77
S-48	Barium	090089-002	mg/kg	231		0.46	1.84
S-48	Barium	090090-002	mg/kg	246		0.492	1.97
	Barium Average			**233.67**			
	Barium StdDev			**11.24**			
	CV%			**4.81**			
S-48	Beryllium	090088-002	mg/kg	0.448		0.0177	0.0885
S-48	Beryllium	090089-002	mg/kg	0.481		0.0184	0.0921
S-48	Beryllium	090090-002	mg/kg	0.467		0.0197	0.0984
	Beryllium Average			**0.47**			
	Beryllium StdDev			**0.02**			
	CV%			**3.56**			
S-48	Cadmium	090088-002	mg/kg	0.31		0.0177	0.177
S-48	Cadmium	090089-002	mg/kg	0.334		0.0184	0.184
S-48	Cadmium	090090-002	mg/kg	0.336		0.0197	0.197
	Cadmium Average			**0.33**			
	Cadmium StdDev			**0.01**			
	CV%			**4.43**			
S-48	Calcium	090088-002	mg/kg	8330		5.84	17.7
S-48	Calcium	090089-002	mg/kg	5190		6.08	18.4

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-48	Calcium	090090-002	mg/kg	4140		6.5	19.7
	Calcium Average			**5886.67**			
	Calcium StdDev			**2180.15**			
	CV%			**37.04**			
S-48	Chromium	090088-002	mg/kg	6.12		0.177	0.531
S-48	Chromium	090089-002	mg/kg	6.47		0.184	0.552
S-48	Chromium	090090-002	mg/kg	6.18		0.197	0.591
	Chromium Average			**6.26**			
	Chromium StdDev			**0.19**			
	CV%			**2.99**			
S-48	Cobalt	090088-002	mg/kg	3.62		0.0531	0.177
S-48	Cobalt	090089-002	mg/kg	3.73		0.0552	0.184
S-48	Cobalt	090090-002	mg/kg	3.65		0.0591	0.197
	Cobalt Average			**3.67**			
	Cobalt StdDev			**0.06**			
	CV%			**1.55**			
S-48	Copper	090088-002	mg/kg	6.98		0.0584	0.177
S-48	Copper	090089-002	mg/kg	7.45		0.0608	0.184
S-48	Copper	090090-002	mg/kg	7.04		0.065	0.197
	Copper Average			**7.16**			
	Copper StdDev			**0.26**			
	CV%			**3.57**			
S-48	Iron	090088-002	mg/kg	10500		29.2	88.5
S-48	Iron	090089-002	mg/kg	11000		30.4	92.1
S-48	Iron	090090-002	mg/kg	9130		6.5	19.7
	Iron Average			**10210.00**			
	Iron StdDev			**968.14**			
	CV%			**9.48**			
S-48	Lead	090088-002	mg/kg	10.3		0.0885	0.354
S-48	Lead	090089-002	mg/kg	10.1		0.0921	0.368
S-48	Lead	090090-002	mg/kg	11.6		0.0984	0.394
	Lead Average			**10.67**			
	Lead StdDev			**0.81**			
	CV%			**7.64**			
S-48	Magnesium	090088-002	mg/kg	3740		1.77	5.31
S-48	Magnesium	090089-002	mg/kg	4030		1.84	5.52
S-48	Magnesium	090090-002	mg/kg	3460		1.97	5.91
	Magnesium Average			**3743.33**			
	Magnesium StdDev			**285.01**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
	CV%			**7.61**			
S-48	Manganese	090088-002	mg/kg	406		0.885	4.42
S-48	Manganese	090089-002	mg/kg	410		0.921	4.6
S-48	Manganese	090090-002	mg/kg	412		0.984	4.92
	Manganese Average			**409.33**			
	Manganese StdDev			**3.06**			
	CV%			**0.75**			
S-48	Nickel	090088-002	mg/kg	5.74		0.0885	0.354
S-48	Nickel	090089-002	mg/kg	6.16		0.0921	0.368
S-48	Nickel	090090-002	mg/kg	5.75		0.0984	0.394
	Nickel Average			**5.88**			
	Nickel StdDev			**0.24**			
	CV%			**4.07**			
S-48	Potassium	090088-002	mg/kg	4390		14.2	53.1
S-48	Potassium	090089-002	mg/kg	5220		14.7	55.2
S-48	Potassium	090090-002	mg/kg	4570		15.7	59.1
	Potassium Average			**4726.67**			
	Potassium StdDev			**436.62**			
	CV%			**9.24**			
S-48	Selenium	090088-002	mg/kg	0.292	U	0.292	0.885
S-48	Selenium	090089-002	mg/kg	0.304	U	0.304	0.921
S-48	Selenium	090090-002	mg/kg	0.325	U	0.325	0.984
	Selenium Average			**0.31**			
	Selenium StdDev			**0.02**			
	CV%			**5.44**			
S-48	Silver	090088-002	mg/kg	0.0977	U	0.0977	0.488
S-48	Silver	090089-002	mg/kg	0.0962	U	0.0962	0.481
S-48	Silver	090090-002	mg/kg	0.0919	U	0.0919	0.46
	Silver Average			**0.10**			
	Silver StdDev			**0.00**			
	CV%			**3.16**			
S-48	Sodium	090088-002	mg/kg	454		14.2	44.2
S-48	Sodium	090089-002	mg/kg	527		14.7	46
S-48	Sodium	090090-002	mg/kg	476		15.7	49.2
	Sodium Average			**485.67**			
	Sodium StdDev			**37.45**			
	CV%			**7.71**			
S-48	Thallium	090088-002	mg/kg	0.144	J	0.0531	0.354
S-48	Thallium	090089-002	mg/kg	0.159	J	0.0552	0.368

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2011

Location	Analyte	Sample ID	Units	Result	Lab Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-48	Thallium	090090-002	mg/kg	0.151	J	0.0591	0.394
	Thallium Average			**0.15**			
	Thallium StdDev			**0.01**			
	CV%			**4.96**			
S-48	Uranium	090088-002	mg/kg	0.605		0.0117	0.0354
S-48	Uranium	090089-002	mg/kg	0.682		0.0122	0.0368
S-48	Uranium	090090-002	mg/kg	0.593		0.013	0.0394
	Uranium Average			**0.63**			
	Uranium StdDev			**0.05**			
	CV%			**7.71**			
S-48	Vanadium	090088-002	mg/kg	24.7		0.0977	0.488
S-48	Vanadium	090089-002	mg/kg	26		0.0962	0.481
S-48	Vanadium	090090-002	mg/kg	24.1		0.0919	0.46
	Vanadium Average			**24.93**			
	Vanadium StdDev			**0.97**			
	CV%			**3.90**			
S-48	Zinc	090088-002	mg/kg	36		1.77	8.85
S-48	Zinc	090089-002	mg/kg	36.6		1.84	9.21
S-48	Zinc	090090-002	mg/kg	34.9		1.97	9.84
	Zinc Average			**35.83**			
	Zinc StdDev			**0.86**			
	CV%			**2.41**			

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.

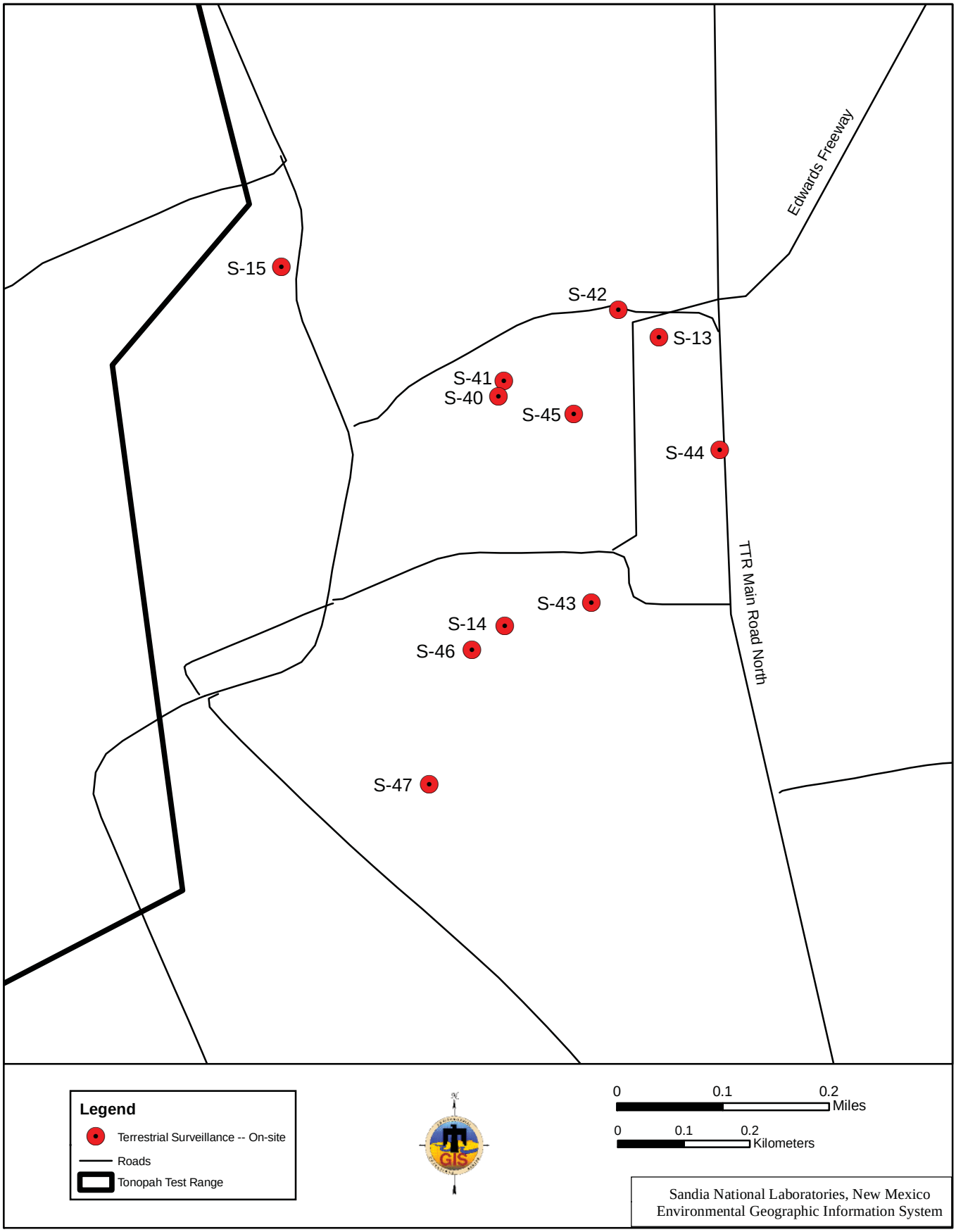

FIGURE A-4. Soil Sampling Locations in the Range Operations Center and Compound (On-Site)

APPENDIX C

2011 TTR WASTEWATER SAMPLING RESULTS

TABLE C-1. Sanitary Outfalls of Inorganic Analyses, May 2011

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	25-May-2011	090643-001	Arsenic		0.005	U	mg/L
TTR	25-May-2011	090643-001	Cadmium		0.001	U	mg/L
TTR	25-May-2011	090643-001	Chromium	0.00181	0.001	J	mg/L
TTR	25-May-2011	090643-001	Copper	0.144	0.003		mg/L
TTR	25-May-2011	090643-001	Lead	0.00543	0.0033	J	mg/L
TTR	25-May-2011	090643-001	Mercury		0.000066	U	mg/L
TTR	25-May-2011	090643-001	Nickel	0.00164	0.0015	J	mg/L
TTR	25-May-2011	090643-001	Selenium		0.006	U	mg/L
TTR	25-May-2011	090643-001	Silver		0.001	U	mg/L
TTR	25-May-2011	090643-001	Zinc	0.126	0.0033		mg/L
TTR	25-May-2011	090643-002	Cyanide, total	0.00648	0.0015		mg/L
TTR	25-May-2011	090643-003	Solids, total suspended	65.2	8.64		mg/L
TTR	25-May-2011	090643-007	Chemical Oxygen Demand	271	6.5		mg/L
TTR	25-May-2011	090643-007	Phenols, Total	0.031	0.0016		mg/L
TTR	25-May-2011	090643-008	Grease and oil	18.9	1.15		mg/L
TTR	25-May-2011	090643-009	Grease and oil	9.25	1.17		mg/L
TTR	25-May-2011	090643-009	Total Petroleum Hydrocarbons	1.5	1.17	J	mg/L

NOTES:

MDL = Method detection limit

mg/L = milligrams per liter

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective (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 C-2. Summary of Sanitary Outfalls of Radiological Analyses, May 2011

Station	Date Collected	Sample ID	Analyte	Activity	Two Sigma Error	Lab Data Qualifier	MDA	Units
TTR	25-May-2011	090643-010	Actinium-228	4	15	U	13.7	pCi/L
TTR	25-May-2011	090643-010	Americium-241	-9.02	12.2	U	19.1	pCi/L
TTR	25-May-2011	090643-010	Beryllium-7	-6	18.5	U	29.6	pCi/L
TTR	25-May-2011	090643-010	Bismuth-212	4.15	43.5	U	45.7	pCi/L
TTR	25-May-2011	090643-010	Bismuth-214	-1.15	6.9	U	7.35	pCi/L
TTR	25-May-2011	090643-010	Cesium-137	0.819	4.68	U	3.23	pCi/L
TTR	25-May-2011	090643-010	Cobalt-60	-2.07	4.19	U	3.51	pCi/L
TTR	25-May-2011	090643-010	Lead-212	0.436	5.84	U	5.99	pCi/L
TTR	25-May-2011	090643-010	Lead-214	-0.81	6.42	U	7.27	pCi/L
TTR	25-May-2011	090643-010	Neptunium-237	-0.797	3.32	U	5.54	pCi/L
TTR	25-May-2011	090643-010	Potassium-40	5.47	53.1	U	32	pCi/L
TTR	25-May-2011	090643-010	Radium-223	-1.16	113	U	57.5	pCi/L
TTR	25-May-2011	090643-010	Radium-224	17.9	38.4	U	57.9	pCi/L
TTR	25-May-2011	090643-010	Radium-226	30.1	84	U	55.6	pCi/L
TTR	25-May-2011	090643-010	Radium-228	4	15	U	13.7	pCi/L
TTR	25-May-2011	090643-010	Sodium-22	-0.591	1.87	U	3.06	pCi/L
TTR	25-May-2011	090643-010	Thorium-227	-5.5	510	U	23	pCi/L
TTR	25-May-2011	090643-010	Thorium-231	-3.05	22.9	U	38.2	pCi/L
TTR	25-May-2011	090643-010	Thorium-234	-66.9	159	U	166	pCi/L
TTR	25-May-2011	090643-010	Uranium-235	-3.58	10.9	U	17.4	pCi/L
TTR	25-May-2011	090643-010	Uranium-238	-66.9	159	U	166	pCi/L
TTR	25-May-2011	090643-011	Alpha, gross	1.5	0.812		0.996	pCi/L
TTR	25-May-2011	090643-011	Beta, gross	20.9	3.63		1.07	pCi/L
TTR	25-May-2011	090643-012	Tritium	120	81.5		119	pCi/L

NOTES:

MDA = minimum detectable amount.

pCi/L = picocuries per liter

U = The result is less than the MDA.

TABLE C-3. Summary of Sanitary Outfalls of Semi-Volitile Organic Compounds, May 2011

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	25-May-2011	090643-006	Acenaphthene		0.31	U	ug/L
TTR	25-May-2011	090643-006	Acenaphthylene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Anthracene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Benzo(a)anthracene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Benzo(a)pyrene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Benzo(b)fluoranthene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Benzo(ghi)perylene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Benzo(k)fluoranthene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Bromophenyl phenyl ether, 4-		2	U	ug/L
TTR	25-May-2011	090643-006	Butylbenzyl phthalate		2	U	ug/L
TTR	25-May-2011	090643-006	Carbazole		0.2	U	ug/L
TTR	25-May-2011	090643-006	Chloro-3-methylphenol, 4-		2	U	ug/L
TTR	25-May-2011	090643-006	Chlorobenzenamine, 4-		2	U	ug/L
TTR	25-May-2011	090643-006	Chloroethoxy)methane, bis(2-		3	U	ug/L
TTR	25-May-2011	090643-006	Chloroethyl)ether, bis(2-		2	U	ug/L
TTR	25-May-2011	090643-006	Chloroisopropyl) ether, bis(2-		2	U	ug/L
TTR	25-May-2011	090643-006	Chloronaphthalene, 2-		0.3	U	ug/L
TTR	25-May-2011	090643-006	Chlorophenol, 2-		2	U	ug/L
TTR	25-May-2011	090643-006	Chlorophenyl phenyl ether, 4-		2	U	ug/L
TTR	25-May-2011	090643-006	Chrysene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Cresol, m,p-	6.85	3	J	ug/L
TTR	25-May-2011	090643-006	Cresol, o-		2	U	ug/L
TTR	25-May-2011	090643-006	Di-n-butyl phthalate		2	U	ug/L
TTR	25-May-2011	090643-006	Di-n-octyl phthalate		3	U	ug/L
TTR	25-May-2011	090643-006	Dibenz[a,h]anthracene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Dibenzofuran		2	U	ug/L
TTR	25-May-2011	090643-006	Dichlorobenzene, 1,2-		2	U	ug/L

TABLE C-3. Summary of Sanitary Outfalls of Semi-Volitile Organic Compounds, May 2011

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	25-May-2011	090643-006	Dichlorobenzene, 1,3-		2	U	ug/L
TTR	25-May-2011	090643-006	Dichlorobenzene, 1,4-		2	U	ug/L
TTR	25-May-2011	090643-006	Dichlorobenzidine, 3,3'-		2	U	ug/L
TTR	25-May-2011	090643-006	Dichlorophenol, 2,4-		2	U	ug/L
TTR	25-May-2011	090643-006	Diethylphthalate		2	U	ug/L
TTR	25-May-2011	090643-006	Dimethylphenol, 2,4-		2	U	ug/L
TTR	25-May-2011	090643-006	Dimethylphthalate		2	U	ug/L
TTR	25-May-2011	090643-006	Dinitro-o-cresol		3	U	ug/L
TTR	25-May-2011	090643-006	Dinitrophenol, 2,4-		5	U	ug/L
TTR	25-May-2011	090643-006	Dinitrotoluene, 2,4-		2	U	ug/L
TTR	25-May-2011	090643-006	Dinitrotoluene, 2,6-		2	U	ug/L
TTR	25-May-2011	090643-006	Diphenyl amine		3	U	ug/L
TTR	25-May-2011	090643-006	Ethylhexyl)phthalate, bis(2-		2	U	ug/L
TTR	25-May-2011	090643-006	Fluoranthene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Fluorene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Hexachlorobenzene		2	U	ug/L
TTR	25-May-2011	090643-006	Hexachlorobutadiene		2	U	ug/L
TTR	25-May-2011	090643-006	Hexachlorocyclopentadiene		3	U	ug/L
TTR	25-May-2011	090643-006	Hexachloroethane		2	U	ug/L
TTR	25-May-2011	090643-006	Indeno(1,2,3-c,d)pyrene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Isophorone		3	U	ug/L
TTR	25-May-2011	090643-006	Methylnaphthalene, 2-		0.3	U	ug/L
TTR	25-May-2011	090643-006	Naphthalene		0.3	U	ug/L
TTR	25-May-2011	090643-006	Nitro-benzene		3	U	ug/L
TTR	25-May-2011	090643-006	Nitroaniline, 2-		2	U	ug/L
TTR	25-May-2011	090643-006	Nitroaniline, 3-		2	U	ug/L
TTR	25-May-2011	090643-006	Nitroaniline, 4-		3	U	ug/L

TABLE C-3. Summary of Sanitary Outfalls of Semi-Volitile Organic Compounds, May 2011

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	25-May-2011	090643-006	Nitrophenol, 2-		2	U	ug/L
TTR	25-May-2011	090643-006	Nitrophenol, 4-		2	U	ug/L
TTR	25-May-2011	090643-006	Nitrosodipropylamine, n-		2	U	ug/L
TTR	25-May-2011	090643-006	Pentachlorophenol		2	U	ug/L
TTR	25-May-2011	090643-006	Phenanthrene		0.2	U	ug/L
TTR	25-May-2011	090643-006	Phenol		1	U	ug/L
TTR	25-May-2011	090643-006	Pyrene		0.3	U	ug/L
TTR	25-May-2011	090643-006	Trichlorobenzene, 1,2,4-		2	U	ug/L
TTR	25-May-2011	090643-006	Trichlorophenol, 2,4,5-		2	U	ug/L
TTR	25-May-2011	090643-006	Trichlorophenol, 2,4,6-		2	U	ug/L

NOTES:

MDL = Minimum detection limit.

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective (PQL) practical quantitation limit.

ug/L = micrograms per liter.

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

TABLE C-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, May 2011

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	25-May-11	090643-005	Acetone		3.5	U	ug/L
TTR	25-May-11	090643-005	Benzene		0.3	U	ug/L
TTR	25-May-11	090643-005	Bromodichloromethane		0.25	U	ug/L
TTR	25-May-11	090643-005	Bromoform		0.25	U	ug/L
TTR	25-May-11	090643-005	Bromomethane		0.3	U	ug/L
TTR	25-May-11	090643-005	Butanone, 2-		1.25	U	ug/L
TTR	25-May-11	090643-005	Carbon disulfide		1.25	U	ug/L
TTR	25-May-11	090643-005	Carbon tetrachloride		0.3	U	ug/L
TTR	25-May-11	090643-005	Chlorobenzene		0.25	U	ug/L
TTR	25-May-11	090643-005	Chloroethane		0.3	U	ug/L
TTR	25-May-11	090643-005	Chloroform		0.25	U	ug/L
TTR	25-May-11	090643-005	Chloromethane		0.3	U	ug/L
TTR	25-May-11	090643-005	Dibromochloromethane		0.3	U	ug/L
TTR	25-May-11	090643-005	Dichloroethane, 1,1-		0.3	U	ug/L
TTR	25-May-11	090643-005	Dichloroethane, 1,2-		0.25	U	ug/L
TTR	25-May-11	090643-005	Dichloroethene, 1,1-		0.3	U	ug/L
TTR	25-May-11	090643-005	Dichloroethene, cis-1,2-		0.3	U	ug/L
TTR	25-May-11	090643-005	Dichloroethene, trans-1,2-		0.3	U	ug/L
TTR	25-May-11	090643-005	Dichloropropane, 1,2-		0.25	U	ug/L
TTR	25-May-11	090643-005	Dichloropropene, cis-1,3-		0.25	U	ug/L
TTR	25-May-11	090643-005	Dichloropropene, trans-1,3-		0.25	U	ug/L
TTR	25-May-11	090643-005	Ethyl benzene		0.25	U	ug/L
TTR	25-May-11	090643-005	Hexanone, 2-		1.25	U	ug/L
TTR	25-May-11	090643-005	Methylene chloride		3	U	ug/L
TTR	25-May-11	090643-005	Pentanone, 4-methyl-, 2-		1.25	U	ug/L
TTR	25-May-11	090643-005	Styrene		0.25	U	ug/L
TTR	25-May-11	090643-005	Tetrachloroethane, 1,1,2,2-		0.25	U	ug/L

TABLE C-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, May 2011

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	25-May-11	090643-005	Tetrachloroethene		0.3	U	ug/L
TTR	25-May-11	090643-005	Toluene		0.25	U	ug/L
TTR	25-May-11	090643-005	Trichloroethane, 1,1,1-		0.325	U	ug/L
TTR	25-May-11	090643-005	Trichloroethane, 1,1,2-		0.25	U	ug/L
TTR	25-May-11	090643-005	Trichloroethene		0.25	U	ug/L
TTR	25-May-11	090643-005	Vinyl acetate		1.5	U	ug/L
TTR	25-May-11	090643-005	Vinyl chloride		0.5	U	ug/L
TTR	25-May-11	090643-005	Xylene		0.3	U	ug/L

NOTES:

MDL = Method detection limit.

ug/L = micrograms per liter.

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