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ANNUAL SITE ENVIRONMENTAL REPORT FOR SANDIA NATIONAL LABORATORIES, TONOPAH TEST RANGE, NEVADA & 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

National Nuclear Security Administration

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Calendar Year 2013 Annual Site Environmental Report for Sandia National Laboratories, Tonopah Test Range, Nevada & Kauai Test Facility, Hawaii

PRODUCED BY:
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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 Field Office (SFO), 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. Navarro Research and Engineering 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 summarizes data and the compliance status of the sustainability, environmental protection, and monitoring program at TTR and KTF through Calendar Year 2013. 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. Sandia is responsible only for those environmental program activities related to its operations. The DOE/NNSA/Nevada Field Office 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 2012).

Calendar Year 2013 Annual Site Environmental Report for
Sandia National Laboratories, Tonopah Test Range, Nevada &
Kauai Test Facility, Hawaii
Final Approval date: August 2014

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Prepared by:
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ES&H and Emergency Management Center

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NOTE TO THE READER

The goals for the TTR and KTF Annual Site Environmental Reports are to present summary environmental performance, compliance with environmental standards and requirements, and to highlight significant facility programs. In addition, the U.S. Department of Energy 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:

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The TTR and KTF Annual Site Environmental Reports can be found at the following website:
http://www.sandia.gov/news/publications/environmental/index.html

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

FIGURES

TABLES

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Acronyms and Abbreviations

A	AEC	U.S. Atomic Energy Commission
	AIRFA	American Indian Religious Freedom Act
	ARPA	Archaeological Resources Protection Act
	ASER	Annual Site Environmental Report
	AST	aboveground storage tank
	AVV	Air/Vacuum Valve
B	BLM	Bureau of Land Management
	BMP	best management practice
C	CAA	Clean Air Act
	CAAA	Clean Air Act Amendments
	CAS	Corrective Action Site
	CAU	Corrective Action Unit
	CEMP	Community Environmental Monitoring Program
	CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
	CFR	Code of Federal Regulations
	CP	Control Point
	CWA	Clean Water Act
	CY	Calendar Year
D	DOD	U.S. Department of Defense
	DOE	U.S. Department of Energy
	DRI	Desert Research Institute
	DU	depleted uranium
E	EA	environmental assessment
	EDE	effective dose equivalent
	E&E	Ecology and Environmental, Inc.
	EG&G	Edgerton, Gemeshausen and Grier, Inc.
	EHS	extremely hazardous substance
	EIS	environmental impact statement
	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
	ESA	Endangered Species Act
	ES&H	Environment, Safety, and Health
F	FFACO	Federal Facility Agreement and Consent Order
	FFCA	Federal Facility Compliance Act
	FIDLER	Field Instrument for the Detection of Low-Energy Radiation
	FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
	FTU	flight test unit
	FY	Fiscal Year

G	GOES	Geostationary Operational Environmental Satellite
	GPS	Global Positioning System
H	HAP	hazardous air pollutant
	HAR	Hawaii Administrative Rules
	HP	horsepower
I	IOC	inorganic compound
	ISMS	Integrated Safety Management System
	ISO	International Organization for Standardization
J	JTA	Joint Test Assembly
K	KTF	Kauai Test Facility
L	LOB	Launch Operations Building
M	MBAS	methylene blue active substances
	MBTA	Migratory Bird Treaty Act
	MCL	maximum contaminant level
	MCLG	Maximum Contaminant Levels Goals
	MDA	minimum detectable activity
	MEI	maximally exposed individual
	MOA	Memorandum of Agreement
	MSDS	Material Safety Data Sheet
	MST	Missile Service Tower
N	N/A	not available
	NAC	Nevada Administrative Code
	NAEG	Nevada Applied Ecology Group
	NAFB	U.S. Nellis Air Force Base
	Navarro	Navarro Research and Engineering
	ND	not detectable
	NDEP	Nevada Division of Environmental Protection
	NEDS	non-explosive destruction site
	NEPA	National Environmental Policy Act
	NESHAP	National Emission Standards for Hazardous Air Pollutants
	NFO	Nevada Field Office
	NHPA	National Historic Preservation Act
	NNSA	National Nuclear Security Administration
	NNSS	Nevada National Security Site
	N.O.S.	not otherwise specified
	NPDES	National Pollution Discharge Elimination System
	NPL	National Priorities List
	NSP	non-covered source permit
	NTTR	Nevada Test and Training Range
	NWHR	Nevada Wild Horse Range
O	O&M	Operation and Maintenance

P	PA	Preliminary Assessment
	PCB	polychlorinated biphenyl
	pH	potential of hydrogen
	PIC	pressurized ion chamber
	PM	particulate matter
	PM_{10}	respirable particulate matter (diameter equal to or less than 10 microns)
	PMRF	Pacific Missile Range Facility
	PWS	public water system
Q	QA	Quality Assurance
R	RCRA	Resource Conservation and Recovery Act
	ROC	Range Operations Center
	RQ	reportable quantity
S	Sandia	Sandia Corporation
	SARA	Superfund Amendments and Reauthorization Act
	SDS	safety data sheet
	SDWA	Safe Drinking Water Act
	SFO	Sandia Field Office
	SHPO	State Historic Preservation Office
	SNL	Sandia National Laboratories
	SNL/NM	Sandia National Laboratories, New Mexico
	SOC	synthetic organic compounds
	SPCC	Spill Prevention Control and Countermeasures
	St Dev	standard deviation
	STARS	Strategic Target System
	SWEIS	Site-Wide Environmental Impact Statement
T	TAL	target analyte list
	TLD	thermoluminescent dosimeter
	TRI	Toxic Release Inventory
	TSCA	Toxic Substances Control Act
	TTR	Tonopah Test Range
U	UDP	underground discharge point
	UPS	uninterruptible power supply
	U.S.	United States
	USAF	U.S. Air Force
	USN	U.S. Navy
	UST	underground storage tank
	UXO	unexploded ordnance
V	VOC	volatile organic compound
W	WRCC	Western Regional Climate Center

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Units of Measure/Radioactivity Measurements

°C	degrees Celsius
°F	degrees Fahrenheit
Bq/m^3	Becquerel per cubic meter
Ci/m^3	curies per cubic meter
ft	feet
gal	gallons
kg	kilograms
kW	kilowatt
lbs	pounds
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mph	miles per hour
mrem	millirems
mrem/year	millirems per year
mSv/yr	millisievert per year
pCi/g	picocuries per gram
ppb	parts per billion
ppm	parts per million
rem	Roentgen equivalent man
µCi/mL	microcuries per milliliter
µg/m^2	micrograms per square meter
µg/m^3	micrograms per cubic meter

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TTR & KTF Executive Summary

Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation 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 Field Office (SFO) 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 2012a),
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001),
- DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2013a), 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) 2013. 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 2013.

Environmental Programs

The following environmental programs are in place at Tonopah Test Range (TTR):

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

Waste Management

Waste generated during 2013 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 facilities. Sandia does not handle waste generated

by ER activities. The Nevada Division of Environmental Protection (NDEP) did not inspect TTR facilities during 2013.

ER Project

ER Project activities at TTR and the Nevada Test and Training Range (NTTR) are conducted through the DOE/NNSA, Nevada Field Office (NFO). 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 2013 included the removal of an inert rocket motor body from inside the Contamination Area at the Clean Slate III site (Corrective Action Unit 414). This was performed as an interim action prior to the future remediation of the site. Personnel from Nevada National Security Site (NNSS) and TTR conducted the removal using a backhoe; an SNL unexploded ordnance (UXO) expert monitored removal operations; NNSS provided radiological control support to the operations and project oversight.

Other ER activities conducted on the TTR and NTTR in 2013 consisted of the annual post-closure inspections of closed/use-restricted Industrial Sites and inspections of radiological postings at the Clean Slate and Double Tracks sites. The inspections were conducted in May 2013, and minor erosion and subsidence repairs were completed in July 2013. Vegetation monitoring was also conducted at select sites in June 2013.

In addition to the inert rocket motor body removal and annual post-closure inspections and repairs, routine air sample collection was also conducted throughout the year at various locations on the TTR and NTTR.

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 2013, soil samples were collected from 15 off-site, 10 perimeter, and 27 on-site locations.

In 2013, soils were analyzed for radiological and non-radiological constituents. The results showed that continued monitoring for elevated americium-241 is required at location S-51, where it continues to be identified as a Priority-1 for americium-241. This location at the edge of "South Plume Area" is expected to have elevated readings and is consistent with the "hot particle" theory, where the presence of americium-241 or plutonium-239/240 in a heterogeneous sample skews the apparent "average" concentration, making it appear greater than it is. Sampling and trend analyses will continue at S-51.

Non-radiological monitoring of target analyte list (TAL) metals for soil samples was conducted at 13 on-site sentinel locations, which identified several Priotity-2 (higher than off-site, but not increasing trend) and several Priority-3 (increasing trend) conditions. All are assumed to represent natural background at their respective locations.

Water Monitoring

Wastewater discharges at TTR did not negatively impact the U.S. Air Force-held National Pollutant Discharge Elimination System permit in 2013.

The public water system 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.

In 2013, all well sample results were below the maximum contaminant levels (MCLs) established for the substances monitored.

There are five septic tank systems located on-site, which are owned by DOE/NNSA at TTR (the newest of which is inactive). None of these systems required maintenance, sampling, or pumping in 2013.

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. The arsenic removal media was changed out and replaced with new media in February 2013.

Air Quality Compliance

Radiological air emissions are regulated by National Emission Standards for Hazardous Air Pollutants. The only radionuclide sources at TTR are the three Clean Slate sites, which are sources of diffuse radionuclide emissions as a result of the re-suspension of contaminated soils. These sites are currently being addressed by DOE/NNSA/NFO under the ER Project. The calculated dose for the maximally exposed individual 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) as specified in Title 40 Code of Federal Regulations (CFR), Subpart H, *National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities*. 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 a portable screen, multiple generators, 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/SFO. The NEPA Team completed two DOE NEPA checklists for TTR that were transmitted to the DOE/NNSA/SFO for review and determination in 2013.

The DOE/NNSA has prepared a Site-Wide Environmental Impact Statement (SWEIS) for the continued operation of activities at the NNSS and off-site locations, which include TTR. A Record of Decision for the completed document has not been issued. Personnel from TTR and the NEPA Team supported preliminary analyses for potential upcoming projects at TTR, such as the upgrade of the fiber optic cable communications loop, and a series of liquid natural gas burn and dispersal experiments.

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, 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. The EPA's recommendation is addressed by collecting environmental soil samples for TAL metal analysis every five years.

Environmental Programs

The following environmental programs are in place at KTF:

- NEPA,

- Water Monitoring,
- Air Emission Monitoring,
- Terrestrial Surveillance, and
- Waste Management.

NEPA

At KTF, NEPA compliance is coordinated between personnel from KTF, SNL/NM, and the DOE/NNSA/SFO. The NEPA Team completed two DOE NEPA checklists for KTF that were transmitted to the DOE/NNSA/SFO for review and determination in 2013.

In 2013, DOE made the decision to retain the land use permit for the Mount Haleakala facility on Maui, so that current capabilities could be maintained for support of future KTF test operations. The Kokole Point launch complex and associated facilities was transferred to the U.S. Navy in 2013.

Water Monitoring

In 2013, 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 2013. As a best management practice, personnel periodically perform sampling. All 3 septic tanks were inspected and pumped in 2013. Historically, no contaminants have been identified above the reporting limits from these past sampling events. During 2013, no sampling of septic tank systems was conducted at KTF.

Air Emissions Monitoring

Sandia was in compliance with all air quality regulations in 2013. The State of Hawaii requires an Annual and Semi-Annual Monitoring Report for air emissions. The Semi-Annual Monitoring Report Form for the first half of 2013 was submitted to the State of Hawaii in July 2013. The 2013 Annual Emissions Monitoring Report for air emissions was submitted to the State of Hawaii in February 2014.

For the period of February 1, 2012 through January 31, 2013, the highest total combined operating hours for a rolling twelve month period was 2,176.5 hours, which occurred in the period including October 2012 through September 2013. This shows compliance with the permit operating conditions.

In accordance with the KTF permit conditions, beginning October 1, 2010, each diesel engine generator shall be fired only on Fuel Oil No. 2 with maximum sulfur content not to exceed 0.15 percent by weight and a minimum cetane index of 40. According to testing data provided by the vendor, the cetane index for fuel purchased in 2013 was at least 54.3 and sulfur content was a maximum of 0.0009 percent. These conditions show compliance with permitted operating limits.

Terrestrial Surveillance

Terrestrial surveillance is conducted every five years at KTF. Sampling was conducted in 2012, which confirmed that KTF operations made no detectable environmental impact. Sampling was not conducted in 2013.

Waste Management

Some hazardous waste is generated through normal operations at KTF. Sandia is classified as a conditionally exempt small quantity generator, and follows applicable RCRA requirements.

Chapter 1
TTR Introduction

Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, 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 Field Office (SFO) 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. Navarro Research and Engineering (Navarro) 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. Navarro 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 2012a),
- DOE Order 435.1, Chg 1, Radioactive Waste Management (DOE 2001),
- DOE Order 458.1, Radiation Protection of the Public and the Environment (DOE 2013a), 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) 2013 (unless otherwise noted). 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, terrestrial monitoring and surveillance, the Environmental Restoration (ER) Project, and the National Environmental Policy Act. DOE Order 231.1B, *Environment, Safety, and Health Reporting* (DOE 2012a), 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 guideline 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/SFO that it had fully implemented an EMS in accordance with the requirements outlined in DOE Order 231.1B (DOE 2012a). Since 2006, Sandia has continued working to improve environmental management based on best management practices, benchmarking, and process improvements. In December 2011, an assessment was conducted at TTR to determine the extent of implementation of the International Organization for Standardization (ISO) 14001 EMS standard (ISO 2004), based on the potential to expand the scope of the existing Sandia National Laboratories, New Mexico (SNL/NM) ISO 14001 certification to include TTR. Results of the assessment continue to be

evaluated for potential expansion of the SNL/NM ISO14001 certification to include TTR. A follow-up to the assessment is scheduled for Fiscal Year (FY) 2014.

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 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-1950s. Nevada's Yucca Flat Test 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. During April 2002, a Land Use Permit was signed between the USAF and NNSA entitled, "Department of the Air Force Permit to the National Nuclear Security Administration to Use Property Located on the Nevada Test and Training Range, Nevada" (the Permit) (USAF/DOE/NNSA 2002). The Permit is valid from April 26, 2002 until October 5, 2019. The Permit reduced the size of TTR from approximately 335,655 acres to approximately 179,200 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

TTR is the testing range of choice for all national security missions. The Tonopah Test Range provides research and development test support for the DOE's weapon programs. The range also offers a unique test environment for use by other Government agencies and their contractors.

With capabilities such as modern electronic tracking instrumentation and data acquisition systems, TTR assures customers complete and accurate test data. TTR also provides facilities, a large land area, and the security to conduct a wide variety of tests.

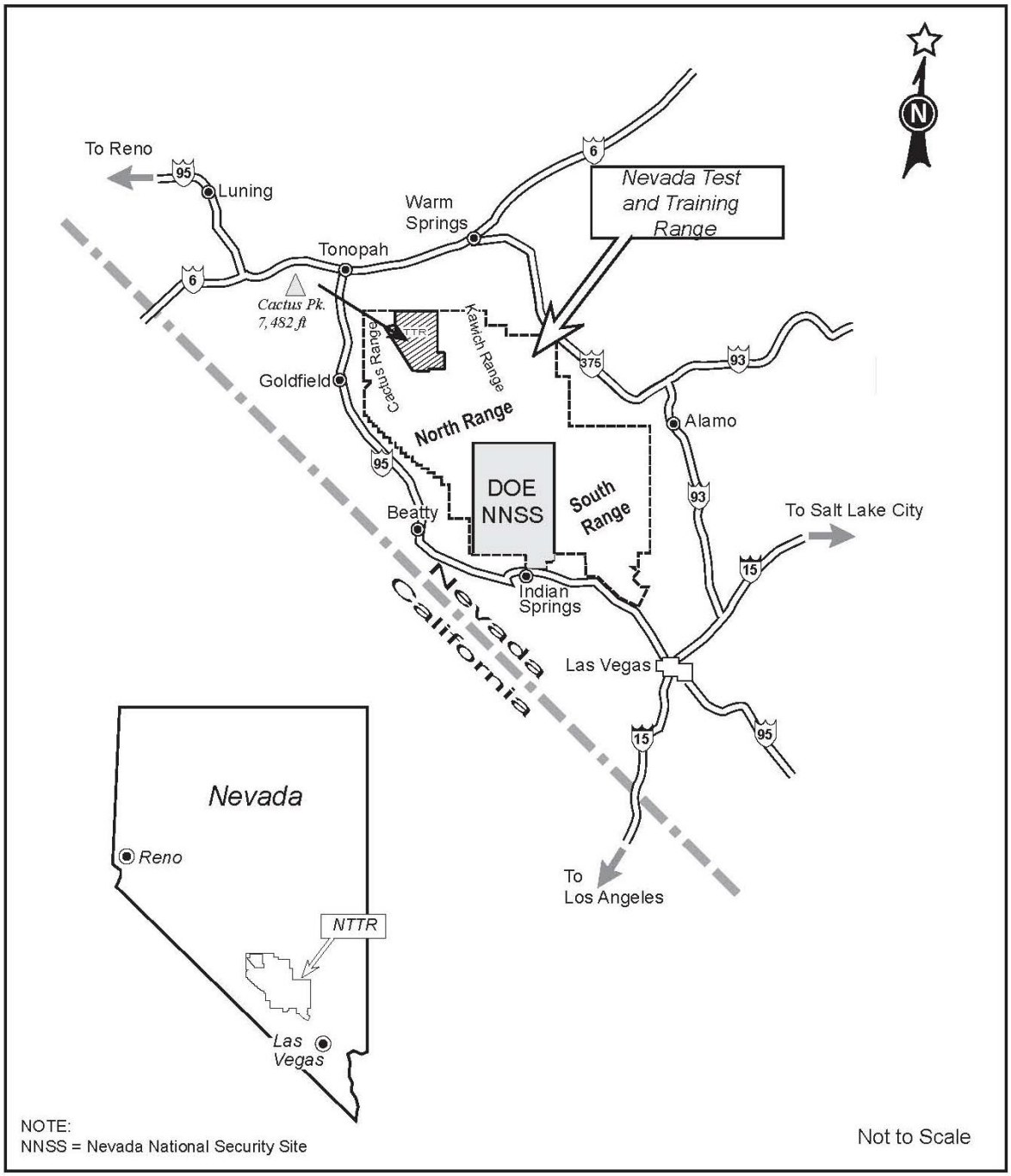

FIGURE 1-1. Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada.

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. 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).

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.

Mission Control Center

The TTR Control Point (CP) tower is a four-story structure that affords a 360 degree view of the site. It houses mission critical systems that coordinate all test activities during testing operations. The control tower houses the Test Director, Camera Control operators, Range Safety Officer, Telemetry Control operators, Test Engineer, Computer operator, Test and Evaluation Command and Control Station operator, Telemetry personnel, and visitors during test operations.

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

ER Project

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 and the Albuquerque and Nevada field offices to designate responsibility for all ER sites to DOE's Nevada Field Office (NFO). The NNSA was established in 2000. Today, responsibility for all ER sites still resides with the NNSA/NFO. However the environmental program management of TTR, as discussed in this ASER, is a joint effort between TTR and SNL/NM employees and contractors, with oversight from DOE/NNSA/SFO.

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 Bureau of Land Management (BLM) and the U.S. Forest Service. Cattle graze this land in the winter and spring. There also is a substantial irrigated farming operation north of the range. TTR 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 (2010 Census population 268) and Tonopah, Nevada (2010 Census population 2,478). Census data indicate a net resident loss of 550 people from the towns of Goldfield (loss of 88 residents) and Tonopah (loss of 462 residents) between the 2000 Census and the 2010 Census. 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 6,450, 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).

TTR "Main Lake" and "Cactus Peak"

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 approximately 100 ft 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 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) or 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 4 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. 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*). Lesser quantities of longspine horsebrush, four-wing saltbush, sagebrush (*Artemisia tridentata*), littleleaf horsebrush (*Tetradymia glabrata*), and snakeweed (*Gutierrezia sarothrae*) shrubs are also common. Indian ricegrass (*Achnatherum hymenoides*) and galleta (*Pleuraphis jamesii*) are frequent 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 the 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 (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*), mourning dove (*Enaida macroura*), and 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. The fourth test site at NTTR is referred to as Double Tracks. In 1996 and 1997, interim corrective actions were performed at Double Tracks and Clean Slate 1. These actions resulted in remediation of the soil contamination to a level of less than or equal to 400 picocuries per gram (pCi/g) of transuranics.

Table 1-1 summarizes test information related to the four Project Roller Coaster sites. DOE/NNSA/NFO 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.

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)

In addition to the activities conducted in 1996 at Double Tracks and 1997 at Clean Slate 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 were presented to DOE/NNSA/NFO 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 2013, at the request of DOE/NNSA/NFO, the DRI maintained three portable environmental monitoring stations (two installed in 2008 and the third installed in 2011) at the TTR as part of the ER Project Soils Sub-Project (Figure 1-2). 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 (CAUs) associated with Operation Roller Coaster on TTR.

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 associated with air borne particulates 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 associated with air borne particulates at the boundaries of the sites 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) 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. Stations 401 and 402 are solar powered with battery backup power; the batteries are recharged continuously by solar panels. All three stations consist of two

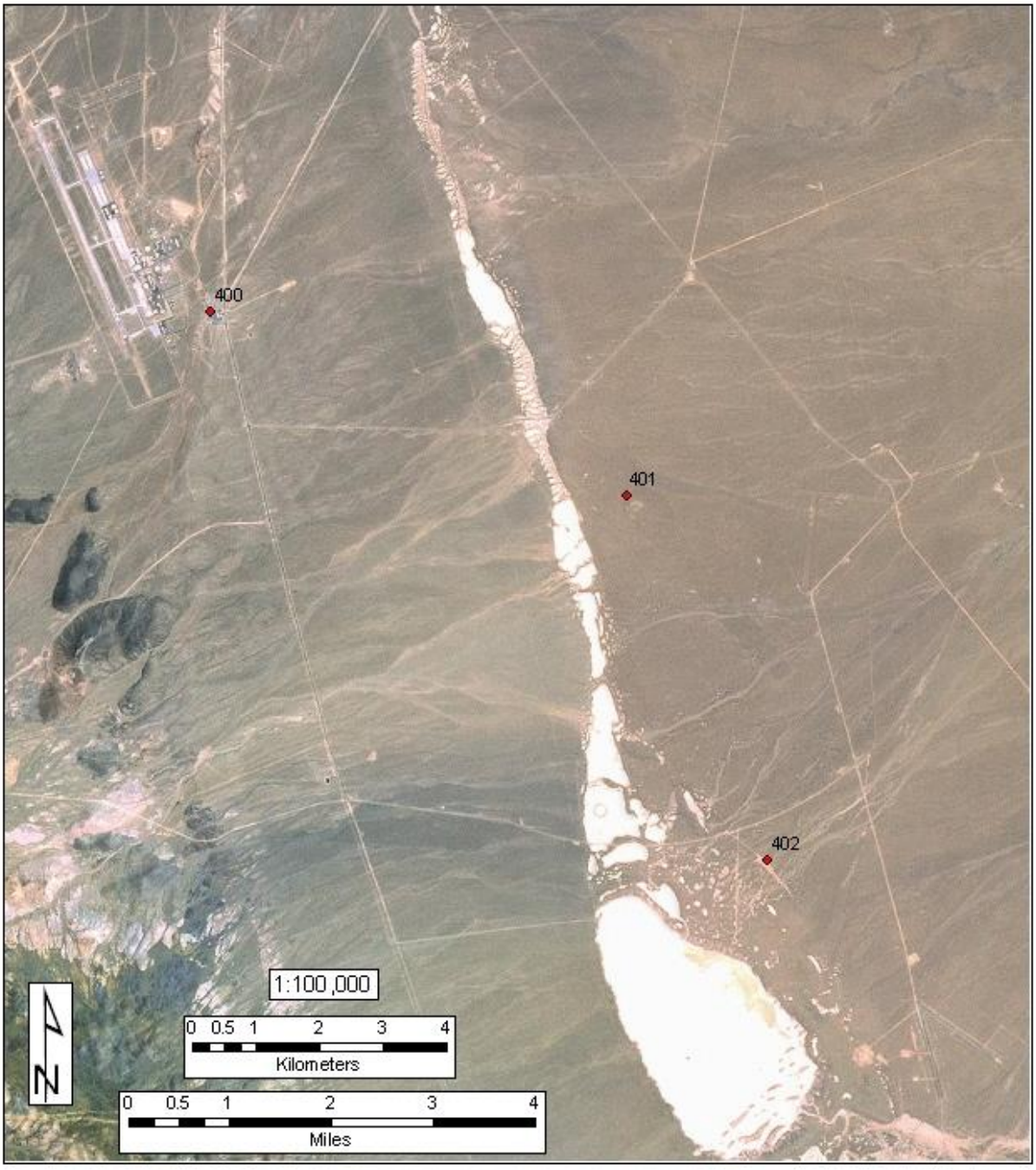

FIGURE 1-2. Soils project monitoring stations at Tonopah Test Range are located at the Range Operations Center (400), Clean Slate 1 (402), and Clean Slate 3 (401).

primary 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 et al. 2008), as well as for ease of access; on-site wind direction measurements have since confirmed the appropriateness of these locations. Although these data are of limited time duration, they are continuous and less influenced by local topography than the CEMP station 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 (ROC)

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 [100 yards] 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 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 (QA) procedures include checking the PIC response and air volume passing through 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 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 (Met-One™). The Met-One™ 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 glass-fiber air filter sample is collected every two weeks and delivered to the Radiological Services Laboratory at the University of Nevada, Las Vegas on a monthly basis for batch processing. Between December 26, 2012 and December 23, 2013, 26 air particulate filter samples were collected and analyzed by gamma spectroscopy and for gross alpha/beta activity. Only naturally occurring radionuclides were identified and measured on these samples; beryllium-7 (26 samples) and lead-210 (21 samples) were the most commonly identified radionuclides with occasional detections of potassium-40 (seven samples) and protactinium-234m (one sample). No anthropogenic gamma-emitting radionuclides such as cesium-137, cobalt-60, or americium-241 have been detected. The mean annual gross alpha activity from all samples (Table 1-2) was 2.03 x 10^{-15} microcuries per milliliter (µCi/mL), with a maximum of 5.69 x 10^{-15} µCi/mL, a minimum of 0.66 x 10^{-15} µCi/mL, and a standard deviation of 1.01 x 10^{-15} µCi/mL. The mean annual gross beta activity from all samples (Table 1-3) was 2.03 x 10^{-14} µCi/mL, with a maximum of 3.25 x 10^{-14} µCi/mL, a minimum of 1.26 x 10^{-14} µCi/mL, and a standard deviation of 0.44 x 10^{-14} µCi/mL.

FIGURE 1-3. Station 400 measures radiological and meteorological conditions near the Range Operations Center (ROC) in the Sandia National Laboratories compound on the Tonopah Test Range.

TABLE 1-2. Gross Alpha Results for TTR Sampling Stations 2013

Sampling Location	Number of Samples	Concentration ($x10^{-15}$ µCi/mL [3.7×10^{-5} Bq/m^3])			
		Mean	Standard Deviation	Minimum	Maximum
400	26	2.03	1.01	0.66	5.69
401 Cellulose	6	1.05	0.30	0.70	1.63
401 Glass	19	1.60	0.67	0.55	3.08
402 Cellulose	7	1.70	0.61	0.89	2.96
402 Glass	19	2.04	0.80	0.35	3.65

NOTES: At Station 400, a glass fiber filter collects particles larger than 0.3 µm.
At Station 401, cellulous fiber filters (collecting particles larger than 20 µm) were replaced by glass fiber filters after sample 7.
At Station 402 cellulose fiber filters were replaced by glass fiber filters after sample 8.
Bq/m^3 = Becquerel per cubic meter
µCi/mL = microcurie per milliliter
µm = micrometer
TTR = Tonopah Test Range

TABLE 1-3. Gross Beta Results for TTR Sampling Stations 2013

Sampling Location	Number of Samples	Concentration ($x10^{-14}$ µCi/mL [3.7×10^{-4} Bq/m^3])			
		Mean	Standard Deviation	Minimum	Maximum
400	26	2.03	0.44	1.26	3.25
401 Cellulose	6	0.82	0.25	0.55	1.24
401 Glass	19	1.64	0.44	0.46	2.30
402 Cellulose	7	1.05	0.29	0.69	1.53
402 Glass	19	2.13	0.67	0.68	3.34

NOTES: At Station 400, a glass fiber filter collects particles larger than 0.3 µm.
At Stations 401, cellulous fiber filters (collecting particles larger than 20 µm) were replaced by glass fiber filters after sample 7.
At Station 402 cellulose fiber filters were replaced by glass fiber filters after sample 8.
Bq/m^3 = Becquerel per cubic meter
µCi/mL = microcurie per milliliter
µm = micrometer
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 QA procedures include checking the PIC response and air volume passing through 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 computes the volume of air passed through the collection filter and run time of the collector. A saltation sensor was installed at Station 401 in August 2011. This instrument measures 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 the 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. The configurations of the solar-powered air sampler and the portable meteorological station are shown in Figure 1-4.

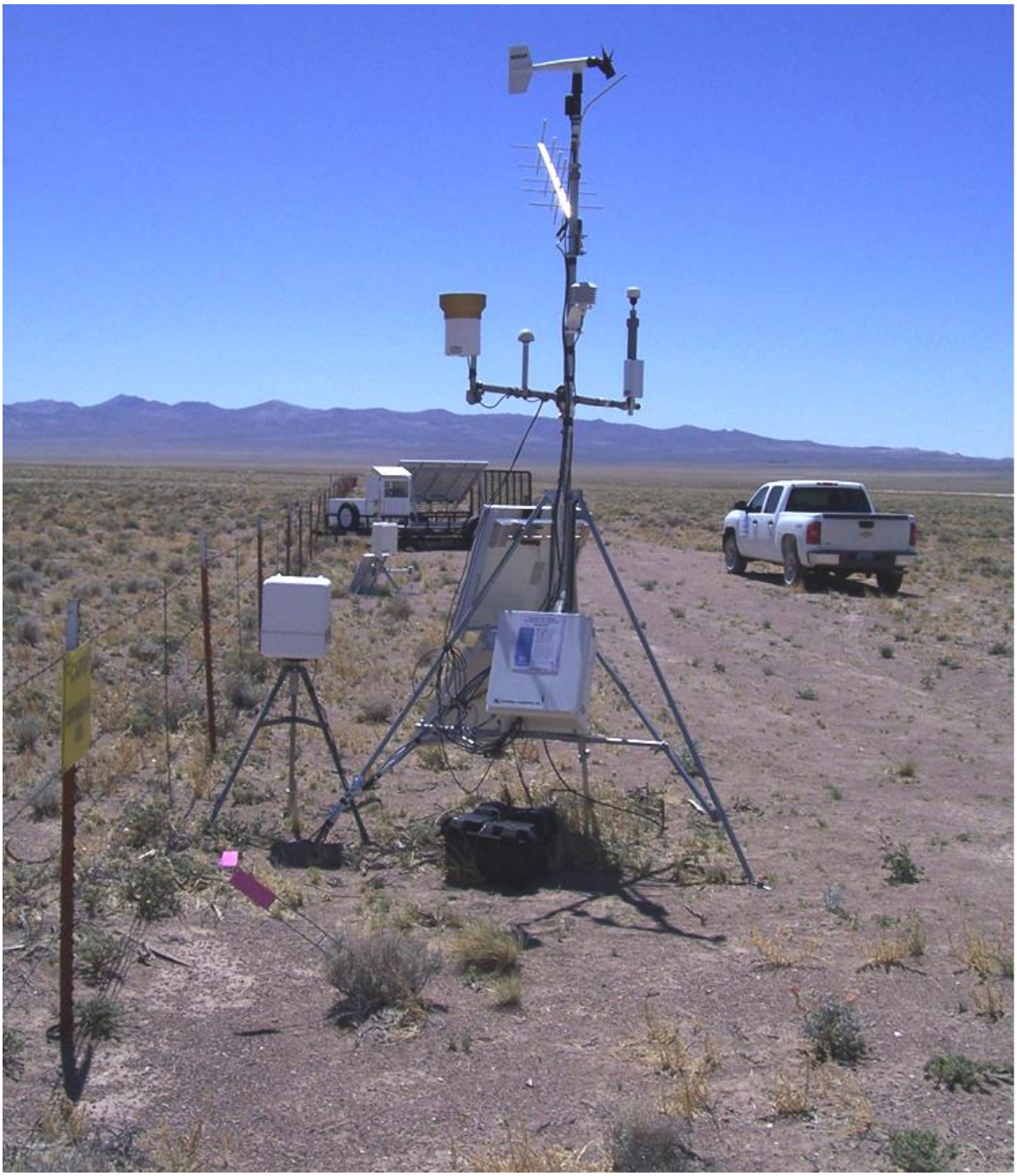

FIGURE 1-4. The solar powered air sampler, saltation sensor, and meteorological tower (background, center, and foreground, respectively) at Station 401 are located along the north fence that bounds the Clean Slate 3 contamination area.

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 monthly basis for batch processing. From December 26, 2012 until April 17, 2013, cellulose fiber filters were used in the collection equipment; after April 17, 2013 glass fiber filters were used. During the year December 26, 2012 to December 23, 2013, 25 air particulate filter samples were collected and analyzed by gamma spectroscopy and for gross alpha/beta activity. Only naturally occurring radionuclides were identified and measured on these samples; beryllium-7 (18 samples) and lead-210 (nine samples) were the most commonly identified radionuclides with minor detections of potassium-40 (seven samples). No anthropogenic gamma emitting radionuclides such as cesium-137, cobalt-60, or americium-241 have been detected. The mean annual gross alpha activity (Table 1-2) from glass filter samples was 1.60×10^{-15} µCi/mL, with a maximum of 3.08×10^{-15} µCi/mL, a minimum of 0.55×10^{-15} µCi/mL, and a standard deviation of 0.67×10^{-15} µCi/mL; the corresponding values for the cellulose filter samples were 1.05×10^{-15} µCi/mL for the average, with a maximum of 1.63×10^{-15} µCi/mL, a minimum of 0.70×10^{-15} µCi/mL, and a standard deviation of 0.30×10^{-15} µCi/mL. The mean annual gross beta activity (Table 1-3) from the glass filter samples was 1.64×10^{-14} µCi/mL, with a maximum of 2.30×10^{-14} µCi/mL, a minimum of 0.46×10^{-14} µCi/mL, and a standard deviation of 0.44×10^{-14} µCi/mL; the corresponding values for the cellulose filter samples were 0.82×10^{-14} µCi/mL for the average, with a maximum of 1.24×10^{-14} µCi/mL, a minimum of 0.55×10^{-14} µCi/mL, and a standard deviation of 0.25×10^{-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 Met-One™, 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 computes the volume of air passed through the collection filter and run time of the collector. 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. Solar panels, with battery assistance, 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 1-5.

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 monthly basis for batch processing. From December 26, 2012 until April 17, 2013, cellulose fiber filters were used in the collection equipment; after April 17, 2013 glass fiber filters were used. Between December 26, 2012 and December 23, 2013, a total of 26 air particulate samples were collected and analyzed by gamma spectroscopy and for gross alpha/beta activity. Only naturally occurring radionuclides were identified and measured on these samplers; beryllium-7 (26 samples) and lead-210 (16 samples) were the most commonly identified radio nuclides; potassium-40 was detected in three samples. No anthropogenic gamma emitting radionuclides such as cesium-137, cobalt-60, or americium-241 have been detected. The mean gross alpha activity (Table 1-2) from glass filter samples was 2.04×10^{-15} µCi/mL, with a maximum of 3.65×10^{-15} µCi/mL, a minimum of 0.35×10^{-15} µCi/mL, and a standard deviation of 0.80×10^{-15} µCi/mL; the corresponding values for the cellulose filter samples were 1.70×10^{-15} µCi/mL for the average, with a maximum of 2.96×10^{-15} µCi/mL, a minimum of 0.89×10^{-15} µCi/mL, and a standard deviation of 0.61×10^{-15} µCi/mL. The mean gross beta activity (Table 1-3) from

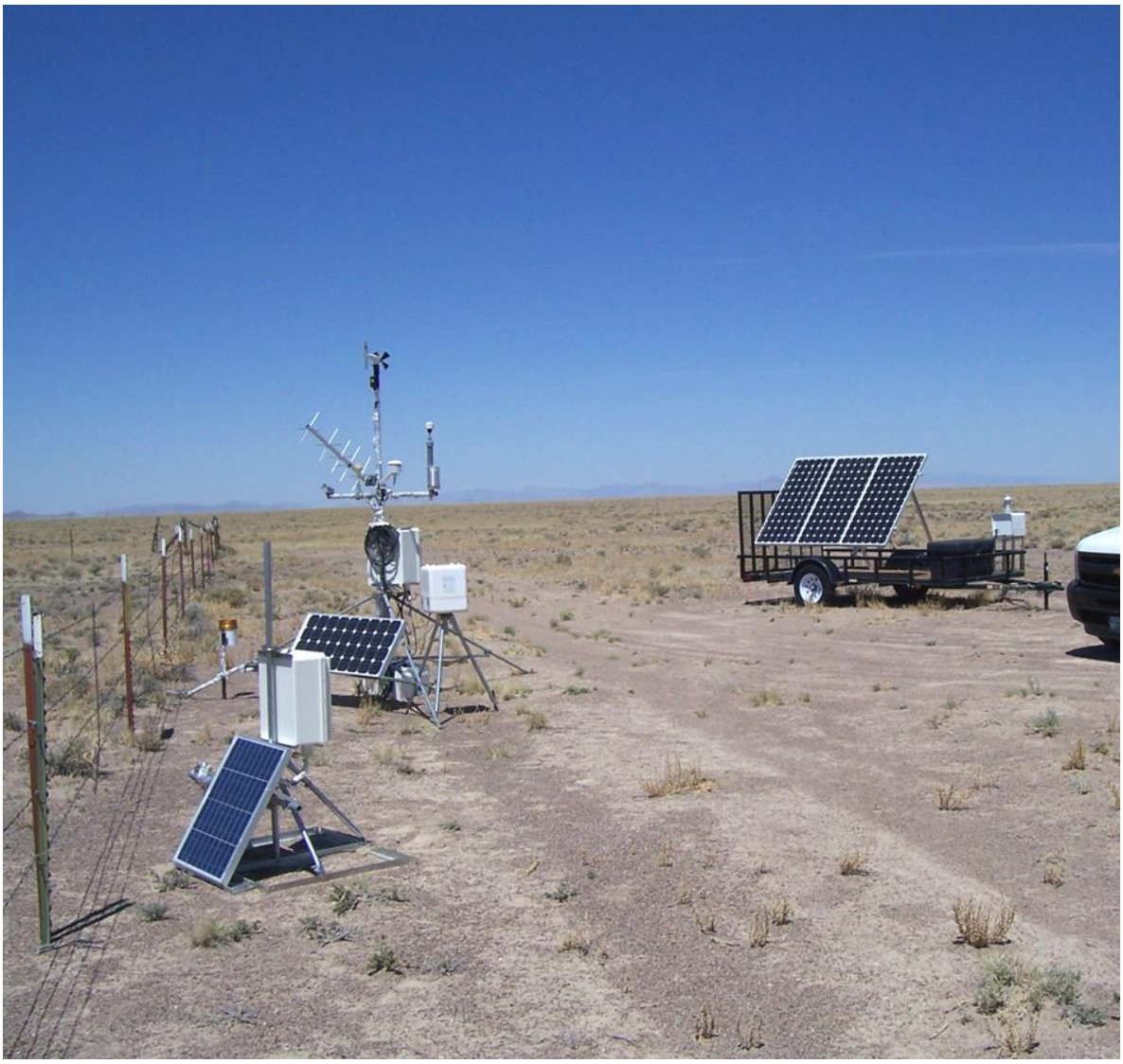

FIGURE 1-5. The solar powered air sampler, saltation sensor, and meteorological tower (center right, foreground left, center left, respectively) at Station 402 are located along the north fence that bounds the Clean Slate 1 contamination area.

glass filter samples was 2.13 x 10^{-14} µCi/mL, with a maximum of 3.34 x 10^{-14} µCi/mL, a minimum of 0.68 x 10^{-14} µCi/mL, and a standard deviation of 0.67 x 10^{-14} µCi/mL; the corresponding values for the cellulose filter samples were 1.05 x 10^{-14} µCi/mL for the average, with a maximum of 1.53 x 10^{-14} µCi/mL, a minimum of 0.69 x 10^{-14} µCi/mL, and a standard deviation of 0.29 x 10^{-14} µCi/mL.

Station 400, 401, and 402 Air Particulate Migration

At Station 400 (ROC), wind speed was observed to be 15 mph or less about 91 percent of the time; wind speeds exceeded 35 mph for only about 20 minutes out of the year. Slightly higher wind speeds were observed at Station 401 (Clean Slate 3) where winds of 15 mph or less were observed 90 percent of the time and wind speed exceeded 35 mph for about 0.03 (2.3 hours) of the year. At Station 402 (Clean Slate 1), wind speed was observed to be 15 mph or less about 91 percent of the time; here the wind speed exceeded 35 mph for about 0.01 (1.2 hours) of the year. Figure 1-6 shows the average respirable particulate matter (diameter equal to or less than 10 microns, [PM_{10}]) concentrations for 5-mph wind speed intervals at all three stations. The PM_{10} concentrations increase approximately exponentially as wind speed increases at all stations. PM_{10} concentrations at all three stations were less than about 11 micrograms per cubic meter (µg/m^3) for wind speeds below 15 mph. At Station 400, PM_{10} concentration peaked (101 µg/m^3) at wind speeds in the range of 25 to 30 mph. At Stations 401 and 402, PM_{10} concentrations rose to 68 (µg/m^3) and 133 (µg/m^3), respectively, for wind speeds above 35 mph.

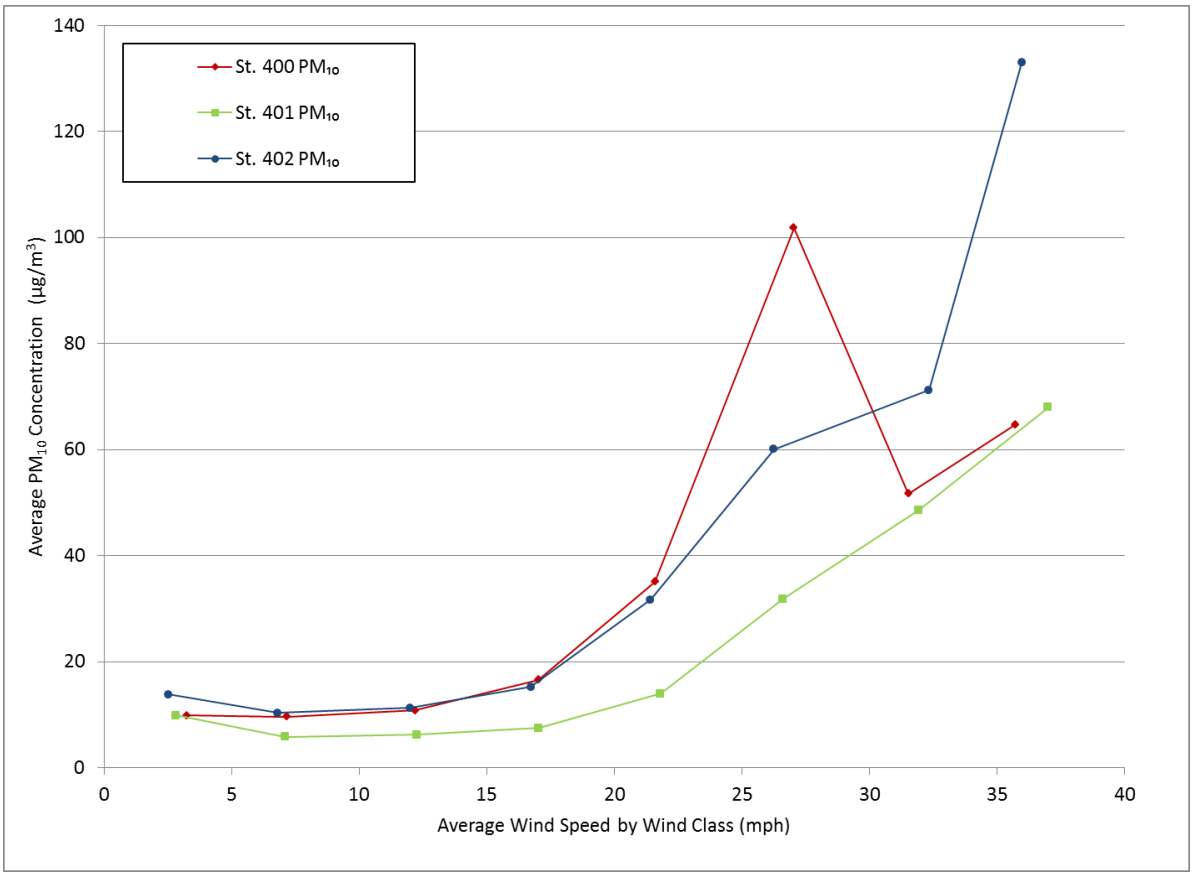

FIGURE 1-6. Wind speed and PM_{10} trends for Stations 400, 401, and 402 for January 1 through December 31, 2013.

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 (EOs) 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 2013 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 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 2013). 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 2013. 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. The release reporting limit for lead is 100 pounds (lbs). The TTR Firing Range is no longer owned or managed by DOE; therefore, there are no reporting requirements associated with the non-recovered lead for DOE or Sandia.

TABLE 2-1. Major Environmental Regulations and Statutes Applicable to TTR[a]

Regulation/Statute	Description
Clean Air Act (CAA) and CAA Amendments (CAAA)	Provides standards to protect the Nation's air quality.
Clean Water Act (CWA)	Provides general water quality standards to protect the Nation's water sources and byways.
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.
Cultural Resources Acts	Includes various acts that protect archeological, historical, religious sites, and resources.
Endangered Species Act (ESA)	Provides special protection status for federally listed endangered or threatened species.
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.
Federal Facility Compliance Act (FFCA)	Directs federal agencies regarding environmental compliance.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	Controls the distribution and use of various pesticides.
Migratory Bird Treaty Act (MBTA) of 1918	Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests.
National Emission Standards for Hazardous Air Pollutants (NESHAP)	Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA.
National Environmental Policy Act (NEPA)	Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making.
Resource Conservation and Recovery Act (RCRA)	Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks.
Safe Drinking Water Act (SDWA)	Enacts specific health standards for drinking water sources.
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.
Toxic Substances Control Act (TSCA)	Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls.

NOTES: [a]This is a partial listing of all applicable environmental regulations and statutes.
TTR = Tonopah Test Range

TABLE 2-2. 2013 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/SFO, which distributes it to the required entities.
304	Emergency Notification		X	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2013.
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 SDS/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/NM 2013a).
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 2013 there were no thresholds exceeded to report.

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 (gives relevant chemical information)
NNSA = National Nuclear Security Administration
RQ = reportable quantity
SARA = Superfund Amendments and Reauthorization Act
SDS = Safety Data Sheet
SFO = Sandia Field Office
SNL/NM = Sandia National Laboratories, New Mexico
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.

Some hazardous waste is generated through normal operations at TTR. Sandia is classified as a small quantity generator, and is subject to the applicable requirements (see Chapter 3, which summarizes hazardous waste management activities during 2013, 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 (as needed).

Sanitary solid waste, which is also regulated under RCRA, is disposed of at the TTR Class II sanitary landfill operated by the U.S. Air Force (USAF) Operations and Maintenance contractor. The landfill is used cooperatively by all organizations at TTR. Sandia also has a contract with the Republic Services Apex landfill, located just north of Las Vegas, to dispose of bulk non-regulated solid waste (such as loader tires) that cannot be disposed of in the USAF Landfill. The main purpose for obtaining this contract is clean-up of the Area 3 Salvage Yard.

Underground Storage Tanks (USTs) and Aboveground Storage Tanks (ASTs)

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. TTR is currently upgrading all AST tank systems.

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 there is currently has no mixed waste stored on-site, these requirements are not applicable to 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. Emissions are tracked and Sandia pays a standard $500 permit fee to the State of Nevada. Sandia met all air quality permit conditions in 2013.

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/NM 1997). The TTR Airport was determined to be the location of the maximally exposed individual. 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 2013, Sandia National Laboratories, Tonopah Test Range* (SNL/NM 2014a) 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 five active septic tank systems (the newest of which is inactive) 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.

Stormwater

The issuance of a NPDES stormwater permit is generally based on whether or not stormwater 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 stormwater runoff and has cognizance over all stormwater 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.

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 regulations. Well 6 normally provides all drinking water for the Area 3 compound. TTR operates under permits issued by the NDEP (one for the public water system and one for the arsenic treatment system). The USAF public water system and the Sandia public water system 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 public water system 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 (PCBs). As defined by TSCA, any material containing PCB with a concentration 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 (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.

There were two asbestos abatement activities conducted at TTR during 2013. The first was conducted in the Building 03-57, Mission Control Center (4th Floor), to remove asbestos-containing mastic from the sub-floor prior to a remodel of the Facility. The second was to remove a boiler and its associated asbestos-containing insulation from the mechanical room of Building 03-73 prior to the installation of a new heating system. All asbestos-related activities are conducted in accordance with applicable regulatory requirements.

Building 03-57 Mission Control Center and
Building 03-73 Boiler Room after asbestos abatement operations

2.1.9 Federal Insecticide, Fungicide, and Rodenticide Act

Chemical pesticides used at TTR include herbicides, rodenticides, and insecticides, as needed. 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 Safety Data Sheets (SDSs), formerly known as Material Safety Data Sheets (MSDSs), for each pesticide. There were no violations of the Federal Insecticide, Fungicide, and Rodenticide Act in 2013.

2.1.10 National Environmental Policy Act

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. Proposed actions that would not significantly impact the human environment are categorically excludable from additional NEPA documentation (as identified in DOE NEPA Implementing Procedures, 10 CFR Part 1021). Other proposed actions may

fit within a class of actions that have environmentally significant impacts associated with them. For this class of proposed actions, the agency must prepare an environmental assessment or an environmental impact statement 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 Field Office (SFO) coordinates NEPA compliance at 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.

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,
- Archaeological Resources Protection Act, and
- American Indian Religious Freedom Act.

The DOE/NNSA/SFO is responsible for determining the level of applicability of cultural resources requirements. In 2013, Sandia's operations generated no impact on cultural resources at TTR.

Historic Building Assessment

In 2011, DOE/NNSA/SFO completed consultation with the Nevada State Historic Preservation Office (SHPO), reaching an agreement on the proposed TTR Historic District. In 2012, DOE/NNSA/SFO provided samples of the documentation created to mitigate the effect of future demolition of properties within the TTR Historic District. The Nevada SHPO reviewed the sample documentation and agreed with its suitability. The DOE/NNSA/SFO and the Nevada SHPO have not yet signed a Memorandum of Agreement (MOA) regarding the historic district and future mitigative efforts at the site.

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*	- - - - - - - - -	Threatened
Ash Meadows milkvetch	*Astragalus phoenix*	Threatened	Threatened
Spring-loving centaury	*Centaurium namophilum*	Threatened	Endangered
Ash Meadows sunray	*Enceliopsis nudicaulis* var. *corrugata*	Threatened	Endangered
Ash Meadows gumplant	*Grindelia fraxinopratensis*	Threatened	Endangered
Ash Meadows ivesia	*Ivesia kingii* var. *eremica*	Threatened	Endangered
Ash Meadows blazingstar	*Mentzelia leucophylla*	Threatened	Endangered
Amargosa niterwort	*Nitrophila mohavensis*	Endangered	Endangered
Williams combleaf	*Polyctenium williamsiae*	- - - - - - - - -	Endangered
INVERTEBRATES			
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	Threatened
Devils Hole pupfish	*Cyprinodon diabolis*	Endangered	Endangered
Ash Meadows Amargosa pupfish	*Cyprinodon nevadensis mionectes*	Endangered	Threatened
Warm Springs Amargosa pupfish	*Cyprinodon nevadensis pectoralis*	Endangered	Endangered
Pahrump poolfish	*Empetrichthys latos latos*	- - - - - - - - -	Endangered
White River spinedace	*Lepidomeda albivallis*	Endangered	Endangered
Moapa dace	*Moapa coriacea*	Endangered	Endangered
Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	Threatened	- - - - - - - - -
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*	Endangered	Endangered
AMPHIBIANS			
Amargosa toad	*Anaxyrus nelsoni*	- - - - - - - - -	State Protected
Northern leopard frog	*Lithobates pipiens*	- - - - - - - - -	State Protected
Columbia spotted frog (Great Basin pop)	*Rana luteiventris* pop. 3	Candidate	State Protected
REPTILES			
Desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	Threatened	Threatened
Banded Gila monster	*Heloderma suspectum cinctum*	- - - - - - - - -	State Protected
Sonoran mountain kingsnake	*Lampropeltis pyromelana*	- - - - - - - - -	State Protected
MAMMALS			
Pallid bat	*Antrozous pallidus*	- - - - - - - - -	State Protected
Spotted bat	*Euderma maculatum*	- - - - - - - - -	Threatened
Pale kangaroo mouse	*Microdipodops pallidus*	- - - - - - - - -	State Protected
Fringed myotis	*Myotis thysanodes*	- - - - - - - - -	State Protected
American pika	*Ochotona princeps*	- - - - - - - - -	State Protected
Brazilian free-tailed bat	*Tadarida brasiliensis*	- - - - - - - - -	State Protected
BIRDS			
Greater sage grouse	*Centrocercus urophasianus*	Candidate	- - - - - - - - -
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Proposed Threatened	State Protected
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	Endangered

Once the MOA is signed, the Historic American Buildings Survey/Historic American Engineering Record Western Region office will provide instructions on the format for the final report on the TTR Historic District and that report will be completed.

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

2.1.15 DOE Directives

DOE directives on the Management and Operating Contract between Sandia and the DOE define the primary contractual obligations for operating TTR. Sandia met all the requirements stated in these DOE directives.

2.1.16 Quality Assurance

As outlined in detail in Chapter 7, 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 of DOE Order 414.1D, *Quality Assurance* (DOE 2011a), 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 2013 Audits

There were no on-site NDEP audits of TTR conducted during 2013; however, personnel from the NDEP Bureau of Air Quality conducted a brief familiarization visit on May 21, 2013 in conjunction with a visit to the USAF Facilities on Range.

An internal Environmental Programs and Assurance Evaluation (Evaluation 2189, 2013-ES-0026 Safe Drinking Water Act [ISO 14001 audit]) was conducted at TTR from July to September, 2013. This audit resulted in one self-identified finding:

- Finding: Air vacuum valves in the TTR water distribution system are not located at least one foot above the ground surface.
    - Nevada Administrative Code (NAC) 445A.67135, Distribution system: Release and blow-off valves, requires vents in a valve to be located at least 1 foot above the grade of the ground surface. At TTR the vents are below the grade of the ground surface.
    - Five Air/Vacuum Valves (AVVs) are located in below grade vaults that are subject to freezing on average of at least once per winter. Three AVVs are located around Treatment Building 03-150 and two are on the northern part of the distribution system near Building 03-73. After an AVV thaws, the float no longer seals properly, causing the valve to leak water into the vault. The undetected leak eventually submerges the AVV causing an unsanitary cross-connection.
    - These valves were installed when the water distributions system was completely renovated in 2005-2006. The AVV issue (along with other concerns) was identified to Facilities in 2007.
- Corrective Action: Hot Box enclosures have been ordered and the 5 AVVs will be raised at least 1 foot above ground level once the enclosures are obtained. This work is scheduled for completion in early 2014.

A recommendation was made during the internal Environmental Programs and Assurance Evaluation conducted in October 2012 to investigate the addition of security fencing, signage, and illumination at the public water system pump house, storage tower, and treatment plant. Upon investigation by Sandia personnel in 2013, it was determined that, due to the location of these facilities, additional fencing and illumination was not necessary. However, these facilities have been posted with "Authorized Personnel Only" signage in order to restrict access, as recommended.

A summary of 2013 environmental audits is presented in Table 2-4.

Subsurface Air Vacuum Valves

Heated Enclosures for raised Air Vacuum Valves

TABLE 2-4. Summary of Environmental Audits Performed at TTR During Calendar Year 2013

Type/Subject	Date	Audit Organization	Findings Summary
Evaluation 2189 2013-ES-0026 Safe Drinking Water Act [ISO 14001 audit]	July to September, 2013	00857	The TTR portion of this audit produced one finding: Finding 1: Air vacuum valves in the TTR water distribution system are not located at least one foot above the ground surface. Nevada Administrative Code (NAC) 445A.67135, Distribution system: Release and blow-off valves, requires vents in a valve to be located at least 1 foot above the grade of the ground surface. At TTR the vents are below the grade of the ground surface. These valves were installed when the water distributions system was completely renovated in 2005. Hot Box enclosures have been ordered and the 5 air vacuum valves will be raised at least 1 foot above ground level once the enclosures are obtained.

NOTES: ISO = International Organization for Standardization
TTR = Tonopah Test Range

2.3 2013 Issues and Actions for TTR

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

Federal Facility Agreement and Consent Order (FFACO) Compliance for Environmental Restoration (ER) Activities

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

- Nevada National Security Site,
- Areas within TTR,
- Areas within the Nevada Test and Training Range,

- 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 document (DOD/DOE/State of Nevada 1996). The list of sites has been modified for consistency with NDEP requirements and grouped into Corrective Action Units (CAUs), which are listed by Corrective Action Site (CAS) numbers. Each CAU/CAS is listed in the FFACO in the following appendices:

- Appendix II (Corrective Action Sites/Units; this section includes inactive CAUs/CASs),
- Appendix III (Corrective Action Investigations/Corrective Actions; this section includes active CAUs/CASs), and
- Appendix IV (Closed Corrective Action Units; this section lists CAUs/CASs where corrective actions are complete).

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

2.4 Environmental Permits

Environmental compliance permits for TTR include those for hazardous materials storage, public water supply, RCRA, and air quality. The State of Nevada issues permits for these Sandia TTR activities directly to DOE/NNSA/SFO, and they are administered by Navarro Research and Engineering (Navarro) on behalf of Sandia. Sandia and Navarro ensure that all permit conditions are met. Table 2-5 lists all permits and registrations in effect in 2013.

2.5 Occurrence Reporting

Under DOE Manual 231.1-2 (DOE 2003), 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 (DOE 2003), 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 2013.

TABLE 2-5. Summary of Permits at TTR During Calendar Year 2013

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 (Amended with corrections 10/03/2011)	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**	September 14, 2012	September 30, 2013	State of Nevada
Permit to Operate a Treatment Plant	NV-3014-TP11-12NTNC	September 14, 2012 and August 29, 2013	September 30, 2013 and September 30, 2014	State of Nevada
Nevada State Fire Marshal (Hazardous Material)				
Hazardous Materials Permit	20965 FDID Number (13007)	February 2013	February 28, 2014	State of Nevada

NOTES: *Generator identification number (not a permit number)
**The State of Nevada Bureau of Health Protection Services renews the permit for Well 6 (NV-3014-12NTNC) annually.
> = greater than
AP = Air Permit
FDID = Fire Department Identification
NTNC = Non-Transient Non-Community
NV = Nevada
RCRA = Resource Conservation and Recovery Act
TTR = Tonopah Test Range

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Chapter 3
TTR Environmental Programs Information

Environmental Restoration (ER), Waste Management, and the National Environmental Policy Act (NEPA) are some of the programs and activities the Tonopah Test Range (TTR) uses to comply with various federal and state regulations and U.S. Department of Energy (DOE) directives. Presidential Executive Orders 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 ER Project Activities

ER Project activities at TTR and the Nevada Test and Training Range (NTTR) were initiated in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. Responsibility for all TTR and NTTR ER sites resides with DOE National Nuclear Security Administration (NNSA), Nevada Field Office (NFO).

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 (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 (CASs),
- Grouped CASs into Corrective Action Units (CAUs),
- Prioritized CAUs, and
- Implemented corrective action activities.

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

CAUs located at TTR and NTTR are addressed by two ER Activities:

- **Industrial Sites Activity** – Sites historically used to support nuclear testing and Sandia National Laboratories (SNL) activities. Industrial sites include historical septic tanks systems, landfills, sewage lagoons, depleted uranium sites, and ordnance testing sites.
- **Soil Activity** – 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 and NTTR were derived from the Preliminary Assessment (PA) and the Federal Facility Preliminary Assessment Review (Ecology and Environment, Inc. [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 (Operation Roller Coaster) are discussed in Chapter 1. These sites are listed under Soil CAUs/CASs in Table 3-1 as CAUs 411, 412, 413, and 414. Project 57, which is located on NTTR, is listed under Soils CAUs in Table 3-1 as CAU 415.

Table 3-1 summarizes the existing Industrial Sites and Soils CAUs and CASs at TTR and NTTR. The ER activities planned for these CASs range from "no activities currently planned" to "Nevada Division of Environmental Protection-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).

2013 ER Project Activities

ER activities in 2013 included the removal of an inert rocket motor body from inside the Contamination Area at the Clean Slate III site (CAU 414). This was performed as an interim action prior to the future remediation of the site. Personnel from NNSS and TTR conducted the removal using a backhoe; a SNL unexploded ordnance (UXO) expert monitored removal operations; NNSS provided radiological control support to the operations and project oversight.

Other ER activities conducted on the TTR and NTTR in 2013 consisted of the annual post-closure inspections of closed/use-restricted Industrial Sites and inspections of radiological postings at the Clean Slate and Double Tracks sites. The inspections were conducted in May 2013, and minor erosion and subsidence repairs were completed in July 2013. Vegetation monitoring was also conducted at select sites in June 2013.

In addition to the inert rocket motor body removal and annual post-closure inspections and repairs, routine air sample collection was also conducted throughout the year at various locations on the TTR and NTTR.

TABLE 3-1. NNSA/NFO ER Project TTR and NTTR CAUs and CASs 2013 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 and 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. NNSA/NFO ER Project TTR and NTTR CAUs and CASs 2013 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 429 – *Closed* Area 3 Building 03-55 and Area 9 Building 09-52 Underground Discharge Points (TTR)		
03-51-001-0355	Photo Shop UDP, Drains	Photo Shop
09-51-001-0952	Mobile Photographic Lab UDPs	Area 9
CAU 430 – *Closed* Buried DU Artillery Round #1 (TTR)		
TA-55-003-0960	Depleted Uranium Artillery Round	South of Area 9
CAU 453 – *Closed* Area 9 UXO Landfill (TTR)		
09-55-001-0952	Area 9 Landfill	Area 9

See notes at end of table.

TABLE 3-1. NNSA/NFO ER Project TTR and NTTR CAUs and CASs 2013 Status (Continued)

Industrial Sites CAUs/CASs		
CAS Number	**CAS Description**	**General Location**
CAU 461 – *Closed* Test Area JTA Sites (TTR)		
TA-52-002-TAML	DU Impact Site	Main Lake
TA-52-003-0960	DU Artillery Round #2	South of Area 9
TTR-001	1987 W-79 JTA	Unknown
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	JTA DU Sites	Antelope Lake
TA-52-006-TAPL	DU Site	Colimbo Detonation Area
TA-54-001-TANL	Contaminated Tank and Steel Structure	NEDS Lake
CAU 485 – *Closed* Cactus Spring Ranch Pu and DU Site (TTR)		
TA-39-001-TAGR	Cactus Spring Ranch, Soil Contamination	West of Target Areas
CAU 486 – *Closed* Double Tracks RadSafe Area (TTR)		
71-23-001-71DT	Double Tracks RadSafe Area	Nellis Range 71
CAU 487 – *Closed* Thunderwell Site (TTR)		
RG-26-001-RGRV	Thunderwell Site	Thunderwell Site
CAU 489 – *Closed* WWII UXO Sites (TTR)		
RG-55-001-RGMN	WWII Ordnance Site	Mellan Airstrip
RG-55-002-RGHS	WWII Ordnance Site	H-Site Road
RG-55-003-RG36	WWII Ordnance Site	Gate 36E
CAU 490 – *Closed* Station 44 Burn Area (TTR)		
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

See notes at end of table.

TABLE 3-1. NNSA/NFO ER Project TTR and NTTR CAUs and CASs 2013 Status (Concluded)

Soil Sites CAUs/CASs:		
CAS Number	**CAS Description**	**General Location**
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
CAU 415 – *Not Started* Project 57 No. 1 Plutonium Dispersion (NTTR)		
NAFR-23-02	Pu Contaminated Soil	Nellis Range 13
CAU 541 – *Investigation Phase* Small Boy		
05-23-04	Atmospheric Tests (6) - BFa[1] Site	BFa, NTTR
05-45-03	Atmospheric Test Site - Small Boy	Frenchman Flat - Area 5, NTTR

SOURCE: FFACO, as amended (DOD/DOE/State of NV, 1996)

NOTES: (1) BFa is the site name and not an acronym.
CAS = Corrective Action Site
CAU = Corrective Action Unit
DU = depleted uranium
ER = Environmental Restoration
FFACO = Federal Facility Agreement and Consent Order
JTA = Joint Test Assembly
NEDS = Non-Explosive Destruction Site
NFO = Nevada Field Office
NNSA = U.S. Department of Energy, National Nuclear Security Administration
NTTR = Nevada Test and Training Range
Pu = plutonium
TTR = Tonopah Test Range
UDP = underground discharge point
UPS = Uninterruptible Power Supply
UXO = unexploded ordnance
WWII = World War II

3.2 Waste Management Programs

All waste generated at TTR, which excludes any waste generated by ER activities, is managed by Navarro Research & Engineering (Navarro) 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 2013 was as follows:

Waste Type	**Weight**
RCRA hazardous waste	4,276 kilograms (kg) (9,407 pounds [lbs]) [3,756 (kg) of the total was E-Waste sent for recycling inadvertently manifested as hazardous waste.]
Non-RCRA regulated	1,930 kg (4,246 lbs)
Non Salvage Yard Recycled material	1,337 kg (2,941 lbs)
Salvage Yard Metals Recycling	176,121 kg (387,466 lbs)
Toxic Substances Control Act (TSCA) waste (Asbestos)	0 kg (0 lbs)
Radioactive waste	0 kg (0 lbs)
Sanitary landfill:	
U.S. Air Force (USAF) Sanitary Landfill	15,768 kg (34,690 lbs)
Construction debris:	
USAF Construction Landfill	89,282 kg (196,420 lbs)
Tires:	
Phoenix Recycling Technologies	0 kg (0 lbs) [Phoenix Tire Recycling closed shop in 2013, a new contract for tire recycling will be sought in 2014.]
Battery recycling:	
Battery Recycling	3,034 kg (6,674 lbs)
Apex Landfill:	
Tires too large for recycling were disposed of at this landfill	0 kg (0 lbs)
Hydrocarbon Contaminated Waste:	
U.S. Ecology Landfill Beatty	0 kg (0 lbs)

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

TTR Area 3 Salvage Yard Metals Staging Line

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 are sent for recycling or disposed of through the waste disposal contractor. Recycled or energy-recovered quantities shipped off-site in 2013 are presented in Table 3-2.

Radioactive Waste Management

There were no shipments of radioactive waste in 2013.

TABLE 3-2. Recycled or Energy-Recovered Quantities Shipped Off-Site During Calendar Year 2013

Categories of Waste Recycled or Energy-Recovered	Shipped (lbs)	Shipped (kg)
NAPA Auto Batteries Recycled	6,674	3,034
Used Oil	981	446
Combustible Liquid, N.O.S.	176	80
Used Antifreeze	864	393
Batteries Wet Filled with Acid (Lead Acid)	255	116
E-Waste	8,263	3,756
Fluorescent Lights	546	248
Photographic Fixer	245	112
Salvage Yard Metals Recycling	387,466	176,120
TOTALS	**405,470**	**184,305**

NOTES: The lb or kg column weights are provided for convenience and indicate the same recycled material.
kg = kilograms
lbs = pounds
N.O.S. = Not Otherwise Specified

3.3 Spill Prevention Control and Countermeasures (SPCC) Plan

The *SPCC Plan for SNL Tonopah Test Range* (SNL/NM 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 trailer), eight aboveground storage tanks, a bulk storage area for 55-gallon drums, and a transformer storage area that are covered by the SPCC at TTR. Inspections are conducted monthly. Any issues identified during the inspections are promptly corrected, or are tracked via the work request process. Refueling platforms have been constructed by the Navarro Ironworkers for most of the "Lube Cube" Stationary tanks to aid refueling and inspection of the tanks, and minimize the spill and accident potential during refueling.

2,000 Gallon Diesel Fuel Tank for TTR Area 3 Emergency Backup Generator

3.4 National Environmental Policy Act (NEPA) Program

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

Personnel from TTR and the SNL/NM NEPA Team supported preliminary analyses for potential upcoming projects at TTR, including an upgrade of the fiber optic cable communications loop and a series of liquid natural gas burn and dispersal experiments.

The DOE/NNSA has prepared a Site-Wide Environmental Impact Statement (SWEIS) for the continued operation of activities at the Nevada National Security Site (NNSS) and off-site locations, which include TTR (DOE 2013b). A Record of Decision for the completed document has not been issued.

The SNL/NM NEPA Team completed two DOE NEPA checklists for TTR that were transmitted to the DOE/NNSA/SFO for review and determination in 2013.

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, Nevada System of Higher Education

The DRI trains and provides monitoring station managers through the Community Environmental Monitoring Program (CEMP) to collect samples from the off-site air monitoring equipment set up at 23 locations within communities surrounding the NNSS. These include the towns of Tonopah and Goldfield near the TTR. The DRI maintains the equipment and sends collected samples to Test America Labs in St. Louis for analysis and reporting of gross alpha and beta activity of individual filters, and gamma spectroscopy on quarterly composite samples from each station. Stations also record real-time gamma readings measured by a pressurized ion chamber, and an environmental thermoluminescent dosimeter (TLD) is used for confirmation of gamma readings.

The DRI also provides external quality assurance on samples taken by the CEMP through duplicate sampling at 10 percent sample of the stations. Duplicate samples are analyzed by University of Nevada, Las Vegas' radioanalytical lab. Data collected from the DRI's CEMP program are reported in the annual report of the NNSS Annual Site Environmental Report (ASER) (DOE 2012b).

There are now three DRI portable monitoring stations in use at TTR which are modeled in part after the CEMP stations previously mentioned. Station 400 is located near the TTR Range Operations Center, Station 401 is located near Clean Slate 3, and the newest (Station 402) is located near Clean Slate 1.

The DRI also performs other monitoring as requested by the DOE, such as archeological surveys. No cultural resource surveys were performed on the TTR at the request of DOE or Sandia in 2013.

Navarro

As part of its TTR support activities, Navarro personnel perform environmental monitoring activities for DOE and/or Sandia when necessary. This can include:

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

3.6 Summary of Release Reporting

The following two release reporting documents must be submitted to external regulatory agencies if releases exceed applicable threshold quantities:

- *NESHAP Annual Report for CY 2013, Sandia National Laboratories, Tonopah Test Range* (SNL/NM 2014a) 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. 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 in millirems per year for the maximally exposed individual.
- State of Nevada Extremely Hazardous Material Reporting Requirements – This is not currently required since extremely hazardous materials are not used during TTR routine operations.

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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 documents such as Environmental Impact Statements, 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 2013a), and to satisfy Sandia Corporation (Sandia) Environmental Management System 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 2012a). Concentration limits for radionuclides and metals in terrestrial media are not well defined. However, a comparison of the results from on-site and perimeter locations to off-site results are made 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 is available in the *Calendar Year (CY) 2006 Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii* (SNL/NM 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 in *The Role of Data Analysis in Sampling Design of Environmental Monitoring* (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.

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.

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/NM 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 2013, americium-241 at location S-51 continues to be identified as Priority-1. This location at the edge of "South Plume Area" is expected to have elevated readings and is consistent with the "hot particle" theory, where the presence of americium-241 or plutonium-239/240 in a heterogeneous sample skews the apparent "average" concentration, making it appear greater than it is. Sampling and trend analyses will continue for plutonium-239/240 and americium-241 at this location.

From 2000 through 2013, Sandia National Laboratories, New Mexico (SNL/NM) has used the same analytical laboratory for metals and radiological analyses.

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 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 provided in Appendix A.

- 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 2 inches of soil using a hand trowel. The 2013 analytical results can be found in Appendix B of this report and are summarized in this section. A detailed statistical analyses was performed on the 2013 data.

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

- Gamma-emitting radionuclides – Gamma spectroscopy is used to detect the emission of gamma radiation from radioactive materials. Radionuclide identification is possible by measuring the spectrum of gamma energies associated with a sample, since each radionuclide has a unique and consistent series of gamma emissions. Cesium-137 is an example of a long-lived gamma emitter that is prevalent in the environment (as fallout from historical nuclear weapons testing). Other gamma-emitters of interest at TTR are americium-241 and depleted uranium from past explosives testing.

- Plutonium – Due to past explosives testing, plutonium is present in some limited areas of TTR. One of the indicators of the presence of weapons–grade plutonium is radionuclide americium-241. Isotopic plutonium analysis is sometimes performed on any sample for which gamma spectroscopy identified americium-241 in concentrations greater than its minimum detectable activity (MDA).

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

Location	Location Number	Sample Location	Soil Sampling	Replicate*	TLD
Range Operations Center	S-40	Wastewater 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 – Rock Mound/Orange Block	X		
	S-39	Mellan Hill - North	X		
	S-53	Main Road/Lake Road Southeast	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.
CP = Control Point
TLD = Thermoluminescent Dosimeter
TTR = Tonopah Test Range

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	Mile Marker 6	X		
	C-33	Mile Marker 10	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

- 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 (TLDs) are used to measure ambient gamma exposure rates. Several natural gamma radiation sources exist, including cosmic radiation and radioactive materials that exist in geologic materials at TTR. The TLD network was established to determine the regional gamma exposure rate due to natural sources and to determine the impact, if any, of Sandia operations on those levels. The TLDs 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 location (S-51) was higher than off-site and with an increasing trend (Priority-1), and one location (S-09) was higher than off-site (Priority-2) for americium-241. Overall summary statistics for all radiological results are presented in Table 4-5. The Priority-1 location (S-51) and the Priority-2 location (S-09), along with the associated summary statistics for 2013, are listed in Table 4-6.

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

Americium-241

In 2013, one on-site location (S-51) was identified as Priority-1 (higher than off-site and increasing trend) for americium-241 with a value of 5.72 picocuries per gram (pCi/g). The first time this location had been identified as a Priority-1 was in 2009 with a value of 4.27 pCi/g and subsequently 6.51 pCi/g in 2010. The maximum result for this location to date was 11.2 pCi/g in 2012. The location at the edge of the "South Plume Area" is expected to have elevated readings. This is consistent with the "hot particle" theory; however, sampling and trend analyses will continue at S-51. The historical results can be seen in Figure 4-1. One location (S-09) was identified as Priority-2 (higher than off-site, but no increasing trend) with a value of 1.47 pCi/g.

There were no locations that exhibited Priority-3 or Priority-4 characteristics.

Plutonium-239/240

No on-site locations were identified as Priority-1 (higher than off-site and increasing trend) and one on-site location (S-51) was identified as Priority-2 (higher than off-site) for plutonium-239/240. The 2013 results showed that the plutonium-239/240 is consistent with "historical" slightly elevated levels at S-51 with a value of 22.3 pCi/g. This is also related to the elevated americium-241 results discussed above. The historical results can be seen in Figure 4-1.

There were no locations that exhibited Priority-3 or Priority-4 characteristics in 2013. The higher-than-normal plutonium-239/240 results are to be expected in the "South Plume Area". Spikes in the year-to-year results are likely due to the "hot particle theory", where the presence of americium-241 or plutonium-239/240 in a heterogeneous sample skews the apparent "average" concentration, making it appear greater than it is. Sampling and trend analysis will continue for plutonium-239/240 (and americium-241) at this location.

TABLE 4-5. Summary Statistics for TTR Radiological Soil Locations for Calendar Years 2000 – 2013 (all units in pCi/g)

Analyte	Class	Number of Samples	Average	Median	Std Dev	Minimum	Maximum
Americium-241	Perimeter	112	0.019	0.0223	0.058	-0.237	0.13
	On-Site	293	0.292	0.052	1.06	-0.231	11.20
	Off-Site	196	0.020	0.024	0.046	-0.202	0.13
Cesium-137	Perimeter	112	0.202	0.155	0.156	0.012	0.89
	On-Site	304	0.244	0.225	0.188	0.000	1.49
	Off-Site	196	0.211	0.166	0.159	-0.002	0.93
Plutonium-238	Perimeter	17	0.0042	0.003	0.008	-0.006	0.03
	On-Site	102	0.138	0.0150	0.855	-0.010	8.43
	Off-Site	34	0.003	0.0009	0.005	-0.004	0.02
Plutonium-239/240	Perimeter	17	0.021	0.0164	0.017	0.001	0.07
	On-Site	102	15.32	0.359	119.34	-0.008	1,200.00
	Off-Site	34	0.014	0.011	0.013	-0.001	0.05
Plutonium-242	On-Site	5	3.51	3.490	0.032	3.490	3.56
Uranium (mg/kg)	Perimeter	72	0.71	0.692	0.180	0.427	1.55
	On-Site	249	0.72	0.71	0.197	0.463	1.51
	Off-Site	126	0.75	0.69	0.205	0.463	1.55
Uranium-235	Perimeter	112	0.075	0.074	0.055	-0.059	0.25
	On-Site	304	0.087	0.079	0.062	-0.071	0.39
	Off-Site	196	0.084	0.077	0.060	-0.10	0.29
Uranium-238	Perimeter	112	1.221	1.245	0.528	0.003	2.65
	On-Site	303	1.288	1.220	0.516	0.032	3.13
	Off-Site	192	1.240	1.150	0.528	0.136	3.09

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

TABLE 4-6. Summary Statistics for TTR Radiological Soil Locations Noted as Priority-1 and Priority-2 for Calendar Year 2013 (all units in pCi/g)

Analyte	Location	Priority	Sample Size	2013 Result	Average	Median	Std Dev	Minimum	Maximum
Americium-241	S-51	Priority-1	14	5.72	3.22	2.19	3.32	-0.01	11.2
Plutonium-239/240	S-51	Priority-2	9	22.3	20.8	4.87	41.4	0.15	130
Americium-241	S-09	Priority-2	14	1.47	1.74	1.35	1.14	0.47	3.58

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

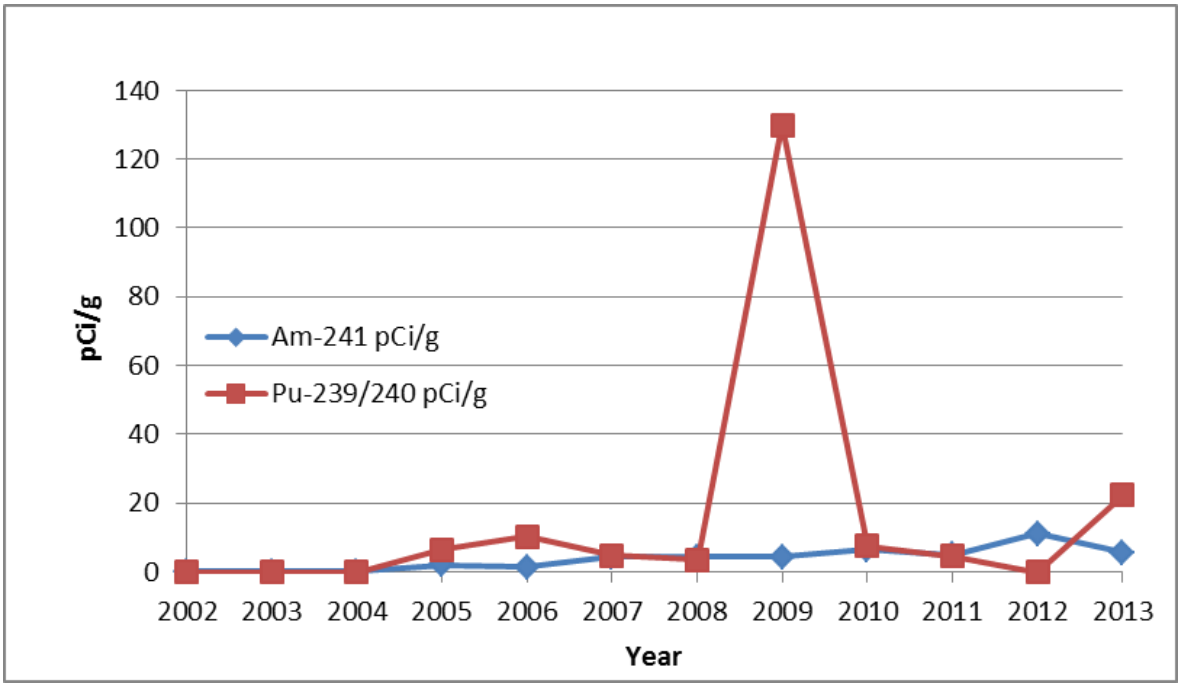

FIGURE 4-1. Historical Plutonium-239 and Americium-241 at TTR S-51

TLD Results

Sampling for 2013 was conducted from January 2013 through January 2014. When a TLD location has a missing quarter, the data are not included in the summary statistics (there were no missing TLDs in 2013). Summary statistics for the past fourteen years are shown in Table 4-7. 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 4-2 graphically portrays the TLD results from 2000 through 2013. TLD results and TLD measurements, by quarter and location type, for 2013 are provided in Appendix B of this report.

TABLE 4-7. Summary Statistics for TTR TLDs by Location Class for Calendar Years 2000 – 2013 (all units in mrem)

Location Class	Sample Size	Average	Median	Std Dev	Minimum	Maximum
On-Site	142	160.2	159.9	13.0	132.4	228.8
Perimeter	77	158.8	158.5	16.9	100.0	216.0
Off-Site	43	144.0	149.0	15.2	105.1	166.4

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

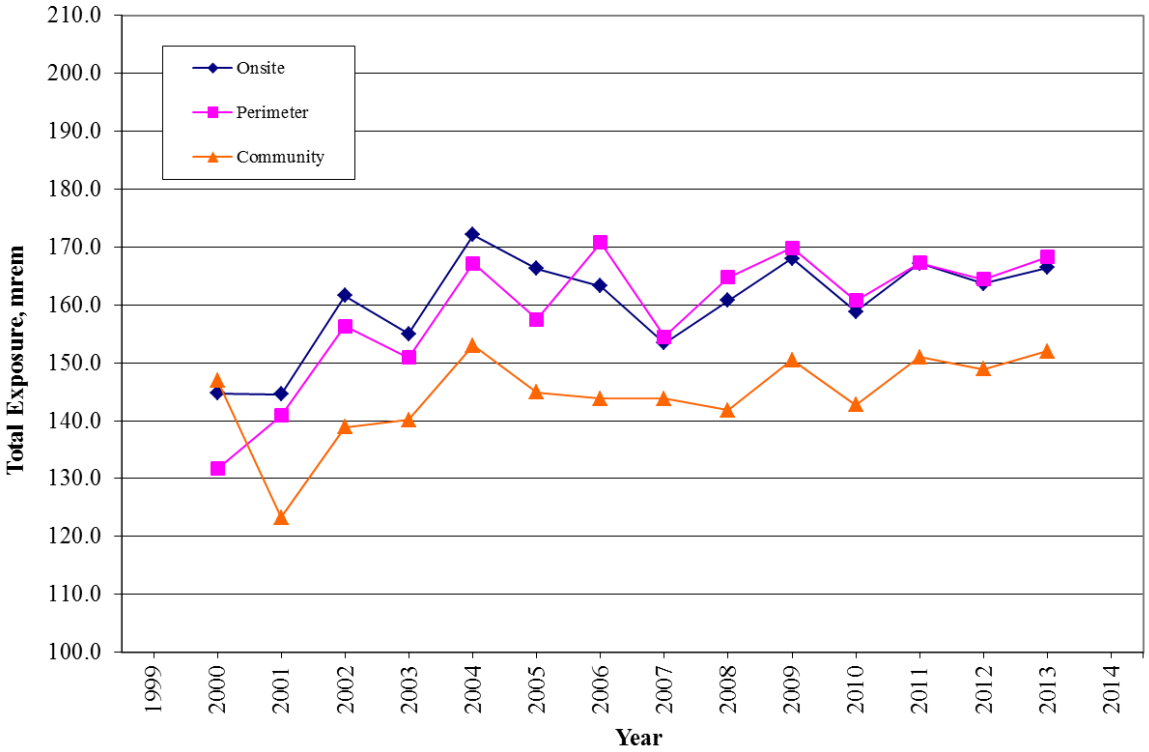

FIGURE 4-2. Tonopah Test Range TLD Exposure, 2000-2013

4.1.6 Non-Radiological Parameters and Results

In 2013, 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/NM 2006). Several target analyte list (TAL) metals exhibited a Priority-2 condition (higher than off-site) (Table 4-8) or Priority-3 (not higher than off-site) with increasing trend as shown in Table 4-9. All values were well below the U.S. Environmental Protection Agency (EPA) Region 9 Soil Screening Levels (residential use) shown in Table 4-10. All are assumed to represent natural background. There were no Priority-1 metals noted at any other of the sampled locations.

TAL metals analyses are planned for additional locations every three to five years. The next routine sampling for both sentinel and surveillance locations will occur in 2016.

TABLE 4-8. Summary Statistics for TTR Non-Radiological Soil Locations Noted as Priority-2 for Calendar Year 2013 (all units in mg/kg)

Analyte	Location	Sample Size	2013 Result	Average	Median	Std Dev	Minimum	Maximum
Beryllium	P-35	5	1.08	1.04	1.08	0.17	0.79	1.19
Cobalt	S-09	8	5.34	5.78	5.72	0.61	4.88	6.75
	P-35	5	6.93	7.64	6.93	1.71	6.30	10.4
Copper	P-35	5	11.9	25.8	26.7	9.76	11.9	36.0
Iron	P-35	5	15,600	16,840	16,600	3,547	11,700	20,600
Manganese	P-35	5	18.7	831	780	215	633	1160
Nickel	P-35	5	12.4	12.42	12.40	2.86	9.00	16.8

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

TABLE 4-9. Summary Statistics for TTR Non-Radiological Soil Locations Noted as Priority-3 for Calendar Year 2013 (all units in mg/kg)

Analyte	Location	Sample Size	2013 Result	Average	Median	Std Dev	Minimum	Maximum
Cadmium	S-03	8	0.21	0.16	0.19	0.06	0.04	0.22
Nickel	S-49	8	7.02	6.22	6.30	0.57	5.48	7.02
Potassium	S-38	8	5,010	3,411	3.440	732	2,280	4,360
	C-27	5	5,500	4,212	4,140	835	3,160	5,500

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

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

	Nevada Background Soil Concentrations[1]		EPA Region 9 Regional Screening Levels (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	77,000	1,100,000	4,500	100,000
Antimony	< 1.0	1.0	31	470	0.25	0.6
Arsenic	2.9	24	0.67	3.0	1	93
Barium	150	3,000	15,000	220,000	20	1,500
Beryllium	ND	5.0	160	2,300	0.04	2.54
Cadmium	ND	11	70	980	0.41	0.57
Calcium	600	320,000	N/A	N/A	N/A	N/A
Chromium (III)	7.0	150	120,000	1,800,000	7	1,500
Cobalt	ND	20	23	350	3	50
Copper	7	150	3,100	47,000	3	300
Iron	1,000	100,000	55,000	820,000	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	26,000	20	3,000
Mercury	0.01	0.82	9.4	40	0.02	1.5
Molybdenum	ND	7.0	390	5,800	0.8	3.3
Nickel	5	50	1,500	22,000	5	150
Potassium	1,900	63,000	N/A	N/A	N/A	N/A
Selenium	< 0.1	1.1	390	5,800	0.1	4
Silica (Silicon)	150,000	440,000	N/A	N/A	24,000	368,000
Silver	0.5	5	390	5,800	0.2	3.2

See notes at end of table.

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

	Nevada Background Soil Concentrations[1]		EPA Region 9 Regional Screening Levels (Soil Screening Levels[2])		U.S. Background Soil Concentrations[3]	
Analyte	**Lower Limit**	**Upper Limit**	**Residential**	**Industrial**	**Lower Limit**	**Upper Limit**
Sodium	500	100,000	N/A	N/A	N/A	N/A
Strontium	100	1,500	47,000	700,000	7	1,000
Thallium	N/A	N/A	0.78	12	0.02	2.8
Titanium	700	5,000	140,000	600,000	20	1,000
Vanadium	30	150	390	5,800	0.7	98
Zinc	10	2,100	23,000	350,000	13	300

NOTES: (1) Dragun, James, A. Chiasson, *Elements in North American Soils*, 2005.
(2) EPA Region 9 Preliminary Regional Screening Levels, U.S. EPA, Updated May 2014.
(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
U.S. = United States

4.2 Water Monitoring

This section discusses the results for potable water, water conservation, wastewater effluent sampling, and stormwater 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 (Nevada Division of Environmental Protection [NDEP] 2011). Analytes are sampled at different intervals, as shown in Table 4-11. The NDEP currently provides Public Monitoring and Reporting Requirements for each PWS around March of each year. The 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.

TABLE 4-11. Routine Production Well Monitoring at TTR

Analyte	Reporting Frequency
Total Coliform	Quarterly
Arsenic	Quarterly
Disinfectant Residual	Quarterly (Checked Daily)
Total Trihalomethanes/Haloacetic Acids (5)	Annually
Di (2-Ethylhexyl) Phthalate (DEHP) ***also known as*** Bis(2-ethylhexyl) phthalate	As required by NDEP, usually every 3 years
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

The State of Nevada maintains information on the TTR 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 untreated water is required to be between 6.5 and 7.0 on the pH scale for efficient/effective operation of the arsenic removal system.

Production Well Monitoring Activities and Results

There was one planned distribution system repair that resulted in a loss of distribution system pressure. Gaskets on the Distribution Pipe Valves within the hot box connecting the SNL PWS to the USAF PWS were leaking and needed to be replaced. A Drinking Water Public Notice was issued in advance of the repair event to Area 3 personnel. The system was returned to normal status after bacteriological sampling indicated no contamination occurred as a result of the loss of pressure or repair.

Hot Box Valves SNL Area 3 to USAF Area 10 PWS Connections

In 2013, all sample results were below the maximum contaminant levels (MCLs) established for the substances monitored.

There were 4 compliance arsenic samples collected in 2013. Three samples contained less than 1 parts per billion (ppb) arsenic and 1 sample contained 13 ppb arsenic. The MCL for arsenic in drinking water is 10 ppb as a running annual average. The 13 ppb arsenic sample result occurred during the 1st quarter of 2013. Once the 13 ppb result was received, it was determined that the arsenic removal media was exhausted and it was changed out in February 2013 (after nearly 5 years of useful service). The highest running annual average for arsenic in the drinking water during 2013 was 5.6 ppb, which occurred during the first quarter prior to the arsenic removal media change-out.

During 2013, Well 6 produced 694,100 gallons (gal) of water that was chlorinated and sent to the elevated water storage tower. This equals an average monthly production of approximately 58,000 gal during 2013. Daily production during 2013 averaged approximately 1,900 gal.

During 2013, approximately 267,000 gal of water was treated to remove arsenic and sent to the drinking water distribution system. This equates to a monthly average of approximately 22,250 gal and a daily consumption rate of 732 gal.

A total of 387 pounds (lbs) of carbon dioxide was used during the year for pH adjustment (32 lbs per month or 1.0 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 1992a). For the plan's education conservation measures, an estimate of the amount of water that may be conserved each year as a result of the adoption of the plan is approximately 22,630 gal based on approximately one (1) gal of water per person per day. 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 Sandia or Navarro Research and Engineering (Navarro) 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; 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 ASER as Appendix C – "Wastewater Sampling Results". These systems are periodically sampled as a BMP and do not require sampling by the NDEP. During 2013 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,
- Phenolic compounds (phenol containing compounds are not used at TTR),
- Chemical oxygen demand,
- VOCs,
- Semivolatile Organic Compounds,
- Metals (arsenic, cadmium, chromium, copper, nickel, silver, zinc, lead, selenium, and mercury),
- Total Petroleum Hydrocarbons,
- Oil and grease, and
- Tritium, gamma spectroscopy, gross alpha/beta.

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

Septic Tank Systems

Septic tank systems are sampled as needed. There are five septic tank systems (36-01, 09-52 [inactive/never used], 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 septic tank systems are used in remote locations and are maintained by the TTR Facilities group. The sewage from these locations flows into septic tank systems and associated drain fields. None of these systems required maintenance, sampling, or pumping in 2013. All other remaining septic tank systems have been closed, or are undergoing closure and are being addressed by the ER Project.

4.2.4 Stormwater Monitoring

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

4.3 Radiological Air Monitoring

Air Quality Compliance 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 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/NM 1997). 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/NM 1997). The dose assessment result from the continuous monitoring was 0.024 mrem/yr. This was approximately 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/NM 2014a). The results from the 1996 to 1997 monitoring will continue to be used for as long as there is no change in the status of the Clean Slate sites. Table 4-12 summarizes these dose assessment results. Future TTR activities are not expected to change; however, if new sources or modifications to the existing sources are anticipated, they will be evaluated for NESHAP applicability.

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

4.4 Non-Radiological Air Emissions

The 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 2013, there were emissions from the portable screen, generators, and activities at the maintenance shop. The portable screen was operated for 104.5 hours during 2013, and contributed 0.01 tons of particulate matter (PM) emissions. There were three generators operated in 2013 that are part of the Class II Air Quality Permit. The first generator is 670 horsepower (HP) in size, was operated for 107 hours, and contributed 1.1 tons of emissions (NOx, CO, SOx, PM_{10}, VOC, and hazardous air pollutants [HAPs]). The second generator is 268 HP in size, was operated for 122 hours, and contributed 0.9 tons of emissions (NOx, CO, SOx, PM_{10}, VOC, and HAPs). The third generator is 268 HP in size, was operated for 100 hours, and contributed 0.7 tons of emissions (NOx, CO, SOx, PM_{10}, VOC, and HAPs). The maintenance shop activities (painting, welding, and woodworking) operated for a combined 423.8 hours or less during 2013 and contributed 0.2 tons of emissions (PM, HAPs, and VOCs). The actual emissions were well within the permit limits to assure compliance with the permit.

Chapter 5
2013 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 United States (U.S.) military agencies under the DOE/NNSA Inter Agency Work program. The DOE/NNSA, Sandia Field Office (SFO) 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). Remote facilities used in support of KTF operations include Mount Haleakala (Maui) and Kahili Point (Kauai). This Annual Site Environmental Report (ASER) summarizes data and the compliance status of environmental protection and monitoring programs at KTF for Calendar Year (CY) 2013. This report was prepared in accordance with DOE Order 231.1B, *Environment, Safety, and Health Reporting* (DOE 2012a).

5.1 Facilities and Operations

KTF has been an active rocket launching facility since 1962. The KTF and Remote Range 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 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 the Missile Defense Agency. From 1992 to 2013 there have been 55 launches from KTF, 1 launch from the Kokole Point site, and 29 launches from PMRF supported by KTF personnel.

The KTF launch 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). In addition to rocket launch pad sites, KTF facilities include missile and payload assembly buildings, launch operations and data acquisition facilities, maintenance shops, and a trailer dock compound for administration and other office processing.

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 mission 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 activities are performed. Environment controls using dehumidifiers remain in operation (to protect equipment). Additionally, there are a number of

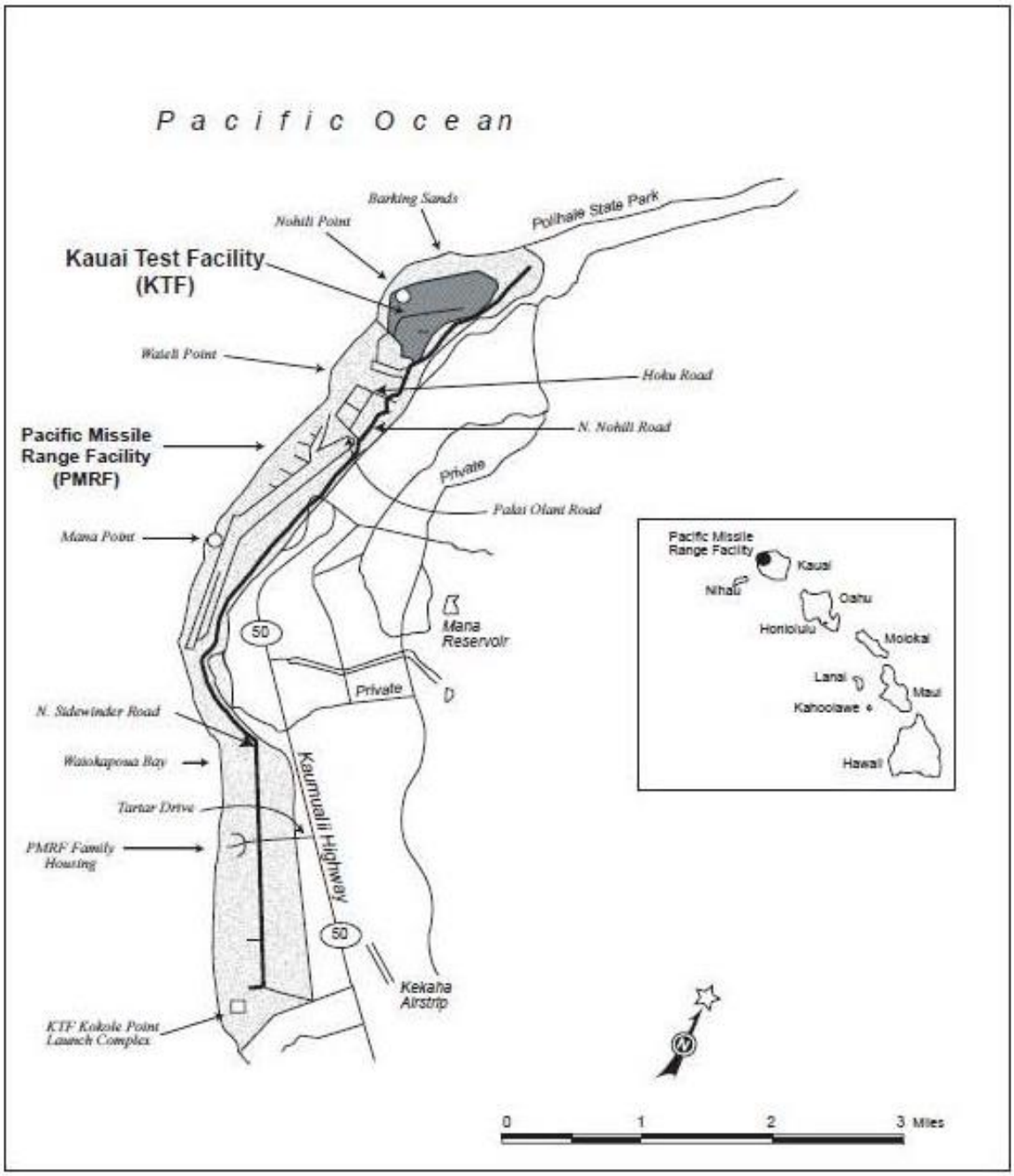

FIGURE 5-1. Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area (The Kauai Test Facility [KTF] is to the north, near Nohili Point)

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 include Mount Haleakala (Maui) and Kahili Point (Kauai), but have not been used by Sandia for several years. The land permit for the Mount Haleakala facility on Maui has been retained to support future KTF test operations. New diversification efforts are being explored for these sites. The Kokole Point launch complex and associated facilities was transferred to the U.S. Navy (USN) in 2013.

5.2 2013 Rocket Launches

There were four rocket launches supported by KTF in 2013. The launches were covered by the KTF Environmental Assessment (EA), published in July 1992 (DOE 1992b) and the USN, Hawaii Range Complex Environmental Impact Statement (DOD 2008):

- AEGIS BMD, FTM-20, February 12, 2013 (from KTF)
- AEGIS BMD, FTM-19, May 15, 2013 (from PMRF)
- AEGIS BMD, FTM-21, September 18, 2013 (from PMRF)
- AEGIS BMD, FTM-22, October 13, 2013 (from PMRF)

5.3 Demographics

There were 14 permanent on-site personnel at KTF in 2013. During campaign operations when rocket launches occurred, there were approximately 150 additional people working 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 operations at KTF in 2013 (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 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 2012. Table 5-3 lists SARA Title III reporting requirements.

TABLE 5-1. Major Environmental Regulations and Statutes Applicable to KTF[a]

Regulation/Statute	Description
Clean Air Act (CAA) and CAA Amendments (CAAA)	Provides standards to protect the Nation's air quality.
Clean Water Act (CWA)	Provides general water quality standards to protect the Nation's water sources and byways.
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.
Cultural Resources Acts	Includes various acts that protect archeological, historical, religious sites, and resources.
Endangered Species Act (ESA)	Provides special protection status for federally listed endangered or threatened species.
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.
Federal Facility Compliance Act (FFCA)	Directs federal agencies regarding environmental compliance.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	Controls the distribution and use of various pesticides.
Migratory Bird Treaty Act (MBTA) of 1918	Prevents the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests.
National Emission Standards for Hazardous Air Pollutants (NESHAP)	Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA.
National Environmental Policy Act (NEPA)	Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making.
Resource Conservation and Recovery Act (RCRA)	Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks.
Safe Drinking Water Act (SDWA)	Enacts specific health standards for drinking water sources.
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.
Toxic Substance Control Act (TSCA)	Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls.

NOTES: [a]This is a partial listing of all the applicable environmental regulations and statues.
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*	September 23, 1994	Not specified	EPA Region IX and Hawaii Dept. of Health
Underground Storage Tank (UST) (2,500)	Not applicable	September 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 Noncovered Source Permit update was issued on March 3, 2009 (Hawaii DOH 2009).
*Generator ID number (not a permit number)
EPA = U.S. Environmental Protection Agency
KTF = Kauai Test Facility

TABLE 5-3. 2013 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/SFO, which distributes it to the required entities.
304	Emergency Notification		✓	No RQ releases of an EHS, or as defined under CERCLA occurred.
311-312	SDS/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/SFO for distribution to the required entities; (b) the AQC Program provides SDS/MSDSs for each chemical entry on a Tier II form and provides the report to DOE/NNSA/SFO for distribution to the required entities.
313	Toxic Chemical Release Forms		✓	Sandia Corporation is below the reporting threshold in 2013 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/SFO = U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office
EHS = extremely hazardous substance
EPA = U.S. Environmental Protection Agency
EPCRA = Emergency Planning and Community Right-to-Know Act
KTF = Kauai Test Facility
lbs = pounds
MSDS = Material Safety Data Sheet (provides relevant chemical information)
RQ = reportable quantity
SARA = Superfund Amendments and Reauthorization Act
SDS = Safety Data Sheet
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 of this ASER. Some hazardous waste is generated through normal operations at KTF. Sandia is classified as a conditionally exempt 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. Sandia 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. Proposed actions that would not significantly impact the human environment are categorically excludable from additional NEPA documentation (as identified in DOE NEPA Implementing Procedures, 10 Code of Federal Regulations (CFR) Part 1021). Other proposed actions may fit within a class of actions that have environmentally significant impacts associated with them. For this class of proposed actions, the agency must prepare an environmental assessment or an environmental impact statement 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/SFO.

In 2013, DOE made the decision to retain the land use permit for the Mount Haleakala facility, maintain current capabilities, and support future test operations. The Kokole Point launch complex and associated facilities was transferred to the USN in 2013.

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 environmental impact statement (EIS) must be prepared.

Table 5-4 lists all threatened and endangered state and federal listed species occurring on the island of Kauai.

Cultural Resources Acts

The three primary cultural resources acts applicable at KTF are:

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

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	*Huperzia 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*	Endangered	Endangered
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
No common name	*Cyperus pennatiformis*	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
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

See notes at end of table.

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

Common Name	Scientific Name	Federal Status	State Status
PLANTS (Continued)			
Flowering Plants (Continued)			
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
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
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

See notes at end of table.

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

Common Name	Scientific Name	Federal Status	State Status
PLANTS (Continued)			
Flowering Plants (Continued)			
Mann's bluegrass	*Poa mannii*	Endangered	Endangered
Hawaiian bluegrass	*Poa sandvicensis*	Endangered	Endangered
No common name	*Poa siphonoglossa*	Endangered	Endangered
(=Na`ena`e) lo`ulu	*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
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

See notes at end of table.

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

Common Name	Scientific Name	Federal Status	State Status
ANIMALS (Continued)			
Birds (Continued)			
`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
Green sea turtle	*Chelonia mydas*	Threatened	Threatened
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Endangered
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	Endangered
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	Endangered
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened	Threatened
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 musaphilia*	Endangered	Endangered
Hawaiian picture-wing fly	*Drosophila sharpi*	Endangered	Endangered
Pacific Hawaiian damselfly	*Megalagrion pacificum*	Endangered	Endangered
Orangeblack Hawaiian damselfly	*Megalagrion xanthomelas*	Candidate	Candidate
Crustaceans			
Kauai cave amphipod	*Spelaeorchestia koloana*	Endangered	Endangered

NOTES: KTF = Kauai Test Facility

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 a DOE/NNSA responsibility to ensure that impacts to cultural resources are assessed and appropriate actions taken to mitigate any impact. In 2013, SFO completed consultation with the State of Hawaii State Historic Preservation Officer (SHPO) regarding the KTF properties at Kokole Point, located at the southern tip of the PMRF. KTF maintained a launch pad, equipment building, telescoping tower, and berm to house a diagnostic trailer at the site to support launches directed out over the water. SFO determined, and SHPO concurred, that the properties were not historically significant and that their removal to allow the USN to construct a facility at the site would not cause an adverse effect on a historic property.

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 (EOs)

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

- 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. Within the boundaries of PMRF, no federal air emission permits are held either by DOE for KTF.

The two electrical generators at KTF are permitted for operation by the State of Hawaii under a "Noncovered Source Permit (NSP)" (Hawaii DOH 2009). These generators are subject to the provisions of the following federal regulations:

1. 40 CFR Part 60, Standards of Performance for New Stationary Sources, Subpart A, General Provisions; and
2. 40 CFR Part 60 Standards of Performance for New Stationary Sources, Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines.

Any major requirements of these standards are detailed in special conditions within the permit.

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 2013.

Oil Storage Guidelines

There is one 2,500-gallon (gal) underground storage tank (UST) at KTF, which is owned by the DOE. There is also one 10,000-gal aboveground storage tank (AST) inside the Main Compound. Sandia cooperates with the USN's spill control guidelines contained in the *Spill Prevention Control and Countermeasures Plan*, *Pacific Missile Range Facility* (NAVFAC 2012).

Safe Drinking Water Act (SDWA)

The SDWA does not apply directly to SNL 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 (PCBs) and asbestos. The transformers on the KTF site have been tested and are free of PCBs. A comprehensive asbestos survey was conducted by the SNL/NM Asbestos Management Team in July 2008. A total of 110 pounds (lbs) of Asbestos-Containing Materials were identified at KTF and 91 lbs 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 were no reportable occurrences at KTF in 2013.

5.5 Environmental Program Activities

This section describes two environmental programs:

- NEPA and
- ER Project

NEPA Activities
In 2013, DOE made the decision to retain the land use permit for the Mount Haleakala facility, so that current capabilities could be maintained for support of future test operations.

The SNL/NM NEPA Team completed two DOE NEPA checklists for KTF that were transmitted to the DOE/NNSA/SFO for review and determination in 2013.

ER Project Activities
There are no ER sites at KTF. The three ER sites identified in 1995 were given a Site Evaluation Accomplished 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. However, this does not preclude that other environmental sampling activities will take place at KTF.

5.6 Environmental Surveillance and Monitoring Activities

Wastewater Monitoring
Activities at KTF produce only sanitary sewage, which is directed into three DOE/NNSA-owned septic tanks and stormwater runoff is directed into two French drains and four area drains with pumping systems in accordance with Hawaii Underground Injection Control regulations (HAR Title 11, Chapter 23). The two older septic tanks for the Launch Operations Building and the Missile Assembly Building 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 tank systems are periodically pumped by licensed, state-certified contractors and inspected by state officials. All three systems were inspected and pumped during 2013. 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, KTF personnel have periodically performed sampling. Historically, no contaminants have been identified above the reporting limits from these past sampling events. During 2013, no sampling of septic tank systems was conducted at KTF.

Air Emission Monitoring
Based on effluent air monitoring results of the Strategic Target System (STARS) Flight Test Unit 1 (FTU-1) in February 1993 (SNL/NM 1993) and the CDX rocket launch in the summer of 1992 (SNL/NM 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 2013 Annual Emissions Report for air emissions was submitted to the State of Hawaii in February 2014 (SNL/NM 2014b). The required $500 annual fee was submitted for 2013 as required. Sandia was in compliance with all air quality regulations in 2013.

The Semi-Annual report for the first half of 2013 was submitted to the State of Hawaii in July 2013 (SNL/NM 2014c).

For the period of February 1, 2012 through January 31, 2013, the highest total combined operating hours for a rolling twelve month period was 2,176.5 hours, which occurred in the period including October 2012 through September 2013 (DOE 2014). This shows compliance with the permit operating conditions.

In accordance with the KTF permit conditions, beginning October 1, 2010, each diesel engine generator shall be fired only on Fuel Oil No. 2 with maximum sulfur content not to exceed 0.15 percent by weight and a minimum cetane index of 40. According to testing data provided by the vendor, the cetane index for fuel purchased in 2013 was at least 54.3 and sulfur content was a maximum of 0.0009 percent. These conditions show compliance with permitted operating limits.

Meteorological Monitoring

Due to the infrequency of launches, no formal meteorological monitoring equipment is in place for KTF. On-site meteorological instruments are used during test periods only to characterize ground level and atmospheric wind conditions that will affect the flight of the rocket. 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/NM 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

Terrestrial Surveillance is conducted every five years at KTF. Sampling was last conducted in 2012, which confirmed that KTF operations made no detectable environmental impact. Sampling was not conducted in 2013.

Statistical Analysis

A statistical analysis was performed on the target analyte list (TAL) metals results and documented the baseline concentrations at the KTF site. The complete analysis was presented in the *2012 Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii* (SNL/NM 2013). Summary statistics for the 2012 sampling event are presented in Table 5-5. A comparison between on-site and off-site locations was performed to determine if any analyte showed differences between the two location types (there are no perimeter sampling locations at KTF). The results of this statistical analysis are discussed below.

TABLE 5-5. Summary Statistics for Metals in Soil at KTF for Calendar Year 2012 (all units in mg/kg)

Analyte	Mean	Median	Std Dev	Minimum	Maximum
Aluminum	6,496	6,400	2,811	2,270	13,100
Antimony	0.80	0.42	0.75	0.31	3.27
Arsenic	18.72	10.70	16.98	5.96	62.80
Barium	25.79	12.10	36.17	6.86	151.00
Beryllium	0.12	0.11	0.07	0.05	0.27
Cadmium	0.27	0.24	0.13	0.11	0.51
Calcium	259,529	261,000	52,847	185,000	343,000
Chromium	50.48	47.10	21.51	22.20	93.70
Cobalt	18.58	16.30	10.85	4.04	40.08
Copper	37.73	12.30	97.13	5.40	413.00
Iron	19,875	19,400	9,209	7.670	39,600
Lead	4.78	1.63	7.50	0.49	30.70
Magnesium	34,906	28,500	14,462	23,000	66,400
Manganese	381	390	190	118	878
Nickel	221	174	156	42	556
Potassium	325	216	278	100	1,020
Selenium	0.32	0.32	0.01	0.30	0.33
Silver	1.48	1.49	0.69	0.10	2.82
Sodium	2,170	2,010	674	1,650	4,450
Thallium	0.06	0.06	0.00	0.06	0.06
Uranium	1.26	1.29	0.20	0.95	1.68
Vanadium	26.11	29.90	9.70	9.21	40.00
Zinc	335	63	749	21	3,140

NOTES: KTF = Kauai Test Facility
mg/kg = milligrams per kilogram
Std Dev = Standard Deviation

Sampling Locations

Terrestrial surveillance began at KTF in 1994. Sampling occurred in 1999, 2002, 2007, and 2012. Routine terrestrial surveillance is conducted at on-site and off-site locations that remain essentially the same from sampling period to sampling period. Sample locations may be modified as necessary to reflect current operations or to supplement data from existing locations. The sampling locations, number of samples, and analyses performed are prioritized based on the following criteria:

- On-site locations are near areas of known contamination, potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate. A list of on-site sampling locations is shown in Table 5-6. Appendix D, Figure D-1 shows the 17 on-site locations.

- Off-site locations are selected in remote, natural settings, in areas near local population centers, and along highways. The selection of these locations provides a measurement of environmental conditions unaffected by Sandia activities at KTF. Data collected from off-site locations serve as a reference point to compare data collected at on-site locations. Table 5-7 contains a list of the off-site sample locations. Appendix D, Figure D-2 shows the 11 off-site locations.

TABLE 5-6. On-Site Terrestrial Surveillance Locations at KTF

Location Number	Sample Location	Replicate* Location
Various On-Site Locations		
S-12	Near Wind Radar Road	--
S-13	KTF sign – DOE Trail Road	--
S-14	Building 638	--
S-15	Between Building 638 and 639	--
S-16	Building 639 East	--
S-17	Building 640 East	--
S-18	Building 640 West	--
S-19	Building 685 West	--
S-20	MAB Building Parking Lot	--
S-21	Building 645 and 645A South	Yes
S-22	Missile Service Tower Hill	--
S-23	Pad 1 West Corner	--
Main Compound		
S-24	Main Compound – NE Corner Fence	--
S-25	Main Compound – SE Corner Fence	Yes
S-26	Main Compound – N Fence	--
S-27	Main Compound – NW of Launch Ops Bldg	--
S-28	SE Corner of Diesel Fuel Tank, DOE Trail	--

NOTES: -- = There is not a replicate location for this sample location.
*In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.
DOE = U.S. Department of Energy
KTF = Kauai Test Facility
N = North
NE = Northeast
NW = Northwest
SE = Southeast

TABLE 5-7. Off-Site Terrestrial Surveillance Locations at KTF

Location Number	Sample Location	Replicate* Location
C-01	Rec Area I Beach Access sign – North Nohili Road	--
C-02	No Trespassing sign – West of Location C-01	--
C-03	N. Nohili Road and Hoku Road	--
C-04	Hoku Road W of Building 515	--
C-05	Polihale State Park – Monkey Pod Tree	--
C-06	Polihale State Park – Camping sign	--
C-07	Polihale State Park – "Caution Road narrows" sign	Yes
C-08	N. Nohili Road and Palai Olani Road	--
C-09	Kokole Point Launch Area – Building H10	--
C-10	Kokole Point Launch Area – West	--
C-11	Kokole Point Launch Area – South	--

NOTES: -- = There is not a replicate location for this sample location.
*In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.
KTF = Kauai Test Facility

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Chapter 6
TTR & KTF References

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CODE OF FEDERAL REGULATIONS

10 CFR 830 *Nuclear Safety Management*

10 CFR 1021 *National Environmental Policy Act Implementing Procedures*

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

40 CFR 110 *Discharge of Oil*

40 CFR 112 *Oil Pollution Prevention*

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

40 CFR 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 AND 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.)

Note: U.S.C. = United States Code

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.965 to 445A.9706, "Septic Tanks" NAC 445A.228 to 445A.272, "Discharge Permits"	• Septic tanks • Surface water runoff
NAC 445A.450 to 445A. 6731, "Public Water Systems"	• Water Wells • Operator Certification • Treatment of Water • Distribution of Water • Storage Structures • Water conservation plan
Chapter 445B, *Air Controls*	
NAC 445B.001 to 445B.3477, "Air Pollution"	• Open burning • Class II Operating Permit • 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 biphenyl

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Chapter 7
Glossary

A

Aboveground Storage Tank (AST) – A closed container with all the container volume above grade. An AST system is one or more commonly connected aboveground storage tanks including all connected piping, both aboveground and underground, pumps, dispensing, and product transfer apparatus, overfill protection devices, and associated spill containment and collection apparatus.

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.

D

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 percent 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 (EIS) – 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 that 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 Activity – The total radioactivity due to alpha or beta 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 that 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 the 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, 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 tank systems, animal feed lots, agricultural fertilizers, manure, industrial wastewaters, sanitary landfills, and garbage dumps.

Nitrite – 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 that 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

Semivolatile organic compound (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, agricultural operations, and from community activities.

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

T

Thermoluminescent Dosimeter (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 devices can also be used to measure environmental exposure rates.

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 Tank (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 percent 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 Compound (VOC) – Any organic compound that participates in atmospheric photochemical reactions, except those designated by the 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

2013 TTR SAMPLING LOCATION MAPS

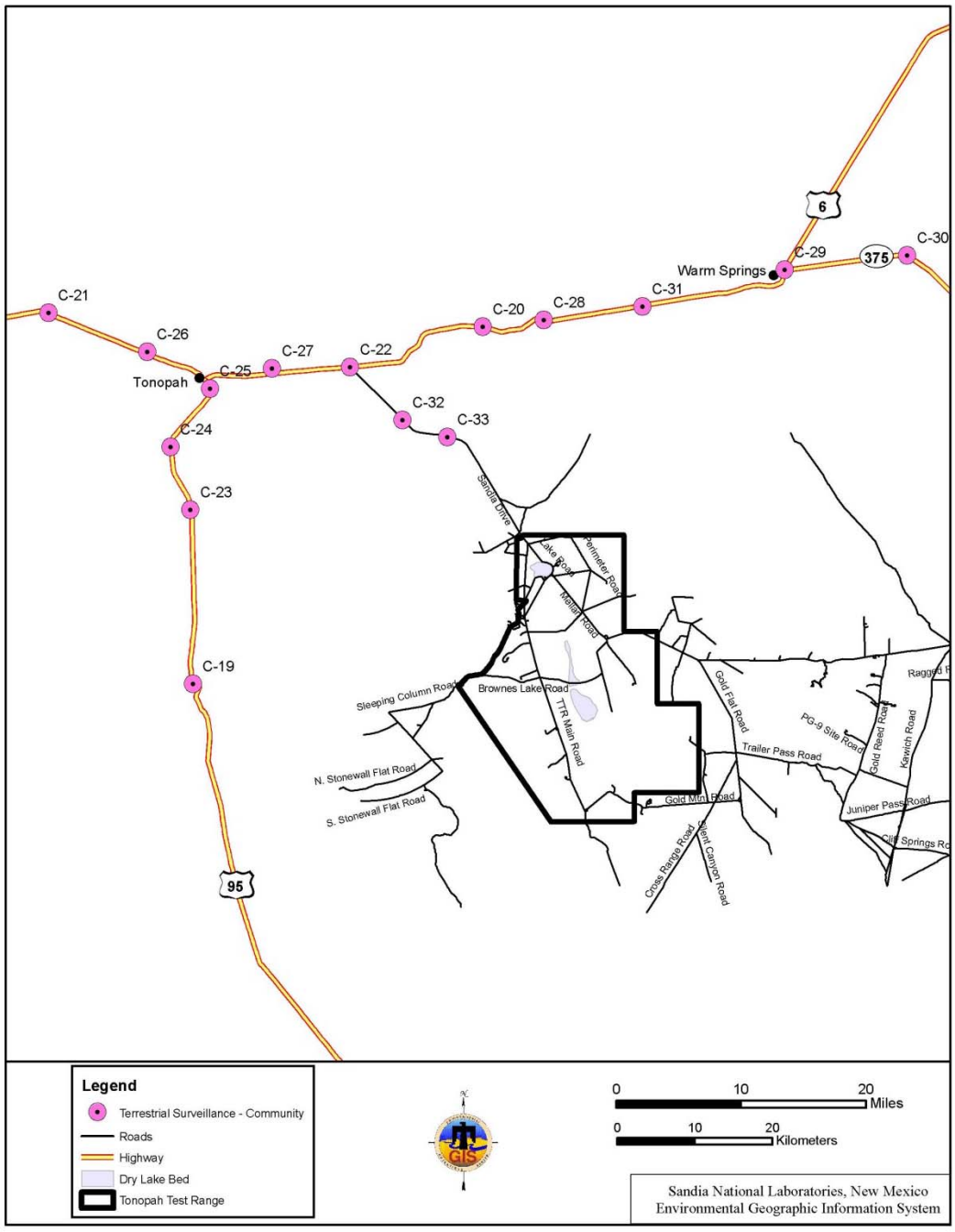

Figure A-1. Off-Site Soil Sampling Locations

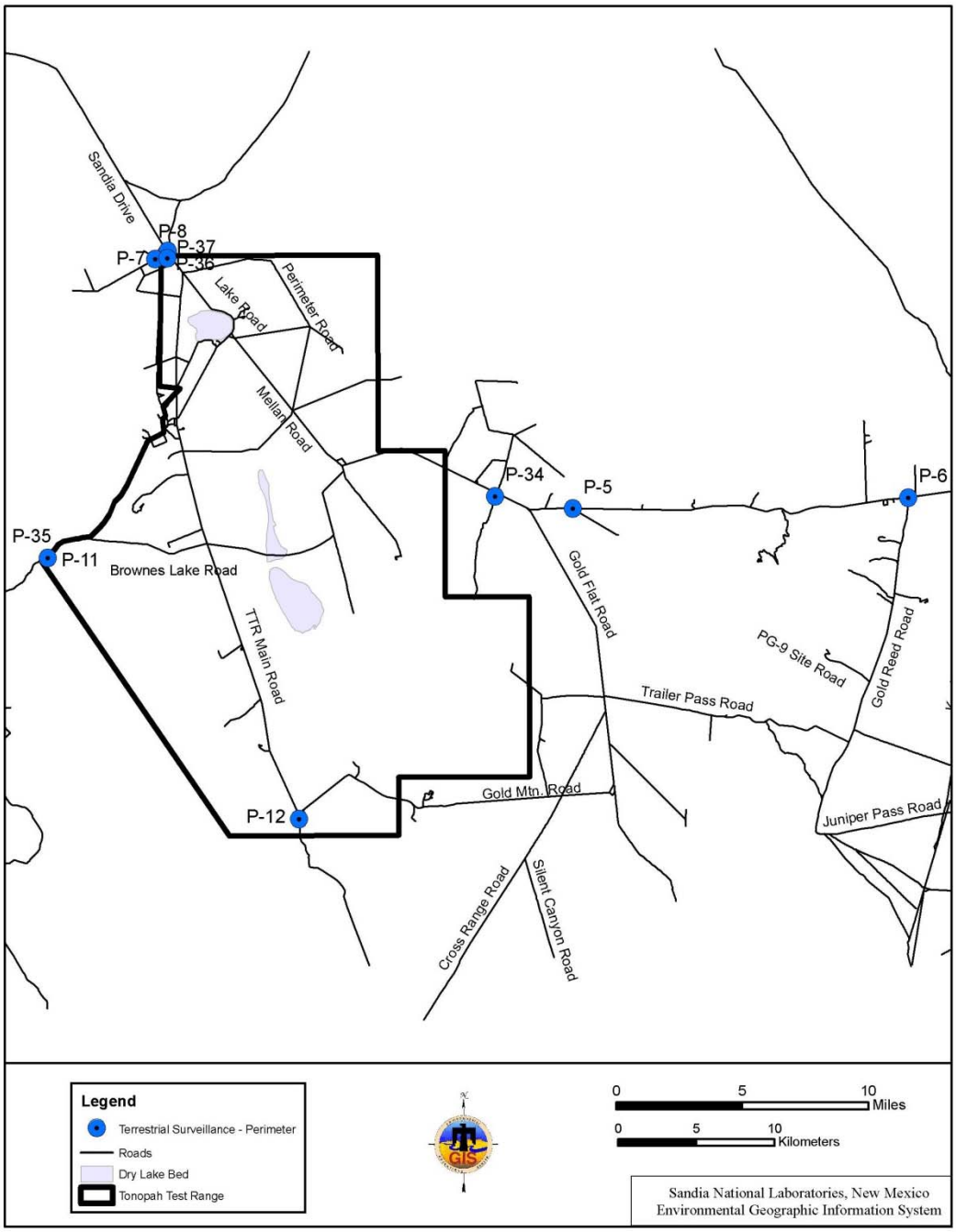

Figure A-2. Perimeter Soil Sampling Locations

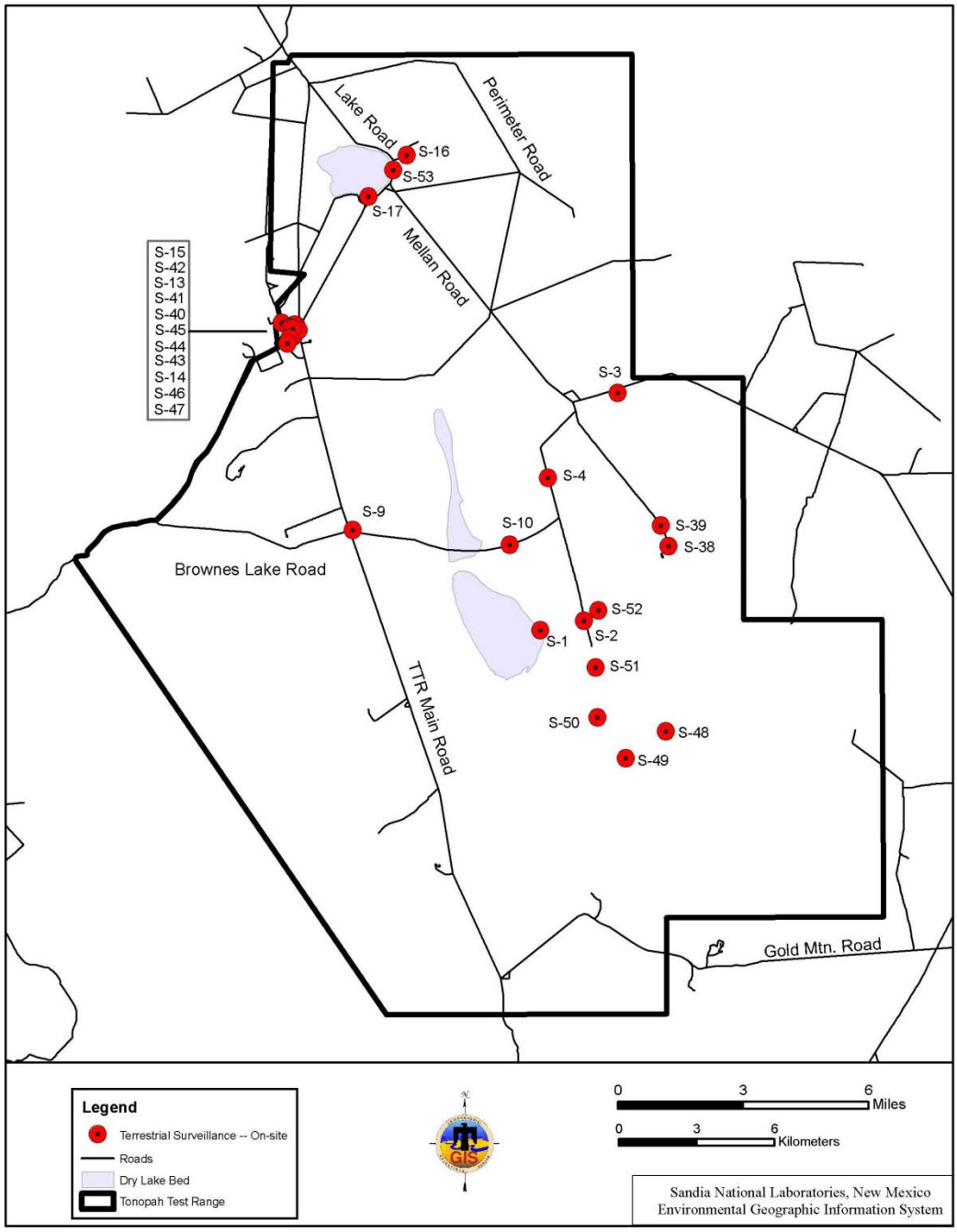

Figure A-3. On-site Soil Sampling Locations

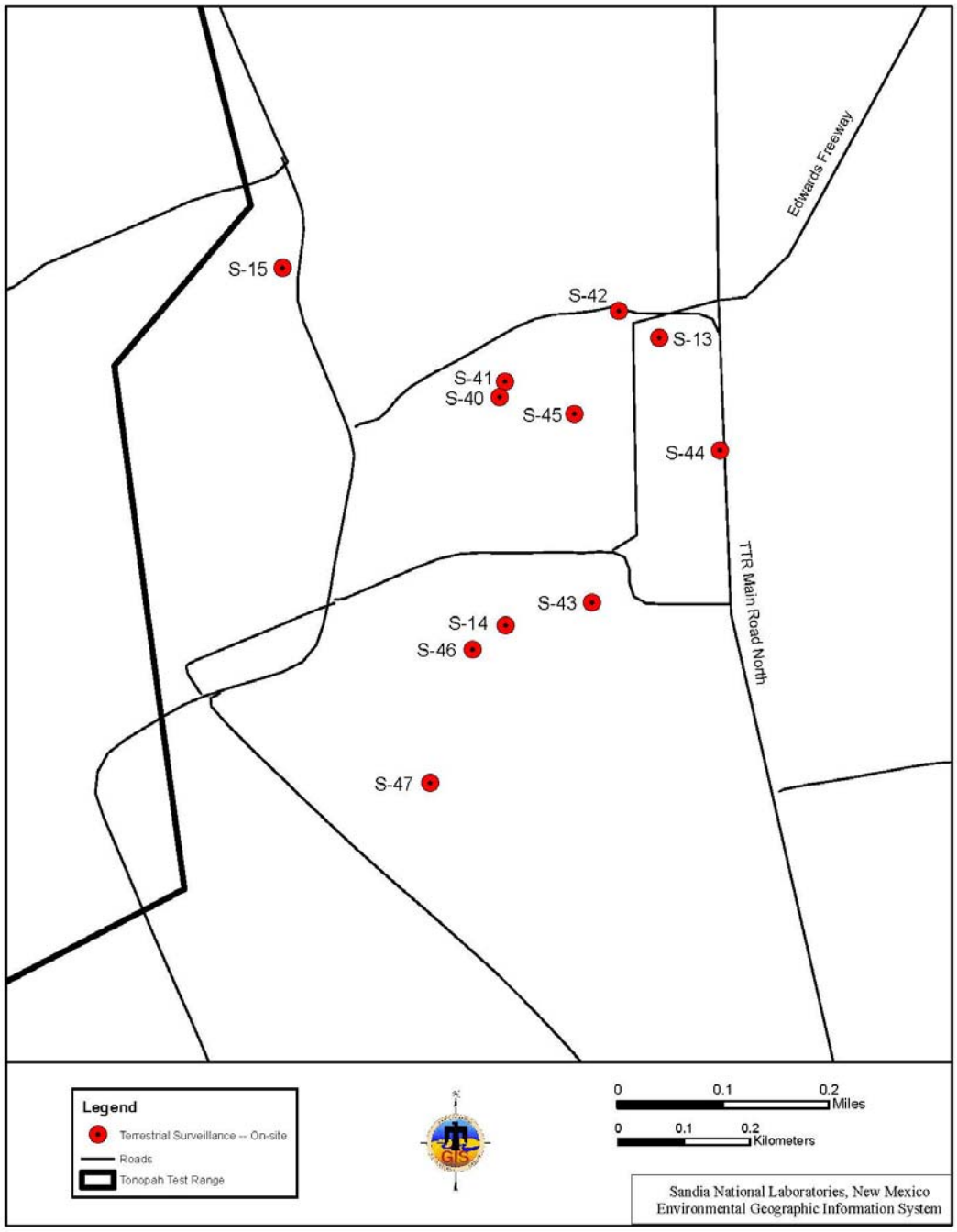

Figure A-4. Sampling Locations in the Range Operations Center and Compound (On-Site)

APPENDIX B

2013 TTR TERRESTRIAL SURVEILLANCE RESULTS

TABLE B-1. Radiological Results for Off-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
C-20	Americium-241	pCi/g	0.0307	0.0705	0.0712	U
C-20	Cesium-137	pCi/g	0.229	0.0297	0.0232	
C-20	Uranium-235	pCi/g	0.018	0.0813	0.14	U
C-20	Uranium-238	pCi/g	0.932	0.775	0.646	
C-21	Americium-241	pCi/g	0.055	0.0589	0.0911	U
C-21	Cesium-137	pCi/g	0.178	0.0289	0.026	
C-21	Uranium-238	pCi/g	1.29	1.03	0.806	
C-22	Americium-241	pCi/g	-0.00854	0.0793	0.135	U
C-22	Cesium-137	pCi/g	0.0763	0.0219	0.0279	
C-22	Uranium-235	pCi/g	0.0481	0.082	0.15	U
C-23	Americium-241	pCi/g	0.0307	0.0595	0.096	U
C-23	Cesium-137	pCi/g	0.0673	0.0227	0.0277	
C-23	Uranium-235	pCi/g	0.172	0.153	0.157	
C-23	Uranium-238	pCi/g	1.75	0.957	0.848	
C-24	Americium-241	pCi/g	0.0138	0.0232	0.0347	U
C-24	Cesium-137	pCi/g	0.0981	0.0235	0.0232	
C-24	Uranium-235	pCi/g	0.139	0.109	0.107	
C-24	Uranium-238	pCi/g	1.7	0.594	0.341	
C-25	Americium-241	pCi/g	0.0572	0.0899	0.15	U
C-25	Cesium-137	pCi/g	-0.00169	0.0176	0.0271	U
C-25	Uranium-235	pCi/g	0.066	0.139	0.151	U
C-25	Uranium-238	pCi/g	0.927	1.34	1.21	U
C-26	Americium-241	pCi/g	0.0913	0.0764	0.113	U
C-26	Cesium-137	pCi/g	0.407	0.0423	0.0252	
C-26	Uranium-235	pCi/g	0.112	0.139	0.141	U
C-26	Uranium-238	pCi/g	1.25	1.08	0.93	
C-27	Americium-241	pCi/g	0.0548	0.0739	0.119	U
C-27	Cesium-137	pCi/g	0.51	0.0553	0.028	
C-27	Uranium-235	pCi/g	0.161	0.121	0.152	
C-27	Uranium-238	pCi/g	1.93	1.39	0.994	
C-28	Americium-241	pCi/g	0.0183	0.026	0.0418	U
C-28	Cesium-137	pCi/g	0.0393	0.0324	0.0307	
C-28	Uranium-235	pCi/g	0.0332	0.116	0.146	U
C-28	Uranium-238	pCi/g	1.55	0.582	0.42	
C-29	Americium-241	pCi/g	0.0367	0.0688	0.115	U
C-29	Cesium-137	pCi/g	0.0796	0.0233	0.0244	
C-29	Uranium-235	pCi/g	0.188	0.127	0.154	
C-29	Uranium-238	pCi/g	1.37	1.12	0.998	
C-30	Americium-241	pCi/g	0.00395	0.0539	0.0929	U
C-30	Cesium-137	pCi/g	0.13	0.0337	0.0315	
C-30	Uranium-235	pCi/g	0.0426	0.166	0.173	U
C-30	Uranium-238	pCi/g	1.15	0.893	0.879	
C-31	Americium-241	pCi/g	0.0825	0.0621	0.0857	U
C-31	Cesium-137	pCi/g	0.129	0.0319	0.0287	
C-31	Uranium-235	pCi/g	0.00546	0.132	0.152	U

TABLE B-1. Radiological Results for Off-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
C-31	Uranium-238	pCi/g	1.02	0.798	0.77	
C-32	Americium-241	pCi/g	0.00696	0.0166	0.0288	U
C-32	Cesium-137	pCi/g	0.0625	0.0265	0.0278	
C-32	Uranium-235	pCi/g	0.0446	0.0529	0.0965	U
C-32	Uranium-238	pCi/g	1.14	0.398	0.28	
C-33	Americium-241	pCi/g	0.0155	0.0815	0.135	U
C-33	Cesium-137	pCi/g	0.11	0.0206	0.0231	
C-33	Uranium-235	pCi/g	0.0576	0.119	0.132	U
C-33	Uranium-238	pCi/g	0.742	1.02	1.13	U

NOTES:

MDA = minimum detectable activity
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, 2013

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
P-06	Americium-241	pCi/g	0.0423	0.055	0.0893	U
P-06	Cesium-137	pCi/g	0.026	0.0173	0.0216	
P-06	Uranium-235	pCi/g	0.0682	0.111	0.122	U
P-06	Uranium-238	pCi/g	2.08	0.922	0.768	
P-08	Americium-241	pCi/g	0.0587	0.102	0.181	U
P-08	Cesium-137	pCi/g	0.118	0.0287	0.0267	
P-08	Uranium-235	pCi/g	0.0149	0.0857	0.149	U
P-11	Americium-241	pCi/g	0.0538	0.0517	0.0759	U
P-11	Cesium-137	pCi/g	0.505	0.0501	0.0247	
P-11	Uranium-235	pCi/g	0.0437	0.132	0.13	U
P-11	Uranium-238	pCi/g	1.48	0.829	0.674	
P-12	Americium-241	pCi/g	0.0321	0.0559	0.0909	U
P-12	Cesium-137	pCi/g	0.171	0.0229	0.0199	
P-12	Uranium-235	pCi/g	0.0219	0.107	0.119	U
P-12	Uranium-238	pCi/g	1.79	0.948	0.769	
P-34	Americium-241	pCi/g	0.0627	0.0846	0.144	U
P-34	Cesium-137	pCi/g	0.206	0.0279	0.0243	
P-34	Uranium-235	pCi/g	0.0621	0.144	0.133	U
P-34	Uranium-238	pCi/g	1.64	1.21	1.16	
P-35	Americium-241	pCi/g	0.0207	0.0625	0.0972	U
P-35	Cesium-137	pCi/g	0.0463	0.0235	0.0273	
P-35	Uranium-235	pCi/g	0.0594	0.121	0.136	U
P-35	Uranium-238	pCi/g	1.36	0.887	0.839	
P-36	Americium-241	pCi/g	0.0222	0.0489	0.0795	U
P-36	Cesium-137	pCi/g	0.128	0.0256	0.0217	
P-36	Uranium-235	pCi/g	0.048	0.121	0.129	U
P-36	Uranium-238	pCi/g	1.59	0.884	0.704	
P-37	Americium-241	pCi/g	0.062	0.0638	0.0971	U
P-37	Cesium-137	pCi/g	0.0298	0.0207	0.0258	
P-37	Uranium-235	pCi/g	0.0771	0.137	0.153	U

NOTES:

MDA = minimum detectable activity

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, 2013

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
S-48	Americium-241	pCi/g	0.0359	0.0235	0.0281	
S-48	Cesium-137	pCi/g	0.348	0.0408	0.0244	
S-48	Plutonium-238	pCi/g	0.0164	0.00979	0.0124	
S-48	Plutonium-238	pCi/g	0.0177	0.0119	0.0124	
S-48	Plutonium-239/240	pCi/g	0.131	0.0327	0.0236	
S-48	Plutonium-239/240	pCi/g	0.044	0.0207	0.0235	
S-48	Uranium-235	pCi/g	0.112	0.0768	0.098	
S-48	Uranium-238	pCi/g	1.54	0.451	0.283	
S-49	Americium-241	pCi/g	0.995	0.106	0.0308	
S-49	Cesium-137	pCi/g	0.491	0.047	0.0195	
S-49	Plutonium-238	pCi/g	0.115	0.16	0.282	U
S-49	Plutonium-239/240	pCi/g	0.601	0.294	0.535	
S-49	Uranium-235	pCi/g	0.0406	0.0904	0.103	U
S-49	Uranium-238	pCi/g	1.47	0.476	0.312	
S-50	Americium-241	pCi/g	0.0524	0.0326	0.0321	
S-50	Cesium-137	pCi/g	0.356	0.0403	0.025	
S-50	Plutonium-238	pCi/g	0.0217	0.0134	0.0142	
S-50	Plutonium-239/240	pCi/g	0.0463	0.0186	0.027	
S-50	Uranium-235	pCi/g	0.0589	0.0966	0.105	U
S-50	Uranium-238	pCi/g	0.992	0.462	0.332	
S-51	Americium-241	pCi/g	5.72	0.506	0.116	
S-51	Cesium-137	pCi/g	0.243	0.0346	0.0231	
S-51	Plutonium-238	pCi/g	1.69	1.01	1.27	
S-51	Plutonium-239/240	pCi/g	22.3	4.42	2.42	
S-51	Uranium-235	pCi/g	0.119	0.108	0.134	U
S-51	Uranium-238	pCi/g	1.27	0.893	0.866	
S-52	Americium-241	pCi/g	0.131	0.0771	0.0709	
S-52	Cesium-137	pCi/g	0.189	0.0263	0.0219	
S-52	Plutonium-238	pCi/g	0.0169	0.0111	0.0151	
S-52	Plutonium-239/240	pCi/g	0.345	0.0668	0.0286	
S-52	Uranium-235	pCi/g	0.0172	0.104	0.121	U
S-52	Uranium-238	pCi/g	1.23	0.72	0.635	

NOTES:

MDA = minimum detectable activity
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, 2013

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
S-40	Americium-241	pCi/g	0.1	0.0773	0.104	U
S-40	Cesium-137	pCi/g	0.0677	0.0304	0.0335	
S-40	Uranium-235	pCi/g	0.00722	0.108	0.191	U
S-40	Uranium-238	pCi/g	1.71	1.06	0.916	
S-41	Americium-241	pCi/g	0.0801	0.0842	0.131	U
S-41	Cesium-137	pCi/g	0.0506	0.0277	0.0303	
S-41	Uranium-235	pCi/g	0.212	0.154	0.174	
S-41	Uranium-238	pCi/g	1.52	1.16	1.1	
S-42	Americium-241	pCi/g	0.0576	0.103	0.177	U
S-42	Cesium-137	pCi/g	0.164	0.0309	0.0309	
S-42	Uranium-235	pCi/g	0.0407	0.105	0.184	U
S-42	Uranium-238	pCi/g	2.04	1.76	1.37	
S-43	Americium-241	pCi/g	0.0302	0.0856	0.142	U
S-43	Cesium-137	pCi/g	0.0449	0.0284	0.0316	
S-43	Uranium-235	pCi/g	0.00394	0.154	0.189	U
S-43	Uranium-238	pCi/g	2.46	1.47	1.2	
S-44	Americium-241	pCi/g	0.000777	0.084	0.143	U
S-44	Cesium-137	pCi/g	0.119	0.0293	0.0248	
S-44	Uranium-235	pCi/g	0.0957	0.14	0.15	U
S-44	Uranium-238	pCi/g	1.37	1.32	1.14	
S-45	Americium-241	pCi/g	0.0793	0.0963	0.153	U
S-45	Cesium-137	pCi/g	0.00614	0.0267	0.0289	U
S-45	Uranium-235	pCi/g	0.144	0.137	0.157	U
S-45	Uranium-238	pCi/g	3.06	1.74	1.22	
S-46	Americium-241	pCi/g	0.0544	0.0826	0.13	U
S-46	Cesium-137	pCi/g	0.0657	0.024	0.0318	
S-46	Uranium-235	pCi/g	0.161	0.176	0.181	U
S-47	Americium-241	pCi/g	0.0519	0.0666	0.105	U
S-47	Cesium-137	pCi/g	0.101	0.0246	0.0279	
S-47	Uranium-235	pCi/g	0.0431	0.122	0.149	U
S-47	Uranium-238	pCi/g	1.6	1.01	0.894	

NOTES:

MDA = minimum detectable activity
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, 2013

Location	Analyte	Units	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
S-02	Americium-241	pCi/g	0.0668	0.0584	0.0745	U
S-02	Cesium-137	pCi/g	0.446	0.0429	0.0217	
S-02	Uranium-235	pCi/g	0.16	0.133	0.122	
S-02	Uranium-238	pCi/g	1.57	0.826	0.695	
S-03	Americium-241	pCi/g	0.0841	0.0972	0.0996	U
S-03	Cesium-137	pCi/g	0.208	0.0366	0.0319	
S-03	Plutonium-238	pCi/g	0.03	0.0191	0.0227	
S-03	Plutonium-239/240	pCi/g	0.832	0.14	0.0431	
S-03	Uranium-235	pCi/g	0.0404	0.156	0.175	U
S-03	Uranium-238	pCi/g	1.59	0.985	0.884	
S-04	Americium-241	pCi/g	0.0629	0.0806	0.125	U
S-04	Cesium-137	pCi/g	0.344	0.0408	0.0312	
S-04	Uranium-235	pCi/g	0.0312	0.0974	0.176	U
S-04	Uranium-238	pCi/g	1.53	1.21	1.05	
S-09	Americium-241	pCi/g	1.47	0.179	0.112	
S-09	Cesium-137	pCi/g	0.162	0.03	0.0292	
S-09	Plutonium-238	pCi/g	0.282	0.274	0.252	
S-09	Plutonium-238	pCi/g	0.0431	0.0363	0.0423	
S-09	Plutonium-238	pCi/g	0.403	0.23	0.22	
S-09	Plutonium-239/240	pCi/g	5.41	1.05	0.479	
S-09	Plutonium-239/240	pCi/g	3.03	0.441	0.0804	
S-09	Plutonium-239/240	pCi/g	56.1	7.52	0.418	
S-09	Uranium-235	pCi/g	0.0672	0.138	0.147	U
S-09	Uranium-238	pCi/g	1.68	0.983	0.897	
S-10	Americium-241	pCi/g	0.0318	0.0815	0.134	U
S-10	Cesium-137	pCi/g	0.0885	0.0252	0.0296	
S-10	Uranium-235	pCi/g	0.0211	0.143	0.174	U
S-10	Uranium-238	pCi/g	1.07	1.09	1.13	U
S-38	Americium-241	pCi/g	0.0714	0.0437	0.0714	U
S-38	Cesium-137	pCi/g	0.159	0.0309	0.0315	
S-38	Uranium-235	pCi/g	0.0246	0.157	0.151	U
S-38	Uranium-238	pCi/g	0.991	0.639	0.453	
S-39	Americium-241	pCi/g	0.0542	0.0748	0.0938	U
S-39	Cesium-137	pCi/g	0.215	0.0277	0.0215	
S-39	Uranium-235	pCi/g	0.0787	0.116	0.12	U
S-39	Uranium-238	pCi/g	1.21	0.914	0.798	
S-53	Americium-241	pCi/g	0.0407	0.0654	0.11	U
S-53	Cesium-137	pCi/g	0.136	0.0237	0.0267	
S-53	Uranium-235	pCi/g	0.159	0.139	0.139	
S-53	Uranium-238	pCi/g	1.93	1.2	0.925	

NOTES:

MDA = minimum detectable activity
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, 2013

Location	Analyte	Units	Sample Identification	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
C-29	Americium-241	pCi/g	093467-001	0.0367	0.0688	0.115	U
C-29	Americium-241	pCi/g	093468-001	0.0316	0.0644	0.103	U
C-29	Americium-241	pCi/g	093469-001	0.0366	0.0331	0.0491	U
			Average	**0.03**			
			Std Dev	**0.00**			
			CV (%)	**8.34**			
			Minimum	**0.03**			
			Maximum	**0.04**			
C-29	Cesium-137	pCi/g	093467-001	0.080	0.0233	0.0244	
C-29	Cesium-137	pCi/g	093468-001	0.06	0.0212	0.0244	
C-29	Cesium-137	pCi/g	093469-001	0.0736	0.0242	0.0276	
			Average	**0.07**			
			Std Dev	**0.01**			
			CV (%)	**17.32**			
			Minimum	**0.06**			
			Maximum	**0.08**			
C-29	Uranium-235	pCi/g	093467-001	0.188	0.127	0.154	
C-29	Uranium-235	pCi/g	093468-001	0.145	0.132	0.145	U
C-29	Uranium-235	pCi/g	093469-001	0.00039	0.102	0.142	U
			Average	**0.11**			
			Std Dev	**0.10**			
			CV (%)	**88.44**			
			Minimum	**0.00**			
			Maximum	**0.19**			
C-29	Uranium-238	pCi/g	093467-001	1.37	1.12	0.998	
C-29	Uranium-238	pCi/g	093468-001	1.84	1.08	0.886	
C-29	Uranium-238	pCi/g	093469-001	1.520	0.689	0.469	
			Average	**1.58**			
			Std Dev	**0.24**			
			CV (%)	**15.23**			
			Minimum	**1.37**			

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Sample Identification	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
			Maximum	**1.84**			
P-11	Americium-241	pCi/g	093499-001	0.0538	0.0517	0.0759	U
P-11	Americium-241	pCi/g	093500-001	0.0782	0.113	0.177	U
P-11	Americium-241	pCi/g	093501-001	0.0659	0.083	0.135	U
			Average	**0.07**			
			Std Dev	**0.01**			
			CV (%)	**18.49**			
			Minimum	**0.05**			
			Maximum	**0.08**			
P-11	Cesium-137	pCi/g	093499-001	0.505	0.0501	0.0247	
P-11	Cesium-137	pCi/g	093500-001	0.79	0.0791	0.0248	
P-11	Cesium-137	pCi/g	093501-001	0.562	0.0561	0.0239	
			Average	**0.62**			
			Std Dev	**0.15**			
			CV (%)	**24.52**			
			Minimum	**0.51**			
			Maximum	**0.79**			
P-11	Uranium-235	pCi/g	093499-001	0.044	0.132	0.13	U
P-11	Uranium-235	pCi/g	093500-001	0.23	0.123	0.152	
P-11	Uranium-235	pCi/g	093501-001	0.115	0.153	0.138	U
			Average	**0.13**			
			Std Dev	**0.09**			
			CV (%)	**72.55**			
			Minimum	**0.04**			
			Maximum	**0.23**			
P-11	Uranium-238	pCi/g	093499-001	1.48	0.829	0.674	
P-11	Uranium-238	pCi/g	093501-001	1.880	1.29	1.06	
			Average	**1.68**			
			Std Dev	**0.28**			
			CV (%)	**16.84**			
			Minimum	**1.48**			

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Sample Identification	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
			Maximum	**1.88**			
S-03	Americium-241	pCi/g	093482-001	0.0841	0.0972	0.0996	U
S-03	Americium-241	pCi/g	093483-001	0.564	0.22	0.152	
S-03	Americium-241	pCi/g	093484-001	0.0646	0.0476	0.0659	U
			Average	**0.24**			
			Std Dev	**0.28**			
			CV (%)	**119.07**			
			Minimum	**0.06**			
			Maximum	**0.56**			
S-03	Cesium-137	pCi/g	093482-001	0.208	0.0366	0.0319	
S-03	Cesium-137	pCi/g	093483-001	0.25	0.0304	0.0245	
S-03	Cesium-137	pCi/g	093484-001	0.19	0.0244	0.0201	
			Average	**0.21**			
			Std Dev	**0.03**			
			CV (%)	**13.77**			
			Minimum	**0.19**			
			Maximum	**0.25**			
S-03	Plutonium-238	pCi/g	093483-R01	0.03	0.0191	0.0227	
			Average	**0.03**			
			Std Dev	**n/a**			
			CV (%)	**na**			
			Minimum	**0.03**			
			Maximum	**0.03**			
S-03	Plutonium-239/240	pCi/g	093483-R01	0.832	0.14	0.0431	
			Average	**0.83**			
			Std Dev	**n/a**			
			CV (%)	**na**			
			Minimum	**0.83**			
			Maximum	**0.83**			
S-03	Uranium-235	pCi/g	093482-001	0.0404	0.156	0.175	U
S-03	Uranium-235	pCi/g	093483-001	0.07	0.129	0.143	U

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Sample Identification	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
S-03	Uranium-235	pCi/g	093484-001	-0.0134	0.0752	0.113	U
			Average	**0.03**			
			Std Dev	**0.04**			
			CV (%)	**130.88**			
			Minimum	**-0.01**			
			Maximum	**0.07**			
S-03	Uranium-238	pCi/g	093482-001	1.590	0.985	0.884	
S-03	Uranium-238	pCi/g	093483-001	1.89	1.35	1.26	
S-03	Uranium-238	pCi/g	093484-001	0.451	0.839	0.562	U
			Average	**1.31**			
			Std Dev	**0.76**			
			CV (%)	**57.94**			
			Minimum	**0.45**			
			Maximum	**1.89**			
S-09	Americium-241	pCi/g	093477-001	1.47	0.179	0.112	
S-09	Americium-241	pCi/g	093478-001	0.719	0.158	0.133	
S-09	Americium-241	pCi/g	093479-001	1.86	0.173	0.1	
			Average	**1.35**			
			Std Dev	**0.58**			
			CV (%)	**42.97**			
			Minimum	**0.72**			
			Maximum	**1.86**			
S-09	Cesium-137	pCi/g	093477-001	0.162	0.03	0.0292	
S-09	Cesium-137	pCi/g	093478-001	0.154	0.0287	0.0303	
S-09	Cesium-137	pCi/g	093479-001	0.136	0.0301	0.0289	
			Average	**0.15**			
			Std Dev	**0.01**			
			CV (%)	**8.84**			
			Minimum	**0.14**			
			Maximum	**0.16**			
S-09	Plutonium-238	pCi/g	093477-R01	0.282	0.274	0.252	

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Sample Identification	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
S-09	Plutonium-238	pCi/g	093478-R01	0.043	0.0363	0.0423	
S-09	Plutonium-238	pCi/g	093479-R01	0.403	0.23	0.22	
			Average	**0.24**			
			Std Dev	**0.18**			
			CV (%)	**75.46**			
			Minimum	**0.04**			
			Maximum	**0.40**			
S-09	Plutonium-239/240	pCi/g	093477-R01	5.41	1.05	0.479	
S-09	Plutonium-239/240	pCi/g	093478-R01	3.03	0.441	0.0804	
S-09	Plutonium-239/240	pCi/g	093479-R01	56.100	7.52	0.418	
			Average	**21.51**			
			Std Dev	**29.98**			
			CV (%)	**139.34**			
			Minimum	**3.03**			
			Maximum	**56.10**			
S-09	Uranium-235	pCi/g	093477-001	0.0672	0.138	0.147	U
S-09	Uranium-235	pCi/g	093478-001	0.14	0.122	0.172	U
S-09	Uranium-235	pCi/g	093479-001	0.08	0.102	0.182	U
			Average	**0.10**			
			Std Dev	**0.04**			
			CV (%)	**39.40**			
			Minimum	**0.07**			
			Maximum	**0.14**			
S-09	Uranium-238	pCi/g	093477-001	1.680	0.983	0.897	
S-09	Uranium-238	pCi/g	093478-001	1.23	1.1	1.09	
S-09	Uranium-238	pCi/g	093479-001	1.49	0.832	0.879	
			Average	**1.47**			
			Std Dev	**0.23**			
			CV (%)	**15.40**			
			Minimum	**1.23**			
			Maximum	**1.68**			

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Sample Identification	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
S-48	Americium-241	pCi/g	093490-001	0.0359	0.0235	0.0281	
S-48	Americium-241	pCi/g	093491-001	0.028	0.0605	0.101	U
S-48	Americium-241	pCi/g	093492-001	0.06	0.0603	0.0614	
			Average	**0.04**			
			Std Dev	**0.02**			
			CV (%)	**44.18**			
			Minimum	**0.03**			
			Maximum	**0.06**			
S-48	Cesium-137	pCi/g	093490-001	0.348	0.0408	0.0244	
S-48	Cesium-137	pCi/g	093491-001	0.318	0.0334	0.0201	
S-48	Cesium-137	pCi/g	093492-001	0.241	0.0292	0.0205	
			Average	**0.30**			
			Std Dev	**0.06**			
			CV (%)	**18.26**			
			Minimum	**0.24**			
			Maximum	**0.35**			
S-48	Plutonium-238	pCi/g	093490-R01	0.0164	0.00979	0.0124	
S-48	Plutonium-238	pCi/g	093492-R01	0.02	0.0119	0.0124	
			Average	**0.02**			
			Std Dev	**0.00**			
			CV (%)	**5.39**			
			Minimum	**0.02**			
			Maximum	**0.02**			
S-48	Plutonium-239/240	pCi/g	093490-R01	0.044	0.0207	0.0235	
S-48	Plutonium-239/240	pCi/g	093492-R01	0.131	0.0327	0.0236	
			Average	**0.09**			
			Std Dev	**0.06**			
			CV (%)	**70.31**			
			Minimum	**0.04**			
			Maximum	**0.13**			
S-48	Uranium-235	pCi/g	093490-001	0.112	0.0768	0.098	

Table B-6. Radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Sample Identification	Activity and/or Concentration	Two Sigma Error	MDA	Laboratory Data Qualifiers
S-48	Uranium-235	pCi/g	093491-001	0.0422	0.102	0.105	U
S-48	Uranium-235	pCi/g	093492-001	0.01	0.101	0.114	U
			Average	**0.05**			
			Std Dev	**0.05**			
			CV (%)	**95.81**			
			Minimum	**0.01**			
			Maximum	**0.11**			
S-48	Uranium-238	pCi/g	093490-001	1.540	0.451	0.283	
S-48	Uranium-238	pCi/g	093492-001	1.6	0.68	0.535	
			Average	**1.57**			
			Std Dev	**0.04**			
			CV (%)	**2.70**			
			Minimum	**1.54**			
			Maximum	**1.60**			

NOTES:

CV = Coefficient of variation, only meaningful if data contains non-zero values.
MDA = minimum detectable activity
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 by Quarter and Location Class for Calendar Year 2013

Location Class	Location Number	1st Quarter (91 Days)		2nd Quarter (84 Days)		3rd Quarter (90 Days)		4th Quarter (98 Days)	
		Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error
On-Site	S-01	44.8	5.4	38.1	0.9	33.9	0.8	56.6	0.7
On-Site	S-02	42.2	5.3	38.1	0.8	35.3	0.9	56.0	1.0
On-Site	S-03	42.8	5.4	38.5	0.8	36.0	1.6	55.0	0.6
On-Site	S-04	42.7	5.6	0.0	0.7	35.3	0.9	55.9	0.8
On-Site	S-09	39.4	5.3	37.6	0.9	32.8	0.9	50.0	0.7
On-Site	S-10	45.0	6.6	37.0	0.8	34.5	1.2	54.6	1.8
On-Site	S-13	41.0	5.3	33.6	1.0	33.4	1.0	51.4	0.7
On-Site	S-14	39.9	5.5	35.6	0.8	38.9	6.2	48.5	0.6
On-Site	S-15	41.5	5.4	36.8	1.3	34.3	0.9	52.7	0.6
On-Site	S-16	40.5	5.5	35.6	1.2	34.1	1.2	51.4	1.1
On-Site	S-17	39.9	5.3	0.0	0.7	33.7	0.9	52.1	1.2
Perimeter	P-05	41.1	5.3	41.4	1.5	33.9	1.5	54.7	0.7
Perimeter	P-06	39.2	5.3	43.2	0.8			50.9	0.8
Perimeter	P-07	38.9	5.3	35.1	0.7	31.7	0.9	49.9	0.8
Perimeter	P-08	37.9	5.3	33.1	0.9	31.9	2.1	50.1	1.0
Perimeter	P-11	49.2	5.4	42.8	1.5	42.5	1.3	58.0	0.7
Perimeter	P-12	42.7	5.7	38.2	0.8	35.2	2.0	53.1	1.0
Community	C-19	31.7	5.3	28.2	0.9	27.8	2.9	44.6	0.7
Community	C-21	40.9	5.3	37.5	1.2	34.4	0.8	53.6	0.6
Community	C-22	39.5	5.3	34.3	0.8	33.0	1.6	50.4	0.6

NOTES:

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

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-48	Aluminum	mg/kg	10800		15	50
S-48	Antimony	mg/kg	0.301	*U	0.301	0.912
S-48	Arsenic	mg/kg	2.01		0.2	1
S-48	Barium	mg/kg	198		0.1	0.4
S-48	Beryllium	mg/kg	0.664		0.02	0.1
S-48	Cadmium	mg/kg	0.23		0.02	0.2
S-48	Calcium	mg/kg	9590		6.6	20
S-48	Chromium	mg/kg	5.3		0.2	0.6
S-48	Cobalt	mg/kg	3.98		0.06	0.2
S-48	Copper	mg/kg	7.12		0.066	0.2
S-48	Iron	mg/kg	7830		6.6	20
S-48	Lead	mg/kg	8.89	N	0.1	0.4
S-48	Magnesium	mg/kg	4940		2	6
S-48	Manganese	mg/kg	410		1	5
S-48	Nickel	mg/kg	7.93		0.1	0.4
S-48	Potassium	mg/kg	4720		16	60
S-48	Selenium	mg/kg	0.33	U	0.33	1
S-48	Silver	mg/kg	0.0912	U	0.0912	0.456
S-48	Sodium	mg/kg	396		16	50
S-48	Thallium	mg/kg	0.131	J	0.06	0.4
S-48	Uranium	mg/kg	0.493		0.0132	0.04
S-48	Vanadium	mg/kg	32.8	*	0.0912	0.456
S-48	Zinc	mg/kg	33.1		0.4	2
S-49	Aluminum	mg/kg	12900		14.9	49.7
S-49	Antimony	mg/kg	0.32	*U	0.32	0.969
S-49	Arsenic	mg/kg	3.12		0.199	0.994
S-49	Barium	mg/kg	193		0.0994	0.398
S-49	Beryllium	mg/kg	0.661		0.0199	0.0994
S-49	Cadmium	mg/kg	0.357		0.0199	0.199
S-49	Calcium	mg/kg	7040		6.56	19.9
S-49	Chromium	mg/kg	6.78		0.199	0.596
S-49	Cobalt	mg/kg	4.17		0.0596	0.199
S-49	Copper	mg/kg	8.25		0.0656	0.199
S-49	Iron	mg/kg	9350		6.56	19.9

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-49	Lead	mg/kg	12.5	N	0.0994	0.398
S-49	Magnesium	mg/kg	5430		1.99	5.96
S-49	Manganese	mg/kg	495		0.994	4.97
S-49	Nickel	mg/kg	7.02		0.0994	0.398
S-49	Potassium	mg/kg	6610		15.9	59.6
S-49	Selenium	mg/kg	0.328	U	0.328	0.994
S-49	Silver	mg/kg	0.0969	U	0.0969	0.484
S-49	Sodium	mg/kg	497		15.9	49.7
S-49	Thallium	mg/kg	0.15	J	0.0596	0.398
S-49	Uranium	mg/kg	0.656		0.0131	0.0398
S-49	Vanadium	mg/kg	23	*	0.0969	0.484
S-49	Zinc	mg/kg	40.5		0.398	1.99
S-50	Aluminum	mg/kg	10100		14.8	49.3
S-50	Antimony	mg/kg	0.33	*U	0.33	1
S-50	Arsenic	mg/kg	2.49		0.197	0.986
S-50	Barium	mg/kg	167		0.0986	0.394
S-50	Beryllium	mg/kg	0.519		0.0197	0.0986
S-50	Cadmium	mg/kg	0.275		0.0197	0.197
S-50	Calcium	mg/kg	4470		6.51	19.7
S-50	Chromium	mg/kg	5.81		0.197	0.592
S-50	Cobalt	mg/kg	3.34		0.0592	0.197
S-50	Copper	mg/kg	6.47		0.0651	0.197
S-50	Iron	mg/kg	8120		6.51	19.7
S-50	Lead	mg/kg	9.72	N	0.0986	0.394
S-50	Magnesium	mg/kg	3800		1.97	5.92
S-50	Manganese	mg/kg	340		0.986	4.93
S-50	Nickel	mg/kg	5.44		0.0986	0.394
S-50	Potassium	mg/kg	5510		15.8	59.2
S-50	Selenium	mg/kg	0.325	U	0.325	0.986
S-50	Silver	mg/kg	0.1	U	0.1	0.5
S-50	Sodium	mg/kg	515		15.8	49.3
S-50	Thallium	mg/kg	0.146	J	0.0592	0.394
S-50	Uranium	mg/kg	0.6		0.013	0.0394
S-50	Vanadium	mg/kg	30	*	0.1	0.5

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-50	Zinc	mg/kg	32.2		0.394	1.97
S-51	Aluminum	mg/kg	8950		2.87	9.58
S-51	Antimony	mg/kg	0.332	*J	0.327	0.99
S-51	Arsenic	mg/kg	2.16		0.192	0.958
S-51	Barium	mg/kg	158		0.0958	0.383
S-51	Beryllium	mg/kg	0.509		0.0192	0.0958
S-51	Cadmium	mg/kg	0.275		0.0192	0.192
S-51	Calcium	mg/kg	5220		6.32	19.2
S-51	Chromium	mg/kg	4.91		0.192	0.575
S-51	Cobalt	mg/kg	3.82		0.0575	0.192
S-51	Copper	mg/kg	5.92		0.0632	0.192
S-51	Iron	mg/kg	6580		6.32	19.2
S-51	Lead	mg/kg	10.5	N	0.0958	0.383
S-51	Magnesium	mg/kg	3600		1.92	5.75
S-51	Manganese	mg/kg	532		0.958	4.79
S-51	Nickel	mg/kg	5.55		0.0958	0.383
S-51	Potassium	mg/kg	4130		15.3	57.5
S-51	Selenium	mg/kg	0.316	U	0.316	0.958
S-51	Silver	mg/kg	0.099	U	0.099	0.495
S-51	Sodium	mg/kg	335		15.3	47.9
S-51	Thallium	mg/kg	0.124	J	0.0575	0.383
S-51	Uranium	mg/kg	0.482		0.0126	0.0383
S-51	Vanadium	mg/kg	21.6	*	0.099	0.495
S-51	Zinc	mg/kg	28.7		0.383	1.92
S-52	Aluminum	mg/kg	7050		2.83	9.43
S-52	Antimony	mg/kg	0.324	*U	0.324	0.98
S-52	Arsenic	mg/kg	2.57		0.189	0.943
S-52	Barium	mg/kg	112		0.0943	0.377
S-52	Beryllium	mg/kg	0.401		0.0189	0.0943
S-52	Cadmium	mg/kg	0.175	J	0.0189	0.189
S-52	Calcium	mg/kg	2620		6.23	18.9
S-52	Chromium	mg/kg	3.23		0.189	0.566
S-52	Cobalt	mg/kg	2.11		0.0566	0.189
S-52	Copper	mg/kg	3.8		0.0623	0.189

TABLE B-8. Non-radiological Results for South Plume Area Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-52	Iron	mg/kg	4860		6.23	18.9
S-52	Lead	mg/kg	8.09	N	0.0943	0.377
S-52	Magnesium	mg/kg	2170		1.89	5.66
S-52	Manganese	mg/kg	272		0.943	4.72
S-52	Nickel	mg/kg	3.19		0.0943	0.377
S-52	Potassium	mg/kg	3240		15.1	56.6
S-52	Selenium	mg/kg	0.311	U	0.311	0.943
S-52	Silver	mg/kg	0.098	U	0.098	0.49
S-52	Sodium	mg/kg	297		15.1	47.2
S-52	Thallium	mg/kg	0.0904	J	0.0566	0.377
S-52	Uranium	mg/kg	0.626		0.0125	0.0377
S-52	Vanadium	mg/kg	10.6	*	0.098	0.49
S-52	Zinc	mg/kg	21.7		0.377	1.89

NOTES:

*** = Recovery or relative percent difference not within acceptance limits.**
CV = coefficient of variation
J = The associated value is an estimated quantity.
MDL = method detection limit
mg/kg = milligram per kilogram
N = Results associated with a spike analysis were outside control limits.
PQL = Practical quantitation limit.
Std Dev = standard deviation
U = The analyte was analyzed for but not detected above MDL.

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-02	Aluminum	mg/kg	10900		14.3	47.7
S-02	Antimony	mg/kg	2.32	*	0.316	0.958
S-02	Arsenic	mg/kg	3.33		0.191	0.954
S-02	Barium	mg/kg	99.9		0.0954	0.382
S-02	Beryllium	mg/kg	0.663		0.0191	0.0954
S-02	Cadmium	mg/kg	0.155	J	0.0191	0.191
S-02	Calcium	mg/kg	3040		6.3	19.1
S-02	Chromium	mg/kg	5.28		0.191	0.573
S-02	Cobalt	mg/kg	2.91		0.0573	0.191
S-02	Copper	mg/kg	5.19		0.063	0.191
S-02	Iron	mg/kg	7700		6.3	19.1
S-02	Lead	mg/kg	8.86	N	0.0954	0.382
S-02	Magnesium	mg/kg	3340		1.91	5.73
S-02	Manganese	mg/kg	279		0.954	4.77
S-02	Nickel	mg/kg	5.48		0.0954	0.382
S-02	Potassium	mg/kg	3960		15.3	57.3
S-02	Selenium	mg/kg	0.315	U	0.315	0.954
S-02	Silver	mg/kg	0.0958	U	0.0958	0.479
S-02	Sodium	mg/kg	223		15.3	47.7
S-02	Thallium	mg/kg	0.142	J	0.0573	0.382
S-02	Uranium	mg/kg	0.742		0.0126	0.0382
S-02	Vanadium	mg/kg	12.6	*	0.0958	0.479
S-02	Zinc	mg/kg	32.9		0.382	1.91
S-03	Aluminum	mg/kg	6420		14.9	49.8
S-03	Antimony	mg/kg	0.351	J	0.324	0.98
S-03	Arsenic	mg/kg	5.48		0.199	0.996
S-03	Barium	mg/kg	89.9		0.0996	0.398
S-03	Beryllium	mg/kg	0.344		0.0199	0.0996
S-03	Cadmium	mg/kg	0.21		0.0199	0.199
S-03	Calcium	mg/kg	1760		6.57	19.9

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Chromium	mg/kg	3.42		0.199	0.598
S-03	Cobalt	mg/kg	2.58		0.0598	0.199
S-03	Copper	mg/kg	4.06		0.0657	0.199
S-03	Iron	mg/kg	5350		6.57	19.9
S-03	Lead	mg/kg	8.83		0.0996	0.398
S-03	Magnesium	mg/kg	1860		1.99	5.98
S-03	Manganese	mg/kg	348		0.996	4.98
S-03	Nickel	mg/kg	3.23		0.0996	0.398
S-03	Potassium	mg/kg	2170		79.7	299
S-03	Selenium	mg/kg	0.329	NU	0.329	0.996
S-03	Silver	mg/kg	0.098	U	0.098	0.49
S-03	Sodium	mg/kg	163		15.9	49.8
S-03	Thallium	mg/kg	0.0886	J	0.0598	0.398
S-03	Uranium	mg/kg	0.721		0.0131	0.0398
S-03	Vanadium	mg/kg	17.5		0.098	0.49
S-03	Zinc	mg/kg	19.4		0.398	1.99
S-04	Aluminum	mg/kg	6190		13.6	45.3
S-04	Antimony	mg/kg	0.523	J	0.291	0.882
S-04	Arsenic	mg/kg	2.47		0.181	0.906
S-04	Barium	mg/kg	104		0.0906	0.362
S-04	Beryllium	mg/kg	0.491		0.0181	0.0906
S-04	Cadmium	mg/kg	0.277		0.0181	0.181
S-04	Calcium	mg/kg	2830		5.98	18.1
S-04	Chromium	mg/kg	2.66		0.181	0.543
S-04	Cobalt	mg/kg	2.01		0.0543	0.181
S-04	Copper	mg/kg	4.07		0.0598	0.181
S-04	Iron	mg/kg	5730		5.98	18.1
S-04	Lead	mg/kg	6.61		0.0906	0.362
S-04	Magnesium	mg/kg	2280		1.81	5.43
S-04	Manganese	mg/kg	471		0.906	4.53

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-04	Nickel	mg/kg	2.83		0.0906	0.362
S-04	Potassium	mg/kg	2470		72.5	272
S-04	Selenium	mg/kg	0.299	NU	0.299	0.906
S-04	Silver	mg/kg	0.0882	U	0.0882	0.441
S-04	Sodium	mg/kg	286		14.5	45.3
S-04	Thallium	mg/kg	0.0877	J	0.0543	0.362
S-04	Uranium	mg/kg	0.695		0.012	0.0362
S-04	Vanadium	mg/kg	14		0.0882	0.441
S-04	Zinc	mg/kg	21.4		0.362	1.81
S-09	Aluminum	mg/kg	9350		14.5	48.4
S-09	Antimony	mg/kg	0.452	J	0.321	0.973
S-09	Arsenic	mg/kg	2.69		0.194	0.969
S-09	Barium	mg/kg	86.6		0.0969	0.388
S-09	Beryllium	mg/kg	0.459		0.0194	0.0969
S-09	Cadmium	mg/kg	0.156	J	0.0194	0.194
S-09	Calcium	mg/kg	5950		6.4	19.4
S-09	Chromium	mg/kg	5.77		0.194	0.581
S-09	Cobalt	mg/kg	5.34		0.0581	0.194
S-09	Copper	mg/kg	5.52		0.064	0.194
S-09	Iron	mg/kg	9460		6.4	19.4
S-09	Lead	mg/kg	6.76		0.0969	0.388
S-09	Magnesium	mg/kg	4950		1.94	5.81
S-09	Manganese	mg/kg	298		0.969	4.84
S-09	Nickel	mg/kg	5.21		0.0969	0.388
S-09	Potassium	mg/kg	2950		77.5	291
S-09	Selenium	mg/kg	0.32	NU	0.32	0.969
S-09	Silver	mg/kg	0.0973	U	0.0973	0.486
S-09	Sodium	mg/kg	206		15.5	48.4
S-09	Thallium	mg/kg	0.105	J	0.0581	0.388
S-09	Uranium	mg/kg	0.443		0.0128	0.0388

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-09	Vanadium	mg/kg	29.8		0.0973	0.486
S-09	Zinc	mg/kg	31.9		0.388	1.94
S-10	Aluminum	mg/kg	7910		14.9	49.6
S-10	Antimony	mg/kg	0.282	U	0.282	0.853
S-10	Arsenic	mg/kg	3.52		0.198	0.992
S-10	Barium	mg/kg	125		0.0992	0.397
S-10	Beryllium	mg/kg	0.477		0.0198	0.0992
S-10	Cadmium	mg/kg	0.268		0.0198	0.198
S-10	Calcium	mg/kg	4130		6.55	19.8
S-10	Chromium	mg/kg	3.77		0.198	0.595
S-10	Cobalt	mg/kg	3.07		0.0595	0.198
S-10	Copper	mg/kg	5.05		0.0655	0.198
S-10	Iron	mg/kg	6740		6.55	19.8
S-10	Lead	mg/kg	7.41		0.0992	0.397
S-10	Magnesium	mg/kg	2590		1.98	5.95
S-10	Manganese	mg/kg	490		0.992	4.96
S-10	Nickel	mg/kg	3.62		0.0992	0.397
S-10	Potassium	mg/kg	3100		79.4	298
S-10	Selenium	mg/kg	0.327	NU	0.327	0.992
S-10	Silver	mg/kg	0.0853	U	0.0853	0.427
S-10	Sodium	mg/kg	260		15.9	49.6
S-10	Thallium	mg/kg	0.102	J	0.0595	0.397
S-10	Uranium	mg/kg	0.799		0.0131	0.0397
S-10	Vanadium	mg/kg	14		0.0853	0.427
S-10	Zinc	mg/kg	25.9		0.397	1.98
S-38	Aluminum	mg/kg	13600		14.7	49
S-38	Antimony	mg/kg	0.706	J	0.294	0.891
S-38	Arsenic	mg/kg	4.46		0.196	0.98
S-38	Barium	mg/kg	113		0.098	0.392
S-38	Beryllium	mg/kg	0.668		0.0196	0.098

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-38	Cadmium	mg/kg	0.227		0.0196	0.196
S-38	Calcium	mg/kg	23200		32.4	98
S-38	Chromium	mg/kg	6.63		0.196	0.588
S-38	Cobalt	mg/kg	3.12		0.0588	0.196
S-38	Copper	mg/kg	6.13		0.0647	0.196
S-38	Iron	mg/kg	8720		6.47	19.6
S-38	Lead	mg/kg	9.74		0.098	0.392
S-38	Magnesium	mg/kg	4850		1.96	5.88
S-38	Manganese	mg/kg	256		0.98	4.9
S-38	Nickel	mg/kg	6.47		0.098	0.392
S-38	Potassium	mg/kg	5010		78.4	294
S-38	Selenium	mg/kg	0.324	NU	0.324	0.98
S-38	Silver	mg/kg	0.0891	U	0.0891	0.446
S-38	Sodium	mg/kg	651		15.7	49
S-38	Thallium	mg/kg	0.18	J	0.0588	0.392
S-38	Uranium	mg/kg	0.74		0.0129	0.0392
S-38	Vanadium	mg/kg	17.6		0.0891	0.446
S-38	Zinc	mg/kg	30.2		0.392	1.96
S-39	Aluminum	mg/kg	11600		14.5	48.4
S-39	Antimony	mg/kg	0.351	J	0.317	0.962
S-39	Arsenic	mg/kg	5.52		0.194	0.969
S-39	Barium	mg/kg	140		0.0969	0.388
S-39	Beryllium	mg/kg	0.611		0.0194	0.0969
S-39	Cadmium	mg/kg	0.33		0.0194	0.194
S-39	Calcium	mg/kg	4150		6.4	19.4
S-39	Chromium	mg/kg	6.79		0.194	0.581
S-39	Cobalt	mg/kg	3.96		0.0581	0.194
S-39	Copper	mg/kg	8.14		0.064	0.194
S-39	Iron	mg/kg	9270		6.4	19.4
S-39	Lead	mg/kg	11.3		0.0969	0.388

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-39	Magnesium	mg/kg	4400		1.94	5.81
S-39	Manganese	mg/kg	560		0.969	4.84
S-39	Nickel	mg/kg	6.71		0.0969	0.388
S-39	Potassium	mg/kg	4200		77.5	291
S-39	Selenium	mg/kg	0.32	NU	0.32	0.969
S-39	Silver	mg/kg	0.0962	U	0.0962	0.481
S-39	Sodium	mg/kg	380		15.5	48.4
S-39	Thallium	mg/kg	0.166	J	0.0581	0.388
S-39	Uranium	mg/kg	0.908		0.0128	0.0388
S-39	Vanadium	mg/kg	21.3		0.0962	0.481
S-39	Zinc	mg/kg	36.3		0.388	1.94
S-53	Aluminum	mg/kg	6420	*	2.81	9.36
S-53	Antimony	mg/kg	0.322	*U	0.322	0.977
S-53	Arsenic	mg/kg	2.59		0.187	0.936
S-53	Barium	mg/kg	138		0.0936	0.375
S-53	Beryllium	mg/kg	0.356		0.0187	0.0936
S-53	Cadmium	mg/kg	0.174	J	0.0187	0.187
S-53	Calcium	mg/kg	6610		6.18	18.7
S-53	Chromium	mg/kg	3.32	*	0.187	0.562
S-53	Cobalt	mg/kg	1.84		0.0562	0.187
S-53	Copper	mg/kg	4.1		0.0618	0.187
S-53	Iron	mg/kg	4930		6.18	18.7
S-53	Lead	mg/kg	5.03		0.0936	0.375
S-53	Magnesium	mg/kg	2660	*	1.87	5.62
S-53	Manganese	mg/kg	165	*	0.187	0.936
S-53	Nickel	mg/kg	2.94		0.0936	0.375
S-53	Potassium	mg/kg	3370		15	56.2
S-53	Selenium	mg/kg	0.309	U	0.309	0.936
S-53	Silver	mg/kg	0.0977	U	0.0977	0.488
S-53	Sodium	mg/kg	885	*	15	46.8

TABLE B-9. Non-radiological Results for Various On-Site Soil Sampling Locations at TTR, 2013

Location	Analyte	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-53	Thallium	mg/kg	0.0818	J	0.0562	0.375
S-53	Uranium	mg/kg	0.567		0.0124	0.0375
S-53	Vanadium	mg/kg	11.7		0.0977	0.488
S-53	Zinc	mg/kg	16.7		0.375	1.87

NOTES:

*** = Recovery or relative percent difference not within acceptance limits.**
CV = coefficient of variation
J = The associated value is an estimated quantity.
MDL = method detection limit
mg/kg = milligram per kilogram
N = Results associated with a spike analysis were outside control limits.
PQL = Practical quantitation limit.
Std Dev = standard deviation
U = The analyte was analyzed for but not detected above MDL.

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
C-29	Aluminum	093467-002	mg/kg	6470	*	2.99	9.98
C-29	Aluminum	093468-002	mg/kg	7500	*	2.98	9.94
C-29	Aluminum	093469-002	mg/kg	5360		14.4	47.9
			Average	**6443.33**			
			Std Dev	**1070.25**			
			CV (%)	**16.61**			
			Minimum	**5360.00**			
			Maximum	**7500.00**			
C-29	Antimony	093467-002	mg/kg	4.14	*	0.33	1
C-29	Antimony	093468-002	mg/kg	3.16	*	0.306	0.928
C-29	Antimony	093469-002	mg/kg	4.28		0.301	0.911
			Average	**3.86**			
			Std Dev	**0.61**			
			CV (%)	**15.81**			
			Minimum	**3.16**			
			Maximum	**4.28**			
C-29	Arsenic	093467-002	mg/kg	9.71		0.2	0.998
C-29	Arsenic	093468-002	mg/kg	8.34		0.199	0.994
C-29	Arsenic	093469-002	mg/kg	7.23		0.192	0.958
			Average	**8.43**			
			Std Dev	**1.24**			
			CV (%)	**14.74**			
			Minimum	**7.23**			
			Maximum	**9.71**			
C-29	Barium	093467-002	mg/kg	364		0.499	2
C-29	Barium	093468-002	mg/kg	410		0.497	1.99
C-29	Barium	093469-002	mg/kg	280.00		0.479	1.92
			Average	**351.33**			
			Std Dev	**65.92**			
			CV (%)	**18.76**			
			Minimum	**280.00**			
			Maximum	**410.00**			
C-29	Beryllium	093467-002	mg/kg	0.454		0.02	0.0998

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
C-29	Beryllium	093468-002	mg/kg	0.523		0.0199	0.0994
C-29	Beryllium	093469-002	mg/kg	0.45		0.0192	0.0958
			Average	**0.48**			
			Std Dev	**0.04**			
			CV (%)	**8.63**			
			Minimum	**0.45**			
			Maximum	**0.52**			
C-29	Cadmium	093467-002	mg/kg	0.68		0.02	0.2
C-29	Cadmium	093468-002	mg/kg	0.679		0.0199	0.199
C-29	Cadmium	093469-002	mg/kg	0.832		0.0192	0.192
			Average	**0.73**			
			Std Dev	**0.09**			
			CV (%)	**12.01**			
			Minimum	**0.68**			
			Maximum	**0.83**			
C-29	Calcium	093467-002	mg/kg	28600		32.9	99.8
C-29	Calcium	093468-002	mg/kg	24500.00		32.8	99.4
C-29	Calcium	093469-002	mg/kg	31500		31.6	95.8
			Average	**28200.00**			
			Std Dev	**3517.10**			
			CV (%)	**12.47**			
			Minimum	**24500.00**			
			Maximum	**31500.00**			
C-29	Chromium	093467-002	mg/kg	5.53	*	0.2	0.599
C-29	Chromium	093468-002	mg/kg	5.65	*	0.199	0.596
C-29	Chromium	093469-002	mg/kg	6.46		0.192	0.575
			Average	**5.88**			
			Std Dev	**0.51**			
			CV (%)	**8.60**			
			Minimum	**5.53**			
			Maximum	**6.46**			
C-29	Cobalt	093467-002	mg/kg	3.47		0.0599	0.2
C-29	Cobalt	093468-002	mg/kg	3.14		0.0596	0.199

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
C-29	Cobalt	093469-002	mg/kg	2.26		0.0575	0.192
			Average	**2.96**			
			Std Dev	**0.63**			
			CV (%)	**21.16**			
			Minimum	**2.26**			
			Maximum	**3.47**			
C-29	Copper	093467-002	mg/kg	8.72		0.0659	0.2
C-29	Copper	093468-002	mg/kg	8.74		0.0656	0.199
C-29	Copper	093469-002	mg/kg	9.45		0.0632	0.192
			Average	**8.97**			
			Std Dev	**0.42**			
			CV (%)	**4.64**			
			Minimum	**8.72**			
			Maximum	**9.45**			
C-29	Iron	093467-002	mg/kg	6430		6.59	20
C-29	Iron	093468-002	mg/kg	6240.00		6.56	19.9
C-29	Iron	093469-002	mg/kg	5270		6.32	19.2
			Average	**5980.00**			
			Std Dev	**622.17**			
			CV (%)	**10.40**			
			Minimum	**5270.00**			
			Maximum	**6430.00**			
C-29	Lead	093467-002	mg/kg	16		0.0998	0.399
C-29	Lead	093468-002	mg/kg	19.9		0.0994	0.398
C-29	Lead	093469-002	mg/kg	15.90		0.0958	0.383
			Average	**17.27**			
			Std Dev	**2.28**			
			CV (%)	**13.21**			
			Minimum	**15.90**			
			Maximum	**19.90**			
C-29	Magnesium	093467-002	mg/kg	7280	*	2	5.99
C-29	Magnesium	093468-002	mg/kg	7210	*	1.99	5.96
C-29	Magnesium	093469-002	mg/kg	13200		9.58	28.7

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Average	**9230.00**			
			Std Dev	**3438.30**			
			CV (%)	**37.25**			
			Minimum	**7210.00**			
			Maximum	**13200.00**			
C-29	Manganese	093467-002	mg/kg	348.00	*	0.998	4.99
C-29	Manganese	093468-002	mg/kg	384	*	0.994	4.97
C-29	Manganese	093469-002	mg/kg	292		0.958	4.79
			Average	**341.33**			
			Std Dev	**46.36**			
			CV (%)	**13.58**			
			Minimum	**292.00**			
			Maximum	**384.00**			
C-29	Nickel	093467-002	mg/kg	13.7		0.0998	0.399
C-29	Nickel	093468-002	mg/kg	12.70		0.0994	0.398
C-29	Nickel	093469-002	mg/kg	14		0.0958	0.383
			Average	**13.47**			
			Std Dev	**0.68**			
			CV (%)	**5.05**			
			Minimum	**12.70**			
			Maximum	**14.00**			
C-29	Potassium	093467-002	mg/kg	2300		16	59.9
C-29	Potassium	093468-002	mg/kg	2790		15.9	59.6
C-29	Potassium	093469-002	mg/kg	2160.00		76.6	287
			Average	**2416.67**			
			Std Dev	**330.81**			
			CV (%)	**13.69**			
			Minimum	**2160.00**			
			Maximum	**2790.00**			
C-29	Selenium	093467-002	mg/kg	0.406	J	0.329	0.998
C-29	Selenium	093468-002	mg/kg	0.414	J	0.328	0.994
C-29	Selenium	093469-002	mg/kg	0.448	JN	0.316	0.958
			Average	**0.42**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Std Dev	**0.02**			
			CV (%)	**5.28**			
			Minimum	**0.41**			
			Maximum	**0.45**			
C-29	Silver	093467-002	mg/kg	0.10	U	0.1	0.5
C-29	Silver	093468-002	mg/kg	0.0928	U	0.0928	0.464
C-29	Silver	093469-002	mg/kg	0.0911	U	0.0911	0.455
			Average	**0.09**			
			Std Dev	**0.00**			
			CV (%)	**4.99**			
			Minimum	**0.09**			
			Maximum	**0.10**			
C-29	Sodium	093467-002	mg/kg	291	*	16	49.9
C-29	Sodium	093468-002	mg/kg	312.00	*	15.9	49.7
C-29	Sodium	093469-002	mg/kg	290		15.3	47.9
			Average	**297.67**			
			Std Dev	**12.42**			
			CV (%)	**4.17**			
			Minimum	**290.00**			
			Maximum	**312.00**			
C-29	Thallium	093467-002	mg/kg	0.233	J	0.0599	0.399
C-29	Thallium	093468-002	mg/kg	0.201	J	0.0596	0.398
C-29	Thallium	093469-002	mg/kg	0.24	J	0.0575	0.383
			Average	**0.22**			
			Std Dev	**0.02**			
			CV (%)	**9.11**			
			Minimum	**0.20**			
			Maximum	**0.24**			
C-29	Uranium	093467-002	mg/kg	0.834		0.0132	0.0399
C-29	Uranium	093468-002	mg/kg	0.945		0.0131	0.0398
C-29	Uranium	093469-002	mg/kg	0.797		0.0126	0.0383
			Average	**0.86**			
			Std Dev	**0.08**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			CV (%)	**8.97**			
			Minimum	**0.80**			
			Maximum	**0.95**			
C-29	Vanadium	093467-002	mg/kg	31.80		0.1	0.5
C-29	Vanadium	093468-002	mg/kg	26.9		0.0928	0.464
C-29	Vanadium	093469-002	mg/kg	31.3		0.0911	0.455
			Average	**30.00**			
			Std Dev	**2.70**			
			CV (%)	**8.99**			
			Minimum	**26.90**			
			Maximum	**31.80**			
C-29	Zinc	093467-002	mg/kg	54.8		0.399	2
C-29	Zinc	093468-002	mg/kg	60.00		0.398	1.99
C-29	Zinc	093469-002	mg/kg	54.8		0.383	1.92
			Average	**56.53**			
			Std Dev	**3.00**			
			CV (%)	**5.31**			
			Minimum	**54.80**			
			Maximum	**60.00**			
P-11	Aluminum	093499-002	mg/kg	5830		2.63	8.76
P-11	Aluminum	093500-002	mg/kg	6740		2.96	9.86
P-11	Aluminum	093501-002	mg/kg	5620.00		3	10
			Average	**6063.33**			
			Std Dev	**595.34**			
			CV (%)	**9.82**			
			Minimum	**5620.00**			
			Maximum	**6740.00**			
P-11	Antimony	093499-002	mg/kg	0.328	*U	0.328	0.994
P-11	Antimony	093500-002	mg/kg	0.406	*J	0.312	0.945
P-11	Antimony	093501-002	mg/kg	0.69	*J	0.309	0.936
			Average	**0.47**			
			Std Dev	**0.19**			
			CV (%)	**40.14**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Minimum	**0.33**			
			Maximum	**0.69**			
P-11	Arsenic	093499-002	mg/kg	5.40		0.175	0.876
P-11	Arsenic	093500-002	mg/kg	6.07		0.197	0.986
P-11	Arsenic	093501-002	mg/kg	12.2		0.2	1
			Average	**7.89**			
			Std Dev	**3.75**			
			CV (%)	**47.50**			
			Minimum	**5.40**			
			Maximum	**12.20**			
P-11	Barium	093499-002	mg/kg	181		0.438	1.75
P-11	Barium	093500-002	mg/kg	176.00		0.0986	0.394
P-11	Barium	093501-002	mg/kg	159		0.1	0.4
			Average	**172.00**			
			Std Dev	**11.53**			
			CV (%)	**6.70**			
			Minimum	**159.00**			
			Maximum	**181.00**			
P-11	Beryllium	093499-002	mg/kg	0.563		0.0175	0.0876
P-11	Beryllium	093500-002	mg/kg	0.651		0.0197	0.0986
P-11	Beryllium	093501-002	mg/kg	0.61		0.02	0.1
			Average	**0.61**			
			Std Dev	**0.04**			
			CV (%)	**7.24**			
			Minimum	**0.56**			
			Maximum	**0.65**			
P-11	Cadmium	093499-002	mg/kg	0.222		0.0175	0.175
P-11	Cadmium	093500-002	mg/kg	0.242		0.0197	0.197
P-11	Cadmium	093501-002	mg/kg	0.225		0.02	0.2
			Average	**0.23**			
			Std Dev	**0.01**			
			CV (%)	**4.70**			
			Minimum	**0.22**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Maximum	**0.24**			
P-11	Calcium	093499-002	mg/kg	2100.00		5.78	17.5
P-11	Calcium	093500-002	mg/kg	2400		6.51	19.7
P-11	Calcium	093501-002	mg/kg	2140		6.6	20
			Average	**2213.33**			
			Std Dev	**162.89**			
			CV (%)	**7.36**			
			Minimum	**2100.00**			
			Maximum	**2400.00**			
P-11	Chromium	093499-002	mg/kg	3.28		0.175	0.525
P-11	Chromium	093500-002	mg/kg	3.91		0.197	0.592
P-11	Chromium	093501-002	mg/kg	3.19		0.2	0.6
			Average	**3.46**			
			Std Dev	**0.39**			
			CV (%)	**11.34**			
			Minimum	**3.19**			
			Maximum	**3.91**			
P-11	Cobalt	093499-002	mg/kg	4.16		0.0525	0.175
P-11	Cobalt	093500-002	mg/kg	5.09		0.0592	0.197
P-11	Cobalt	093501-002	mg/kg	6.03		0.06	0.2
			Average	**5.09**			
			Std Dev	**0.94**			
			CV (%)	**18.36**			
			Minimum	**4.16**			
			Maximum	**6.03**			
P-11	Copper	093499-002	mg/kg	5.46		0.0578	0.175
P-11	Copper	093500-002	mg/kg	6.71		0.0651	0.197
P-11	Copper	093501-002	mg/kg	5.73		0.066	0.2
			Average	**5.97**			
			Std Dev	**0.66**			
			CV (%)	**11.02**			
			Minimum	**5.46**			
			Maximum	**6.71**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
P-11	Iron	093499-002	mg/kg	9710.00		28.9	87.6
P-11	Iron	093500-002	mg/kg	10700		32.5	98.6
P-11	Iron	093501-002	mg/kg	9410		6.6	20
			Average	**9940.00**			
			Std Dev	**675.06**			
			CV (%)	**6.79**			
			Minimum	**9410.00**			
			Maximum	**10700.00**			
P-11	Lead	093499-002	mg/kg	17	N	0.0876	0.35
P-11	Lead	093500-002	mg/kg	17.80	N	0.0986	0.394
P-11	Lead	093501-002	mg/kg	19.9	N	0.1	0.4
			Average	**18.23**			
			Std Dev	**1.50**			
			CV (%)	**8.21**			
			Minimum	**17.00**			
			Maximum	**19.90**			
P-11	Magnesium	093499-002	mg/kg	1880		1.75	5.25
P-11	Magnesium	093500-002	mg/kg	2180		1.97	5.92
P-11	Magnesium	093501-002	mg/kg	1820.00		2	6
			Average	**1960.00**			
			Std Dev	**192.87**			
			CV (%)	**9.84**			
			Minimum	**1820.00**			
			Maximum	**2180.00**			
P-11	Manganese	093499-002	mg/kg	528		0.876	4.38
P-11	Manganese	093500-002	mg/kg	557		0.986	4.93
P-11	Manganese	093501-002	mg/kg	498		1	5
			Average	**527.67**			
			Std Dev	**29.50**			
			CV (%)	**5.59**			
			Minimum	**498.00**			
			Maximum	**557.00**			
P-11	Nickel	093499-002	mg/kg	3.54		0.0876	0.35

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
P-11	Nickel	093500-002	mg/kg	4.34		0.0986	0.394
P-11	Nickel	093501-002	mg/kg	3.53		0.1	0.4
			Average	**3.80**			
			Std Dev	**0.46**			
			CV (%)	**12.22**			
			Minimum	**3.53**			
			Maximum	**4.34**			
P-11	Potassium	093499-002	mg/kg	2240		14	52.5
P-11	Potassium	093500-002	mg/kg	2720.00		15.8	59.2
P-11	Potassium	093501-002	mg/kg	2120		16	60
			Average	**2360.00**			
			Std Dev	**317.49**			
			CV (%)	**13.45**			
			Minimum	**2120.00**			
			Maximum	**2720.00**			
P-11	Selenium	093499-002	mg/kg	0.289	U	0.289	0.876
P-11	Selenium	093500-002	mg/kg	0.325	U	0.325	0.986
P-11	Selenium	093501-002	mg/kg	0.33	U	0.33	1
			Average	**0.31**			
			Std Dev	**0.02**			
			CV (%)	**7.11**			
			Minimum	**0.29**			
			Maximum	**0.33**			
P-11	Silver	093499-002	mg/kg	0.0994	U	0.0994	0.497
P-11	Silver	093500-002	mg/kg	0.0945	U	0.0945	0.473
P-11	Silver	093501-002	mg/kg	0.0936	U	0.0936	0.468
			Average	**0.10**			
			Std Dev	**0.00**			
			CV (%)	**3.26**			
			Minimum	**0.09**			
			Maximum	**0.10**			
P-11	Sodium	093499-002	mg/kg	138.00		14	43.8
P-11	Sodium	093500-002	mg/kg	145		15.8	49.3

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
P-11	Sodium	093501-002	mg/kg	136		16	50
			Average	**139.67**			
			Std Dev	**4.73**			
			CV (%)	**3.38**			
			Minimum	**136.00**			
			Maximum	**145.00**			
P-11	Thallium	093499-002	mg/kg	0.109	J	0.0525	0.35
P-11	Thallium	093500-002	mg/kg	0.13	J	0.0592	0.394
P-11	Thallium	093501-002	mg/kg	0.104	J	0.06	0.4
			Average	**0.11**			
			Std Dev	**0.01**			
			CV (%)	**12.53**			
			Minimum	**0.10**			
			Maximum	**0.13**			
P-11	Uranium	093499-002	mg/kg	0.427		0.0116	0.035
P-11	Uranium	093500-002	mg/kg	0.473		0.013	0.0394
P-11	Uranium	093501-002	mg/kg	0.49		0.0132	0.04
			Average	**0.46**			
			Std Dev	**0.03**			
			CV (%)	**7.29**			
			Minimum	**0.43**			
			Maximum	**0.49**			
P-11	Vanadium	093499-002	mg/kg	15.1	*	0.0994	0.497
P-11	Vanadium	093500-002	mg/kg	16.5	*	0.0945	0.473
P-11	Vanadium	093501-002	mg/kg	14.2	*	0.0936	0.468
			Average	**15.27**			
			Std Dev	**1.16**			
			CV (%)	**7.59**			
			Minimum	**14.20**			
			Maximum	**16.50**			
P-11	Zinc	093499-002	mg/kg	41.10		0.35	1.75
P-11	Zinc	093500-002	mg/kg	48		0.394	1.97
P-11	Zinc	093501-002	mg/kg	41.5		0.4	2

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Average	**43.53**			
			Std Dev	**3.87**			
			CV (%)	**8.90**			
			Minimum	**41.10**			
			Maximum	**48.00**			
S-03	Aluminum	093482-002	mg/kg	6420		14.9	49.8
S-03	Aluminum	093483-002	mg/kg	7790.00		14.9	49.6
S-03	Aluminum	093484-002	mg/kg	7740		14.5	48.4
			Average	**7316.67**			
			Std Dev	**776.94**			
			CV (%)	**10.62**			
			Minimum	**6420.00**			
			Maximum	**7790.00**			
S-03	Antimony	093482-002	mg/kg	0.351	J	0.324	0.98
S-03	Antimony	093483-002	mg/kg	0.33	U	0.33	1
S-03	Antimony	093484-002	mg/kg	0.40	J	0.319	0.965
			Average	**0.36**			
			Std Dev	**0.04**			
			CV (%)	**10.26**			
			Minimum	**0.33**			
			Maximum	**0.40**			
S-03	Arsenic	093482-002	mg/kg	5.48		0.199	0.996
S-03	Arsenic	093483-002	mg/kg	2.79		0.198	0.992
S-03	Arsenic	093484-002	mg/kg	2.66		0.194	0.969
			Average	**3.64**			
			Std Dev	**1.59**			
			CV (%)	**43.69**			
			Minimum	**2.66**			
			Maximum	**5.48**			
S-03	Barium	093482-002	mg/kg	89.90		0.0996	0.398
S-03	Barium	093483-002	mg/kg	95.2		0.0992	0.397
S-03	Barium	093484-002	mg/kg	90		0.0969	0.388
			Average	**91.70**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Std Dev	**3.03**			
			CV (%)	**3.31**			
			Minimum	**89.90**			
			Maximum	**95.20**			
S-03	Beryllium	093482-002	mg/kg	0.344		0.0199	0.0996
S-03	Beryllium	093483-002	mg/kg	0.42		0.0198	0.0992
S-03	Beryllium	093484-002	mg/kg	0.405		0.0194	0.0969
			Average	**0.39**			
			Std Dev	**0.04**			
			CV (%)	**10.69**			
			Minimum	**0.34**			
			Maximum	**0.42**			
S-03	Cadmium	093482-002	mg/kg	0.21		0.0199	0.199
S-03	Cadmium	093483-002	mg/kg	0.224		0.0198	0.198
S-03	Cadmium	093484-002	mg/kg	0.22		0.0194	0.194
			Average	**0.22**			
			Std Dev	**0.01**			
			CV (%)	**3.24**			
			Minimum	**0.21**			
			Maximum	**0.22**			
S-03	Calcium	093482-002	mg/kg	1760		6.57	19.9
S-03	Calcium	093483-002	mg/kg	1970		6.55	19.8
S-03	Calcium	093484-002	mg/kg	1890		6.4	19.4
			Average	**1873.33**			
			Std Dev	**105.99**			
			CV (%)	**5.66**			
			Minimum	**1760.00**			
			Maximum	**1970.00**			
S-03	Chromium	093482-002	mg/kg	3.42		0.199	0.598
S-03	Chromium	093483-002	mg/kg	4.73		0.198	0.595
S-03	Chromium	093484-002	mg/kg	4.27		0.194	0.581
			Average	**4.14**			
			Std Dev	**0.66**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			CV (%)	**16.05**			
			Minimum	**3.42**			
			Maximum	**4.73**			
S-03	Cobalt	093482-002	mg/kg	2.58		0.0598	0.199
S-03	Cobalt	093483-002	mg/kg	2.85		0.0595	0.198
S-03	Cobalt	093484-002	mg/kg	2.81		0.0581	0.194
			Average	**2.75**			
			Std Dev	**0.15**			
			CV (%)	**5.31**			
			Minimum	**2.58**			
			Maximum	**2.85**			
S-03	Copper	093482-002	mg/kg	4.06		0.0657	0.199
S-03	Copper	093483-002	mg/kg	5.32		0.0655	0.198
S-03	Copper	093484-002	mg/kg	4.99		0.064	0.194
			Average	**4.79**			
			Std Dev	**0.65**			
			CV (%)	**13.64**			
			Minimum	**4.06**			
			Maximum	**5.32**			
S-03	Iron	093482-002	mg/kg	5350		6.57	19.9
S-03	Iron	093483-002	mg/kg	6580		6.55	19.8
S-03	Iron	093484-002	mg/kg	6380		6.4	19.4
			Average	**6103.33**			
			Std Dev	**660.03**			
			CV (%)	**10.81**			
			Minimum	**5350.00**			
			Maximum	**6580.00**			
S-03	Lead	093482-002	mg/kg	8.83		0.0996	0.398
S-03	Lead	093483-002	mg/kg	7.89		0.0992	0.397
S-03	Lead	093484-002	mg/kg	7.49		0.0969	0.388
			Average	**8.07**			
			Std Dev	**0.69**			
			CV (%)	**8.52**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Minimum	**7.49**			
			Maximum	**8.83**			
S-03	Magnesium	093482-002	mg/kg	1860		1.99	5.98
S-03	Magnesium	093483-002	mg/kg	2380.00		1.98	5.95
S-03	Magnesium	093484-002	mg/kg	2390		1.94	5.81
			Average	**2210.00**			
			Std Dev	**303.15**			
			CV (%)	**13.72**			
			Minimum	**1860.00**			
			Maximum	**2390.00**			
S-03	Manganese	093482-002	mg/kg	348		0.996	4.98
S-03	Manganese	093483-002	mg/kg	341		0.992	4.96
S-03	Manganese	093484-002	mg/kg	331.00		0.969	4.84
			Average	**340.00**			
			Std Dev	**8.54**			
			CV (%)	**2.51**			
			Minimum	**331.00**			
			Maximum	**348.00**			
S-03	Nickel	093482-002	mg/kg	3.23		0.0996	0.398
S-03	Nickel	093483-002	mg/kg	4.23		0.0992	0.397
S-03	Nickel	093484-002	mg/kg	4.09		0.0969	0.388
			Average	**3.85**			
			Std Dev	**0.54**			
			CV (%)	**14.06**			
			Minimum	**3.23**			
			Maximum	**4.23**			
S-03	Potassium	093482-002	mg/kg	2170.00		79.7	299
S-03	Potassium	093483-002	mg/kg	2730		79.4	298
S-03	Potassium	093484-002	mg/kg	2660		77.5	291
			Average	**2520.00**			
			Std Dev	**305.12**			
			CV (%)	**12.11**			
			Minimum	**2170.00**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Maximum	**2730.00**			
S-03	Selenium	093482-002	mg/kg	0.329	NU	0.329	0.996
S-03	Selenium	093483-002	mg/kg	0.33	NU	0.327	0.992
S-03	Selenium	093484-002	mg/kg	0.32	NU	0.32	0.969
			Average	**0.33**			
			Std Dev	**0.00**			
			CV (%)	**1.45**			
			Minimum	**0.32**			
			Maximum	**0.33**			
S-03	Silver	093482-002	mg/kg	0.098	U	0.098	0.49
S-03	Silver	093483-002	mg/kg	0.1	U	0.1	0.5
S-03	Silver	093484-002	mg/kg	0.10	U	0.0965	0.483
			Average	**0.10**			
			Std Dev	**0.00**			
			CV (%)	**1.79**			
			Minimum	**0.10**			
			Maximum	**0.10**			
S-03	Sodium	093482-002	mg/kg	163		15.9	49.8
S-03	Sodium	093483-002	mg/kg	267		15.9	49.6
S-03	Sodium	093484-002	mg/kg	221		15.5	48.4
			Average	**217.00**			
			Std Dev	**52.12**			
			CV (%)	**24.02**			
			Minimum	**163.00**			
			Maximum	**267.00**			
S-03	Thallium	093482-002	mg/kg	0.09	J	0.0598	0.398
S-03	Thallium	093483-002	mg/kg	0.116	J	0.0595	0.397
S-03	Thallium	093484-002	mg/kg	0.0983	J	0.0581	0.388
			Average	**0.10**			
			Std Dev	**0.01**			
			CV (%)	**13.76**			
			Minimum	**0.09**			
			Maximum	**0.12**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-03	Uranium	093482-002	mg/kg	0.721		0.0131	0.0398
S-03	Uranium	093483-002	mg/kg	0.69		0.0131	0.0397
S-03	Uranium	093484-002	mg/kg	0.717		0.0128	0.0388
			Average	**0.71**			
			Std Dev	**0.02**			
			CV (%)	**2.62**			
			Minimum	**0.69**			
			Maximum	**0.72**			
S-03	Vanadium	093482-002	mg/kg	17.5		0.098	0.49
S-03	Vanadium	093483-002	mg/kg	14.9		0.1	0.5
S-03	Vanadium	093484-002	mg/kg	15.40		0.0965	0.483
			Average	**15.93**			
			Std Dev	**1.38**			
			CV (%)	**8.66**			
			Minimum	**14.90**			
			Maximum	**17.50**			
S-03	Zinc	093482-002	mg/kg	19.4		0.398	1.99
S-03	Zinc	093483-002	mg/kg	22.8		0.397	1.98
S-03	Zinc	093484-002	mg/kg	22.7		0.388	1.94
			Average	**21.63**			
			Std Dev	**1.93**			
			CV (%)	**8.94**			
			Minimum	**19.40**			
			Maximum	**22.80**			
S-09	Aluminum	093477-002	mg/kg	9350.00		14.5	48.4
S-09	Aluminum	093478-002	mg/kg	14000		14.4	48
S-09	Aluminum	093479-002	mg/kg	12600		14.9	49.6
			Average	**11983.33**			
			Std Dev	**2385.55**			
			CV (%)	**19.91**			
			Minimum	**9350.00**			
			Maximum	**14000.00**			
S-09	Antimony	093477-002	mg/kg	0.452	J	0.321	0.973

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-09	Antimony	093478-002	mg/kg	0.31	U	0.314	0.952
S-09	Antimony	093479-002	mg/kg	0.288	U	0.288	0.873
			Average	**0.35**			
			Std Dev	**0.09**			
			CV (%)	**25.09**			
			Minimum	**0.29**			
			Maximum	**0.45**			
S-09	Arsenic	093477-002	mg/kg	2.69		0.194	0.969
S-09	Arsenic	093478-002	mg/kg	3.39		0.192	0.96
S-09	Arsenic	093479-002	mg/kg	2.99		0.198	0.992
			Average	**3.02**			
			Std Dev	**0.35**			
			CV (%)	**11.62**			
			Minimum	**2.69**			
			Maximum	**3.39**			
S-09	Barium	093477-002	mg/kg	86.6		0.0969	0.388
S-09	Barium	093478-002	mg/kg	148		0.096	0.384
S-09	Barium	093479-002	mg/kg	123		0.0992	0.397
			Average	**119.20**			
			Std Dev	**30.88**			
			CV (%)	**25.90**			
			Minimum	**86.60**			
			Maximum	**148.00**			
S-09	Beryllium	093477-002	mg/kg	0.46		0.0194	0.0969
S-09	Beryllium	093478-002	mg/kg	0.818		0.0192	0.096
S-09	Beryllium	093479-002	mg/kg	0.674		0.0198	0.0992
			Average	**0.65**			
			Std Dev	**0.18**			
			CV (%)	**27.78**			
			Minimum	**0.46**			
			Maximum	**0.82**			
S-09	Cadmium	093477-002	mg/kg	0.156	J	0.0194	0.194
S-09	Cadmium	093478-002	mg/kg	0.26		0.0192	0.192

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-09	Cadmium	093479-002	mg/kg	0.244		0.0198	0.198
			Average	**0.22**			
			Std Dev	**0.05**			
			CV (%)	**24.97**			
			Minimum	**0.16**			
			Maximum	**0.26**			
S-09	Calcium	093477-002	mg/kg	5950		6.4	19.4
S-09	Calcium	093478-002	mg/kg	8760		6.33	19.2
S-09	Calcium	093479-002	mg/kg	8460.00		6.55	19.8
			Average	**7723.33**			
			Std Dev	**1543.06**			
			CV (%)	**19.98**			
			Minimum	**5950.00**			
			Maximum	**8760.00**			
S-09	Chromium	093477-002	mg/kg	5.77		0.194	0.581
S-09	Chromium	093478-002	mg/kg	7.91		0.192	0.576
S-09	Chromium	093479-002	mg/kg	6.81		0.198	0.595
			Average	**6.83**			
			Std Dev	**1.07**			
			CV (%)	**15.67**			
			Minimum	**5.77**			
			Maximum	**7.91**			
S-09	Cobalt	093477-002	mg/kg	5.34		0.0581	0.194
S-09	Cobalt	093478-002	mg/kg	6.89		0.0576	0.192
S-09	Cobalt	093479-002	mg/kg	5.68		0.0595	0.198
			Average	**5.97**			
			Std Dev	**0.81**			
			CV (%)	**13.65**			
			Minimum	**5.34**			
			Maximum	**6.89**			
S-09	Copper	093477-002	mg/kg	5.52		0.064	0.194
S-09	Copper	093478-002	mg/kg	8.45		0.0633	0.192
S-09	Copper	093479-002	mg/kg	7.53		0.0655	0.198

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Average	**7.17**			
			Std Dev	**1.50**			
			CV (%)	**20.91**			
			Minimum	**5.52**			
			Maximum	**8.45**			
S-09	Iron	093477-002	mg/kg	9460		6.4	19.4
S-09	Iron	093478-002	mg/kg	13600		31.7	96
S-09	Iron	093479-002	mg/kg	11700.00		32.7	99.2
			Average	**11586.67**			
			Std Dev	**2072.33**			
			CV (%)	**17.89**			
			Minimum	**9460.00**			
			Maximum	**13600.00**			
S-09	Lead	093477-002	mg/kg	6.76		0.0969	0.388
S-09	Lead	093478-002	mg/kg	11.8		0.096	0.384
S-09	Lead	093479-002	mg/kg	10.3		0.0992	0.397
			Average	**9.62**			
			Std Dev	**2.59**			
			CV (%)	**26.90**			
			Minimum	**6.76**			
			Maximum	**11.80**			
S-09	Magnesium	093477-002	mg/kg	4950.00		1.94	5.81
S-09	Magnesium	093478-002	mg/kg	6200		1.92	5.76
S-09	Magnesium	093479-002	mg/kg	5210		1.98	5.95
			Average	**5453.33**			
			Std Dev	**659.57**			
			CV (%)	**12.09**			
			Minimum	**4950.00**			
			Maximum	**6200.00**			
S-09	Manganese	093477-002	mg/kg	298		0.969	4.84
S-09	Manganese	093478-002	mg/kg	557.00		0.96	4.8
S-09	Manganese	093479-002	mg/kg	375		0.992	4.96
			Average	**410.00**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Std Dev	**133.00**			
			CV (%)	**32.44**			
			Minimum	**298.00**			
			Maximum	**557.00**			
S-09	Nickel	093477-002	mg/kg	5.21		0.0969	0.388
S-09	Nickel	093478-002	mg/kg	7.54		0.096	0.384
S-09	Nickel	093479-002	mg/kg	6.76		0.0992	0.397
			Average	**6.50**			
			Std Dev	**1.19**			
			CV (%)	**18.24**			
			Minimum	**5.21**			
			Maximum	**7.54**			
S-09	Potassium	093477-002	mg/kg	2950		77.5	291
S-09	Potassium	093478-002	mg/kg	5050		76.8	288
S-09	Potassium	093479-002	mg/kg	4440		79.4	298
			Average	**4146.67**			
			Std Dev	**1080.29**			
			CV (%)	**26.05**			
			Minimum	**2950.00**			
			Maximum	**5050.00**			
S-09	Selenium	093477-002	mg/kg	0.32	NU	0.32	0.969
S-09	Selenium	093478-002	mg/kg	0.317	NU	0.317	0.96
S-09	Selenium	093479-002	mg/kg	0.327	NU	0.327	0.992
			Average	**0.32**			
			Std Dev	**0.01**			
			CV (%)	**1.60**			
			Minimum	**0.32**			
			Maximum	**0.33**			
S-09	Silver	093477-002	mg/kg	0.0973	U	0.0973	0.486
S-09	Silver	093478-002	mg/kg	0.10	U	0.0952	0.476
S-09	Silver	093479-002	mg/kg	0.0873	U	0.0873	0.436
			Average	**0.09**			
			Std Dev	**0.01**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			CV (%)	**5.65**			
			Minimum	**0.09**			
			Maximum	**0.10**			
S-09	Sodium	093477-002	mg/kg	206		15.5	48.4
S-09	Sodium	093478-002	mg/kg	246		15.4	48
S-09	Sodium	093479-002	mg/kg	207.00		15.9	49.6
			Average	**219.67**			
			Std Dev	**22.81**			
			CV (%)	**10.38**			
			Minimum	**206.00**			
			Maximum	**246.00**			
S-09	Thallium	093477-002	mg/kg	0.105	J	0.0581	0.388
S-09	Thallium	093478-002	mg/kg	0.184	J	0.0576	0.384
S-09	Thallium	093479-002	mg/kg	0.169	J	0.0595	0.397
			Average	**0.15**			
			Std Dev	**0.04**			
			CV (%)	**27.48**			
			Minimum	**0.11**			
			Maximum	**0.18**			
S-09	Uranium	093477-002	mg/kg	0.44		0.0128	0.0388
S-09	Uranium	093478-002	mg/kg	0.595		0.0127	0.0384
S-09	Uranium	093479-002	mg/kg	0.532		0.0131	0.0397
			Average	**0.52**			
			Std Dev	**0.08**			
			CV (%)	**14.59**			
			Minimum	**0.44**			
			Maximum	**0.60**			
S-09	Vanadium	093477-002	mg/kg	29.8		0.0973	0.486
S-09	Vanadium	093478-002	mg/kg	25.80		0.0952	0.476
S-09	Vanadium	093479-002	mg/kg	30.7		0.0873	0.436
			Average	**28.77**			
			Std Dev	**2.61**			
			CV (%)	**9.07**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Minimum	**25.80**			
			Maximum	**30.70**			
S-09	Zinc	093477-002	mg/kg	31.9		0.388	1.94
S-09	Zinc	093478-002	mg/kg	41.5		0.384	1.92
S-09	Zinc	093479-002	mg/kg	38.10		0.397	1.98
			Average	**37.17**			
			Std Dev	**4.87**			
			CV (%)	**13.10**			
			Minimum	**31.90**			
			Maximum	**41.50**			
S-48	Aluminum	093490-002	mg/kg	10800		15	50
S-48	Aluminum	093491-002	mg/kg	11700		15	50
S-48	Aluminum	093492-002	mg/kg	10700		14.7	49.1
			Average	**11066.67**			
			Std Dev	**550.76**			
			CV (%)	**4.98**			
			Minimum	**10700.00**			
			Maximum	**11700.00**			
S-48	Antimony	093490-002	mg/kg	0.301	*U	0.301	0.91
S-48	Antimony	093491-002	mg/kg	0.315	*U	0.315	0.96
S-48	Antimony	093492-002	mg/kg	0.33	*U	0.33	1.00
			Average	**0.32**			
			Std Dev	**0.01**			
			CV (%)	**4.60**			
			Minimum	**0.30**			
			Maximum	**0.33**			
S-48	Arsenic	093490-002	mg/kg	2.01		0.2	1.00
S-48	Arsenic	093491-002	mg/kg	2.3		0.2	1
S-48	Arsenic	093492-002	mg/kg	2.56		0.196	0.98
			Average	**2.29**			
			Std Dev	**0.28**			
			CV (%)	**12.01**			
			Minimum	**2.01**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Maximum	**2.56**			
S-48	Barium	093490-002	mg/kg	198		0.1	0.40
S-48	Barium	093491-002	mg/kg	242		0.5	2.00
S-48	Barium	093492-002	mg/kg	207		0.491	1.96
			Average	**215.67**			
			Std Dev	**23.25**			
			CV (%)	**10.78**			
			Minimum	**198.00**			
			Maximum	**242.00**			
S-48	Beryllium	093490-002	mg/kg	0.664		0.02	0.1
S-48	Beryllium	093491-002	mg/kg	0.543		0.02	0.1
S-48	Beryllium	093492-002	mg/kg	0.518		0.0196	0.0982
			Average	**0.58**			
			Std Dev	**0.08**			
			CV (%)	**13.58**			
			Minimum	**0.52**			
			Maximum	**0.66**			
S-48	Cadmium	093490-002	mg/kg	0.23		0.02	0.2
S-48	Cadmium	093491-002	mg/kg	0.302		0.02	0.2
S-48	Cadmium	093492-002	mg/kg	0.268		0.0196	0.196
			Average	**0.27**			
			Std Dev	**0.04**			
			CV (%)	**13.51**			
			Minimum	**0.23**			
			Maximum	**0.30**			
S-48	Calcium	093490-002	mg/kg	9590		6.6	20
S-48	Calcium	093491-002	mg/kg	8950		6.6	20
S-48	Calcium	093492-002	mg/kg	3830		6.48	19.6
			Average	**7456.67**			
			Std Dev	**3157.05**			
			CV (%)	**42.34**			
			Minimum	**3830.00**			
			Maximum	**9590.00**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-48	Chromium	093490-002	mg/kg	5.3		0.2	0.6
S-48	Chromium	093491-002	mg/kg	5.81		0.2	0.6
S-48	Chromium	093492-002	mg/kg	5.95		0.196	0.589
			Average	**5.69**			
			Std Dev	**0.34**			
			CV (%)	**6.02**			
			Minimum	**5.30**			
			Maximum	**5.95**			
S-48	Cobalt	093490-002	mg/kg	3.98		0.06	0.2
S-48	Cobalt	093491-002	mg/kg	3.66		0.06	0.2
S-48	Cobalt	093492-002	mg/kg	3.75		0.0589	0.196
			Average	**3.80**			
			Std Dev	**0.17**			
			CV (%)	**4.35**			
			Minimum	**3.66**			
			Maximum	**3.98**			
S-48	Copper	093490-002	mg/kg	7.12		0.066	0.2
S-48	Copper	093491-002	mg/kg	7.05		0.066	0.2
S-48	Copper	093492-002	mg/kg	6.83		0.0648	0.196
			Average	**7.00**			
			Std Dev	**0.15**			
			CV (%)	**2.16**			
			Minimum	**6.83**			
			Maximum	**7.12**			
S-48	Iron	093490-002	mg/kg	7830		6.6	20
S-48	Iron	093491-002	mg/kg	8040		6.6	20
S-48	Iron	093492-002	mg/kg	8390		6.48	19.6
			Average	**8086.67**			
			Std Dev	**282.90**			
			CV (%)	**3.50**			
			Minimum	**7830.00**			
			Maximum	**8390.00**			
S-48	Lead	093490-002	mg/kg	8.89	N	0.1	0.4

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-48	Lead	093491-002	mg/kg	9.72	N	0.1	0.4
S-48	Lead	093492-002	mg/kg	11.8	N	0.0982	0.393
			Average	**10.14**			
			Std Dev	**1.50**			
			CV (%)	**14.79**			
			Minimum	**8.89**			
			Maximum	**11.80**			
S-48	Magnesium	093490-002	mg/kg	4940		2	6
S-48	Magnesium	093491-002	mg/kg	4070		2	6
S-48	Magnesium	093492-002	mg/kg	3740		1.96	5.89
			Average	**4250.00**			
			Std Dev	**619.92**			
			CV (%)	**14.59**			
			Minimum	**3740.00**			
			Maximum	**4940.00**			
S-48	Manganese	093490-002	mg/kg	410		1	5
S-48	Manganese	093491-002	mg/kg	401		1	5
S-48	Manganese	093492-002	mg/kg	454		0.982	4.91
			Average	**421.67**			
			Std Dev	**28.36**			
			CV (%)	**6.73**			
			Minimum	**401.00**			
			Maximum	**454.00**			
S-48	Nickel	093490-002	mg/kg	7.93		0.1	0.4
S-48	Nickel	093491-002	mg/kg	5.83		0.1	0.4
S-48	Nickel	093492-002	mg/kg	5.9		0.0982	0.393
			Average	**6.55**			
			Std Dev	**1.19**			
			CV (%)	**18.20**			
			Minimum	**5.83**			
			Maximum	**7.93**			
S-48	Potassium	093490-002	mg/kg	4720		16	60
S-48	Potassium	093491-002	mg/kg	5210		16	60

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
S-48	Potassium	093492-002	mg/kg	4490		15.7	58.9
			Average	**4806.67**			
			Std Dev	**367.74**			
			CV (%)	**7.65**			
			Minimum	**4490.00**			
			Maximum	**5210.00**			
S-48	Selenium	093490-002	mg/kg	0.33	U	0.33	1
S-48	Selenium	093491-002	mg/kg	0.33	U	0.33	1
S-48	Selenium	093492-002	mg/kg	0.324	U	0.324	0.982
			Average	**0.33**			
			Std Dev	**0.00**			
			CV (%)	**1.06**			
			Minimum	**0.32**			
			Maximum	**0.33**			
S-48	Silver	093490-002	mg/kg	0.0912	U	0.0912	0.456
S-48	Silver	093491-002	mg/kg	0.0956	U	0.0956	0.478
S-48	Silver	093492-002	mg/kg	0.1	U	0.1	0.5
			Average	**0.10**			
			Std Dev	**0.00**			
			CV (%)	**4.60**			
			Minimum	**0.09**			
			Maximum	**0.10**			
S-48	Sodium	093490-002	mg/kg	396		16	50
S-48	Sodium	093491-002	mg/kg	469		16	50
S-48	Sodium	093492-002	mg/kg	408		15.7	49.1
			Average	**424.33**			
			Std Dev	**39.15**			
			CV (%)	**9.23**			
			Minimum	**396.00**			
			Maximum	**469.00**			
S-48	Thallium	093490-002	mg/kg	0.131	J	0.06	0.4
S-48	Thallium	093491-002	mg/kg	0.135	J	0.06	0.4
S-48	Thallium	093492-002	mg/kg	0.15	J	0.0589	0.393

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			Average	**0.14**			
			Std Dev	**0.01**			
			CV (%)	**7.22**			
			Minimum	**0.13**			
			Maximum	**0.15**			
S-48	Uranium	093490-002	mg/kg	0.493		0.0132	0.04
S-48	Uranium	093491-002	mg/kg	0.6		0.0132	0.04
S-48	Uranium	093492-002	mg/kg	0.498		0.013	0.0393
			Average	**0.53**			
			Std Dev	**0.06**			
			CV (%)	**11.39**			
			Minimum	**0.49**			
			Maximum	**0.60**			
S-48	Vanadium	093490-002	mg/kg	32.8	*	0.0912	0.456
S-48	Vanadium	093491-002	mg/kg	30.6	*	0.0956	0.478
S-48	Vanadium	093492-002	mg/kg	30.2	*	0.1	0.5
			Average	**31.20**			
			Std Dev	**1.40**			
			CV (%)	**4.49**			
			Minimum	**30.20**			
			Maximum	**32.80**			
S-48	Zinc	093490-002	mg/kg	33.1		0.4	2
S-48	Zinc	093491-002	mg/kg	30.9		0.4	2
S-48	Zinc	093492-002	mg/kg	32.5		0.393	1.96
			Average	**32.17**			
			Std Dev	**1.14**			

Table B-10. Non-radiological Replicate Sampling for Soil Sampling Locations at TTR, 2013

Location	Analyte	Sample Identification	Units	Result	Laboratory Data Qualifiers	Decision Level (MDL)	Detection Limit (PQL)
			CV (%)	3.54			
			Minimum	30.90			
			Maximum	33.10			

NOTES:

*** = Recovery or relative percent difference not within acceptance limits.**
CV = coefficient of variation
J = The associated value is an estimated quantity.
MDL = method detection limit
mg/kg = milligram per kilogram
N = Results associated with a spike analysis were outside control limits.
PQL = Practical quantitation limit.
Std Dev = standard deviation
U = The analyte was analyzed for but not detected.

APPENDIX C

2013 TTR WASTEWATER SAMPLING RESULTS

TABLE C-1. Sanitary Outfalls of Inorganic Analyses, June 2013

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	19-Jun-2013	094214-001	Aluminum	0.119	0.068	J	mg/L
TTR	19-Jun-2013	094214-001	Arsenic	0.0156	0.005	J	mg/L
TTR	19-Jun-2013	094214-001	Boron	0.53	0.015		mg/L
TTR	19-Jun-2013	094214-001	Cadmium		0.001	U	mg/L
TTR	19-Jun-2013	094214-001	Chromium	0.00124	0.001	J	mg/L
TTR	19-Jun-2013	094214-001	Copper	0.08	0.003		mg/L
TTR	19-Jun-2013	094214-001	Lead	0.00683	0.0033	J	mg/L
TTR	19-Jun-2013	094214-001	Molybdenum	0.0025	0.002	J	mg/L
TTR	19-Jun-2013	094214-001	Nickel		0.0015	U	mg/L
TTR	19-Jun-2013	094214-001	Selenium		0.006	U	mg/L
TTR	19-Jun-2013	094214-001	Silver		0.001	U	mg/L
TTR	19-Jun-2013	094214-001	Zinc	0.0797	0.0033		mg/L
TTR	19-Jun-2013	094214-002	Cyanide, total	0.00309	0.00167	J	mg/L
TTR	19-Jun-2013	094214-003	Solids, total suspended	54.5	4.32		mg/L
TTR	19-Jun-2013	094214-007	Phenols, Total		0.00167	U	mg/L
TTR	19-Jun-2013	094214-008	Grease and oil	4.48	1.16		mg/L
TTR	19-Jun-2013	094214-009	Grease and oil	5.43	1.15		mg/L
TTR	19-Jun-2013	094214-009	drocarbons, Total Extractable Petrc	1.56	1.15	JN	mg/L
TTR	19-Jun-2013	094214-013	Chemical Oxygen Demand	188	6.67		mg/L

NOTES:

MDL = Method detection limit

mg/L = milligrams per liter

N = Results associated with a spike analysis that was outside control limits

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

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, June 2013

Station	Date Collected	Sample ID	Analyte	Activity	Two Sigma Error	Lab Data Qualifier	MDA	Units
TTR	19-Jun-2013	094214-010	Actinium-228	1.72	16.6	U	13.1	pCi/L
TTR	19-Jun-2013	094214-010	Americium-241	-32.4	17.9	U	15.8	pCi/L
TTR	19-Jun-2013	094214-010	Beryllium-7	2.18	19.4	U	33.8	pCi/L
TTR	19-Jun-2013	094214-010	Bismuth-212	-73	59.1	U	50.1	pCi/L
TTR	19-Jun-2013	094214-010	Bismuth-214	-4.83	7.37	U	7.34	pCi/L
TTR	19-Jun-2013	094214-010	Cesium-137	1.87	2.21	U	3.62	pCi/L
TTR	19-Jun-2013	094214-010	Cobalt-60	0.023	1.74	U	3.08	pCi/L
TTR	19-Jun-2013	094214-010	Lead-212	-1.57	6	U	6.72	pCi/L
TTR	19-Jun-2013	094214-010	Lead-214	-3.7	7.73	U	8.01	pCi/L
TTR	19-Jun-2013	094214-010	Neptunium-237	-1.48	3.98	U	6.83	pCi/L
TTR	19-Jun-2013	094214-010	Potassium-40	40	38.5		29.5	pCi/L
TTR	19-Jun-2013	094214-010	Radium-223	9.34	39.8	U	69.9	pCi/L
TTR	19-Jun-2013	094214-010	Radium-224	-95.3	72.1	U	65.7	pCi/L
TTR	19-Jun-2013	094214-010	Radium-226	51.5	81.5	U	64.1	pCi/L
TTR	19-Jun-2013	094214-010	Radium-228	1.72	16.6	U	13.1	pCi/L
TTR	19-Jun-2013	094214-010	Sodium-22	0.987	1.97	U	3.49	pCi/L
TTR	19-Jun-2013	094214-010	Thorium-227	14.2	17.3	U	27.3	pCi/L
TTR	19-Jun-2013	094214-010	Thorium-231	30.5	30.3	U	38.9	pCi/L
TTR	19-Jun-2013	094214-010	Thorium-234	-143	159	U	151	pCi/L
TTR	19-Jun-2013	094214-010	Uranium-235	-4.31	19.8	U	20.2	pCi/L
TTR	19-Jun-2013	094214-010	Uranium-238	-143	159	U	151	pCi/L
TTR	19-Jun-2013	094214-011	Alpha, gross	1.3	0.747		0.959	pCi/L
TTR	19-Jun-2013	094214-011	Beta, gross	16	3.04		1.88	pCi/L
TTR	19-Jun-2013	094214-012	Tritium	-46.6	80.7	U	163	pCi/L

NOTES:

MDA = minimum detectable activity

pCi/L = picocuries per liter

U = The result is less than the MDA

TABLE C-3. Summary of Sanitary Outfalls of Semi-Volatile Organic Compounds, June 2013

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	19-Jun-2013	094214-006	1,1'-Biphenyl		3	U	ug/L
TTR	19-Jun-2013	094214-006	Acenaphthene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Acenaphthylene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Acetophenone		3	U	ug/L
TTR	19-Jun-2013	094214-006	Anthracene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Atrazine		3	U	ug/L
TTR	19-Jun-2013	094214-006	Benzaldehyde		3	U	ug/L
TTR	19-Jun-2013	094214-006	Benzo(a)anthracene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Benzo(a)pyrene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Benzo(b)fluoranthene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Benzo(ghi)perylene		0.3	*U	ug/L
TTR	19-Jun-2013	094214-006	Benzo(k)fluoranthene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Bromophenyl phenyl ether, 4-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Butylbenzyl phthalate		3	U	ug/L
TTR	19-Jun-2013	094214-006	Caprolactam		3	U	ug/L
TTR	19-Jun-2013	094214-006	Carbazole		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Chloro-3-methylphenol, 4-		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Chlorobenzenamine, 4-		3.3	U	ug/L
TTR	19-Jun-2013	094214-006	Chloroethoxy)methane, bis(2-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Chloroethyl)ether, bis(2-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Chloroisopropyl) ether, bis(2-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Chloronaphthalene, 2-		0.41	U	ug/L
TTR	19-Jun-2013	094214-006	Chlorophenol, 2-		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Chlorophenyl phenyl ether, 4-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Chrysene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Cresol, m,p-		3.7	NU	ug/L
TTR	19-Jun-2013	094214-006	Cresol, o-		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Di-n-butyl phthalate		3	U	ug/L
TTR	19-Jun-2013	094214-006	Di-n-octyl phthalate		3	U	ug/L
TTR	19-Jun-2013	094214-006	Dibenz[a,h]anthracene		0.3	*U	ug/L
TTR	19-Jun-2013	094214-006	Dibenzofuran		3	U	ug/L
TTR	19-Jun-2013	094214-006	Dichlorobenzidine, 3,3'-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Dichlorophenol, 2,4-		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Diethylphthalate		3	U	ug/L
TTR	19-Jun-2013	094214-006	Dimethylphenol, 2,4-		3	U	ug/L

TABLE C-3. Summary of Sanitary Outfalls of Semi-Volatile Organic Compounds, June 2013

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	19-Jun-2013	094214-006	Dimethylphthalate		3	U	ug/L
TTR	19-Jun-2013	094214-006	Dinitro-o-cresol		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Dinitrophenol, 2,4-		5	NU	ug/L
TTR	19-Jun-2013	094214-006	Dinitrotoluene, 2,4-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Dinitrotoluene, 2,6-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Dioxane, 1,4-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Diphenyl amine		3	U	ug/L
TTR	19-Jun-2013	094214-006	Ethylhexyl)phthalate, bis(2-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Fluoranthene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Fluorene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Hexachlorobenzene		3	U	ug/L
TTR	19-Jun-2013	094214-006	Hexachlorobutadiene		3	U	ug/L
TTR	19-Jun-2013	094214-006	Hexachlorocyclopentadiene		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Hexachloroethane		3	U	ug/L
TTR	19-Jun-2013	094214-006	Indeno(1,2,3-c,d)pyrene		0.3	*U	ug/L
TTR	19-Jun-2013	094214-006	Isophorone		3.5	U	ug/L
TTR	19-Jun-2013	094214-006	Methylnaphthalene, 2-		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Naphthalene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Nitro-benzene		3	U	ug/L
TTR	19-Jun-2013	094214-006	Nitroaniline, 2-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Nitroaniline, 3-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Nitroaniline, 4-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Nitrophenol, 2-		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Nitrophenol, 4-		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Nitrosodipropylamine, n-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Pentachlorophenol		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Phenanthrene		0.3	U	ug/L
TTR	19-Jun-2013	094214-006	Phenol		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Pyrene		0.3	U	ug/L

TABLE C-3. Summary of Sanitary Outfalls of Semi-Volatile Organic Compounds, June 2013

Station	Date Collected	Sample ID	Analyte	Result	MDL	Lab Data Qualifier	Units
TTR	19-Jun-2013	094214-006	Trichlorobenzene, 1,2,4-		3	U	ug/L
TTR	19-Jun-2013	094214-006	Trichlorophenol, 2,4,5-		3	NU	ug/L
TTR	19-Jun-2013	094214-006	Trichlorophenol, 2,4,6-		3	NU	ug/L

NOTES:

*** = Recovery or %RPD not within acceptance limits and/or spike amount not compatible with the sample or the duplicate RPS's are not applicable where the concentrations falls below the effective PQL.**
MDL = Minimum detection limit.
N = Results associated with a spike analysis that was outside control limits.
J = Estimated value, the analyte concentration fell above the effective MDL and below the effective practical quantitation limit (PQL).
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, June 2013

Station	Date Collected	Sample Identified	Analyte	Result	MDL	Laboratory Data Qualifier	Units
TTR	19-Jun-13	094214-005	Acetone	10.3	3		ug/L
TTR	19-Jun-13	094214-005	Benzene		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Bromochloromethane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Bromodichloromethane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Bromoform		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Bromomethane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Butanone, 2-		2	U	ug/L
TTR	19-Jun-13	094214-005	Carbon disulfide		1.5	U	ug/L
TTR	19-Jun-13	094214-005	Carbon tetrachloride		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Chlorobenzene		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Chloroethane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Chloroform		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Chloromethane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Cyclohexane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dibromo-3-chloropropane, 1,2-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dibromochloromethane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dibromoethane, 1,2-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichlorobenzene, 1,2-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichlorobenzene, 1,3-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichlorobenzene, 1,4-	2.72	0.3		ug/L
TTR	19-Jun-13	094214-005	Dichlorodifluoromethane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichloroethane, 1,1-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichloroethane, 1,2-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichloroethene, 1,1-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichloroethene, cis-1,2-		0.3	U	ug/L

TABLE C-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, June 2013

Station	Date Collected	Sample Identified	Analyte	Result	MDL	Laboratory Data Qualifier	Units
TTR	19-Jun-13	094214-005	Dichloroethene, trans-1,2-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichloropropane, 1,2-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichloropropene, cis-1,3-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Dichloropropene, trans-1,3-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Ethyl benzene		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Hexanone, 2-		2.2	U	ug/L
TTR	19-Jun-13	094214-005	Isopropylbenzene		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Methyl acetate		1.5	U	ug/L
TTR	19-Jun-13	094214-005	Methylcyclohexane		3	U	ug/L
TTR	19-Jun-13	094214-005	Methylene chloride		3	U	ug/L
TTR	19-Jun-13	094214-005	Pentanone, 4-methyl-, 2-		1.5	U	ug/L
TTR	19-Jun-13	094214-005	Styrene		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Tert-butyl methyl ether		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Tetrachloroethane, 1,1,2,2-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Tetrachloroethene		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Toluene		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Trichloro-1,2,2-trifluoroethane, 1,1,2-		1.5	U	ug/L
TTR	19-Jun-13	094214-005	Trichlorobenzene, 1,2,3-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Trichlorobenzene, 1,2,4-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Trichloroethane, 1,1,1-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Trichloroethane, 1,1,2-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Trichloroethene		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Trichlorofluoromethane		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Vinyl chloride		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Xylene		0.3	U	ug/L

TABLE C-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, June 2013

Station	Date Collected	Sample Identified	Analyte	Result	MDL	Laboratory Data Qualifier	Units
TTR	19-Jun-13	094214-005	Xylene, m-, p-		0.3	U	ug/L
TTR	19-Jun-13	094214-005	Xylene, o-		0.3	U	ug/L

NOTES:

MDL = Method detection limit

g/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.

APPENDIX D

KTF SAMPLING LOCATION MAPS

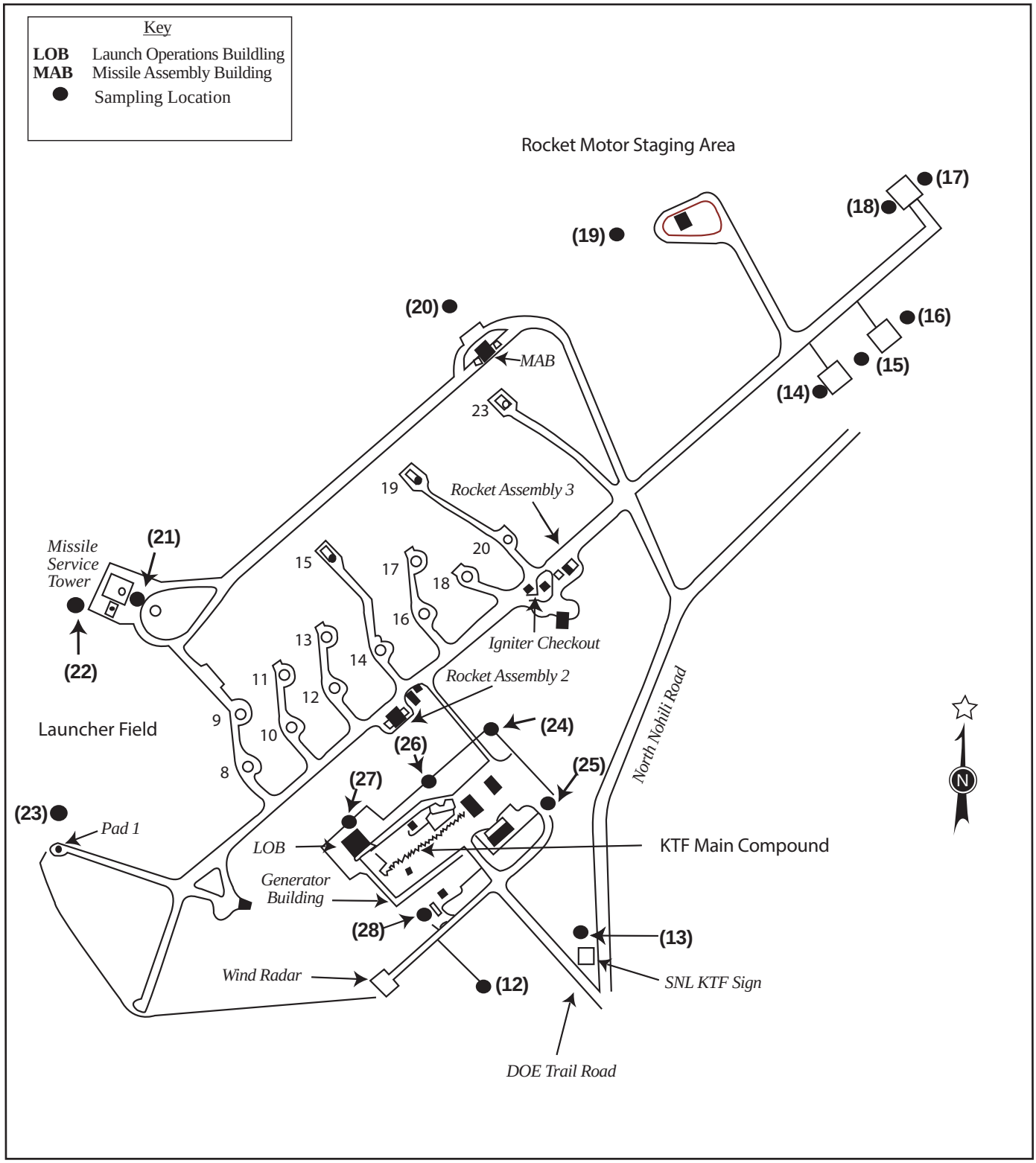

FIGURE D-1. On-site Sample Locations at the Kauai Test Facility

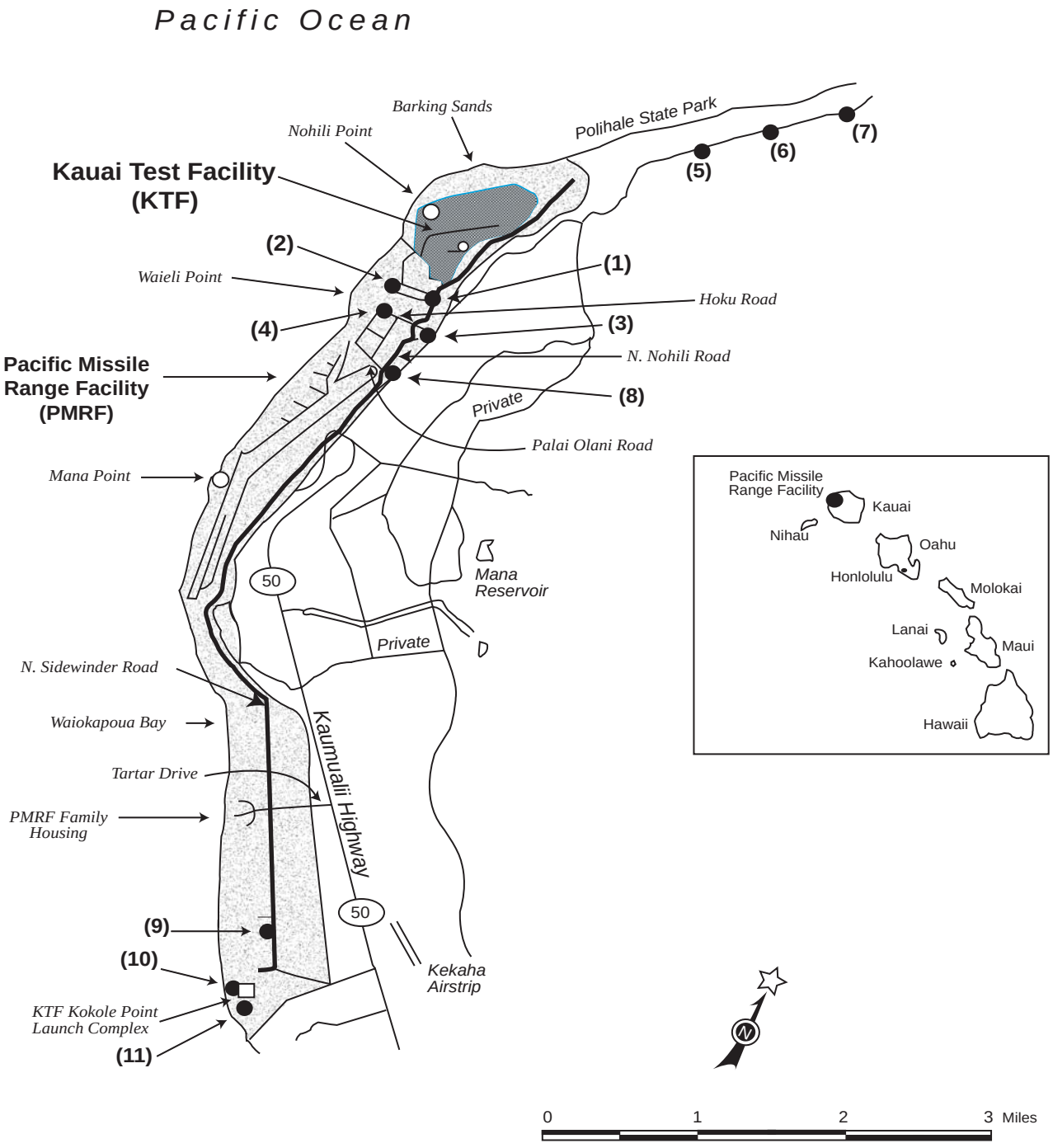

FIGURE D-2. Off-site Sampling Locations Near the Kauai Test Facility