SANDIA REPORT
SAND2008-5070P
Unlimited Release
Printed September 2008

Calendar Year 2007

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

*Snow Egret on one of the lake beds at TTR*
*Photo by: Steve Cox*

*Green Sea Turtle off Coast of Kauai.*
*Photo by Adriana Canavan*

Rebecca Sanchez, Karen Agogino, Susan Koss, Eleni Otto, and Jacqueline Orozco

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94Al85000.



Sandia National Laboratories

National Nuclear Security Administration

Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.



Available to DOE and DOE contractors from
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

Telephone: (865)576-8401
Facsimile: (865)576-5728
E-Mail: reports@adonis.osti.gov
Online ordering: http://www.osti.gov/bridge

Available to the public from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Telephone: (800) 553-6847
Facsimile: (703) 605-6900
E-Mail: orders@ntis.fedworld.gov
Online order: http://www.ntis.gov/ordering.htm

**SAND2008-5070P**
**Unlimited Release**
**Printed September 2008**

# Annual Site Environmental Report

## Tonopah Test Range, Nevada & Kauai Test Facility, Hawaii

**DOE/NNSA/SSO**
**Project Lead**
*Karen Agogino*

**SANDIA CORPORATION**
**Project Lead**
*Rebecca Sanchez*

**Team Lead, Graphic and Document Specialist**
*Susan Koss*

**Technical Editor and Graphics**
*Eleni Otto*

**Document Production Team Support**
*Jacqueline Orozco*

**Produced by:**
Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-1042

## ABSTRACT

Tonopah Test Range (TTR) in Nevada and Kauai Test Facility (KTF) in Hawaii are government-owned, contractor-operated facilities operated by Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation. The U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA), through the Sandia Site Office (SSO), in Albuquerque, NM, administers the contract and oversees contractor operations at TTR and KTF. Sandia manages and conducts operations at TTR in support of the DOE/NNSA's Weapons Ordnance Program and has operated the site since 1957. Washington Group International subcontracts to Sandia in administering most of the environmental programs at TTR. Sandia operates KTF as a rocket preparation launching and tracking facility. This Annual Site Environmental Report (ASER) summarizes data and the compliance status of the environmental protection and monitoring program at TTR and KTF through Calendar Year (CY) 2007. The compliance status of environmental regulations applicable at these sites include state and federal regulations governing air emissions, wastewater effluent, waste management, terrestrial surveillance, and Environmental Restoration (ER) cleanup activities. Sandia is responsible only for those environmental program activities related to its operations. The DOE/NNSA/Nevada Site Office (NSO) retains responsibility for the cleanup and management of ER TTR sites. Currently, there are no ER Sites at KTF. Environmental monitoring and surveillance programs are required by DOE Order 450.1, *Environmental Protection Program* (DOE 2007a) and DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting Manual* (DOE 2007).

Calendar Year 2007 Annual Site Environmental Report
Sandia National Laboratories, Tonopah Test Range, Nevada &
Kauai Test Facility, Hawaii
Final Approval date: August 2008

Work performed under Contract No. DE-ACO4-94AL85000

Prepared for:
U.S. Department of Energy, National Nuclear Security Administration
Sandia Site Office, Albuquerque, NM

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

## ACKNOWLEDGMENTS

We wish to thank the following individuals who contributed their time and expertise assisting in the production of the TTR and KTF annual reports:

*Karen Agogino*
*Brenda Bailey-White*
*Linda Bayliss*
*Joseph Bonaguidi*
*Kevin Cabble*
*Amber Cantwell*
*Christopher Catechis*
*Charlene Cunningham*
*William Forston*
*Michael du Mond*
*Tess Goering*
*Susan Gorman*
*Adrian Jones*
*Susan Koss*
*Al Lopez*
*Mark Miller*
*Lucie Mayeux*
*Jacqueline Orozco*
*Eleni Otto*
*Jennifer Payne*
*Stephanie Salinas*
*Rebecca Sanchez*
*Rebecca Ullrich*
*Katrina Wagner*

## NOTE TO THE READER

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

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

U.S. Department of Energy
National Nuclear Security Administration
Sandia Site Office
P.O. Box 5400
Albuquerque, NM 87185-5400
Attention: Karen Agogino

This page intentionally left blank.

**NOTE: Appendices are either located after Chapter 6 or on the CD that is affixed to the back cover of this document.**



**FIGURES**



**TABLES**

**ACRONYMS AND ABBREVIATIONS**

| | | |
|---|---|---|
| **A** | AEA | Atomic Energy Act |
| | ACM | Asbestos Containing Material |
| | AEC | U.S. Atomic Energy Commission |
| | AIRFA | American Indian Religious Freedom Act |
| | ARPA | Archaeological Resources Protection Act |
| | ASER | Annual Site Environmental Report |
| | AST | aboveground storage tank |
| | AQC | Air Quality Compliance |
| **B** | BLM | U.S. Bureau of Land Management |
| | BMP | Best Management Practice |
| | BSA | Bulk Storage Areas |
| **C** | CAA | Clean Air Act |
| | CAAA | Clean Air Act Amendments |
| | CAS | Corrective Action Site |
| | CAU | Corrective Action Unit |
| | CEMP | Community Environmental Monitoring Program |
| | CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| | CFR | Code of Federal Regulations |
| | COD | chemical oxygen demand |
| | CWA | Clean Water Act |
| | CY | Calendar Year |
| **D** | D&D | decontamination and demolition |
| | DMR | Discharge Monitoring Report |
| | DoD | U.S. Department of Defense |
| | DOE | U.S. Department of Energy |
| | DOE/AL | U.S. Department of Energy, Albuquerque Operations Office |
| | DRI | Desert Research Institute, Water Resource Center, University of Nevada System |
| | DU | depleted uranium |
| **E** | EA | environmental assessment |
| | EDE | effective dose equivalent |
| | EG&G | Edgerton, Gemeshausen and Grier, Inc. |
| | EHS | extremely hazardous substance |
| | EIS | environmental impact statement |
| | EM | Environmental Management (Department) |
| | EMS | Environmental Management System |
| | EO | Executive Order |
| | EPA | U.S. Environmental Protection Agency |
| | EPCRA | Emergency Planning and Community Right-to-Know Act |
| | ER | Environmental Restoration |
| | ERDA | U.S. Energy Research and Development Administration |
| | ES&H | Environment, Safety, and Health |
| | ESA | Endangered Species Act |
| **F** | FFCA | Federal Facilities Compliance Act |
| | FFACO | Federal Facilities Agreement and Consent Order |
| | FIDLER | field instrument for the detection of low-energy radiation |
| | FIFRA | Federal Insecticide, Fungicide, and Rodenticide Act |
| | FONSI | Finding of No Significant Impact |
| **H** | HAR | Hawaii Administrative Rules |
| | HQ | headquarters |

| | | |
|---|---|---|
| | HI | Hawaii |
| **I** | IDW | Investigation-Derived Waste |
| | IHIR | Industrial Hygiene Investigative Report |
| | IOC | inorganic compounds |
| | ISMS | Integrated Safety Management System |
| **J** | JTA | Joint Test Assembly |
| **K** | KTF | Kauai Test Facility |
| **L** | LDR | Land Disposal Restriction |
| | LLW | low-level waste |
| | LOB | Launch Operations Building |
| **M** | MAB | Missile Assembly Building |
| | MBTA | Migratory Bird Treaty Act |
| | MDA | minimum detectable activity |
| | MOA | Memorandum of Agreement |
| | MEI | maximally exposed individual |
| | MSDS | Material Safety Data Sheet |
| | MST | Missile Service Tower |
| | MW | mixed waste |
| **N** | NAC | Nevada Administrative Code |
| | NAEG | Nevada Applied Ecology Group |
| | NAFB | Nellis Air Force Base (Range Complex) |
| | NDEM | Nevada Division of Emergency Management |
| | NDEP | Nevada Department of Environmental Protection |
| | NEPA | National Environmental Policy Act |
| | NESHAP | National Emission Standards for Hazardous Air Pollutants |
| | NFA | No Further Action |
| | NHPA | National Historic Preservation Act |
| | NM | New Mexico |
| | NNSA | National Nuclear Security Administration |
| | NOT | Notice of Termination |
| | NPDES | National Pollutant Discharge Elimination System |
| | NPL | National Priorities List |
| | NSP | Non-covered Source Permit |
| | NSPS | New Source Performance Standard |
| | NSO | Nevada Site Office |
| | NTS | Nevada Test Site |
| | NTTR | Nevada Test and Training Range |
| | NV | Nevada |
| **O** | OEIS | Overseas Environmental Impact Statement |
| | O&M | Operations and Maintenance |
| **P** | PA | Preliminary Assessment |
| | PCB | polychlorinated biphenyl |
| | pH | Potential of Hydrogen |
| | PMRF | Pacific Missile Range Facility |
| | PMS | portable monitoring station |
| | PPE | personal protective equipment |
| | PPM | parts per million |
| | PSD | Prevention of Significant Deterioration |

| | | |
|---|---|---|
| | PVC | polyvinylchloride |
| | PWS | Public Water System |
| **Q** | QA | quality assurance |
| **R** | R&D | research and development |
| | RCRA | Resource Conservation and Recovery Act |
| | ROD | Record of Decision |
| | RQ | Reportable Quantity |
| | RY | reporting year |
| **S** | SAIC | Science Applications International Corporation |
| | SARA | Superfund Amendments and Reauthorization Act |
| | SDWA | Safe Drinking Water Act |
| | SHPO | State Historic Preservation Office |
| | SME | Subject Matter Expert |
| | SNL | Sandia National Laboratories |
| | SNL/KTF | Kauai Test Facility |
| | SNL/NM | Sandia National Laboratories, New Mexico |
| | SOC | Synthetic Organic Compounds |
| | SOP | Standard Operating Procedure |
| | SPCC | Spill Prevention, Control, and Countermeasures |
| | SSO | Sandia Site Office |
| | STARS | Strategic Targeting System |
| | SVOC | semi-volatile organic compound |
| | SWPPP | Storm Water Pollution Prevention Plan |
| **T** | TAL | toxic analyte list (metals) |
| | TLD | thermoluminescent dosimeter |
| | TQ | threshold quantity |
| | TRPH | total recoverable petroleum hydrocarbon |
| | TRI | Toxic Release Inventory |
| | TSCA | Toxic Substances Control Act |
| | TSD | treatment, storage, and disposal (facility) |
| | TTR | Tonopah Test Range |
| **U** | UDP | underground discharge points |
| | USAF | U.S. Air Force |
| | USFS | U.S. Forest Service |
| | USGS | U.S. Geological Survey |
| | USN | United States Navy |
| | UST | underground storage tank |
| | UXO | unexploded ordnance |
| **V** | VOC | volatile organic compound |
| **W** | WGI | Washington Group International |
| | WSMR | White Sands Missile Range |
| | WWII | World War 2 |

**Units of Measure**

| | | | |
|---|---|---|---|
| ºC | degree Celsius | m | meter |
| cm | centimeter | $m^2$ | square meter |
| ºF | degree Fahrenheit | $m^3$ | cubic meter |
| ft | feet | mg | milligram |
| g | gram | mi | mile |
| in | inch | ppm | parts per million |
| km | kilometer | yd | yard |
| kg | kilogram | $yd^3$ | cubic yard |
| yr | year | lb | p o u n d |
| Std Dev | standard deviation | | |

**Radioactivity Measurements**

| | | | |
|---|---|---|---|
| Ci | curie (unit of radioactivity) | pCi/g | picocurie per gram |
| mrem | millirem (unit of radiation dose) | rem | roentgen equivalent man (unit of radiation dose) |
| mrem/yr | millirem per year | | |
| mR/yr | milliroentgen per year | mSv | millisievert (unit of radiation dose) |
| pCi | picocurie | µg/$m^2$ | microgram per square meter |
| µR/hr | microroentgen per hour | µg/g | microgram per gram |

**Chemical Abbreviations**

| | | | |
|---|---|---|---|
| Am-241 | americium-241 | Cs-137 | cesium-137 |
| Pu-238 | plutonium-238 | Pu-239 | plutonium-239 |
| Pu-240 | plutonium-240 | $U_{tot}$ | uranium, total |

**Approximate Conversion Factors for Selected SI (Metric) Units**

| Multiply Si (metric) unit | by | To obtain U.S. customary unit |
|---|---|---|
| Celsius (ºC) | [°F] = [°C] × 9⁄5 + 32 | Fahrenheit (ºF) |
| centimeter (cm) | 0.39 | inch (in.) |
| cubic meter ($m^3$) | 35 | cubic feet ($ft^3$) |
| gram (g) | 0.035 | ounce (oz) |
| hectare (ha) | 2.5 | acre |
| kilogram (kg) | 2.2 | pound (lb) |
| kilometer (km) | 0.62 | mile (mi) |
| liter (L) | 0.26 | gallon (gal) |
| meter (m) | 3.3 | feet (ft) |
| milligram per liter (mg/L) | 1 | parts per million (ppm) |
| microgram per gram (mg/g) | 1 | parts per million (ppm) |
| square kilometer ($km^2$) | 0.39 | square mile ($mi^2$) |

This page intentionally left blank.

# TTR & KTF

# EXECUTIVE SUMMARY

*"Pronghorn at TTR" 2007 Photo Contest, photo by Steve Cox.*

**Tonopah Test Range (TTR)**
**Environmental Programs:**

Waste Management
Environmental Restoration (ER) Project
Terrestrial Surveillance
Water Quality Monitoring
Air Quality Compliance (AQC)
National Environmental Policy Act
(NEPA) Activities

**Kauai Test Facility (KTF)**
**Environmental Programs:**

National Environmental Policy Act
(NEPA) Activities
Water Quality / Waste Water Monitoring
Air Quality / Emissions Monitoring
Terrestrial Surveillance

Sandia Corporation (Sandia) is a wholly owned subsidiary of Lockheed Martin Corporation. The Tonopah Test Range (TTR) in Nevada and the Kauai Test Facility (KTF) in Hawaii are owned by the U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA). Both sites are contractor-operated by Sandia. The DOE/NNSA/Sandia Site Office (SSO) in Albuquerque, New Mexico executes the DOE/NNSA direction.

This Annual Site Environmental Report (ASER) is prepared in accordance with the following DOE orders that pertain to environmental protection and management:

- DOE Order 450.1, *Environmental Protection Program* (DOE 2005);
- DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting* (DOE 2007);
- DOE Manual 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003);
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001);
- DOE Order 5400.5, Chg 2, *Radiation Protection of the Public and the Environment* (DOE 1993), and

This ASER summarizes data from environmental protection and monitoring programs at TTR and KTF for Calendar Year (CY) 2007. It also covers Sandia's compliance with environmental statutes, regulations, and permit provisions, and highlights other significant environmental programs and efforts at TTR and KTF. This report is a key component of Sandia's and DOE's efforts to keep the public informed about environmental conditions throughout the DOE/NNSA complex.

## ***TTR***

Sandia conducts operations at TTR in support of the DOE/NNSA's Weapons Ordnance Program. Sandia's activities involve research and development 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 two reportable occurrences at TTR in 2007 (see Chapter 2 for further details):

- Coliform contamination in the drinking water faucet.
- Deaths of 71 wild horses July 2007 from a herd that frequently drank from a man-made depression on a dry lake bed controlled by Sandia. Sampling was conducted in February of 2008, and a report is expected in 2008.

### *Environmental Programs*

The following environmental programs are in place at TTR:

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

### *Waste Management*

Waste generated during 2007 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.

### *ER Project*

ER activities at TTR are conducted through the DOE/NNSA/Nevada Site Office (NSO). ER sites that are scheduled for remediation, or that have been closed at TTR, include areas impacted from target tests and detonations, including non-impacted surface debris and areas impacted by ordnance, depleted uranium, and heavy metals.

### *Terrestrial Surveillance*

Soil is the only terrestrial medium sampled at TTR. Samples are collected to detect air-deposited pollutants or contaminants transported and deposited as a result of surface water runoff. During 2007, soil samples were collected from 16 off-site, 10 perimeter, and 27 on-site locations.

In 2007, soils were analyzed for radiological constituents. The results showed no anomalies that required further investigation.

Non-radiological monitoring of soil samples is historically monitored every 3 to 5 years, and was not conducted during 2007. A summary report for non-radiological constituents collected between 1994 and 2005 was prepared, analyzed, and published in a summary report (SNL 2006). The results showed no anomalies that required further investigation.

In the future, routine sampling for non-radiological parameters at fixed locations will be reduced, and more emphasis placed on sampling specific areas of interest with potential environmental impact. However, the total number of samples collected annually should remain approximately the same.

The next sampling for Non-radiological constituents is scheduled for 2008

***Water Quality Monitoring***

Wastewater monitoring results confirmed that all permit conditions set by the State of Nevada were met in 2007. There were no permit violations in 2007 with respect to wastewater discharges.

The public water system (PWS) at TTR is registered with the Nevada Department of Environmental Protection (NDEP) as a non-transient, non-community water system under the identification number NV003014. Production Well 6 supplies potable water for TTR's potable water and fire water distribution systems. The well water is routinely sampled and analyzed per the requirements of the NDEP to demonstrate conformance with primary drinking water standards.

There were two Drinking Water Public Notices issued to Area 3 personnel during 2007. The first was due to low residual chlorine levels in the water coming into the compound from the U. S. Air Force (USAF) PWS. The second incident, a sink faucet in the breakroom of a normal sample location became contaminated with total coliform bacteria.

In 2007, all other analytes were below the maximum contaminant levels (MCLs) with the exception of Di (2-Ethylhexyl) Phthalate. The well water will continue to be monitored quarterly for Di (2-Ethylhexyl) Phthalate until it is undetected in two consecutive quarterly samples. In 2007, all secondary contaminant sample results were within the State of Nevada's defined MCL with the exception of iron and potential of hydrogen (pH) (see Chapter 4, Section 4.2.1). A carbon dioxide gas injection system is being installed to reduce the pH of the supply water to improve the efficiency of the arsenic removal system. For the majority of 2007, the potable water at TTR has been supplied by the USAF through an interconnect between the two water systems.

***Air Quality Compliance***

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

TTR's Class II Air Quality Permit requires emission reports from significant non-radionuclide sources. At TTR, these sources include the screening plant, portable screen, and maintenance shop activities. Maintenance shop activities at TTR include the paint shop, welding shop and carpentry shops. In 2007, there were emissions from the portable screen and activities at the maintenance shop. The portable screen was operated for 27.5 hours during CY 2007, and contributed 1.9 tons of particulate matter (PM) emissions. The maintenance shop activities operated for 10 hours or less during CY 2007 and contributed less than 0.01 tons of emissions (PM, hazardous air pollutants [HAPS] and volatile organic compounds [VOCs]).

***NEPA***

At TTR, NEPA compliance is coordinated between Sandia and DOE/NNSA/SSO. A total of four TTR NEPA reviews were processed during 2007. Two NEPA reviews were completed by Sandia National Laboratories New Mexico (SNL/NM). Two NEPA checklists were submitted to DOE/NNSA/SSO for review.

TTR is under evaluation in the DOE Draft Complex Transformation Supplemental Programmatic Environmental Impact Statement (Draft Complex

Transformation SPEIS; formerly Complex 2030 SEIS) (DOE/EIS-0236-S4) that will outline a plan to establish a smaller, more efficient nuclear weapons complex able to respond to future challenges.

***KTF***

KTF is operated by Sandia as a rocket preparation, launching, and tracking facility for DOE/NNSA, as well as providing support of other U.S. military agencies. KTF exists as a facility within the boundaries of the U.S. Department of Defense (DoD) Pacific Missile Range Facility (PMRF). KTF is located on the island of Kauai at the north end of the PMRF near Nohili Point; it has been used as an active rocket launching facility since 1962.

The EPA recommended continued reevaluation for environmental contamination due to the launching facility. Rocket exhaust continues to be the main source of metals and other non-reportable air emission releases.

There were no reportable occurrences at KTF in 2007.

***Environmental Programs***

The following environmental programs are in place at KTF:

- NEPA
- Water quality monitoring
- Air Emission Monitoring
- Terrestrial surveillance (every five years at the KTF location).

***NEPA***

The DOE/NNSA/SSO coordinates NEPA compliance at KTF with SNL/NM personnel. In 2005, a DOE/NNSA/SSO NEPA determination was made to review and update the Site-Wide Environmental Assessment (EA) for KTF. During 2006, the U.S. Navy initiated preparation of the Draft Environmental Impact Statement (EIS), Overseas Environmental Impact Statement (OEIS) for the Hawaii Range Complex. During 2007, the U.S. Navy continued preparation of the EIS/OEIS. The environmental impact analysis for KTF will be included in this EIS.

There were five NEPA reviews for KTF submitted to DOE/NNSA/SSO in 2007.

***Water Quality Monitoring***

There were no compliance issues with respect to any state or federal water pollution regulations in 2007 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 2007. As a best management practice (BMP), Sandia periodically performs sampling. No contaminants were identified above the reporting limits from past sampling events.

The EPA has concerns with storm water runoff washing off the launcher pads and discharging to the ocean. Some of the downstream pathways include habitat for several federally designated endangered or threatened species. The EPA has therefore recommended periodic evaluations for environmental contamination.

***Air Emissions Monitoring***

Sandia was in compliance with all air quality regulations in 2007. The State of Hawaii requires an Annual Fee and Monitoring Report for air emissions. The report for 2007 was submitted to the State of Hawaii on February 5, 2008 (SNL 2007).

In 2007, the total fuel usage from activities that was reported to the State of Hawaii was 16,440 gallons (gal) of diesel fuel. The total hours of operation for the permitted generators was 1,590 hours combined. Rocket launches at the site were within acceptable limits.

***Terrestrial Surveillance***

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

chapter one

# TTR INTRODUCTION

*"Fence Lizard" 2007 Photo Contest, photo by Steve Cox.*

**In This Chapter...**

Tonopah Test Range (TTR)
History and Operations
Site Description and Demographics
Regional Geology, Hydrology, Climate, and Fauna
Clean Slate and Double Track Sites

**Environmental Snapshot**

*The climate at TTR is typical of high desert, mid-latitude locations with large diurnal and seasonal changes in temperature and little total rainfall. Temperature extremes on the test range vary from a high near 40 ºC (104 ºF) in summer, to lows approaching -30 ºC (-22 ºF) in winter.*

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

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

This Annual Site Environmental Report (ASER) is prepared in accordance with the following DOE orders that pertain to environmental protection and management:

- DOE Order 450.1, *Environmental Protection Program* (DOE 2007)
- DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting* (DOE 2007)
- DOE Manual 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003)
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001)
- DOE Order 5400.5, Chg 2, *Radiation Protection of the Public and the Environment* (DOE 1993)

This ASER summarizes data from environmental protection and monitoring programs at TTR for 2007. It also discusses Sandia's compliance with environmental statutes, regulations, permit provisions and other significant environmental activities. Environmental programs includes:

- waste management
- air, water, and terrestrial monitoring and surveillance
- Environmental Restoration (ER) Project; and
- National Environmental Policy Act (NEPA).

DOE Order 450.1 specifies the requirements for environmental monitoring conducted at and around the TTR site. This ASER is an important component of the DOE's and Sandia's efforts to keep the public informed about environmental conditions at DOE/NNSA facilities.

Sandia's strategy for managing and implementing its Environment, Safety, and Health (ES&H) Program is described in the Integrated Safety Management System (ISMS). The ISMS is structured around five safety management functions and provides processes to guide line management in identifying and controlling hazards. Sandia is utilizing an Environmental Management System (EMS) as an enhancement of the ISMS. The EMS is that part of the ISMS that addresses the environmental consequences of Sandia National Laboratories New Mexico (SNL/NM's) activities, products, and services. In 2007, SNL/NM continued working to improve environmental management (EM) based on best management practices (BMPs), bench marking, and process improvements. On December 2, 2005, Sandia informed the DOE/NNSA/SSO that it had fully implemented an EMS in accordance with the requirements outlined in DOE Order 450.1.

## *1.1 TTR HISTORY AND OPERATIONS*

In 1940, President Franklin Delano Roosevelt established the Las Vegas Bombing and Gunnery Range (now referred to as NTTR), which is part of the Nellis Air Force Base (NAFB) Complex. The NAFB Complex, located eight miles north of Las Vegas, Nevada, includes several auxiliary small arms ranges and the NTTR, which is divided into the North Range and the South Range (Figure 1-1). The Nevada Test Site (NTS) is located between these two ranges. The entire NAFB Complex is comprised of approximately three million acres. TTR is located 32 miles southeast of Tonopah, Nevada.

### *TTR Site Characteristics*

The topography at TTR is characterized by a broad, flat valley bordered by two north and south trending mountain ranges: the Cactus Range to the west (occurring mostly within the boundaries of TTR) and the Kawich Range to the east. Cactus Flat is the valley floor where the main operational area of TTR is located. An area of low hills outcrops in the south. Elevations range from 5,347 feet at the valley floor to 7,482 feet at Cactus Peak. The elevation of the town of Tonopah is 6,030 feet.

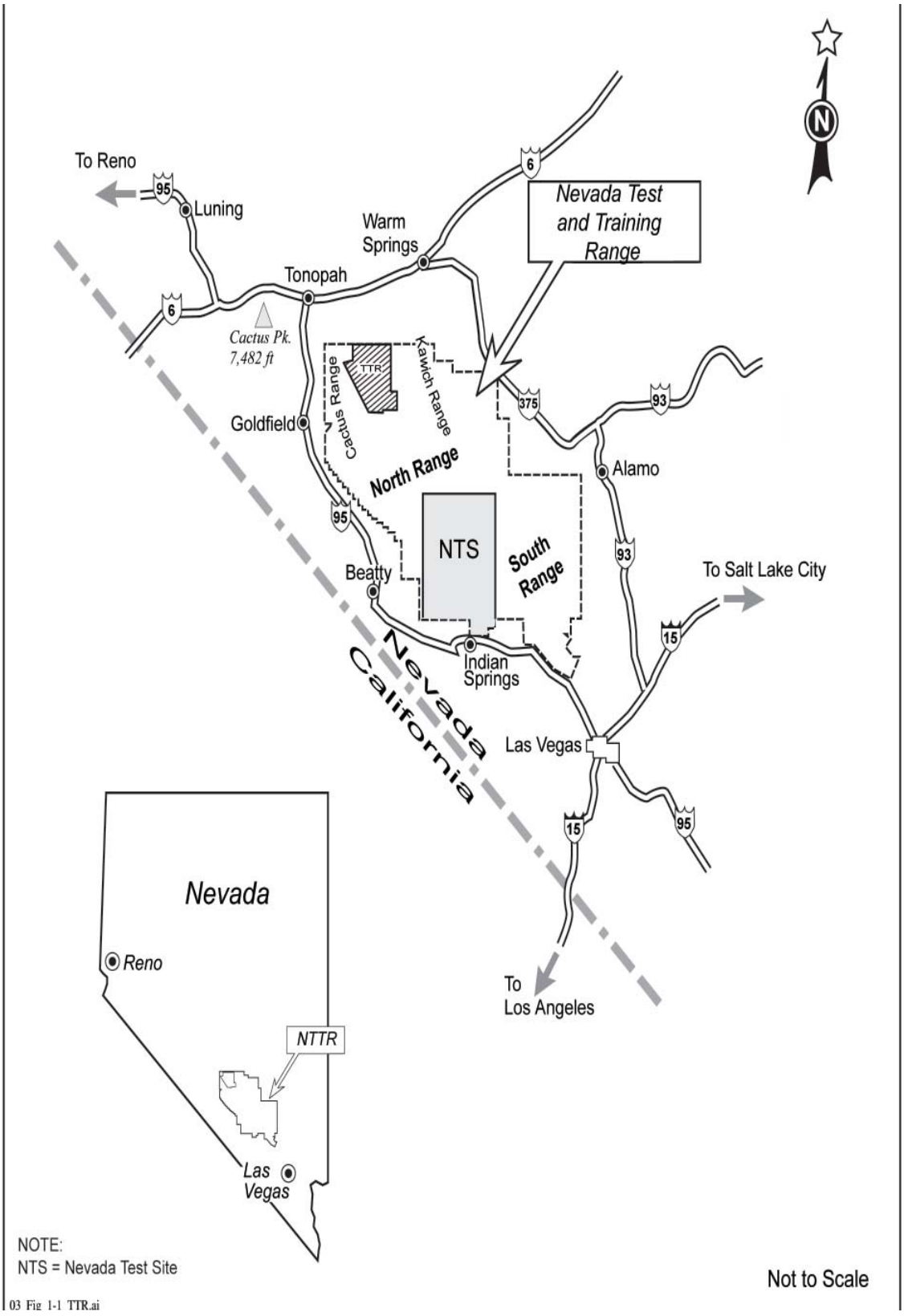



**FIGURE 1-1.** Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada.

***TTR Site Selection***

TTR was selected as a test range after similar facilities at Salton Sea Test Base in California, as well as Yucca Flat on the NTS, became inadequate. By the mid-1950s, the atmosphere at Salton Sea Test Base became permeated with haze, which limited visibility and hampered photography. Nevada's Yucca Flat site also became inadequate due to the increasing emphasis on low-altitude approaches and deliveries that required flat terrain and a long approach corridor. The TTR site was located in the northwest corner of the (then) Las Vegas Bombing and Gunnery Range. The site, which was approximately seven times the size of Salton Sea Test Base, was well suited because it had immense areas of flat terrain needed for the increasing use of rockets and low-altitude, high-speed aircraft operations. A permit from the U.S.A.F. was obtained in 1956, and TTR became operational to test new weapon systems in 1957. Following World War II, 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.

***Operations Control Center***

The Main Compound in Area 3 is the heart of test range activities. The Operations Control Center controls and coordinates all test functions and affords a 360 degree view of the site. During test operations, the test director, range safety officer, test project engineer, camera controller, and range communicator operate the consoles in the Operations Control Center to control and coordinate all test functions.

***TTR Activities***

Principal DOE activities at TTR include stockpile reliability testing; research and development (R&D) testing support for structural development; arming, fusing, and firing systems testing; and testing nuclear weapon delivery systems. No nuclear devices are tested at TTR.

TTR is instrumented with a wide array of signal tracking equipment that includes video; high-speed cameras; radar tracking devices used to characterize ballistics, aerodynamics, and parachute performance on artillery shells; bomb drops; missiles; and rockets.

In recent years, specific test activities at TTR have consisted of the following:

- Air drops (trajectory studies of simulated weapons)
- Gun firings
- Ground-launched rockets (study of aeroballistics and material properties)
- Air-launched rockets (deployed from aircraft)
- Explosive testing (e.g., shipping and storage containers)
- Static rocket tests (related to the Trident Submarine Program)
- Ground penetrator tests

These activities require a remote range for both public safety and to maintain national security. The majority of test activities at TTR occur within Cactus Flat, a valley with almost no topographical relief flanked by mountains and hills.

***Site Responsibility***

On October 1, 1997, a Memorandum of Agreement (MOA) was signed between DOE/NNSA/SSO and the DOE/NNSA, Nevada Site Office (NSO) regarding operational test activities at TTR (DOE 1994). It was determined that DOE/NNSA/SSO is responsible for the oversight of TTR; however, DOE/NNSA/NSO will continue oversight of ER activities at TTR. Environmental program management, as discussed in this ASER, is a joint effort between TTR and SNL/NM employees and contractors, with oversight from DOE/NNSA/SSO. In April 2002, a Land Use Permit was signed between the USAF and NNSA entitled, "Department of the Air Force Permit to the National Nuclear Security Administration To Use Property Located On The Nevada Test and Training Range, Nevada" (USAF/DOE/NNSA 2002). The current size of TTR is now approximately 280 square miles (179,200 acres). Prior to the April 2002 lease agreement, the footprint was 335,655 acres.

## *1.2 SITE DESCRIPTION AND DEMOGRAPHICS*

TTR is located within the NTTR at its northern boundary. The area north of the TTR boundary is comprised of sparsely populated public lands jointly administered by the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). The land is currently used to graze cattle.

There also is a substantial irrigated farming operation north of the range. To the east of TTR, and within the NTTR, is the Nevada Wild Horse Range, which is administered by BLM.

The nearest residents are located in the town of Goldfield (population 659), approximately 22 miles west of the site boundary. The town of Tonopah (population 4,400) is approximately 30 miles northwest of the site (DOC 2008). Las Vegas is 140 miles southeast of TTR. The total population within the 50 mile radius around TTR is approximately 7,000, which includes the potential population at TTR if all housing units at the site were occupied.

## *1.3 REGIONAL GEOLOGY, HYDROLOGY, CLIMATE, AND FAUNA*

### Geology

The regional area around TTR is located in the western part of the Basin and Range geophysical province. This area is marked by horst and graben topography, a system of mountains and down-dropped fault valleys formed through regional extension. TTR lies northeast of the Walker Lane, a zone of transcurrent faulting and shear, and the Las Vegas Valley shear zone to the southeast (Sinnock 1982).

The Cactus Range to the west of TTR is the remnants of a major volcanic center consisting of relatively young (six-million year old) folded and faulted tertiary volcanics. This range is one of at least five northwest trending, raised structural blocks that lie along the Las Vegas Valley/Walker Lane lineaments (ERDA 1975).

### *Surface Water*

Drainage patterns within and near TTR are intermittent (ephemeral stream channels) and end in closed basins. Ephemeral streams occasionally carry spring runoff to the center of Cactus Flat where there is a string of north-south trending dry lakebeds; however, due to the high rate of evaporation, little is recharged to the groundwater (DRI 1991).

There are several small springs within the Cactus and Kawich Ranges. Three occur within TTR's boundaries: Cactus Springs, Antelope Springs, and Silverbow Springs. Water from these springs does not travel more than several tens of meters before it dissipates through evaporation and infiltration. The effect on the landscape is purely local.

### *Groundwater*

TTR obtains its water from local wells. The U.S. Geological Survey (USGS) has recorded groundwater depths from 21 to 454 feet at the site. Groundwater is encountered at the Antelope Mine well in the Cactus Range at 21 feet and at the EH2 well near the TTR Airport at 454 feet. The depth to groundwater at the Area 9 well, located at the north end of the site, is approximately 131 feet. South of the Area 9 well, groundwater is encountered at 361 to 394 feet in Area 3. The static water level at the main water supply well (Well 6) is approximately 350 feet.

### *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 40º C (104º F) in summer, with lows approaching -30º C (-22º F) in winter. July and August are the hottest months with highs generally between 32º to 37º C (90sº F) during the day and dropping to between 10º and 15º C (50sº F) at night. January conditions vary from highs of 5º to 10º C (40sº F) to lows -7º to -11º C (teensº F). An eight year climatology developed from data taken in the 1960s identified the record high of 38.8º C (102º F) with a record low of -31º C (-24º F) (Schaeffer 1970).

Rainfall, though sparse, is dependent on elevation. Annual average rainfall in the desert valley floor is 4 inches, while in nearby mountains as much as 12 inches falls (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 6.7 m/s (15 miles an hour). During the spring and fall, a diurnal cycle to the wind may occur, bringing northwest drainage winds for a time in the earlier hours, and shifting to southerly winds by afternoon.

### *Vegetation*

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

TTR's vegetation is divided into two basic types by elevation: salt desert shrub in low areas and northern desert shrub at high elevations (USAF 1999, DRI 1991). Salt desert shrub is characteristic of poorly drained soils and common along dry lakebeds. Specific plants in this group include shadescale (*Atriplex confertilfolia*), Russian thistle (*Salsola kali*), and sagebrush (*Artemesia tridentata*). Northern desert shrub, found in the Cactus Range, includes a variety of sagebrush, rabbitbrush (*Chrysothamnus nauseosus*), squirrel tail (*Elymus longifolius*), juniper (*Juniperus spp.*), and Nevada bluegrass (*Poa nevadensis*). Joshua tree (*Yucca brevifolia*) and juniper grow in the transition zone at the base of the mountains.

***Wildlife***

The Nevada Wild Horse Range, and other wild horse land-use areas, compose a significant portion of the North Range with herds common in Cactus and Gold Flats, Kawich Valley, Goldfield Hills, and the Stonewall Mountains. Hundreds of wild horses (*Equus caballus*) graze freely throughout TTR, and activities on-site have had little affect on the horse population or their grazing habits. The BLM routinely rounds up a portion of the herds for auction through the Wild Horse and Burro Adoption Program.

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

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

## *1.4 CLEAN SLATE AND DOUBLE TRACK SITES*

In May and June 1963, Project Roller Coaster conducted a series of four nuclear weapons destruction tests that resulted in plutonium dispersal in surrounding soils. Three of these tests were conducted within the boundaries of TTR, the fourth was conducted on the NTTR just west of TTR. The three Project Roller Coaster test sites at TTR are referred to as Clean Slates 1, 2, and 3 (Figure 1-2). The fourth test site at NTTR is referred to as Double Tracks. In 1996, Double Tracks was closed after

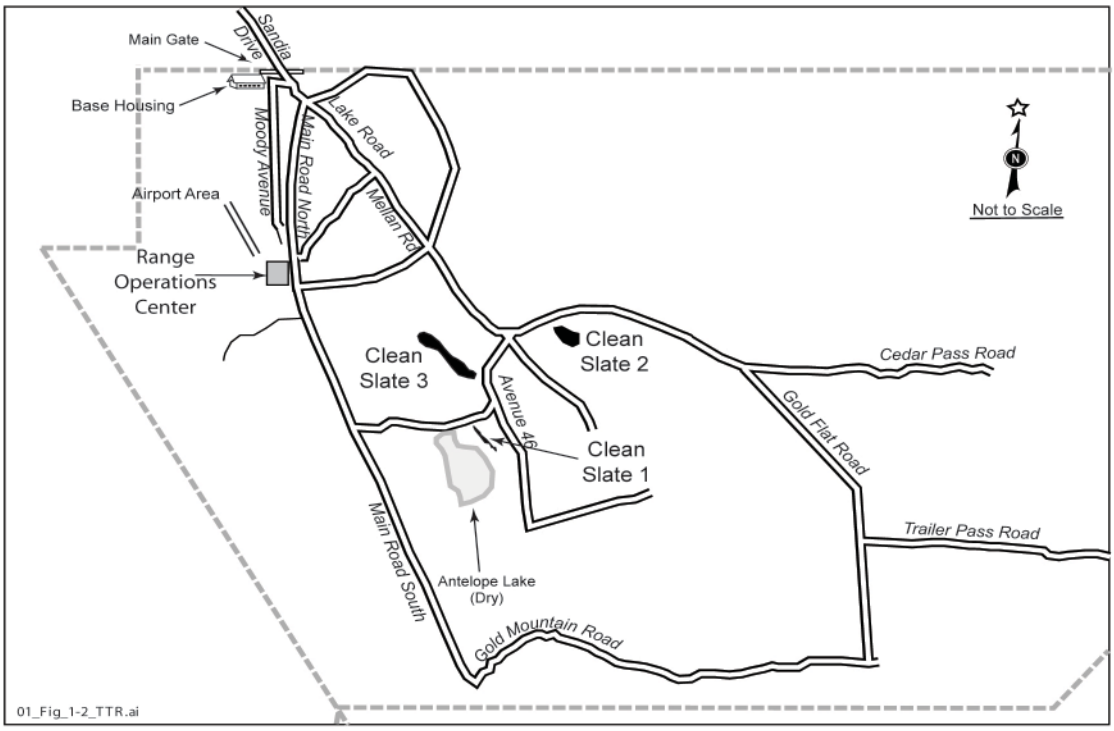



**FIGURE 1-2.** Location of Facilities Operated by SNL/NSO at TTR

**TABLE 1-1.** Project Roller Coaster Test Information

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

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

soil contamination was remediated to a level of less than or equal to 200 picocuries per gram (pCi/g) of transuranics.

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

The initial cleanup of each Clean Slate site was conducted shortly after each test. Test-related debris was bladed into a hole at test ground zero and backfilled. An initial fence was built around each test area where the soil contamination was set at approximately 1,000 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. Soil sampling is conducted periodically at these sites, and the areas are visually inspected twice a year to determine whether any fence repairs are required. Any horses that may wander inside the fenced areas are promptly relocated.

In 1977, an aerial radiological survey was performed by EG&G, Inc. for the Nevada Applied Ecology Group (NAEG) (EG&G 1995). The aerial radiological surveys were undertaken to supplement the FIDLER and previous soil sample measurements of transuranics. The objective was to determine the extent of surficial distribution of plutonium and

*Antelope Dry Lake Bed at TTR*
*Photo by Jennifer Payne*

other transuranic elements dispersed during Project Roller Coaster tests. Radiation isopleths showing soil activity due to americium-241 (Am-241), plutonium-239 (Pu-239), and plutonium-240 (Pu-240) were drawn for each area. The cumulative area of the diffuse sources, as determined by the aerial radiological survey, is 20 million square meters (approximately 4900 acres). The results of the survey found transuranic contamination outside the fenced area in the downwind direction (EG&G 1995).

***Air Monitoring at ER sites***

Remediation activities were conducted at Clean Slate 1 in 1997. The Desert Research Institute (DRI) collected air monitoring data from several locations in the vicinity of Clean Slate 1 before, during, and after remediation activities. The data has been presented to DOE/NNSA/NSO in the form of a draft report (DRI 1997). The report documented the as-left condition at the site, but does not require follow-up action. DOE/NNSA/NSO suspended air monitoring in April 2000 and will not resume until active remediation efforts at the Clean Slate sites begin again.

*"Vista at TTR" Photo by staff.*

chapter two

# TTR COMPLIANCE SUMMARY

*"Protecting the Herd" 2007 Photo Contest, photo by Steven Feador.*

**In This Chapter...**



**Environmental Snapshot**

*Chemical pesticides used at TTR include herbicides, rodenticides, and insecticides. All chemicals used are Environmental Protection Agency (EPA) approved, and applied in accordance with applicable label guidelines and regulations.*

Sandia Corporation (Sandia) is responsible for environment, safety, and health (ES&H) compliance with federal environmental statutes, regulations, Executive Orders (EOs), and U.S. Department of Energy (DOE) orders applicable to Tonopah Test Range (TTR).

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 2007 are also presented in this chapter.

The State of Nevada administers most environmental regulations applicable to 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, EOs, and DOE orders that pertain to the environment.

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

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

CERCLA defines assessment activities and reporting requirements for inactive waste sites at federal facilities. As required by CERCLA, a Preliminary Assessment (PA) was submitted in 1988 for all facilities listed on the federal agency hazardous waste compliance docket. Sites with significant contamination were put on the National Priorities List (NPL) for cleanup (EPA 2008). 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 2007. Table 2-1 lists SARA Title III reporting requirements.

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

SARA Title III (also known as EPCRA) requires the submittal of a Toxic Release Inventory (TRI) report for chemical releases over a given threshold quantity (TQ). The release reporting limit for lead is 100 pounds (lb). The TTR Firing Range released approximately 1,433 lbs of non-recovered lead in 2007. This information will be reported in the Reporting Year (RY) 2007 TRI Report (to be published in 2008).

### *2.1.3 Resource Conservation and Recovery Act (RCRA)*

Under the RCRA Hazardous Waste Permit Program (40 Code of Federal Regulations [CFR] 270), TTR is permitted as a "small quantity generator." 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. At TTR, hazardous waste shipments are scheduled to occur at least two to three times a year.

Sanitary solid waste, which is also regulated under RCRA, is disposed of at landfills on-site. There is one Class II sanitary landfill in operation at TTR operated by the U.S. Air Force (USAF) Operations and Maintenance contractor. The landfill is used cooperatively by all organizations at TTR. In November 2007 a contract was obtained with the Republic Services landfill located at Apex just north of Las Vegas to dispose of bulk non-regulated solid waste there. The main purpose for obtaining this contract is clean-up of the Area 3 Salvage Yard. This waste material is not being disposed of in the USAF Landfill on Range due to volume restrictions. This is a part of the SNL Unneeded Materials effort.

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

RCRA, Subchapter I (40 CFR 280) sets forth requirements for USTs that contain hazardous materials or petroleum products. 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,

**Major Environmental Regulations & Statutes Applicable to TTR**

**Clean Air Act (CAA) and CAA Amendments (CAAA )**

Provides health standards to protect the nation's air quality. http://www.epa.gov/oar/oaq_caa.html

**Clean Water Act (CWA)**

Provides general water quality standards to protect the nation's water sources and byways. http://www.epa.gov/region09/water/

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

Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances. http://www.epa.gov//lawsregs/laws/cercla.html

**Cultural Resources Acts**

Cultural resources acts - Includes various acts that protect archeological, historical, religious sites, and resources. http://recreation.usgs.gov/env_guide/cultural.html

**Endangered Species Act (ESA)**

Provides special protection status for federally listed endangered or threatened species. http://www.epa.gov//lawsregs/laws/esa.html

**Executive Orders (EOs)**

Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and that promote greening the government through leadership in environmental management. http://www.archives.gov/federal_register/executive_orders/disposition.html

**Federal Facility Compliance Act (FFCA)**

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

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

Controls the distribution and use of various pesticides. http://www.epa.gov//lawsregs/laws/fifra.html

**Migratory Bird Treaty Act (MBTA) of 1918**

Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests. http://tis.eh.doe.gov/oepa/laws/mbta.html

**National Emission Standards for Hazardous Air Pollutants (NESHAP)**

Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA. http://www.epa.gov/radiation/neshaps/

**National Environmental Policy Act (NEPA)**

Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making. http://tis.eh.doe.gov/NEPA/

**Resource Conservation and Recovery Act (RCRA)**

Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (USTs). http://www.epa.gov//lawsregs/laws/rcra.html

**Safe Drinking Water Act (SDWA)**

Provides specific health standards for drinking water sources. http://www.epa.gov/safewater/sdwa/sdwa.html

**Superfund Amendments and Reauthorization Act (SARA)**

SARA,Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates comunication standards for hazardous materials over a threshold amount that are stored or used in a community. http://www.epa.gov//lawsregs/laws/epcra.html

**Toxic Substance Control Act (TSCA)**

Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs). http://www.epa.gov/compliance/civil/tsca/index.html

**TABLE 2-1.** 2007 SARA Title III (or EPCRA) Reporting Requirements Applicable to TTR

| Section | SARA Title III Section Title | Requires Reporting? | | Description |
|---|---|---|---|---|
| | | Yes | No | |
| **302–303** | Emergency Planning | X | | Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/SSO, which distributes it to the required entities. |
| **304** | Emergency Notification | | X | No RQ releases of an EHS, or as defined under CERCLA, occurred in 2007. |
| **311-312** | Hazardous Chemical Storage Reporting Requirements | X | | There are two "Community Right-to-Know" reporting requirements: (a) SNL/NM completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) TTR provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA's alternative MSDS reporting, which is detailed in 40 CFR Part 370.21. |
| **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 2007, a report was submitted for lead. |

**NOTES:**
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
DOE = U.S. Department of Energy
SSO = Sandia Site Office
EHS = extremely hazardous substance
bs = pounds
SARA = Superfund Amendments and Reauthorization Act
EPCRA = Emergency Planning and Community Right-to-Know Act
NNSA = National Nuclear Security Administration
CFR = Code of Federal Regulations
EPA = U.S. Environmental Protection Agency
TRI = Toxic Release Inventory
RQ = reportable quantity

and one diesel tank that had supplied generator fuel in Area 9. There are no ASTs requiring registration with the State of Nevada at TTR.

### *2.1.4 Federal Facility Compliance Act (FFCA)*

The FFCA amendments to RCRA specifically address Land Disposal Restriction (LDR) requirements for the treatment of mixed waste (MW) at federal facilities. Since TTR does not generate MW and currently has no MW stored on-site, this statute is not applicable to Sandia's operations at TTR.

### *2.1.5 Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990*

CAA and CAAA of 1990 requirements are regulated by State of Nevada air quality regulations. Air emissions from non-radionuclide sources, such as a screening plant, portable screen, or maintenance shop activities, are permitted under a Class II Air Quality Permit. Sandia tracks emissions and pays a fee to the State of Nevada based on the total standard tons emitted. Sandia met all air quality permit conditions in 2007.

**National Emission Standards for Hazardous Air Pollutants (NESHAP) Compliance**

The EPA retains compliance authority for all radionuclide air releases, which are regulated by NESHAP and implemented under 40 CFR 61, Subpart H. The Clean Slate sites, as discussed in Chapter 1, have been the only source of radionuclide air emissions at TTR. Continuous air monitoring was conducted from February 22, 1996 to February 25, 1997 (SNL 1997). The TTR Airport was determined to be the location of the maximally exposed individual (MEI). The result of 0.024 millirems per year (mrem/yr) was below the threshold of 0.1 mrem/yr, for which continuous air monitoring would be required, and approximately 400 times less than the EPA standard of 10 mrem/yr. The NESHAP Annual Report for 2007 (SNL 2008b) and Chapter 4 of this report discuss these monitoring results.

### *2.1.6 Clean Water Act (CWA)*

Wastewater effluents and potable water supplies are controlled by the CWA and State of Nevada water pollution and sanitary waste system regulations. The State of Nevada, Department of Environmental Protection (NDEP) administer regulations relevant to wastewater discharges. At TTR, wastewater is discharged to the sewer system that is connected to the USAF sewage lagoon and to six septic tank systems.

There were no excursions or other permit violations in 2007 with respect to wastewater discharges.

***Storm Water***

The issuance of a National Pollutant Discharge Elimination System (NPDES) storm water permit is generally based on whether or not storm water runoff is discharged to "Waters of the U.S." This definition includes rivers, lakes, streams, and swamps, as well as channels and arroyos that lead to waters that are currently used, have been used in the past, or may be susceptible for use in interstate or foreign commerce. The TTR site is primarily a closed basin with runoff evaporating or infiltrating to the ground. The USAF has permitted its airfield and Area 10 for storm water runoff and has cognizance over all storm water issues at the site. The State of Nevada has determined that there are no industrial activities at TTR that require permitting. New construction activities that exceed one acre of soil disturbance may require permitting under the Construction General Permit.

### *2.1.7 Safe Drinking Water Act (SDWA)*

Sandia meets standards for drinking water as defined in the SDWA and NDEP public water supply and public water system regulations. Well 6 normally provides all drinking water for Sandia's operations at TTR and is operated under a permit issued by the NDEP. Chapter 4 of this report discusses monitoring activities. The NDEP, Bureau of Safe Drinking Water, characterizes this Public Water System (PWS) as a Non-Transient Non-Community system.

The USAF PWS provided drinking water to the Sandia National Laboratories Area 3 compound for the majority of 2007. In January 2007 the arsenic removal media in the water treatment facility was determined to be exhausted (no longer effective) and needed to be replaced. Because the media is very expensive and only lasted a fraction of it's effective service life, water operator personnel explored other options for reducing the naturally high potential of Hydrogen (pH) and thereby extend the service life of the arsenic removal media before putting the system back online. It was determined that replacing the HCL injection system with a Carbon Dioxide gas injection system would be as effective and less hazardous. After justifying the change, obtaining approvals from DOE and the State of Nevada NDEP, the system was on order and scheduled to be installed in May 2008.

There were two Drinking Water Public Notices issued to Area 3 personnel during 2007. The first was due to low residual chlorine levels in the Water coming into the compound from the USAF PWS. USAF personnel were notified and the problem was resolved. The second incident resulted in a Notice of Violation issued by the NDEP for violating the Total Coliform Rule of the Safe Drinking Water Act. A sink faucet in the breakroom of a normal sample location became contaminated with total coliform bacteria. The exceedance of the State of Nevada Maximum Contaminant Level (MCL) for the Total Coliform Rule resulted in an issuance of a Notice of Violation on November 14, 2007 and required additional coliform sampling. The notice of Violation resulted in a DOE occurrence report on November 15, 2007. Subsequent samples tested negative for fecal and e-coli bacteria. The faucet was replaced after the second positive sample and no further positive total coliform samples occurred.

In September of 2007 two weeks were spent repairing minor corrosion inside the new elevated water tower.

### *2.1.8 Toxic Substances Control Act (TSCA)*

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

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

Chemical pesticides used at TTR include herbicides, rodenticides, and insecticides, as required. All chemicals used are EPA approved and applied in accordance with applicable label guidelines and regulations. Sandia retains records of the quantities and types of pesticides that are used as well as Material Safety Data Sheets (MSDSs) for each pesticide. There were no violations of FIFRA in 2007.

### *2.1.10 National Environmental Policy Act (NEPA)*

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

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

Table 2-2 lists all federal and state protected species occurring within Nye County and having the potential to occur at TTR.

### *2.1.12 Migratory Bird Treaty Act (MBTA)*

The MBTA of 1918 implemented the 1916 Convention for the Protection of Migratory Birds. The original statute implemented the agreement between the United States (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 with NEPA compliance reviews and the Ecology Program.

### *2.1.13 Cultural Resources Acts*

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

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

The DOE/NNSA/SSO is responsible for determining the level of applicability of cultural resources requirements. In 2007, Sandia's operations did not impact any known cultural resources sites at TTR.

***Historical Building Assessment***

In 2004, DOE/NNSA/SSO initiated a consultation with the Nevada State Historic Preservation Office (SHPO) on 212 buildings at TTR. The SHPO did not concur with the DOE determination of eligibility for the 212 buildings. At the SHPO's request, Sandia contracted with an architectural historian to evaluate the TTR buildings under National Register Criterion C. A revised report on the buildings at TTR will be submitted to SSO for transmittal to the Nevada SHPO.

### *2.1.14 Environmental Compliance EOs*

EO 11988, *Floodplain Management, a*s 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

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

| Common Name | Scientific Name | Federal Status | State of Nevada Protected Status |
|---|---|---|---|
| **PLANTS** | | | |
| Sodaville Milkvetch | *Astragalus lentiginosus var. sesquimetralis* | - - - - - - - - - | State Protected |
| Halfring Milkvetch | *Astragalus mohavensis var hemigyrus* | SOC | State Protected |
| Ash Meadows Milkvetch | *Astragalus phoenix* | Threatened | State Protected |
| Spring-loving centaury | *Centaurium namophilum* | Threatened | State Protected |
| Armored Hedgehog Cactus | *Echinocereus engelmannii var. armatus* | - - - - - - - - - | State Protected |
| Ash Meadows Sunray | *Enceliopsis nudicaulis var. corrugata* | Threatened | State Protected |
| Mojave Barrel Cactus | *Ferocactus cylindraceus var. lecontei* | - - - - - - - - - | State Protected |
| Sunnyside Green Gentian | *Frasera gypsicola* | SOC | State Protected |
| Ash Meadows Gumplant | *Grindelia fraxinopratensis* | Threatened | State Protected |
| Ash Meadows Mousetails | *Ivesia kingii var. eremica* | Threatened | State Protected |
| Ash Meadows Blazingstar | *Mentzelia leucophylla* | Threatened | State Protected |
| Amargosa Niterwort | *Nitrophila mohavensis* | Endangered | State Protected |
| Sand Cholla | *Opuntia pulchella* | - - - - - - - - - | State Protected |
| Williams Combleaf | *Polyctenium williamsiae* | - - - - - - - - - | State Protected |
| Blaine Pincushion | *Sclerocactus blainei* | SOC | State Protected |
| Tonopah Pincushion | *Sclerocactus nyensis* | - - - - - - - - - | State Protected |
| Hermit Cactus | *Sclerocactus polyancistrus* | - - - - - - - - - | State Protected |
| **INSECTS** | | | |
| Ash Meadows Naucorid | *Ambrysus amargosus* | Threatened | - - - - - - - - - |
| **FISH** | | | |
| White River Desert Sucker | *Catostomus clarki intermedius* | SOC | State Protected |
| Moorman White River Springfish | *Crenichthys baileyi thermophilus* | SOC | State Protected |
| Railroad Valley Springfish | *Crenichthys nevadae* | Threatened | State Protected |
| Devils Hole Pupfish | *Cyprinodon diabolis* | Endangered | State Protected |
| Ash Meadows Amargosa Pupfish | *Cyprinodon nevadensis mionectes* | Endangered | State Protected |
| Warm Springs Amargosa Pupfish | *Cyprinodon nevadensis pectoralis* | Endangered | State Protected |
| Pahrump Poolfish | *Empetrichthys latos latos* | Endangered | State Protected |
| White River Spinedace | *Lepidomeda albivallis* | Endangered | State Protected |
| Moapa Dace | *Moapa coriacea* | Endangered | State Protected |
| Lahontan Cutthroat Trout | *Oncorhynchus clarki henshawi* | Threatened | State Protected |
| Big Smoky Valley Speckled Dace | *Rhinichthys osculus lariversi* | - - - - - - - - - | State Protected |
| Ash Meadows Speckled Dace | *Rhinichthys osculus nevadensis* | Endangered | State Protected |
| Big Smokey Valley Tui Chub | *Siphateles bicolor* ssp. 8 | SOC | State Protected |
| Hot Creek Valley Tui Chub | *Siphateles bicolor* ssp. 5 | SOC | State Protected |
| Little Fish Lake Valley Tui Chub | *Siphateles bicolor* ssp. 4 | - - - - - - - - - | State Protected |
| Railroad Valley Tui Chub | *Siphateles bicolor* ssp. 7 | SOC | State Protected |
| **AMPHIBIANS** | | | |
| Amargosa Toad | *Bufo nelsoni* | - - - - - - - - - | State Protected |
| Columbia Spotted Frog | *Rana luteiventris* pop 3 | Candidate | - - - - - - - - - |
| **REPTILES** | | | |
| Banded Gila Monster | *Heloderma suspectum cinctum* | SOC | State Protected |
| Desert Tortoise (Mojave Desert pop.) | *Gopherus agassizii* | Threatened | State Protected |
| **MAMMALS** | | | |
| Spotted Bat | *Euderma maculatum* | SOC | State Protected |
| Pygmy Rabbit | *Brachylagus idahoensis* | SOC | State Protected |
| American Pika | *Ochotona princeps* | - - - - - - - - - | State Protected |
| Kit Fox | *Vulpes macrotis* | - - - - - - - - - | State Protected |
| **BIRDS** | | | |
| Northern Goshawk | *Accipiter gentilis* | SOC | State Protected |
| Golden Eagle | *Aquila chrysaetos* | - - - - - - - - - | State Protected |
| Long-eared Owl | *Asio otus* | - - - - - - - - - | State Protected |
| Western Burrowing Owl | *Athene cunicularia hypugaea* | SOC | State Protected |
| Juniper Titmouse | *Baeolophus griseus* | - - - - - - - - - | State Protected |
| Ferruginous Hawk | *Buteo regalis* | SOC | State Protected |
| Swainson's Hawk | *Buteo swainsoni* | - - - - - - - - - | State Protected |
| Sage Grouse | *Centrocercus urophasianus* | - - - - - - - - - | State Protected |
| Western Snowy Plover | *Charadrius alexandrinus nivosus* | Threatened | State Protected |
| Mountain Plover | *Charadrius montanus* | Proposed Threatened | State Protected |
| Black Tern | *Chlidonias niger* | SOC | State Protected |
| Western Yellow-billed Cuckoo | *Coccyzus americanus occidentalis* | Candidate | State Protected |
| Yellow Warbler | *Dendroica petechia* | - - - - - - - - - | State Protected |
| Southwestern Willow Flycatcher | *Empidonax traillii extimus* | Endangered | State Protected |
| Prairie Falcon | *Falco mexicanus* | - - - - - - - - - | State Protected |
| Common Yellowthroat | *Geothlypis trichas* | - - - - - - - - - | State Protected |
| Greater Sandhill Crane | *Grus canadensis tabida* | - - - - - - - - - | State Protected |
| Pinyon Jay | *Gymnorhinus cyanocephalus* | - - - - - - - - - | State Protected |
| Yellow-breasted Chat | *Icteria virens* | - - - - - - - - - | State Protected |
| Western Least Bittern | *Ixobrychus exilis hesperis* | SOC | State Protected |
| Loggerhead Shrike | *Lanius ludovicianus* | SOC | State Protected |
| Lewis' Woodpecker | *Melanerpes lewis* | - - - - - - - - - | State Protected |
| Long-billed Curlew | *Numenius americanus* | - - - - - - - - - | State Protected |
| Macgillivray's Warbler | *Oporornis tolmiei* | - - - - - - - - - | State Protected |
| Mountain Quail | *Oreortyx pictus* | - - - - - - - - - | State Protected |
| Flammulated Owl | *Otus flammeolus* | - - - - - - - - - | State Protected |
| Osprey | *Pandion haliaetus* | - - - - - - - - - | State Protected |
| Phainopepla | *Phainopepla nitens* | - - - - - - - - - | State Protected |
| White-faced Ibis | *Plegadis chihi* | SOC | State Protected |
| Vesper Sparrow | *Pooecetes gramineus* | - - - - - - - - - | State Protected |
| Yuma Clapper Rail | *Rallus longirostris yumanensis* | Endangered | State Protected |
| Red-naped Sapsucker | *Sphyrapicus nuchalis* | - - - - - - - - - | State Protected |
| Crissal Thrasher | *Toxostoma crissale* | - - - - - - - - - | State Protected |
| Orange-crowned Warbler | *Vermivora celata* | - - - - - - - - - | State Protected |
| Lucy's Warbler | *Vermivora luciae* | - - - - - - - - - | State Protected |
| Grey vireo | *Vireo vicinior* | - - - - - - - - - | State Protected |

**NOTES:** SOC = Species of Concern

TTR; however, some very limited wetlands exist in the vicinity of several springs. These provide an important source of drinking water for wildlife in the area. Sandia complies with all applicable mandates stated in these EOs.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended, requires that, to the greatest extent practicable and permitted by law and consistent with the principles set forth in the Report on the National Performance Review (Gore 1993), each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. Sandia must include in the assessment of its operations any disproportionate impacts on minority or low-income populations within the area of influence of the laboratories' operations.

EO 13423, *Strengthening Federal Environmental , Energy, and Transportation Management* ,was issued in January 2007, EO 13423, sets goals in the areas of energy efficiency, acquisition, renewable energy, toxics reductions, recycling, sustainable buildings, electronics stewardship, fleets, and water conservation. EO 13423 also requires more widespread use of Environmental Management Systems as the framework in which to manage and continually improve these sustainable practices. EO 13423 incorporates the requirements of and cancels Executive Orders 13101, 13123, 13134, 13148, and 13149, which were implemented through DOE Order 450.1 in 2007. DOE revised Order 450.1 to include the requirements of EO 13423 in June 2008. Anticipating this change, SNL/TTR established new EMS objectives and targets starting in fiscal year 2008 to support upcoming requirements.

## *2.2 2007 AUDITS*

On December 5, 2007 a Resource Conservation Recovery Act (RCRA) Compliance Evaluation Inspection was accomplished on the Sandia Facilities by the NDEP Federal Facilities Bureau. The Inspectors included Tim Murphy (Chief of the Bureau of Federal Facilities), Michael Verchick (Compliance and Enforcement Branch, Bureau of Waste Management), and John Stuto (Compliance and Enforcement Branch, Bureau of Waste Management). Lorenz "Richie" Spangler (Sandia Waste Management Project Lead) and William Forston (Local Washington Group International [WGI] Senior Environmental Safety and Healthe (ES&H) Specialist) accompanied the Inspectors throughout their evaluation of the Sandia Facility. There were no violations noted during the inspection. A summary of 2007 Audits is provided in Table 2-3.

The.inspector's summary is stated, below. "The SNL/DOE facility at the Test Site has a highly organized and well-managed waste management program, with a very robust electronic tracking system for their waste. No recommendations from NDEP are necessary to improve on the existing system."

## *2.3 2007 ISSUES AND ACTIONS FOR TTR*

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

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

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

- NTS
- Areas within TTR
- Areas within the NTTR
- Central Nevada Test Area
- Project Shoal Area (east of Carson City in Churchill County)

A summary of DOE/NNSA's ER sites in Nevada can be found in the FFACO report (DoD/DOE/State of Nevada 1996). The list of sites has been modified for consistency with NDEP requirements and grouped into Corrective Action Units (CAUs), which are listed by Corrective Action Site (CAS) numbers. Each CAU/CAS is listed in the FFACO under Appendix II (Corrective Action Sites/Units, this section includes inactive CAU/CASs), Appendix

III (Corrective Action Investigations/Corrective Actions, this section includes active CAU/CASs), and Appendix IV (Closed Corrective Action Units, this section lists CAU/CASs where corrective actions are complete). The FFACO is updated every six months. A listing of ER sites located at TTR is shown in Chapter 3, Table 3-1.

### *2.4 ENVIRONMENTAL PERMITS*

Environmental compliance permits for TTR include those for potable water supply, RCRA, and specific air emission units such as screening plants. The permit application and registration of Sandia activities at TTR are issued directly by the State of Nevada to either DOE/NNSA/Nevada Site Office (NSO) or DOE/NNSA/SSO and administered by WGI on behalf of Sandia. Sandia and WGI ensure that all permit conditions are met. Table 2-4 lists all permits and registrations in effect in 2007.

### *2.5 OCCURRENCE REPORTING*

There were two reportable occurrences in 2007. The first was the coliform contamination of the drinking water faucet described in Section 2.1.7.

The second Occurrence Report involved the deaths of 71 wild horses that occurred in July of 2007. The horses were from a herd that frequently drank from a man-made depression on a dry lake bed controlled by Sandia. Initial sampling and necropsy results indicated that high nitrate levels may have caused the deaths. The source of the nitrates is believed to be evaporation, due to drought conditions. The mineral content of the water became higher and higher as the drought deepened. The BLM issued a press release regarding the incident. The BLM, with assistance from the USAF and DOE, contracted with the University of Nevada's Desert Research Institute to sample water and soil on the TTR to determine the source of the nitrates that may have caused the deaths. This sampling was conducted in February of 2008, and a report is expected in mid-2008.

*"Horse pond at TTR after a heavy rain." Photo by staff.*

**TABLE 2-3.** Summary of Environmental Audits Performed at TTR in 2007

| Type/Subject | Date | Audit Organization | Findings Summary |
|---|---|---|---|
| RCRA Compliance Evaluation Inspection | December 5, 2007 | State of Nevada/ NDEP/ Bureau of Federal Facilities | No Findings or Recommendations. State of Nevada Auditors commended us as a highly organized and well-managed waste management program with a very robust electronic tracking system for our waste. |

**NOTES:** RCRA = Resource Conservation and Recovery Act
NDEP = Nevada Department of Environmental Protection

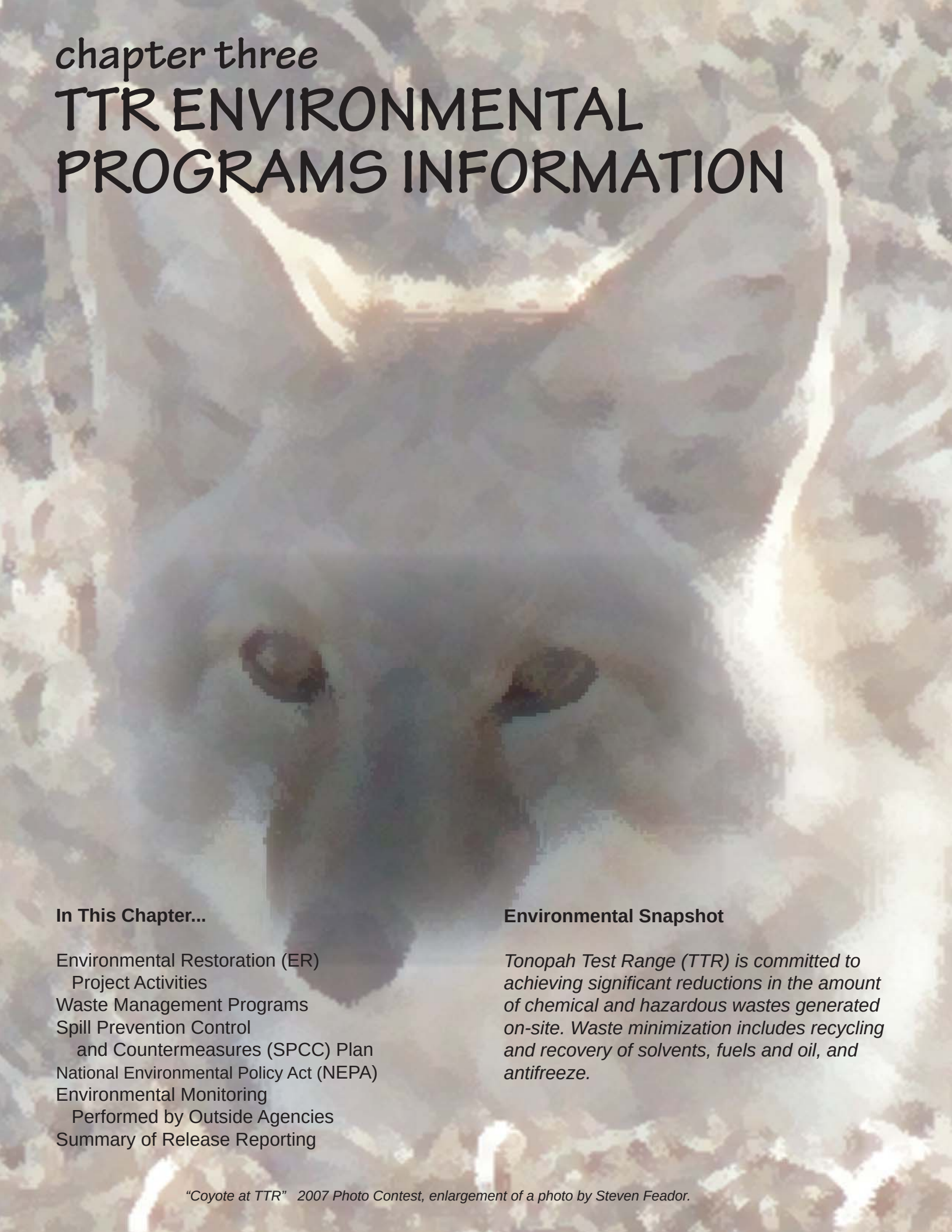
**TABLE 2-4.** 2007 Summary of Permit Ownership at TTR

| Permit Type and Location | Permit Number | Issue Date | Expiration Date | Comments |
|---|---|---|---|---|
| ***Air Quality Permits*** | | | | |
| Class II Air Quality Operation Permit | AP8733-0680.02 | Original issue date: July 23, 2006<br><br>Reissue Date: December 11, 2007 | July 23, 2011 | 1- 3' x 5' Screening Plant<br>1- 12' X 8' Portable Screen<br>Welding Shops<br>Carpenter Shop<br>Paint Shop<br>Non-Permit Equipment List<br>Generators (10 emission units)<br>Boilers (2 emission units)<br>Maintenance Activities (5 emission units)<br>Propane Storage Tanks (23 emission units)<br>Surface Area Disturbance (> 5 acres) |
| ***RCRA - Hazardous Waste*** | | | | |
| Hazardous Waste Generator | NV1890011991 | January 7, 1993 | Indefinite | State of Nevada |
| ***Stormwater Permit (Construction)*** | | | | |
| None in 2007 | | | | |
| ***Production Well (Drinking Water)*** | | | | |
| Well 6 Production Well | NY-3014-12NTNC | September 2007 | September 2008* | State of Nevada |
| Permit to Operate a Treatment Plant | NY-3014-TP11-12NTNC | September 2007 | September 2008* | State of Nevada |

**NOTES:** * The State of Nevada Bureau of Health Protection Services renews the permit for Well 6 (NY-3014-12NC) annually.
"Emission units" are sources such as generators and boilers

chapter three

# TTR ENVIRONMENTAL PROGRAMS INFORMATION



**In This Chapter...**



**Environmental Snapshot**

*Tonopah Test Range (TTR) is committed to achieving significant reductions in the amount of chemical and hazardous wastes generated on-site. Waste minimization includes recycling and recovery of solvents, fuels and oil, and antifreeze.*

*"Coyote at TTR" 2007 Photo Contest, enlargement of a photo by Steven Feador.*

The Environmental Restoration (ER) Project, the Waste Management Program, and the National Environmental Policy Act (NEPA) Program are some of the programs and activities TTR utilizes to comply with various state and federal regulations, Executive Orders (EOs), and U.S. Department of Energy (DOE) orders. 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*

The ER Project at TTR was initiated in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. In late 1992 and early 1993, an agreement was reached between DOE Headquarters (HQ) and the Albuquerque and Nevada field offices to designate responsibility for all ER sites to the DOE/Nevada Site Office (NSO). The National Nuclear Security Administration (NNSA) was established during 2000/2001. Today, responsibility for all ER sites resides with DOE/NNSA/NSO.

Since 1996, cleanup activities for sites located in the State of Nevada have been regulated by the Federal Facility Agreement and Consent Order (FFACO) (DoD/DOE/State of Nevada 1996). The FFACO was negotiated between DOE/NSO, the Nevada Division of Environmental Protection (NDEP), and the U.S. Department of Defense (DoD). The FFACO took effect on May 10, 1996 and accomplished the following:

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

NOTE: the FFACO is also discussed in Section 2.3.of this report.

CAUs located at TTR are addressed by two ER Division Projects:

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

ER site contamination includes radiological constituents (e.g., DU and plutonium) and non-radiological constituents (e.g., munitions, solvents, pesticides, septic sludges, and heavy metals).

### *CAS Identification*

The initial identifications, descriptions, and listings of CASs at TTR were derived from the Preliminary Assessment (PA) and the Federal Facility Preliminary Assessment Review (E&E 1989). In 1993, the potential TTR CASs identified in the PA were subdivided into four "Soil Sites CAUs" and 43 "Industrial Sites CAUs." Twelve additional potential CASs, not included in the PA, were also identified, using the following methods:

- ER sites inventory processes,
- Ordnance removal activities,
- Geophysical surveys,
- Former worker interviews,
- Archive reviews,
- Site visits, and
- Aerial radiological and multispectral surveys (1993 to 1996).

The remediation activities at the Clean Slate and Double Tracks sites (Project Roller Coaster) are discussed in Chapter 1. These sites are listed under Soil Sites CAUs/CASs in Table 3-1 as CAU-411, -412, -413, and -414.

Table 3-1 summarizes the existing Industrial and Soil Sites CAUs and CASs at TTR. The ER activities planned for these CASs range from "no activities currently planned" to "NDEP-approved closure." The list of CAS 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).

### *2007 ER Activities*

Environmental Restoration activities in 2007 were focused on closure field work for CAU 484 (Surface Debris, Waste Sites, and Burn Area) and CAU 496 (Buried Rocket); and planning and field work preparation activities for CAU 408 (Bomblet Target Area), and waste management/disposal.

**TABLE 3-1.** DOE/NNSA/NSO ER Project TTR CAUs and CASs 2007 Status

| **Industrial Sites CAUs/CASs** | | |
|---|---|---|
| **CAS Number** | **CAS Description** | **General Location** |
| **CAU- 400 – *Closed***<br>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***<br>Area 3 Gas Station UST Site, TTR | | |
| 03-02-003-0357 | UST, Gas | First Gas Station, Area 3 |
| **CAU- 402 – *Closed***<br>Area 3 Bldg. 0353 UST Site, TTR | | |
| 03-02-001-0353 | UST, Diesel | Bldg. 0353 |
| **CAU- 403 – *Closed***<br>Area 3 Second Gas Station UST, TTR | | |
| 03-02-004-0360 | USTs | Second Gas Station |
| **1.0 CAU- 404 – *Closed***<br>Roller Coaster Lagoons and Trench, TTR | | |
| TA-03-001-TARC | Roller Coaster Lagoons | NW of Antelope Lake |
| TA-21-001-TARC | Roller Coaster North Disposal Trench | NW of Antelope Lake |
| **CAU- 405 – *Closed***<br>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***<br>**Area 3 Bldg. 03-74 and Bldg. 03-58 UDPs, TTR** | | |
| 03-51-002-0374 | Heavy Duty Shop UDP, Sumps | Bldg. 0374 |
| 03-51-003-0358 | UPS Building UDP | UPS Building, Area 3 |
| **CAU- 407 – *Closed***<br>Roller Coaster Rad Safe Area, TTR | | |
| TA-23-001-TARC | Roller Coaster Rad Safe Area | Northwest of Antelope Lake |
| **CAU- 408 – *Planning Phase***<br>On indefinite Hold Bomblet Target Area, TTR | | |
| TA-55-002-TAB2 | Bomblet Target Areas | Antelope Lake |
| **CAU- 409 – *Closed***<br>Other Waste Sites, TTR | | |
| RG-24-001-RGCR | Battery Dump Site | Cactus Repeater |
| TA-53-001-TAB2 | Septic Sludge Disposal Pit | Bunker 2 |
| TA-53-002-TAB2 | Septic Sludge Disposal Pit | Bunker 2 |
| **CAU- 410 – *Closed***<br>Area 9 Underground Vault and Disposal Trench, TTR | | |
| 09-21-001-09MG | Former Bunker or Underground Vault | East of Area 9 Magazines |
| 09-21-001-TA09 | Disposal Trenches | Area 9 |
| TA-19-002-TAB2 | Debris Mound | Bunker 2 |
| TA-21-003-TANL | Disposal Trench | NEDS Lake |
| TA-21-002-TAAL | Disposal Trench | South Antelope Lake |

Refer to Notes at end of Table 3-1.

**TABLE 3-1.** DOE/NNSA/NSO ER Project TTR CAUs and CASs 2007 Status *(continued)*

| **Industrial Sites CAUs/CASs** | | |
|---|---|---|
| **CAS Number** | **CAS Description** | **General Location** |
| **CAU- 423 – *Closed***<br>Area 3 UDP, Bldg. 0360, TTR | | |
| 03-02-002-0308 | UDP | Bldg. 0360 |
| 03-02-002-0308 | UDP | Bldg. 0360 |
| **CAU- 424 – *Closed***<br>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***<br>Area 9 Main Lake Construction Debris Disposal Area, TTR | | |
| 09-08-001-TA09 | Construction Debris Disposal Area | Area 9/Main Lake |
| **CAU- 426 – *Closed***<br>Cactus Spring Waste Trenches, TTR | | |
| RG-08-001-RGCS | Waste Trenches | Cactus Spring Ranch |
| **CAU- 427 – *Closed***<br>Area 3 Septic Waste Systems 2 and 6, TTR | | |
| 03-05-002-SW02 | Septic Waste System No. 2 | Area 3 |
| 03-05-002-SW06 | Septic Waste System No. 6 | Area 3 |
| **CAU- 428 – *Closed***<br>Area 3 Septic Waste Systens 1 and 5, TTR | | |
| 03-05-002-SW01 | Septic Waste System No. 1 | Area 3 |
| 03-05-002-SW05 | Septic Waste System No. 5 | Area 3 |
| **CAU- 429 – *Closed***<br>Area 3 Bldg. 03-55 and Area 9 Bldg. 09-52 UDPs, TTR | | |
| 03-51-001-0355 | Photo Shop UDPs, Drains | Photo Shop Area 3 |
| 09-51-001-0952 | Mobile Photographic Lab UDPs | Area 9 |
| **CAU- 430 – *Closed***<br>DU Artillery Round #1, TTR | | |
| TA-55-003-0960 | DU Artillery Round | South of Area 9 |
| **CAU- 453 – *Closed***<br>Area 9 UXO Landfill, TTR | | |
| 09-55-001-0952 | Area 9 Landfill | Area 9 |
| **CAU- 461 – *Closed***<br>Test Area JTA Sites, TTR | | |
| TA-52-002-TAML | DU Impact Site | Main Lake |
| TA-52-003-0960 | DU Artillery Round #2 | South of Area 9 |
| TTR-001 | 1987 W-79 JTA | Unknown – South of Area 9 |
| **CAU- 484 – *Closure Phase***<br>Antelope and NEDS Lakes Waste Sites, TTR | | |
| TA-52-001-TANL | NEDS Detonation Area | NEDS Lake |
| TA-52-004-TAAL | Metal Particle Dispersion Test | Antelope Lake |
| TA-52-005-TAAL | JTA DU Sites | Antelope Lake |
| TA-54-001-TANL | Rocket Propellant Burn Area | NEDS Lake |
| RG-52-007-TAML | Davis Gun Site – Mellan | Test Range |
| TA-52-006-TAPL | DU Surface Debris | Colimbo Detonation Area, NEDS Lake |

Refer to Notes at end of Table 3-1.

**TABLE 3-1.** DOE/NNSA/NSO ER Project TTR CAUs and CASs 2007 Status *(concluded)*

| **Industrial Sites CAUs/CASs** | | |
|---|---|---|
| **CAS Number** | **CAS Description** | **General Location** |
| **CAU-485 – *Closed***<br>Cactus Spring Ranch Pu and DU Site, TTR | | |
| TA-39-001-TAGR | Cactus Spring Ranch, Soil Contamination | West of Target Areas |
| **CAU-486 – *Closed***<br>Double Tracks Rad Safe Area, Nellis Range 71 North | | |
| 71-23-001-71DT | Double Tracks Rad Safe Area | Nellis Range 71 North |
| **CAU-487 – *Closed***<br>Thunderwell Site, TTR | | |
| RG-26-001-RGRV | Thunderwell Site | Thunderwell Site |
| **CAU-489 – *Closed***<br>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***<br>Station 44 Burn Area, TTR | | |
| RG-56-001-RGBA | Fire Training Area | Station 44 |
| 03-56-001-03BA | Fire Training Area | Area 3 |
| 03-58-001-03FN | Sandia Service Yard | Area 3 |
| 09-54-001-09L2 | Solid Propellant Burn Site | Area 9 |
| **CAU-495 – *Closed***<br>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***<br>Buried Rocket Site – Antelope Lake, TTR | | |
| TA-55-008-TAAL | Buried Rocket | Antelope Lake |
| **CAU-499 – *Closed***<br>Hydrocarbon Spill Site, TTR | | |
| RG-25-001-RD24 | Hydrocarbon Spill Site | Radar 24 Site |
| **Soil Sites CAUs/CASs:** | | |
| **CAU-411 – *Closed***<br>Double Tracks Plutonium Dispersion, Nellis | | |
| NAFR-23-01 | Pu-contaminated Soil | Double Tracks |
| **CAU-412 – *Closed***<br>Clean Slate 1 Plutonium Dispersion, TTR | | |
| TA-23-01CS | Pu-Contaminated Soil | Clean Slate 1 |
| **CAU-413 – *Remediation Phase***<br>Clean Slate 2 Plutonium Dispersion, TTR | | |
| TA-23-02CS | Pu-Contaminated Soil | Clean Slate 2 |
| **CAU-414 – *Not Started***<br>Clean Slate 3 Plutonium Dispersion, TTR | | |
| TA-23-03CS | Pu-Contaminated Soil | Clean Slate 3 |

**SOURCE:** DoD/DOE/State of NV 1996 and ongoing updates

**NOTE:** DOE = U.S. Department of Energy
CAU = Corrective Action Unit
CAS = Corrective Action Site
DU = depleted uranium
ER = Environmental Restoration
NEDS = Non-Explosive Destruction Site
WWII = World War II
Pu = Plutonium
NNSA = National Nuclear Security Administration
NSO = Nevada Site Office
UDP = underground discharge points
UST = underground storage tank
UXO = unexploded ordnance
TTR = Tonopah Test Range
JTA = Joint Test Assembly

Closure activities for CAU 484 consisted of excavation of depleted uranium debris and impacted soil from NEDS Lake and Antelope Lake, and exploratory excavations at the Mount Helen Davis Gun Penetrator test location. During 2007 CAU 484 closure activities generated 312,046 kilograms (kg) (686,500 pounds [lb]) of radioactive low-level waste (LLW) which was packaged in approved containers and transported to the Nevada Test Site for disposal. Closure activities conducted during 2006 generated an additional 25,455 kg (56,000 lb) of LLW which was also transported to the NTS during 2007 for disposal. All personal protective equipment (PPE) (i.e., paper, plastic, Tyvec, gloves, etc.) used during removal, packaging, and sampling the depleted uranium-impacted media was packaged and disposed with the LLW. Depleted Uranium contamination on NEDS Lake was associated with the Colimbo and NEDS tests, and depleted uranium contamination on Antelope Lake was associated with Davis Gun Penetrator testing. Removal of depleted uranium contamination to cleanup standards approved by the Nevada Department of Environmental Protection was confirmed, using the sodium iodide Kiwi survey vehicle operated by the Department of Energy Remote Sensing Laboratory. Four locations on Antelope Lake contained depleted uranium contamination that was more extensive than anticipated and these four locations were closed in place by constructing a protective cover over each site and installing land-use restriction signs and radiological postings.

Four Mk-82 practice bombs, two practice M-117 bombs, and one 155-millimeter projectile — all weighing approximately 5,455 kg (12,000 lb) — ere identified during the 2006 field investigation. These were removed from Pedro and Antelope Lakes during 2007. The practice ordnance were rendered inert and disposal of the inert unexploded ordnance (UXO) was coordinated with the Air Force. The inert UXO items were transported to the Nellis Range 71 unexploded ordnance pile for disposal. In addition, eight inert 2.75 bomb dummy units (BDUs) were uncovered from one location on Antelope Lake during depleted uranium removal activities. These BDUs were surveyed and released from the contamination area, and were staged on the edge of Antelope Lake. The BDUs will be disposed during 2008. Three metal structures located on the north edge of NEDS Lake were surveyed to confirm it was not radiologically impacted, size reduced as needed, and transported to the Area 3 Sandia salvage yard for reuse or recycling. The debris from NEDS Lake weighed approximately 9,545 kg (21,000 lb).

CAU 496 consisted of a partially buried Honest John M-50 rocket. The rocket was removed and a small area of depleted uranium contamination was present near the inert "warhead." The rocket was removed and the depleted uranium contamination was excavated. Confirmation samples were collected to document clean closure of the site. The rocket waste consisted of 3,182 kg (7,000 lb) of non-impacted metal debris, and the depleted uranium waste consisted of 45 kg (100 lb) of impacted debris and soil. The rocket was surveyed and was transported to the Nellis Range 71 unexploded ordnance pile for disposal. The depleted uranium was removed, packaged, and transported to the Nevada Test Site for disposal. A second rocket identified by Sandia as a Castor rocket (Thiokol XM33), not associated with CAU 496, found during field activities near Clean Slates 3, was removed as a best management practice. The rocket waste consisted of 6,818 kg (15,000 lb) of non-impacted metal debris and was transported to the Nellis Range 71 unexploded ordnance pile for disposal.

Low-Level Waste disposal during 2007 included 25,455 kg (56,000 lb) of depleted uranium debris and soil generated from CAU 484 during closure activities in 2006; 32,418 kg (71,320 lb) of depleted uranium debris and soil generated by Sandia during cleanup activities on Main Lake in 2005 and 2006; and 312,091 kg (686,600 lb) of depleted uranium debris and soil generated during 2007 closure activities at CAU 484 and CAU 496. No RCRA hazardous, TSCA, or mixed waste (MW) was generated during ER activities and/or disposed in 2007.

**Summary, Environmental Restoration Waste Generation/Disposal Activities at TTR — 2007**

| Waste Type | Previously Generated | Generated 2007 | Disposed 2007 |
|---|---|---|---|
| UXO/Rocket Debris | 15,454 kg (34,000 lb) | 23 kg (50 lb) | 15,454 kg (34,000 lb) |
| Low-Level Waste | 57,873 kg (127,320 lb) | 312,091 (686,600 lb) | 369,964 kg (813,920 lb) |
| Non-Impacted Debris | None | 9,545 kg (21,000 lb) | 9,545 kg (21,000 lb) |

**NOTES:** lb = pounds kg = kiligram

**TABLE 3-2.** Sandia Corporation TTR RCRA-Regulated Hazardous Waste Shipped Off-site in 2007

| Waste Description | Waste Codes | Generated (lb) | Generated (kg) |
|---|---|---|---|
| Hazardous Waste Liquid NOS | D011 | 96 | 44 |
| Hazardous Waste Solid NOS | D009 | 37 | 17 |
| Hazardous Waste Solid NOS | F003, F005, D035 | 24 | 11 |
| Waste Aerosols | D001 | 90 | 41 |
| Waste Aerosols | D001 | 178 | 81 |
| Waste Corrosive Liquid | D002 | 4 | 2 |
| Waste Ethanol Mixture | D001 | 7 | 3 |
| Waste Flammable Liquids, NOS | D001, D009 | 13 | 6 |
| Waste Flammable Liquids, NOS | D001, D035 | 22 | 10 |
| Waste Hydrochloric Acid | D002 | 1654 | 752 |
| Waste Hydrochloric Acid | D002 | 15 | 7 |
| Waste Sodium Hydroxide Solution | D002 | 264 | 120 |
| Waste Toxic Liquids | P042 | 9 | 4 |
| Waste Toxic Liquids | P042 | 9 | 4 |
| Waste Water Reactive Solid | D001, D003, D005, D007 | 13 | 6 |
| Waste Zinc Chloride Solution | D002 | 18 | 8 |
| | **TOTALS** | **2,454** | **1,115** |

**NOTES:** NOS = not otherwise specified RCRA = Resource Conservation and Recovery Act kg = kilogram
TTR = Tonopah Test Range lb = pounds

**TABLE 3-3.** Non-RCRA-Regulated Hazardous or Toxic Waste Shipped Off-site in 2007

| Waste Description | Waste Codes | Generated (lb) | Generated (Kg) |
|---|---|---|---|
| Medicine Liquid Toxic | NCR | 51 | 23 |
| Non-Regulated Liquid Waste | | 132 | 60 |
| Non-Regulated Liquid Waste | | 325 | 148 |
| Non-Regulated Liquid Waste | | 66 | 30 |
| Non-Regulated Liquid Waste | | 114 | 52 |
| Non-Regulated Liquid Waste | | 185 | 84 |
| Non-Regulated Liquid Waste | | 686 | 312 |
| Non-Regulated Liquid Waste | | 51 | 23 |
| Non-Regulated Liquid Waste | | 370 | 168 |
| Non-Regulated Liquid Waste | | 194 | 88 |
| Non-Regulated Liquid Waste | | 99 | 45 |
| Non-Regulated Liquid Waste | | 499 | 227 |
| Non-Regulated Liquid Waste | | 3,166 | 1,439 |
| Non-Regulated Liquid Waste | | 741 | 337 |
| Non-Regulated Liquid Waste | | 128 | 58 |
| Non-Regulated Liquid Waste | | 2,653 | 1,206 |
| Regulated Medical Waste | | 31 | 14 |
| Regulated Medical Waste | | 46 | 21 |
| Toxic Solids | | 123 | 56 |
| | **TOTALS** | **9,660** | **4,391** |
| **Landfills** | | | |
| USAF Construction Landfill | NCR | 9,740 | 4,427 |
| Apex Solid Waste Landfill (Tires/Metal) | | 95,000 | 43,182 |
| USAF Sanitary Landfill | | 39,712 | 18,051 |
| | **TOTALS** | **144,425** | **65,660** |
| **Asbestos** | TSCA | **70** | 32 |
| | **TOTAL** | **70** | 32 |

**NOTES:** NCR = no code required
RCRA = Resource Conservation and Recovery Act
IDW = Investigation-Derived Waste
D&D = decontamination and demolition
$yd^3$ = cubic yard
TSCA = Toxic Substances Control Act
LLW = low level waste
UXO = unexploded ordnance
PPE = personal protective equipment
lb = pounds kg = kilogram

**TABLE 3-4.** Recycled Regulated Hazardous or Toxic Waste Shipped Off-site in 2007

| Recycled Material or Energy Recovered Material | Generated (lb) | Generated (Kg) | Gallons |
|---|---|---|---|
| NAPA Auto Batteries Recycled | 5,286 | 2,403 | - - - |
| Used Oil | - - - | - - - | 1,420 |
| Combustible Liquid NOS | 154 | 70 | - - - |
| Batteries Wet Filled with Acid | 194 | 88 | - - - |
| Batteries Dry | 209 | 95 | - - - |
| Electronic Equipment | 2,281 | 1,037 | - - - |
| Fluorescent Lights | 86 | 39 | - - - |
| Incandescent Bulbs | 11 | 5 | - - - |
| Sodium Lamps | 17.6 | 8 | - - - |
| Sodium Lamps | 6.6 | 3 | - - - |
| Batteries Dry | 39.6 | 18 | - - - |
| Batteries Dry | 41.8 | 19 | - - - |
| Non-Regulated Solid Waste | 114.4 | 52 | - - - |
| Batteries Wet Filled with Acid | 180.4 | 82 | - - - |
| Non-Regulated Solid Waste | 99 | 45 | - - - |
| Non-Regulated Solid Waste | 499.4 | 227 | - - - |
| Electronic Equipment | 3,165.8 | 1,439 | - - - |
| Fluorescent Lights | 37.4 | 17 | - - - |
| **TOTALS** | **12,423** | **5,647** | **1,420** |

**NOTES:** lb = pounds kg = kilogram

Activities for CAU 408 consisted of planning, preparation of safety documents and work packages, and development of a subcontract to conduct geophysical surveys and unexploded ordnance clearance of the seven bomblet target areas at TTR. The original area of over 21 square miles was reduced to less than three square miles during development of the Streamlined Approach for Environmental Restoration (SAFER) plan. Prior to initiating the closure activities, work was suspended indefinitely by DOE/NSO Environmental Management because an agreement could not be reached between DOE and the Air Force concerning the scope of work that would be acceptable to both parties. All of the CAU 408 data collected from 2003 to 2007 is being archived. There are currently no plans to resume closure activities at CAU 408.

Washington Group International (WGI) participates in environmental cleanup and restoration activities.

### *3.2 WASTE MANAGEMENT PROGRAMS*

All waste generated at TTR, which excludes any waste generated by ER activities, is managed by WGI under the Waste Management Program. Waste categories include radioactive waste, RCRA-hazardous waste, other chemical waste, and non-hazardous solid waste. Waste minimization and recycling efforts are integrated into Waste Management Program activities.

Waste generated and handled at TTR in 2007 was as follows:

***Waste Type*** ***Weight***

RCRA hazardous waste.....1,115 kg (2,454 lb)
Non-RCRA regulated.....4,391 kg (9,660 lb)
TSCA waste (Asbestos/PCB)..... 32 kg (70 lb)

*Construction debris inc. tires and scrap metal:*
Apex Landfill ..... 95,000 lb
USAF Construction Landfill.....9,740 lb
Sanitary landfill waste..... 39,712 lb
Recycled material.....l5,647 kg (12,423 lb)
Radioactive waste ..... 0 kg

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

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

- Solvents
- Fuels and oil
- Antifreeze (on-site recycling unit)
- Lead acid batteries
- Freon (on-site recovery unit)
- Fluorescent and sodium bulbs
- Mercury-containing equipment

Recyclable waste and used oil was sent for recycling or disposed of through the waste disposal contractor. Recycled or energy-recovered material shipped off site in 2007 is presented in Table 3-4.

***Radioactive Waste Management***
There were no shipments of radioactive waste in 2007.

## *3.3 SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN*

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

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

## *3.4* NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) PROGRAM

***NEPA Activities at TTR***
NEPA compliance is coordinated between Sandia at TTR and NM, and DOE/NNSA/ Sandia Site Office (SSO). The Desert Research Institute (DRI) in Las Vegas, Nevada prepares archaeological and biological surveys and reports. Final reports are submitted to Sandia for transmittal to DOE/NNSA/SSO for review and determination and to consult with state and federal agencies.

The Final Environmental Impact Statement (EIS) for NTS and off-site locations in the State of Nevada, which include TTR, was completed in 1996; the DOE Record of Decision (ROD) was filed on December 9, 1996 (DOE 1996). TTR is currently being considered, along with all of the facilities in the DOE complex, in the Draft Complex Transformation Supplemental Programmatic Environmental Impact Statement (Draft Complex Transformation SPEIS; formerly Complex 2030 SEIS) (DOE/EIS-0236-S4). This PEIS will evaluate the future of the nation's nuclear weapons complex and outline a plan to establish a smaller, more efficient nuclear weapons complex able to respond to future challenges.

*2007 NEPA Documentation*
A total of four TTR NEPA documents were processed during 2007. Two NEPA reviews were completed by Sandia National Laboratories (SNL)/New Mexico (NM). Two NEPA checklists were submitted to DOE/NNSA/SSO for review.

## *3.5 ENVIRONMENTAL MONITORING PERFORMED BY OUTSIDE AGENCIES*

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

***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 DRI.

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

The DRI also provides external quality assurance (QA) on field measurements taken by the EPA at these community monitoring stations. DRI monitors selected locations concurrently using a portable monitoring station (PMS) and thermoluminescent dosimeters (TLDs). The DRI's *Community Radiation Monitoring Program Annual Report* is part of the NTS *Annual Site Environmental Report* (ASER) (DOE 2007a).

The DRI also performs other monitoring as requested by the DOE, such as archeological surveys, which can include evaluating environmental impacts from construction projects at TTR.

***WGI***

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

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

## *3.6 SUMMARY OF RELEASE REPORTING*

The following four release reporting documents must be submitted to external regulatory agencies if releases exceed applicable threshold quantities (TQ):

- *NESHAP Annual Report for CY 2007, SNL/NV* (SNL 2008b) requires that an annual report be submitted from each DOE/NNSA site where facility sources contribute a public dose of over 0.1 millirems per year (mrem/yr). The NESHAP report must be submitted to EPA by June 30th each year following the reporting year. The report includes the calculated effective dose equivalent (EDE) in mrem/yr for the maximally exposed individual (MEI).

- *State of Nevada Extremely Hazardous Material Reporting Requirements* – This is not currently required since extremely hazardous materials are not used during TTR routine operations.

- *Toxic Chemical Release Reporting Community Right-to-Know: Calendar Year 2007* (SNL 2008e) was submitted for lead released at the TTR firing range.

*"Indian Paintbrush growing at TTR" .. Photo by: Jim Galli.*

chapter four

# TTR ENVIRONMENTAL MONITORING

*"Muledeer at Tonapah Test Range (TTR)" Photo by Steve Cox.*

**In This Chapter...**

Terrestrial Surveillance
Water Monitoring
Radiological Air Monitoring
Non-radiological Air Emissions

**Environmental Snapshot**

*One of the goals of the Terrestrial Surveillance Program is to identify and quantify new or existing environmental quality problems and their potential impacts, if any.*

## *4.1 TERRESTRIAL SURVEILLANCE*

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

### *4.1.1 Program Objectives*

The objectives of the Terrestrial Surveillance Program can be summarized by the following excerpts of requirements given in U.S. Department of Energy (DOE) Order 450.1, *Environmental Protection Program* (DOE 2007):

- Collect and analyze samples to characterize environmental conditions and define increasing or decreasing trends,
- Establish background levels of pollutants to define baseline conditions (off-site sampling),
- Provide continuing assessment of pollution abatement programs,
- Identify and quantify new or existing environmental quality problems and their potential impacts, if any, and
- Verify compliance with applicable environmental laws and regulations and commitments made in National Environmental Policy Act (NEPA) documents such as Environmental Impact Statements (EISs), as well as other official documents.

### *4.1.2 Regulatory Standards and Comparisons*

The Terrestrial Surveillance Program is designed and conducted in accordance with the requirements of DOE Order 450.1, *Environmental Protection Program* (DOE 2007a). Concentration limits for radionuclides and metals in terrestrial media are not well defined. However, the terrestrial surveillance coordinator does compare the results from on-site and perimeter locations to off-site results to determine what impact, if any, TTR operations has 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 (SNL 2006).

### *4.1.3 Statistical Analyses*

Samples are generally collected from fixed locations to make useful statistical comparisons with results from previous years. Statistical analyses are performed to determine if a specific result, or group of on-site or perimeter results, differs from off-site values, and to identify trends at a specific sampling location. Since multiple data points are necessary to provide an accurate view of a system, the Terrestrial Surveillance Program does not rely on the results from any single year's sampling event to characterize on-site environmental conditions. Results from a single sampling point may vary from year to year, due to slight changes in sampling locations, differences in climatic conditions, and laboratory variations or errors. As the amount of data increases, the accuracy of the characterization increases.

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

In some instances, this qualitative inspection of the data is augmented by the graphical evaluation methodology noted in Section 4.1.6 of this report. 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. To date, there have been no terrestrial sample results that have indicated a significant level of concern (Priority-1) that would trigger actions at locations that are not already being addressed by the Environmental Restoration (ER) Project.

**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.

Beginning in 2001, the analyses were limited to a five-year period (therefore, this year begins in 2003). The reason for this change was that in 2000, Sandia National Laboratories (SNL)/New Mexico (NM) personnel changed analytical laboratories for lower (better) detection capabilities for many of the metals and radiological analyses. As a result, a large number of false decreasing trends were noted for many of the parameters when the whole data set was analyzed. By limiting the analysis to a five-year period, the trend analysis is more meaningful. The analysis in 2007 utilized data from the same analytical laboratory for the five-year period.

### *4.1.4 Sampling Locations*

Terrestrial surveillance began at TTR in 1992. In addition to routine sampling, a large-scale baseline sampling was performed in 1994 in areas where Sandia Corporation (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 ER sites). A list of on-site sampling locations is shown in Table 4-2. Maps of the on-site sampling locations are shown in Appendix A, Figures A-4 and A-5.

- ***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-6.

- ***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-7. All perimeter locations are in areas which Sandia does not control access.

### *4.1.5 Radiological Parameters and Results*

Soil is the only terrestrial medium sampled at TTR. There are no bodies of water other than the playa lakes – dry lake beds with only occasional standing water. Vegetation is scarce. Soil samples are collected to ascertain the presence of air-deposited pollutants or contaminants that have been transported and deposited as a result of surface water runoff. Samples are collected from the top two inches of soil using a hand trowel. The 2007 analytical results are found in Appendix A of this report and are summarized in this section. The detailed statistical analyses are documented in the *Tonopah Test Range Data Analysis in Support of the Annual Site Environmental Report, 2007* (SNL 2008d).

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

| On-Site Loction | Location Number | Sample Location | Soil Sampling | Replicate* | TLD |
|---|---|---|---|---|---|
| **South Plume** | S-48 | N/S Mellan Airstrip – Antelope Tuff | √ | √ | |
| | S-49 | N/S Mellan Airstrip – SW of S-48 | √ | | |
| | S-50 | N/S Mellan Airstrip – sign post | √ | | |
| | S-51 | N/S Mellan Airstrip – NE of S-50 | √ | √ | |
| | S-52 | NE of NW/SE Mellan Airstrip | √ | | |
| **Range Opertions Center** | S-40 | Waste Water Monitoring Station | √ | | |
| | S-41 | "Danger Powerline Crossing" Sign | √ | | |
| | S-42 | Main Road/Edward's Freeway | √ | | |
| | S-43 | SW Corner of Sandia Corporation, TTR Operations Center | √ | | |
| | S-44 | NE Corner of Sandia Corporation, TTR Operations Center | √ | | |
| | S-45 | Storage Shelters, 03-38/03-39 | √ | | |
| | S-46 | Sand Building | √ | | |
| | S-47 | Generator Storage Area | √ | | |
| **Various On-Site Locations** | S-01 | Antelope Lake Area Fence, Cultural Area Sign | √ | | √ |
| | S-02 | N/S Mellan Airstrip (TLD at South fence post) | √ | | √ |
| | S-03 | TLD at Clean Slate 2 | √ | √ | √ |
| | S-04 | TLD at Clean Slate 3 | √ | | √ |
| | S-09 | Roller Coaster Decon | √ | √ | √ |
| | S-10 | Brownes Road/Denton Freeway | | | √ |
| | S-13 | Area 3 between Bldg. 100 and Caution Sign | | | √ |
| | S-14 | Area 3 CP SW side on fence | | | √ |
| | S-15 | Moody Ave. by cattle guard and entrance to airport and chow hall | | | √ |
| | S-16 | Area 9 by Bldg. 09-08 and LPG storage | | | √ |
| | S-17 | Hard Target area by Bldg. 23-16 | | | √ |
| | S-38 | Mellan Hill – Metal Scrap Pile | √ | | |
| | S-39 | Mellan Hill – North | √ | | |
| | S-53 | Main Road/Lake Road SE | √ | | |

**NOTES:** TLD = Thermoluminescent Dosimeter TTR = Tonopah Test Range
N/S = North/South (runway runs North/South)
*In addition to single samples taken for each location, two replicated samples are collected for internal checks on comparability of sampling and analysis.

**TABLE 4-3.** Off-Site Terrestrial Surveillance Locations at TTR

| On-Site Location | Location Number | Sample Location | Soil Sampling | Replicate* | TLD |
|---|---|---|---|---|---|
| **Off-Site** | C-18 | Tonopah Old Court House | | | |
| | C-19 | Mining Museum, North Goldfield | | | √ |
| | C-20 | State Road 6 Rest Area | √ | | |
| | C-21 | State Road 6/95 Rest Area | √ | | √ |
| | C-22 | Rocket | √ | | √ |
| | C-23 | Alkali/Silver Peak Turnoff | √ | | |
| | C-24 | Cattle Guard | √ | | |
| | C-25 | Tonopah Ranger Station | √ | | |
| | C-26 | Gabbs Pole Line Road | √ | | |
| | C-27 | State Roads 6/376 Junction | √ | | |
| | C-28 | Stone Cabin/Willow Creek | √ | | |
| | C-29 | State Roads 6/375 Junction | √ | √ | |
| | C-30 | State Road 375 Ranch Cattle Gate | √ | | |
| | C-31 | Golden Arrow/Silver Bow | √ | | |
| | C-32 | Five miles south of Rocket | √ | | |
| | C-33 | Nine miles south of Rocket | √ | | |

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

**TABLE 4-4.** Perimeter Terrestrial Surveillance Locations at TTR

| On-Site Location | Location Number | Sample Location | Soil Sampling | Replicate* | TLD |
|---|---|---|---|---|---|
| **Perimeter** | P-05 | O&M Complex - Site 4 Entrance Gate | | | √ |
| | P-06 | Cedar Pass Road Guard Station | √ | | √ |
| | P-07 | On-Base Housing - SW | | | √ |
| | P-08 | On-Base Housing (Main guard gate/power pole CP17) | √ | | √ |
| | P-11 | Cactus Springs (TLD south of P-35) | √ | √ | √ |
| | P-12 | TLD at "US Gov't Property" Sign | √ | | √ |
| | P-34 | O&M Complex (Owan Drive post) | √ | | |
| | P-35 | Cactus Springs (north fence post) | √ | | |
| | P-36 | On-Base Housing (NE fence line) | √ | | |
| | P-37 | On-Base Housing (guard station) | √ | | |

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

Radiological parameters include gamma-emitting radionuclides, plutonium and uranium. This is described in the next sections.

- ***Gamma-emitting radionuclides*** – Gamma spectroscopy is used to detect the emission of gamma radiation from radioactive materials. Radionuclide identification is possible by measuring the spectrum of gamma energies associated with a sample, since each radionuclide has a unique and consistent series of gamma emissions. Cesium-137 (Cs-137) is an example of a long-lived gamma emitter that is prevalent in the environment (as fallout from historical nuclear weapons testing). Other gamma-emitters of interest at TTR are americium-241 (Am-241) and depleted uranium (DU) 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 the radionuclide Am-241. Isotopic plutonium analysis is sometimes performed on any sample for which gamma spectroscopy identified Am-241 in concentrations greater than its minimum detectable activity (MDA).

- ***Uranium*** – Uranium occurs naturally in soils and may also be present as a pollutant in the environment due to past testing conducted at TTR. Total uranium 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 dosimeters are placed on aluminum poles, at a height of approximately one meter, and are exchanged and measured quarterly (January, April, July, and October) at 20 on-site, perimeter, and off-site locations.

***Radiological Results***

The results of the statistical analysis revealed that no on-site or perimeter location was both higher than off-site and with an increasing trend (Priority-1). Overall summary statistics for all radiological results are presented in Table 4-5. The following radiological analytes showed one location as Priority-2 (higher than off-site): Am-241. The Priority-2 location, along with the associated summary statistics, is listed in Table 4-6. There were no radiological analytes which showed Priority-3 (increasing trend). The radiological analyte (only Am-241) is discussed in the section below that list the location showing Priority-2.

**TABLE 4-5.** Summary Statistics for Soil Locations for CY 2007 (all units in pCi/g unless otherwise noted)

| Analyte | Location Class | No. of Samples | Average | Median | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|---|---|
| **Am-241** | On-site | 104 | 0.16 | 0.03 | 0.57 | -0.23 | 4.41 |
| | Perimeter | 40 | 0.02 | 0.02 | 0.06 | -0.19 | 0.12 |
| | Off-site | 70 | 0.004 | 0.01 | 0.05 | -0.20 | 0.11 |
| **Cs-137** | On-site | 104 | 0.25 | 0.24 | 0.17 | 0.01 | 0.78 |
| | Perimeter | 40 | 0.22 | 0.17 | 0.18 | 0.02 | 0.89 |
| | Off-site | 70 | 0.22 | 0.18 | 0.15 | 0.05 | 0.75 |
| **Pu-238** | On-site | 31 | 0.01 | 0.01 | 0.01 | -0.003 | 0.06 |
| | Perimeter | 7 | 0.0002 | -0.001 | 0.01 | -0.01 | 0.01 |
| | Off-site | 13 | -0.0003 | -0.001 | 0.002 | -0.003 | -0.003 |
| **Pu-239/240** | On-site | 31 | 1.20 | 0.35 | 2.19 | -0.01 | 10.20 |
| | Perimeter | 7 | 0.02 | 0.02 | 0.02 | 0.001 | 0.07 |
| | Off-site | 13 | 0.01 | 0.01 | 0.01 | 0.00 | 0.04 |
| **Pu-242** | On-site | 5 | 3.51 | 3.49 | 0.03 | 3.49 | 3.56 |
| **Total Uranium (µg/g)** | On-site | 104 | 0.75 | 0.74 | 0.17 | 0.49 | 1.51 |
| | Perimeter | 40 | 0.73 | 0.70 | 0.19 | 0.48 | 1.49 |
| | Off-site | 70 | 0.77 | 0.71 | 0.20 | 0.47 | 1.55 |
| **U-235** | On-site | 104 | 0.08 | 0.08 | 0.05 | 0.00 | 0.23 |
| | Perimeter | 40 | 0.08 | 0.07 | 0.05 | -0.06 | 0.20 |
| | Off-site | 70 | 0.08 | 0.08 | 0.05 | -0.09 | 0.20 |
| **U-238** | On-site | 104 | 1.09 | 1.04 | 0.40 | 0.03 | 2.39 |
| | Perimeter | 40 | 1.14 | 1.11 | 0.51 | 0.18 | 2.41 |
| | Off-site | 70 | 1.15 | 1.12 | 0.41 | 0.41 | 2.19 |

**NOTES:** Historical summary of all data for all locations and time (pooled)
pCi/g = picocurie per gram µg/g = microgram per gram

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

Am-241
One on-site location (S-09) continues to be identified as Priority-2 (higher than off-site). S-09 is located near the Roller Coaster Decon site. The maximum result for this location was recorded in 2003 and is 2.59 picocuries per gram (pCi/g). No other on-site locations were identified as Priority-2. No perimeter location was identified as Priority-2 or Priority-3 (increasing trend).

***TLD Results***
Sampling for 2007 was conducted from January 2007 through January 2008. When a TLD location has a missing quarter, the data is not included in the summary statistics (there were no missing TLDs in 2007). Summary statistics for the past five years are shown in Table 4-7.

On-site and perimeter locations were statistically different from off-site (community) 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 4-1 graphically portrays the TLD results from 2003 through 2007. TLD results and TLD measurements, by quarter and location type, for 2007 are shown in Tables A-7 and A-8 of Appendix A, respectively.

### *4.1.6 Non-Radiological Parameters and Results*

In 2007, soils were not analyzed for non-radiological constituents; however, all historical non-radiological soil analyses were analyzed and reported in a summary report (SNL 2006). Toxic analyte list (TAL) metals analyses are planned every 3-5 years, with the next sampling scheduled for 2008. In the summary report, the mean values of non-radiological constituents in soils (metals in soils) were less, or not significantly higher, than the State of Nevada soil concentration range. This report serves as a baseline reference for non-radiological constituents in TTR soils. All nonradiological data are consistent with background levels for these constituents. In the future, routine sampling for non-radiological parameters at fixed locations will be reduced and more emphasis placed on sampling specific areas of interest with potential environmental impact.

**TABLE 4-6.** Summary Statistics for Soil Locations Noted as Priority-2 (all units in pCi/g unless otherwise noted)

| Analyte | Location | No. of Samples | Average | Median | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|---|---|
| **Am-241** | S-09 | 5 | 1.15 | 1.02 | .86 | 0.47 | 2.59 |

**NOTES:** pCi/g = picocurie per gram Std Dev = Standard Deviation
Data presented is only for the current five years.

**TABLE 4-7.** Summary Statistics for TLDs by Location Class (all units in mrem), 2003 – 2007.

| Location Class | Sample Size | Average | Median | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|---|
| On-site | 49 | 162.2 | 158.5 | 14.9 | 139.6 | 228.8 |
| Perimeter | 26 | 160.4 | 158.0 | 15.5 | 139.3 | 216.0 |
| Off-site | 14 | 144.6 | 149.1 | 12.8 | 122.0 | 163.2 |

**NOTES:** m/mrem = millirem Std Dev = Standard deviation
Data presented is only for the current five years.

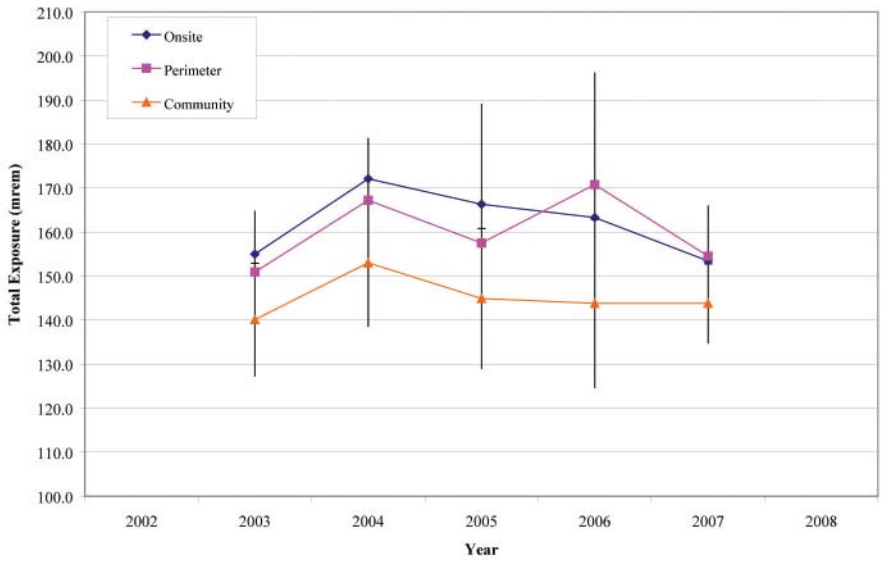



**FIGURE 4-1.** Tonopah Test Range TLD Exposure (2003-2007)

## *4.2 WATER MONITORING*

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

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

### *4.2.1 Production Well Monitoring*

There are three active wells used by 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, which supplies drinking water to the TTR Main Compound in Area 3, 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), and there is no regulatory sampling requirement.

All sampling is conducted in accordance with requirements set by the state (State of Nevada 1997). Analytes are sampled at different intervals, as shown in Table 4-8.

Sampled parameters included (but were not limited to) total coliform, nitrates, Total Trihalomethanes/ Haloacetic Acids, Dioxin, Phthalate, and arsenic.

The U. S. Air Force (USAF) Public Water System (PWS) has provided water to the Area 3 compound from January 24, 2007 and into 2008 while awaiting design, approval and installation of a new pH adjustment system that utilizes carbon dioxide in lieu of concentrated hydrochloric acid. The pH of the raw water is required to be between 6.5 and 7.0 on the pH scale for proper operation of the arsenic removal system.

***Production Well Monitoring Results***

Quarterly Di (2-Ethylhexyl) Phthalate (DEHP) sampling was continued in 2007. In 2005, Di (2-Ethylhexyl) Phthalate was detected in one sample (well below the maximum concentration level [MCL]) and triggered quarterly monitoring for the contaminant until it is undetected in two consecutive quarterly samples. DEHP is the most commonly used of a group of related chemicals called phthalates or phthalic acid esters. The greatest use of DEHP is as a plasticizer for polyvinylchloride (PVC) and other polymers including rubber, cellulose, and styrene. A number of packaging materials and tubings used in the production of foods and beverages are PVC- contaminated with phthalic acid esters, primarily DEHP.

All results for sample analysis listed below were within acceptable MCLs:

- THM/HAA5 – treated water provided to our distribution system by USAF PWS
- Arsenic – treated water provided to our distribution system by the USAF PWS
- Phthalate – raw water from Well 6
- Dioxin – raw water from Well 6
- Nitrate – raw water from Well 6

### *4.2.2 Sewage System and Septic Tank Monitoring*

Sewage from TTR facilities in the Main Compound at Area 3 goes to the USAF facultative sewage lagoon. As a best management practice (BMP), either SNL/NM or Washington Group International (WGI) personnel take annual wastewater samples from Area 3 at the point where wastewater leaves TTR property and enters the USAF system.

The USAF holds the National Pollutant Discharge Elimination System (NPDES) permit for its wastewater discharges. The USAF takes quarterly samples from the headwater end of the lagoon. In

**TABLE 4-8.** Production Well Monitoring at TTR

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

**NOTES:** IOC = inorganic compounds
VOC = volatile organic compounds
SOC = synthetic organic compounds

the past, Sandia provided quarterly sampling results to USAF for inclusion into their USAF Discharge Monitoring Report (DMR); however, the NPDES permit was modified in 1997 and no longer stipulates the requirement of quarterly data from Sandia. Therefore, Sandia now only provides annual sample results to the USAF.

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

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

All analytical results for wastewater sampled at Area 3 were within regulatory limits in 2007.

***Septic Tank Systems***

Septic tank systems are sampled as needed. There are now seven septic systems located on-site, which are owned by DOE/NNSA at TTR. These seven active septic tanks are used in remote locations and are maintained by the TTR facilities group. The sewage from these locations flows into septic tanks and associated drain fields. None of these systems required maintenance, sampling, or pumping in 2007. All other remaining septic systems have been closed or are undergoing closure and are being addressed by the ER Project.

### *4.2.3 Storm Water Monitoring*

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

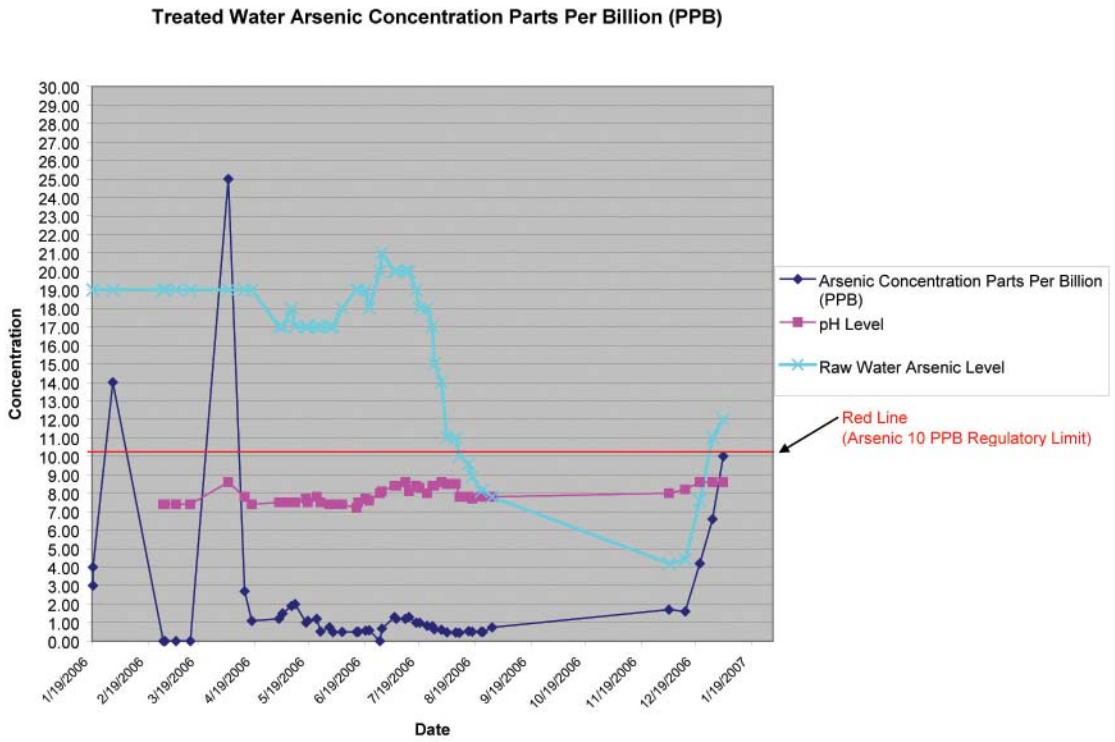



**FIGURE 4-2.** TTR Sampling History and Arsenic Removal System Efficiency

### *4.3 RADIOLOGICAL AIR MONITORING*

Air Quality Compliance (AQC) at TTR is met by adherence to specific permit conditions and local, state, and federal air regulations. Ambient air quality monitoring is not currently required at TTR. Ambient air monitoring was last conducted in 1996 to ascertain the level of radiological constituents in the air as discussed below.

Sandia 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 DU, do not produce significant air emission sources from re-suspension.

***NESHAP***

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

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

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

Although an annual calculated dose assessment is not required for the site, Sandia continues to produce an annual NESHAP report for TTR (SNL 2008b). 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 4-9 summarizes these dose assessment results. Future TTR activities are not expected to change; however, if new sources or modifications to the existing sources are anticipated, they will be evaluated for NESHAP applicability.

### *4.4 NON-RADIOLOGICAL AIR EMISSIONS*

The TTR Class II Air Quality Operating Permit was renewed in CY 2007. There are currently two sources that are not exempt at the facility, including the screening plant and the portable screen. In 2007, neither source was used, thus there were no emissions reported to the State of Nevada.

**TABLE 4-9.** Calculated Dose Assessment Results for On-site Receptor

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

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

*"Security at Tonopah Test Range" Photo by Staff.*

This page intentionally left blank.

# chapter five
# 2007 ANNUAL SITE ENVIRONMENTAL REPORT FOR THE KAUAI TEST FACILITY

*"Island of Kauai"  Photo by Adriana Canavan.*

**In This Chapter...**

Facilities and Operations
2007 Rocket Launches
Demographics
Compliance Summary
Environmental Program Activities
Environmental Surveillance & Monitoring Activities

**Environmental Snapshot**

*There were six rocket launches at Kauai Test Facility KTF in 2007 and they were covered by the KTF Environmental Assessment (EA).*

Kauai Test Facility (KTF) is a government owned, contractor operated laboratory. 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 is operated as a rocket preparation, launching, and tracking facility for DOE/NNSA, as well as in support of other U.S. military agencies. The DOE/NNSA/Sandia Site Office (SSO) in Albuquerque, New Mexico administers the contract and oversees contractor operations at the site. KTF exists as a facility within the boundaries of the U.S. Department of Defense (DoD) Pacific Missile Range Facility (PMRF). KTF is located on the island of Kauai at the north end of the PMRF, near Nohili Point (Figure 5-1). This Annual Site Environmental Report (ASER) summarizes data and the compliance status of environmental protection and monitoring programs at KTF for Calendar Year (CY) 2007. This report was prepared in accordance with DOE Order 450.1, *Environmental Protection Program* (DOE 2007) and DOE Manual 231.1A, *Environment, Safety, and Health Reporting* (DOE 2007).

### *5.1 FACILITIES AND OPERATIONS*

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

The first facilities at KTF were constructed in the early 1960s to support the National Readiness Program. The most recent construction, completed in March 2005, extended the Missile Service Tower (MST) to support DOE and MDA. From 1992 to 2007, there have been 32 launches.

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

The administrative area of KTF, known as the Main Compound, is located within a fenced area near the North Nohili access road from PMRF. Inside the fenced compound, a number of trailers and vans are connected together with a network of concrete docks and covered walkways. The majority of these temporary facilities are used during operational periods to support the field staff at KTF. During non-operational periods, general maintenance continues and dehumidifiers remain in operation (to protect equipment). Additionally, there are a number of permanent buildings, most of which are in use year round to support and maintain KTF facilities.

### *5.2 2007 ROCKET LAUNCHES*

There were six rocket launches from KTF in 2007. The launches were covered by the KTF Environmental Assessment (EA), published in July 1992 (DOE 1992a) and the U.S. DoD, PMRF, *Enhanced Capability Final EIS* (DoD 1998): AEGIS TBMD, FTM 12 E2, June 14, 2007 (2 launches); FTM-12 E3 June 22, 2007; FTM-13 11/06/2007 (2 launches); JFTM-1 E2, December 17, 2007.

### *5.3 DEMOGRAPHICS*

There are 15 permanent on-site personnel at KTF. During operational periods when rocket launches occur, an additional 15 to 130 persons

Rocket Launch at Kauai Test Facility

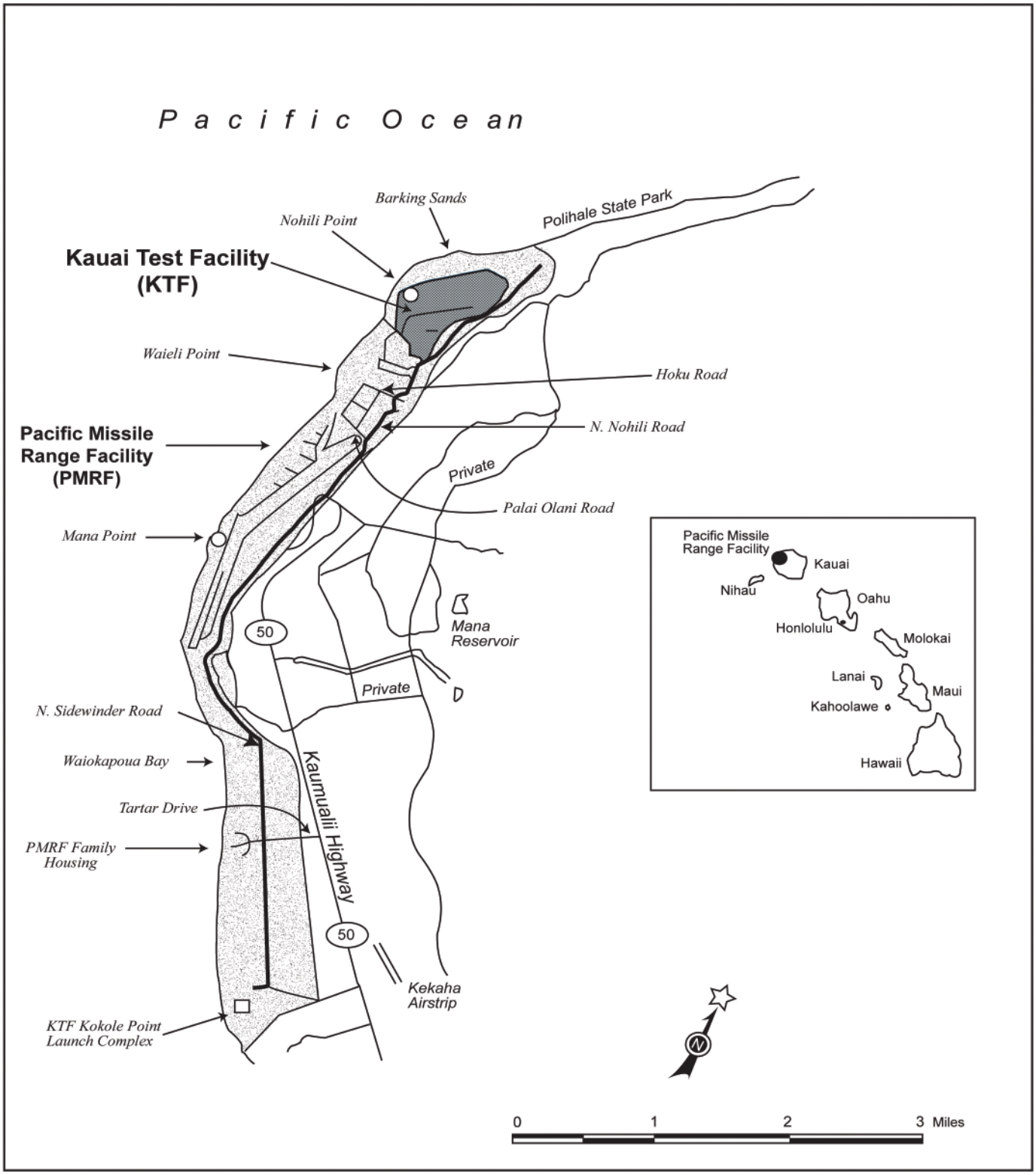



**FIGURE 5-1.** Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area (The Kauai Test Facility [KTF] is to the north, near Nohili Point)

**TABLE 5-1.** 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 | April 30, 2004 | April 29, 2009 | State of Hawaii |
| Resource Conservation and Recovery Act (RCRA) | HI-0000-363309 | Sept. 23, 1994 | Not specified | EPA Region IX and Hawaii Dept. of Health |
| Underground Storage Tank (UST) (2,500) | Not applicable | Sept. 13, 1991 | Indefinite | EPA Region IX and Hawaii Dept. of Health |

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

from the U.S. mainland are brought to KTF (DOE 1992a). The closest population center to KTF is the town of Kekaha (population 3,300), which is eight miles from the site.

### *5.4 COMPLIANCE SUMMARY*

The list of regulations and statutes on page 5-5 provides an overview of the compliance status for Sandia operations at KTF in 2007. Table 5-1 lists the applicable permits in place at KTF.

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

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

***Superfund Amendments and Reauthorization Act (SARA)***
The SARA Title III amended CERCLA requirements for reportable quantity (RQ) releases and chemical inventory reporting as directed by the Emergency Planning and Community Right-to-Know Act (EPCRA), Sections 311 and 312. All required information has been submitted to the State of Hawaii. There were no reportable releases at KTF under EPCRA or CERCLA in 2007. Table 5-2 lists SARA Title III reporting requirements.

***Resource Conservation and Recovery Act (RCRA)***
In 1994, KTF reached "small quantity hazardous waste generator" status as defined by RCRA and, therefore, obtained an EPA identification number. However, the volume of waste generated in 2007 qualified KTF to maintain "conditionally exempt small quantity generator" status.

***Federal Facility Compliance Act (FFCA)***
The FFCA addresses the disposition of mixed waste (MW) at federal facilities. No radioactive waste of any kind has been generated or stored at KTF, and this statute, therefore, is not applicable to the site.

***National Environmental Policy Act (NEPA)***
NEPA requires federal agencies and other organizations that perform federally sponsored projects to consider environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these issues, and include this information in early project planning and decision making. Additionally, if a proposed action is determined to have environmentally "significant" impacts, the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before making an irretrievable commitment of resources or funding. Although a major objective of NEPA is

## Major Environmental Regulations & Statutes Applicable to KTF

**Clean Air Act (CAA) and CAA Amendments (CAAA )**
Provides standards to protect the nation's air quality. *http://www.epa.gov/lawsregs/laws/caa.html*

**Clean Water Act (CWA)**
Provides general water quality standards to protect the nation's water sources and byways.
*http://www.epa.gov/region09/water/*

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**
Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances. *http://www.epa.gov/lawsregs/laws/cercla.html*

**Cultural Resources Acts**
Includes various acts that protect archeological, historical, religious sites, and resources.
*http://recreation.usgs.gov/env_guide/cultural.html*

**Endangered Species Act (ESA)**
Provides special protection status for federally listed endangered or threatened species.
*http://www.epa.gov/lawsregs/laws/esa.html*

**Executive Orders (EOs)**
Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and promotes greening the government through leadership in environmental management.
*http://www.archives.gov/federal_register/executive_orders/disposition.html*

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

**Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)**
Controls the distribution and use of various pesticides. *http://www.epa.gov/lawsregs/laws/fifra.html*

**Migratory Bird Treaty Act (MBTA) of 1918**
Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests. *http://tis.eh.doe.gov/oepa/laws/mbta.html*

**National Emission Standards for Hazardous Air Pollutants (NESHAP)**
Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA.
*http://www.epa.gov/radiation/neshaps/*

**National Environmental Policy Act (NEPA)**
Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision making. *http://www.eh.doe.gov/NEPA/*

.

**Resource Conservation and Recovery Act (RCRA)**
Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks. (USTs). *http://www.epa.gov//lawsregs/laws/rcra.html*

**Safe Drinking Water Act (SDWA)**
Provides specific health standards used for drinking water sources. *http://www.epa.gov/safewater/sdwa/sdwa.html*

**Superfund Amendments and Reauthorization Act (SARA)**
SARA,Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community.
*http://www.epa.gov//lawsregs/laws/epcra.htm*

**Toxic Substance Control Act (TSCA)**
Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs). *http://www.epa.gov/compliance/civil/tsca/index.html*

**TABLE 5-2.** 2007 SARA Title III (or EPCRA) Reporting Requirements Applicable to KTF

| Section | SARA Title III Section Title | Requires Reporting? | | Description |
|---|---|---|---|---|
| | | Yes | No | |
| **302 - 303** | Notification/ Plans | ✓ | | Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/ SSO, which distributes it to the required entities. |
| **304** | Emergency Notification | | ✓ | No RQ releases of an EHS, or as defined under CERCLA occured. |
| **311-312** | MSDSs/ Chemical Purchase Inventory Report | ✓ | | There are two "Community Right-to-Know" reporting requirements: (a) KTF completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) KTF provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA's alternative MSDS reporting, which is detailed in 40 CFR Part 370.21. |
| **313** | Toxic Chemical Release Forms | | ✓ | Sandia Corporation is below the reporting threshold in 2007 for producing a TRI Report for KTF operations. |

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

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/NNSA/SSO coordinates NEPA compliance at KTF with SNL/NM personnel.

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

Table 5-3 lists all threatened and endangered state and federal listed species occurring on the island of Kauai.

***Cultural Resources Acts***
The three primary cultural resources acts applicable at KTF are as follows:

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

At KTF, cultural resources compliance is coordinated through the NEPA Program. Actions that could adversely affect cultural resources are initially analyzed in a NEPA checklist.

***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

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

| Common Name | Scientific Name | Federal Status | State of HI Status |
|---|---|---|---|
| PLANTS | | | |
| Liliwai | *Acaena exigua* | Endangered | Endangered |
| No common name | *Achyranthes mutica* | Endangered | Endangered |
| Kuawawaenohu | *Alsinidendron lychnoides* | Endangered | Endangered |
| Kuawawaenohu | *Alsinidendron viscosum* | Endangered | Endangered |
| No common name | *Astelia waialealae* | Candidate | Candidate |
| No common name | *Bonamia menziesii* | Endangered | Endangered |
| Olulu | *Brighamia insignis* | Endangered | Endangered |
| Uhiuhi | *Caesalpinia kavaiense* | Endangered | Endangered |
| No common name | *Canavalia napaliensis* | Candidate | Candidate |
| No common name | *Canavalia pubescens* | Candidate | Candidate |
| ‘Awiwi | *Centaurium sebaeoides* | Endangered | Endangered |
| No common name | *Chamaesyce eleanoriae* | Candidate | Candidate |
| No common name | *Chamaesyce halemanui* | Endangered | Endangered |
| No common name | *Chamaesyce remyi var. kauaiensis* | Candidate | Candidate |
| No common name | *Chamaesyce remyi var. remyi* | Candidate | Candidate |
| No common name | *Charpentiera densiflora* | Candidate | Candidate |
| Pauoa | *Ctenitis squamigera* | Endangered | Endangered |
| Haha | *Cyanea asarifolia* | Endangered | Endangered |
| Haha | *Cyanea eleeleensis* | Candidate | Candidate |
| Haha | *Cyanea kuhihewa* | Candidate | Candidate |
| Haha | *Cyanea pseudofauriei* | Candidate | Candidate |
| Haha | *Cyanea recta* | Threatened | Threatened |
| Haha | *Cyanea remyi* | Endangered | Endangered |
| Haha | *Cyanea rivularis* | Endangered | Endangered |
| Haha | *Cyanea salicina* | Threatened | Threatened |
| Haha | *Cyanea undulata* | Endangered | Endangered |
| No common name | *Cyperus odoratus* | Candidate | Candidate |
| No common name | *Cyperus pennatiformis ssp. pennatiformis* | Endangered | Endangered |
| Pu’uka’a | *Cyperus trachysanthos* | Endangered | Endangered |
| Mapele | *Cyrtandra cyaneoides* | Endangered | Endangered |
| Mapele | *Cyrtandra kealiae ssp. kealiae* | Threatened | Threatened |
| Mapele | *Cyrtandra oenobarba* | Candidate | Candidate |
| No common name | *Delissea niihauensis ssp. kauaiensis* | Endangered | Endangered |
| No common name | *Delissea rhytidosperma* | Endangered | Endangered |
| Asplenium Leaved Diella | *Diellia erecta* | Endangered | Endangered |
| No common name | *Diellia pallida* | Endangered | Endangered |
| No common name | *Diplazium molokaiense* | Endangered | Endangered |
| No common name | *Dryopteris tenebrosa* | Candidate | Candidate |
| Na’ena’e | *Dubautia imbricata ssp. imbricata* | Candidate | Candidate |
| Na’ena’e | *Dubautia latifolia* | Endangered | Endangered |
| Na’ena’e | *Dubautia pauciflorula* | Endangered | Endangered |
| Na’ena’e | *Dubautia plantaginea ssp. magnifolia* | Candidate | Candidate |
| Na’ena’e | *Dubautia waialealae* | Candidate | Candidate |
| ‘Akoko | *Euphorbia haeleeleana* | Endangered | Endangered |
| Heau | *Exocarpos luteolus* | Endangered | Endangered |
| Mehamehame | *Flueggea neowawraea* | Endangered | Endangered |
| No common name | *Gardenia remyi* | Candidate | Candidate |
| No common name | *Geranium kauaiense* | Candidate | Candidate |
| No common name | *Gouania meyenii* | Endangered | Endangered |

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

| Common Name | Scientific Name | Federal Status | State of HI Status |
|---|---|---|---|
| Honohono | *Haplostachys haplostachya* | Endangered | Endangered |
| ‘Awiwi | *Hedyotis cookiana* | Endangered | Endangered |
| ‘Awiwi | *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 |
| Brackenridge hibiscus | *Hibiscus brackenridgei ssp. mokuleianus* | Endangered | Endangered |
| Hibiscus, Clay’s | *Hibiscus clayi* | Endangered | Endangered |
| Koki’o ke’oke’o | *Hibiscus waimeae ssp. hannerae* | Endangered | Endangered |
| Ischaemum, Hilo | *Ischaemum byrone* | Endangered | Endangered |
| Aupaka | *Isodendrion laurifolium* | Endangered | Endangered |
| Aupaka | *Isodendrion longifolium* | Threatened | Threatened |
| No common name | *Joinvillea ascendens ssp. ascendens* | Candidate | Candidate |
| Koki’o | *Kokia kauaiensis* | Endangered | Endangered |
| Kamakahal | *Labordia helleri* | Candidate | Candidate |
| Kamakahala | *Labordia lydgatei* | Endangered | Endangered |
| Kamakahal | *Labordia pumila* | Candidate | Candidate |
| Kamakahala | *Labordia tinifolia var. wahiawaensis* | Endangered | Endangered |
| No common name | *Lagenifera erici* | Candidate | Candidate |
| No common name | *Lagenifera helenae* | Candidate | Candidate |
| No common name | *Lobelia niihauensis* | Endangered | Endangered |
| No common name | *Lysimachia daphnoides* | Candidate | Candidate |
| No common name | *Lysimachia venosa* | Candidate | Candidate |
| Alani | *Melicope degeneri* | Candidate | Candidate |
| Alani | *Melicope haupuensis* | Endangered | Endangered |
| Alani | *Melicope knudsenii* | Endangered | Endangered |
| Alani | *Melicope macropus* | Candidate | Candidate |
| Alani | *Melicope pallida* | Proposed Endangered | Proposed Endangered |
| Alani | *Melicope paniculata* | Candidate | Candidate |
| Alani | *Melicope puberula* | Candidate | Candidate |
| Alani | *Melicope quadrangularis* | Endangered | Endangered |
| No common name | *Munroidendron racemosum* | Endangered | Endangered |
| Kolea | *Myrsine fosbergii* | Candidate | Candidate |
| Kolea | *Myrsine linearifolia* | Threatened | Threatened |
| Kolea | *Myrsine mezii* | Candidate | Candidate |
| `Aiea | *Nothocestrum latifolium* | Candidate | Candidate |
| ‘Aiea | *Nothocestrum peltatum* | Endangered | Endangered |
| No common name | *Oligadenus periens* | Endangered | Endangered |
| Lau ‘ehu | *Panicum niihauense* | Endangered | Endangered |
| Makou | *Peucedanum sandwicense* | Threatened | Threatened |
| Wawae’iole | *Lycopodium nutans (Phlegmariurus nutans)* | Endangered | Endangered |
| Wawae`iole | *Phlegmariurus nutans* | Endangered | Endangered |
| No common name | *Phyllostegia helleri* | Candidate | Candidate |
| No common name | *Phyllostegia knudsenii* | Endangered | Endangered |
| No common name | *Phyllostegia waimeae* | Endangered | Endangered |
| No common name | *Phyllostegia wawrana* | Endangered | Endangered |
| No common name | *Pittosporum napaliense* | Candidate | Candidate |
| ale | *Plantago princeps var. anomala* | Endangered | Endangered |
| ale | *Plantago princeps var. longibracteata* | Endangered | Endangered |
| No common name | *Platanthera holochila* | Endangered | Endangered |

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

| Common Name | Scientific Name | Federal Status | State of HI Status |
|---|---|---|---|
| Mann's Bluegrass | *Poa mannii* | Endangered | Endangered |
| Hawaiian Bluegrass | *Poa sandvicensis* | Endangered | Endangered |
| No common name | *Poa siphonoglossa* | Endangered | Endangered |
| Lo`ulu | *Pritchardia hardyi* | Candidate | Candidate |
| Lo'ulu | *Pritchardia napaliensis* | Endangered | Endangered |
| Lo'ulu | *Pritchardia viscosa* | Endangered | Endangered |
| Kaulu | *Pteralyxia kauaiensis* | Endangered | Endangered |
| No common name | *Psychotria grandiflora* | Candidate | Candidate |
| No common name | *Psychotria hobdyi* | Candidate | Candidate |
| Kaulu | *Pteralyxia kauaiensis* | Endangered | Endangered |
| No common name | *Ranunculus mauiensis* | Candidate | Candidate |
| No common name | *Remya kauaiensis* | Endangered | Endangered |
| No common name | *Remya montgomeryi* | Endangered | Endangered |
| Naupaka, dwarf | *Scaevola coriacea* | Endangered | Endangered |
| Ma`oli`oli | *Schiedea apokremnos* | Endangered | Endangered |
| No common name | *Schiedea attenuata* | Candidate | Candidate |
| No common name | *Schiedea haupuensis* | 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 spergulina alt. var. leiopoda* | Endangered | Endangered |
| No common name | *Schiedea spergulina alt. var. spergulina* | Threatened | Threatened |
| Laulihilihi | *Schiedea stellarioides* | Endangered | Endangered |
| No common name | *Silene lanceolata* | Endangered | Endangered |
| Popolo ku mai | *Solanum incompletum* | Endangered | Endangered |
| No common name | *Solanum nelsonii* | Candidate | Candidate |
| `Aiakeakua, popolo | *Solanum sandwicense* | Endangered | Endangered |
| No common name | *Spermolepis hawaiiensis* | Endangered | Endangered |
| No common name | *Stenogyne angustifolia* | Endangered | Endangered |
| No common name | *Stenogyne campanulata* | Endangered | Endangered |
| No common name | *Stenogyne kealiae* | Candidate | Candidate |
| No common name | *Viola helenae* | Endangered | Endangered |
| Nani wai`ale`ale | *Viola kauaensis var. wahiawaensis* | Endangered | Endangered |
| Dwarf iliau | *Wilkesia hobdyi* | Endangered | Endangered |
| No common name | *Wollastonia fauriei* | Endangered | Endangered |
| No common name | *Wollastonia micrantha var. exigua* | Endangered | Endangered |
| No common name | *Wollastonia micrantha var. micrantha* | Endangered | Endangered |
| No common name | *Wollastonia waimeaensis* | Endangered | Endangered |
| No common name | *Xylosma crenatum* | Endangered | Endangered |
| A`e | *Zanthoxylum hawaiiense* | Endangered | Endangered |

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

| Common Name | Scientific Name | Federal Status | State of HI Status |
|---|---|---|---|
| | ***ANIMALS*** | | |
| ***Mammals*** | | | |
| Hawaiian Hoary Bat | *Lasiurus cinereus semotus* | Endangered | Endangered |
| Hawaiian Monk Seal | *Monachus schauinslandi* | Endangered | Endangered |
| ***Birds*** | | | |
| Hawaiian Duck | *Anas wyvilliana* | Endangered | Endangered |
| Hawaiian Coot | *Fulica americana alai* | Endangered | Endangered |
| Hawaiian Gallinule | *Gallinula chloropus sandvicensis* | Endangered | Endangered |
| Kauai Nuku pu'u | *Hemignathus lucidus hanapepe* | Endangered | Endangered |
| Kauai 'Akia loa | *Hemignathus procerus* | Endangered | Endangered |
| Black-necked Stilt | *Himantopus mexicanus knudseni* | Endangered | Endangered |
| Kauai 'O'o | *Moho braccatus* | Endangered | Endangered |
| Large Kauai Thrush | *Myadestes myadestinus* | Endangered | Endangered |
| Small Kauai Solitare | *Myadestes palmeri* | Endangered | Endangered |
| Hawaiian Goose | *Nesochen sandvicensis* | Endangered | Endangered |
| No common name | *Psittirostra psittacea* | Endangered | Endangered |
| Dark-rumped Petrel | *Pterodroma phaeopygia sandwichensis* | Endangered | Endangered |
| Newell's Shearwater | *Puffinus auricularis newelli* | Threatened | Threatened |
| ***Reptiles*** | | | |
| Green Sea Turtle | *Chelonia mydas* | Threatened | Threatened |
| Hawksbill Turtle | *Eretmochelys imbricata* | Endangered | Endangered |
| ***Snails*** | | | |
| Newcomb's Snail | *Erinna newcombi* | Threatened | Threatened |
| ***Arachnids*** | | | |
| Kauai Cave Wolf Spider | *Adelocosa anops* | Endangered | Endangered |
| ***Insects*** | | | |
| Blackburn's Sphinx Moth | *Manduca blackburni* | Endangered | Endangered |
| Kauai Pomace Fly | *Drosophila musaphila* | Proposed Endangered | Proposed Endangered |

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 compliance reviews and the Ecology Program.

***Environmental Compliance Executive Orders (EOs)***

The primary EOs related to environmental compliance at KTF are as follows:

- EO 11990, *Protection of Wetlands,* as amended.
- EO 11988, *Floodplain Management*, as amended.
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* as amended.
- EO 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 as the framework in which to manage and continually improve these sustainable practices. EO 13423 incorporates the requirements of and cancels Executive Orders 13101, 13123, 13134, 13148, and 13149, which were implemented through DOE Order 450.1 in 2007. DOE is revisied Order 450.1 to include the requirements of EO 13423 in June 2008. Anticipating this change, SNL/KTF established new EMS objectives and targets starting in fiscal year 2008 to support upcoming requirements.

***Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990***

Ambient air quality is regulated by Hawaii Administrative Rules (HAR), Title 11, Chapter 59 under the jurisdiction of the Hawaii Department of Health, Clean Air Branch. Currently, there are no facilities at KTF that require federal air permits or compliance with the New Source Performance Standards (NSPS), *Prevention of Significant Deterioration* (PSD), or 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants* (NESHAP). Within the boundaries of PMRF, no federal air emission permits are held either by DOE for KTF, or by DoD for PMRF. However, the two electrical generators at KTF are permitted for operation by the State of Hawaii under a "Non-covered Source Permit (NSP)" (Hawaii Department of Health 2004).

*"Butterflies" Photo by Adriana Canavan.*

As required by the State of Hawaii, the 2006 Annual Fee and Monitoring Report (air emissions) was submitted to the State of Hawaii on January 31, 2008 (SNL 2008). In 2007, the total fuel usage reported to the State of Hawaii was 16,440 gallons (gal) of diesel fuel. Total hours of operation for the permitted generators was 1,590 hours combined. Sandia was in compliance with all air quality regulations in 2007.

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

***Clean Water Act (CWA)***
There were no compliance issues with respect to any state or federal water pollution regulations in 2007. There are three septic tanks on-site owned by DOE. The two older septic tanks for the Launch Operations Building (LOB) and the Missile Assembly Building (MAB) do not require permits from the State of Hawaii.

A National Pollutant Discharge Elimination System (NPDES) permit is not required due to the lack of significant storm water runoff discharging into "Waters of the U.S." as defined in 40 CFR 122. However, this is not to say that there is no runoff. The EPA has concern with storm water runoff washing off the launcher pads and discharging to the ocean. Some of the downstream pathways include habitat for several federally designated endangered or threatened species. The EPA has therefore recommended periodic evaluations for environmental contamination.

***Oil Storage –*** There is one underground storage tank (UST) at KTF, which is owned by the DOE. There is also one 10,000 gal above ground fuel tank inside the Main Compound. Sandia cooperates with the U.S. Navy's (USN) spill control guidelines contained in the *Spill Prevention Control and Countermeasures Plan, Pacific Missile Range Facility* (NFEC 2003).

***Safe Drinking Water Act (SDWA)***
The SWDA does not apply directly to Sandia activities at KTF because all drinking water is supplied by the Pacific Missile Range Facility drinking water system or is purchased from commercial suppliers.

***Toxic Substances Control Act (TSCA)***
TSCA regulates the distribution of polychlorinated biphenyls (PCBs) and asbestos. The transformers on the KTF site have been tested and are free of PCBs, and there are no asbestos issues at the site.

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

***Releases and Occurrences***
There were no reportable occurrences at KTF in 2007.

## *5.5 ENVIRONMENTAL PROGRAM ACTIVITIES*

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

**NEPA Program Activities at KTF**
The DOE completed a comprehensive site-wide EA for KTF operations in 1992 (DOE 1992a), which resulted in a Finding of No Significant Impact (FONSI), issued on July 17, 1992. This EA provided NEPA documentation covering all rocket launching activities at KTF; however, in late Fiscal Year (FY) 2005, the DOE/NNSA/SSO determined it was time to review and update the site-wide EA for KTF. During 2006, the USN initiated preparation of a draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for the Hawaii Range Complex. The environmental impact analysis for KTF will be included in this EIS.

**2007 NEPA Documentation**
Five NEPA reviews for KTF were submitted to DOE/NNSA/SSO in 2007.

***ER Project Activities***
There are no ER sites at KTF. The three ER sites identified in 1995 were given a No Further Action (NFA) determination by EPA on September 30, 1996. This confirmed that KTF met all CERCLA requirements and no additional sampling or

remediation would be necessary in the three areas. This, however, does not preclude that other environmental sampling activities will take place at KTF.

## *5.6 ENVIRONMENTAL SURVEILLANCE AND MONITORING ACTIVITIES*

***Wastewater Monitoring***

SNL activities at KTF produce only sanitary sewage, which is directed into nine wastewater systems—three septic tanks and six French drains, four with pumping systems located in the LOB parking lot, the paved drive west of the office complex, the paved lot west of the garage, the drive west of the shops, and two on the parking lot east of the office complex—in accordance with Hawaii Underground Injection Control regulations (HAR Title 11, Chapter 23). The septic systems are periodically pumped by licensed, state-certified contractors and inspected by state officials. No state inspections were conducted during 2007. The limited quantity of sewage released does not impact any protected waters and, as noted earlier, there are no drinking water wells in the area of KTF. As a best management practice (BMP), KTF personnel periodically performs sampling. No contaminants were identified above the reporting limits from past sampling events.

***Air Emission Monitoring***

Based on effluent air monitoring results of the STARS Flight Test Unit 1 (FTU-1) in February 1993 and the CDX rocket launch in the summer of 1992 (SNL 1992), it was determined that rocket launches at 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.

***Meteorological Monitoring***

On-site meteorological instruments are used during test periods to characterize atmospheric transport, diffusion conditions, and stability classes. Due to the infrequency of launches, no formal meteorological monitoring plan is in place for KTF. Climatic information representative of KTF is obtained from PMRF.

***Noise Monitoring***

In accordance with the Quiet Communities Act of 1978 (42 U.S.C. 4901 et seq.), noise monitoring was conducted in February 1993 during the STARS FTU-1 launch to confirm the determination made in the STARS EIS that noise produced from the largest launch would be below maximum acceptable levels (SNL 1993). Data collected in the nearest town of Kekaha indicated that levels were no louder than noise generated from passing vehicles on a nearby highway.

## *5.7 TERRESTRIAL SURVEILLANCE*

Sampling occurred at KTF during July 2007. A total of 28 terrestrial surveillance locations were sampled; 17 on-site locations and 11 community locations. Samples were analyzed for only non-radiological analytes since operations at KTF do not (now or in the past) involve radioactive materials. This year also, the samples were analyzed for perchlorate, a potential by-product of explosives or rocket propellant. These analyses were performed to determine whether this constituent had a potential for environmental concern. Data collected during 2007 are listed in Appendix B, Tables B-1 through B-5.

***Statistical Analysis***

KTF is not sampled on a yearly basis, but as funding permits (at least every five years). Therefore, there were only three years of data (1999, 2002 and 2007) to perform statistical analyses (see Appendix D). No trending was performed since the statistical methodology used requires at least four sampling periods worth of data. A comparison between years was not performed since different analytical laboratories were used, and a comparison between the three years would primarily show analytical laboratory differences.

**Table 5-4.** Summary Statistics of KTF Metals in Soil (All Units in mg/kg.)

| ANALYTE | Mean | Std Dev | Minimum | Median | Maximum |
|---|---|---|---|---|---|
| Aluminum | 6857 | 4576 | 1410 | 6600 | 31400 |
| Antimony | 2.22 | 2.58 | 0.10 | 0.50 | 8.00 |
| Arsenic | 12.88 | 11.99 | 3.84 | 9.05 | 55.70 |
| Barium | 14.86 | 16.56 | 4.34 | 11.00 | 161.00 |
| Beryllium | 0.24 | 0.19 | 0.04 | 0.12 | 0.50 |
| Cadmium | 0.41 | 0.24 | 0.05 | 0.42 | 1.40 |
| Chromium | 57.6 | 32.4 | 11.6 | 51.2 | 180.0 |
| Cobalt | 15.67 | 9.91 | 1.45 | 14.95 | 41.70 |
| Copper | 21.9 | 41.1 | 1.6 | 14.0 | 350.0 |
| Iron | 15738 | 8684 | 2580 | 14000 | 42000 |
| Lead | 6.85 | 9.92 | 0.28 | 4.59 | 64.20 |
| Magnesium | 35472 | 15462 | 14000 | 32400 | 101000 |
| Manganese | 305 | 155 | 77 | 280 | 808 |
| Mercury | 0.04 | 0.04 | 0.001 | 0.01 | 0.10 |
| Nickel | 183 | 137 | 11 | 160 | 670 |
| Potassium | 283.4 | 246.7 | 62.0 | 247.0 | 2000.0 |
| Selenium | 2.72 | 2.64 | 0.15 | 2.46 | 12.00 |
| Silver | 0.29 | 0.29 | 0.04 | 0.20 | 2.13 |
| Sodium | 2234 | 949 | 1060 | 2105 | 9500 |
| Thallium | 6.95 | 9.54 | 0.04 | 3.93 | 65.00 |
| Vanadium | 22.55 | 12.09 | 5.45 | 22.05 | 76.00 |
| Zinc | 123.4 | 315.1 | 2.7 | 38.2 | 2880.0 |

However, a summary report of the entire database for TAL metals was prepared to document the current baseline concentrations at the KTF site (SNL 2008a). Summary statistics are presented on the next page in Table 5-4 (see Appendix C).

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

***Sampling Locations***

Terrestrial surveillance began at KTF in 1994. Sampling occurred in 1999 and then again in 2002 and 2007. Although sample results were recorded in 1994, no information on detection limits or decision levels was kept and as a result this information is only used for historical purposes. Data from 1994 is not used in any statistical analysis. Routine terrestrial surveillance is conducted at onsite and off-site locations that remain essentially the same from sampling period to sampling period. Sample locations may be modified as necessary to reflect current operations or to supplement data from existing locations. To date, the only modification has been to modify the sampling location numbering format to be consistent with the one used at SNL/NM. The sampling locations, number of samples, and analyses performed are prioritized based on the following criteria:

- On-site locations are near areas of known contamination, potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate. A list of on-site sampling locations is shown in Table 5-5. Appendix B, Figure B-1 contains a map of the sampling locations. A total of 17 locations were sampled on-site

- Community (Off-site) locations are selected to provide a measurement of environmental conditions unaffected by Sandia Corporation's activities at KTF. Data collected from off-site locations serve as a reference point

**TABLE 5-5.** 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 | -- |

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

*"Hawaii Landscape" Photo by Adriana Canavan.*

to compare data collected at perimeter and on-site locations. Multiple years of sampling data are compiled to determine statistical averages for off-site concentrations.

Off-site locations are chosen both in remote, natural settings as well as in areas near local population centers and along highways.Table 5-6 contains a list of the off-site sample locations. Eleven off-site locations that were sampled are shown in Figure B-2 of Appendix B.

***Non-radiological Results***

All soil samples are analyzed for the following 21 metals:

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

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

The CY 2007 analytical results are found in Appendix B of this report. The detailed statistical analyses are documented in *2007 Data Analysis in Support of the KTF Annual Site Environmental Report* (SNL 2008a).

Although there were 4 instances (aluminum, cadmium, iron, and vanadium) where one or more metals observed in on-site soil samples were statistically greater that off-site samples, none of these were of concentrations that were of concern, as can be seen by comparing these values in Table 5-7 to corresponding values in Table 5-8.

No published background values have been found for any of the metals that are specific for Hawaii or the island of Kauai. All values are below the EPA Region 9 Preliminary Remediation Goals for residential use and do not indicate an immediate concern.

**TABLE 5-6** Off-site Terrestrial Surveillance Locations at KTF

| Location Number | Sample Location | Replicate* Location |
|---|---|---|
| C-01 | Rec Area I Beach Access sign – N. 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 – Bldg H10 | -- |
| C-10 | Kokole Point Launch Area – West | -- |
| C-11 | Kokole Point Launch Area – South | -- |

**NOTE:** KTF = Kauai Test Facility

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

As seen in Tables B-4 and B-5, there was no perchlorate detected in any of the on-site or community samples above the analytical dectection limit. Therefore, it is not considered to be a potential contaminant of concern.

**TABLE 5-7**. Summary Statistics For Metals That Showed a Statistical Difference Between Community and On-Site Location Types (all units in mg/kg.)

| Metal | Location Type | Sample Size | Mean | Median | Std Dev | Min | Max |
|---|---|---|---|---|---|---|---|
| Aluminum | On-site | 17 | 3864 | 2380 | 3148 | 1410 | 9870 |
| | Community | 11 | 8698 | 7230 | 6243 | 2320 | 31400 |
| Cadmium | On-site | 17 | 0.17 | 0.16 | 0.06 | 0.1 | 0.32 |
| | Community | 11 | 0.46 | 0.36 | 0.29 | 0.16 | 1.25 |
| Iron | On-site | 17 | 12265 | 8150 | 10682 | 3700 | 38200 |
| | Community | 11 | 19740 | 18200 | 7963 | 5580 | 30800 |
| Vanadium | On-site | 17 | 10.5 | 7.8 | 6.8 | 5.4 | 24 |
| | Community | 11 | 19.8 | 19.7 | 5.2 | 7.8 | 29.7 |

*"Hawaii Sunset" Photo by Adriana Canavan.*

**TABLE 5-8.** Various Reference Values for Metals-in-Soil (All units in mg/kg.)

| | EPA Region 9 PRGs (Soil Screening Levels)[2] | | US Soil Concentrations[3] | |
|---|---|---|---|---|
| **Analyte** | **Residential** | **Industrial** | **Lower Limit** | **Upper Limit** |
| Aluminum | 76,000 | 100,000 | 4,500 | 100,000 |
| Antimony | 31 | 410 | 0.25 | 0.6 |
| Arsenic | 0.39 | 1.6 | 1 | 93 |
| Barium | 5,400 | 67,000 | 20 | 1,500 |
| Beryllium | 150 | 1,900 | 0.04 | 2.54 |
| Cadmium | 37 | 450 | 0.41 | 0.57 |
| Chromium | 210 | 450 | 7 | 1,500 |
| Cobalt | 900 | 1,900 | 3 | 50 |
| Copper | 3,100 | 41,000 | 3 | 300 |
| Iron | 23,000 | 100,000 | 5,000 | 50,000 |
| Lead | 400 | 800 | 10 | 70 |
| Magnesium | n/a | n/a | n/a | n/a |
| Manganese | 1,800 | 19,000 | 20 | 3,000 |
| Mercury | 23 | 310 | 0.02 | 1.5 |
| Nickel | 1,600 | 20,000 | 5 | 150 |
| Potassium | n/a | n/a | n/a | n/a |
| Selenium | 390 | 5,100 | 0.1 | 4 |
| Silica (Silicon) | n/a | n/a | 24,000 | 368,000 |
| Silver | 390 | 5,100 | 0.2 | 3.2 |
| Sodium | n/a | n/a | n/a | n/a |
| Strontium | 47,000 | 100,000 | 7 | 1,000 |
| Thallium | 5.2 | 67 | 0.02 | 2.8 |
| Vanadium | 78 | 1,000 | 0.7 | 98 |
| Zinc | 23,000 | 100,000 | 13 | 300 |

**NOTES:**

ND = not detectable

n/a = not available

(1) Dragun, James, A. Chiasson, *Elements in North American Soils*, 1991, Hazardous Materials Control Resources Institute, (Used Nevada Soils to determine values).

(2) EPA Region 9 Preliminary Remediation Goals (PRGs), U.S.E.P.A., October 2004.

(3) US Soil Surface Concentrations, Kabata-Pendias, A., Pendias, H., CRC, *Trace Elements in Soils and Plants*, 3rd Edition, 2000.

chapter six

# TTR & KTF REFERENCES

*"Blacktop at TTR"  Photo by staff.*

**In This Chapter...**

## REFERENCES


**DOC 2008** U.S. Department of Commerce, U.S. Census Bureau, website at <http://www.census.gov/> Washington, DC (2008).

**DoD 1998** U.S. Department of Defense, *Pacific Missile Range Facility Enhanced Capability Final Environmental Impact Statement (EIS)*. U.S. Department of Defense, Department of the Navy, Kauai, HI (December 1998).

**DoD/DOE/ State of NV 1996** U.S. Department of Defense, U.S. Department of Energy, and Nevada Department of Conservation and Natural Resources, *Federal Facility Agreement and Consent Order* (FFACO). State of Nevada Department of Conservation and Natural Resources, Division of Environmental Protection and the U.S. DOE and the U.S DoD in the Matter of Federal Facility Agreement and Consent Order (March 15, 1996). Available on the Web at: http://ndep.nv.gov/boff/ffco.htm.

**DOE 2007** U.S. Department of Energy, *Nevada Test Site Environmental Report 2006*, DOE/NV 25946-259 Prepared by Bechtel for the U.S. DOE/NNSA, Las Vegas NV (2007).

**DOE 2007xxx** DOE Manual 231.1-1A (See DOE Orders Section)

**DOE 2005** DOE Order 450.1 (See DOE Orders Section)

**DOE 2003** DOE Manual 231.1-2 (see DOE Orders Section)

**DOE 2001** DOE Order 435.1 (See DOE Orders Section)

**DOE 1996** U.S. Department of Energy, *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*, DOE/EIS-0243. DOE, Nevada Operations Office, Las Vegas, NV (August 1996).

**DOE 1994** U.S. Department of Energy, *Memorandum of Agreement Between the Nevada Operations Office and the Albuquerque Operations Office*, DE-GM08-98NV13555, as amended (Appendix C, *Tonopah Test Range*, signed October 1997). U.S. Department of Energy, Albuquerque, NM and Las Vegas, NV (1994).

**DOE 1993** DOE Order 5400.5 (See DOE Orders Section)

**DOE 1992** U.S. Department of Energy, *Water Conservation Plan for the Tonopah Test Range*, Range 4809. U.S. Department of Energy/Nevada Operations Office, Las Vegas, NV (1992).

**DOE 1992a** U.S Department of Energy, *Kauai Test Facility Environmental Assessment*, DOE/EA-0492. U.S Department of Energy, Albuquerque Operations Office (DOE/AL), Albuquerque, NM (1992).

**DOE 1990** DOE Secretary of Energy Notice SEN-22-90 (See DOE Orders Section)

**Dragun and Chekiri 2005** Dragun, J. and K. Chekiri, *Elements in North American Soils.* The Association for Environmental Health and Sciences, Amherst, MA (2005).

**DRI 1997** Desert Research Institute (DRI), *Draft Analysis of Ambient Airborne Particulate Matter for Plutonium; Clean Slate 1 During Excavation and Truck Loading, Tonopah Test Range, May 1997 - June 1997*, DRI Document Number 6357-683-7562.1D1. Prepared by DRI for the U.S. Department of Energy/Nevada Field Office, Las Vegas, NV (November 14, 1997).

**DRI 1991** Desert Research Institute, *Special Nevada Report*, DOE/NV/10715-T1. Prepared by Science Applications International Corporation (SAIC) for the Department of the Air Force (September 23, 1991).

**E&E 1989** Ecology and Environment, Inc., *Federal Facility Preliminary Assessment Review*, EPA Region IX, F9-8903-021, NV3570090016. Ecology and Environment, Inc., San Francisco, CA (1989).

**EG&G 1995** Edgerton, Germeshausen & Grier Corporation, *Aerial Radiological Survey of the Tonopah Test Range Including Clean Slate 1, 2, 3, Roller Coaster, Decontamination Area, Cactus Springs Ranch Target Areas, Central Nevada*, EGG-11265-1145. EG&G Energy Measurements, Inc., Las Vegas, NV (1995).

**EG&G 1979** Edgerton, Germeshausen & Grier Corporation, *Status of Endangered and Threatened Plant Species on Tonopah Test Range - A Survey*, EGG-1183-2387. EG&G, Las Vegas, NV (1979).

**EPA 2008** U.S. Environmental Protection Agency, "National Priorities List (NPL) Sites in the United States," available on the Web at http://www.epa.gov/superfund/sites/npl/npl.htm. U.S. Environmental Protection Agency, Washington, DC (2008).

**EPA 1999** U.S. Environmental Protection Agency, *Off-site Environmental Monitoring Report: Radiation Monitoring Around United States Nuclear Test Areas, Calendar Year 1997*, EPA/402-R-98-013, U.S. Environmental Protection Agency, Las Vegas, NV (1999).

**ERDA 1975** U.S. Energy Research and Development Administration, *Environmental Assessment, Tonopah Test Range*, EIA/MA/76-2. U.S. Energy Research and Development Administration (ERDA), Washington, DC (1975).

**Gore 1993** Gore, A., *From Red Tape to Results: Creating a Government that Works Better and Costs Less* (Report of the National Performance Review). U.S. Government Printing Office, Washington, DC (1993).

**Hawaii Dept. of Health, (DOH) 2004** Hawaii Department of Health, "State of Hawaii Noncovered Source Permit No. 0429-01-N, " Expiration Date 04/29/2009. State of Hawaii DOH. Honolulu, HI (April 30, 2004).

**IT 1996** IT Corporation, *Sampling and Analysis Plan for Clean Slate 1*. IT Corporation, Albuquerque, NM (September 1996).

**IT 1993** IT Corporation, *Tonopah Test Range Polychlorinated Biphenyls Sample Results*. IT Corporation, Albuquerque, NM (October 1993).

**Kabata-Pendias 2000** Kabata-Pendias, *Trace Elements in Soils and Plants*, 3rd. Ed. CRC Press, Inc., Boca Raton, FL (2000).

**NFEC 2003** Sandia National Laboratories, *Spill Prevention Control and Countermeasures (SPCC) Plan, Pacific Missile Range Facility, Kauai, Hawaii.* Prepared for Sandia National Laboratories by the Naval Facilities Engineer Command (NFEC), Environmental Division, Pearl Harbor, HI (2003).

**Schaeffer 1970** Schaeffer, J. R., *Climatology of Tonopah Test Range, Nevada 1961-1969*, SC-TM-70-0215. Sandia National Laboratories, Albuquerque, NM (1970).

**Shyr, Herrera, Haaker 1998** Shyr, L, H. Herrera, R. Haaker, *The Role of Data Analysis in Sampling Design of Environmental Monitoring*, SAND98-0612. Sandia National Laboratories, Albuquerque, NM (March 1998).

**Sinnock 1982** Sinnock, S., *Geology of the Nevada Test Site and Nearby Areas - Southern Nevada*, SAND82-2207. Sandia National Laboratories, Albuquerque, NM (1982).

**SNL 2008** **Chemical Analyses of Soil Samples Collected from the Sandia National Laboratories, Kauai Test Facility, HI, 1999-2007, SAND2007-7635.**

**SNL 2008a** Sandia National Laboratories, *KTF Test Range Data Analysis in Support of the Annual Site Environmental Report, 2007*. Sandia National Laboratories, Albuquerque, NM (March 2008).

**SNL 2008b** Sandia National Laboratories, *NESHAP Annual Report for CY 2007, Sandia National Laboratories, Nevada*. Sandia National Laboratories, Albuquerque, NM (2008).

**SNL 2008c** Sandia National Laboratories, "Noncovered Source Permit No. 0429-01-N: 2006 Annual Fee and Monitoring Report" (for Kauai Test Facility). Sandia National Laboratories, Albuquerque, NM. (2008).

**SNL 2008d** Sandia National Laboratories, *Tonopah Test Range Data Analysis in Support of the Annual Site Environmental Report, 2007*. Sandia National Laboratories, Albuquerque, NM (March 2008).

**SNL 2008e** Sandia National Laboratories, *Toxic Chemical Release Reporting Community Right-to-Know: Calendar Year 2007.* Sandia National Laboratories, Albuquerque, NM (June 2008).

**SNL 2006** Sandia National Laboratories, *Chemical Analyses of Soil Samples Collected from the Sandia National Laboratories, Tonopah Test Range Environs, 1994-2005.* SAND2006-2071, Sandia National Laboratories, Albuquerque, NM (May 2006).

**SNL 2004** Sandia National Laboratories, *Spill Prevention Control and Countermeasures (SPCC) Plan for SNL Tonopah Test Range*, Plan 90-12, Rev. 5. Sandia National Laboratories, Albuquerque, NM (August 2004).

**SNL 1997** Sandia National Laboratories, (1) *NESHAP Annual Report for CY 1996* (EPA Summary) and (2) *Radiological Dose Calculations and Supplemental Dose Assessment Data for NESHAP Compliance for Sandia National Laboratories, Nevada, CY 1996*. Sandia National Laboratories, Albuquerque, NM (1997).

**SNL 1996** Sandia National Laboratories, (1) *NESHAP Annual Report for CY 1995* (EPA Summary) and (2) *Radiological Dose Calculations and Supplemental Dose Assessment Data for NESHAP Compliance for Sandia National Laboratories, Nevada, CY 1995*. Sandia National Laboratories, Albuquerque, NM (1996).

**SNL 1993** Sandia National Laboratories, "SNL Acoustic Monitoring Plan of the STARS Flight Test Unit 1." Memo to Linda Ninh from B.E. Swanson. Sandia National Laboratories, Albuquerque, NM (1993).

**SNL 1992** Sandia National Laboratories, "CDX Rocket Motor Effluent Monitoring," Memo from W.E. Stocum (7712) to R.G. Hay (2723). Sandia National Laboratories, Albuquerque, NM (1992).

**State of Nevada 1997** State of Nevada, *State of Nevada Bureau of Health Protection Services Vulnerability Assessment Contamination Monitoring Waiver*. State of Nevada, (Sampling protocols for water quality, expiration date 2010) (October 21, 1997).

**USAF/DOE/ NNSA 2002** U.S. Air Force/DOE/NNSA, *Department of the Air Force Permit to the National Nuclear Security Administration to use Property Located on the Nevada Test and Training Range, Nevada.* U.S. Air Force/DOE/NNSA, Tonopah, Nevada (2002).

**USAF 1999** U.S. Air Force, *Renewal of the Nellis Air Force Range Land Withdrawal: Department of the Air Force Legislative Environmental Impact Statement.* U.S. Air Force, Nellis Air Force Range, Nevada (March 1999).

**EXECUTIVE ORDERS**

**EO 11990** *Protection of Wetlands*, as amended (May 24, 1977).

**EO 11988** *Floodplain Management*, as amended (May 24, 1977).

**EO 12898** *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended (February 11, 1994).

**EO 13423** *Strengthening Federal Environmental, Energy, and Transportation Management* (January 2007).

**EO 13432** *Cooperation Among Agencies in Protecting the Environment With Respect to Greenhouse Gas Emissions From Motor Vehicles, Nonroad Vehicles, and Nonroad Engines.* (May 2007).

**DOE DIRECTIVES**

**DOE 2007** U.S. Department of Energy, *Environment, Safety, and Health Reporting Manual*, DOE Manual 231.1-1A, Change 2. U.S. Department of Energy, Washington, DC (June 12, 2007).

DOE 2007a U.S. Department of Energy, *Environmental Protection Program*, DOE Order 450.1, Administrative Change 1 dated 1/3/07, U.S. Department of Energy, Washington, DC (12/7/2007).

**DOE 2003** U.S. Department of Energy, *Occurrence Reporting and Processing of Operations Information*, DOE Manual 231.1-2. U.S. Department of Energy, Washington, DC (August 18, 2003).

**DOE 2001** U.S. Department of Energy, *Radioactive Waste Management*, DOE Order 435.1, Change 1. U.S. Department of Energy, Washington, DC (August 28, 2001).

**DOE 1993** U.S. Department of Energy, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5, Change 2. U.S. Department of Energy, Washington, DC (January 7, 1993).

**DOE 1990** U.S. Department of Energy, "DOE Policy on Signatures of RCRA Permit Applications," SEN-22-90. U.S. Department of Energy, Washington, DC (5/8/1990).

**CODE OF FEDERAL REGULATIONS**

**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 141.26** "Monitoring Frequency and Compliance Requirements for Radionuclides in Community Water Systems"

**40 CFR 270** "EPA Administered Permit Programs: The Hazardous Waste Permit Program"

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

**40 CFR 355** "Emergency Planning and Notification"

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

**ACTS & STATUTES**

- American Indian Religious Freedom Act (AIRFA) of 1978 (42 U.S.C. §1996)
- Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. § 470aa)
- Atomic Energy Act (AEA) of 1954 (42 U.S.C. §2011 et seq.)
- Clean Air Act (CAA) and CAA Amendments (CAAA) of 1990 (42 U.S.C. §7401)
- Clean Water Act (CWA) of 1977 (The Federal Water Pollution Control Act) (33 U.S.C. §1251)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. §9601) (Amended by SARA)
- Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 U.S.C. § 11001 et seq.) (Also known as SARA Title III)
- Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.)
- Federal Facility Compliance Act (FFCA) of 1992 (42 U.S.C. § 6961)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. § 136)
- Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. § 703 et seq.)
- National Environmental Policy Act (NEPA) of 1969 (42 U.S.C.§4321)
- National Historic Preservation Act of 1966, as amended (16 U.S.C. §470 et seq.)
- Pollution Prevention Act of 1990 (42 U.S.C.§13101 et seq.)
- Quiet Communities Act of 1978 (42 U.S.C. §4901 et seq.)
- Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C. § 6901 et seq.)
- Safe Drinking Water Act (SDWA) (42 U.S.C. §300f)
- Superfund Amendments and Reauthorization Act (SARA) of 1986 (see CERCLA)
- Toxic Substances Control Act (TSCA) of 1976 (15 U.S.C. §2601 et seq)

***STATE OF HAWAII ENVIRONMENTAL REGULATIONS***

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

## *STATE OF NEVADA ENVIRONMENTAL REGULATIONS*

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/CHAPTERS.html**

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

| Chapter 444, Sanitation | Applicable Sources or Activities |
|---|---|
| NAC 444.570 to 444.7499, "Solid Waste Disposal" | • Disposal of construction debris<br>• Disposal of routine non-hazardous solid wastes<br>• Disposal of septic sludge |
| NAC 444A.005 to 444A.500, "Programs for Recycling" | • Recyclable materials including waste tires |
| **Chapter 445A, *Water Controls*** | |
| NAC 445A.070 to 445A.348, "Water Pollution Control" | • Septic tanks<br>• Surface water runoff |
| NAC 445A.450 to 445A. 6731, "Public Water Systems" | • Production well sampling |
| **Chapter 445B, *Air Controls*** | |
| NAC 445B.001 to 445B.3497, "Air Pollution" | • Open burning<br>• Hazardous air pollutants from stacks and vents<br>• Disturbance of soils during construction (particulate matter) |
| NAC 445B.400 to 445B.774, "Emissions From Engines" | • Generators<br>• Mobile sources |
| **Chapter 504, *Wildlife Management and Propagation**** | |
| NAC 504.110 to 504.340, "Wildlife Management Areas" | • Road construction |
| NAC 504.510 to 504.550, "Alteration of Stream System or Watershed" | • Construction activities |
| NAC 504.800 to 504.865, "Preservation of Wild Horses"** | • General activities on the range in wild horse areas |
| **Chapter 534, *Underground Water and Wells*** | |
| NAC 534.010 to 534.500, "Underground Water and Wells" | • Drilling, operation, and abandonment of wells |

**NOTES:** TTR = Tonopah Test Range

*This regulation provides protection to endangered, threatened, and sensitive species.
**Two wild horse units encompass areas within the Nellis Air Force Range:
**"Unit 252:** That portion of Nye County ….. and those portions of the Nellis Air Force Range as authorized by the United States Department of Defense."
**"Unit 253:** That portion of Nye County … including those portions of the Nellis Air Force Range as authorized by the United States Department of Defense and the Nevada Test Site as authorized by the United States Department of Energy." (NAC 504.21, "General Designation of Management Areas and Units")

This page intentionally left blank.

# GLOSSARY

*“Rig at TTR” Photo by TTR Staff.*

This page intentionally left blank.

## A

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

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

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

**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.

**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** – The preferred methods and practices for managing operations.

## C

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

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

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

## D

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

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

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

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

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

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

## E

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

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

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

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

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

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

**Environmental Medium** – A major environmental category that surrounds or contacts humans, animals, plants, and other organisms (e.g. surface water, ground water, soil or air) and through which chemicals or pollutants move.

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

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

## *F*

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

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

## *G*

**Gamma-ray Spectrum** – The set of wavelengths or energies of gamma rays emitted by a given source.

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

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

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

**Groundwater** – The supply of fresh water found beneath the Earth's surface, usually in aquifers, which supply wells and springs. Because ground water 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** – Systematically integrates safety into management and work practices at all levels so that missions are accomplished while protecting the worker, the public, and the environment

## *M*

**Maximally Exposed Individual** (MEI) – The location of a member of the public which receives or has the potential to receive the maximum radiological dose from air emissions of a National Emissions Standards for Hazardous Air Pollutants (NESHAP) radionuclide source.

**Mixed Waste** – Radioactive waste that contains both source material, special nuclear material, or by-product material subject to the Atomic Energy Act of 1954, as

amended; and a hazardous component subject to the Resource Conservation and Recovery Act (RCRA), as amended.

## N

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

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

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

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

## P

**Phenols** – 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" 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** – Quantity of material or product compound or contaminant which when released to the environment is reportable to a regulatory agency.

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

## S

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

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

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

## T

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

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

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

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

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

## *U*

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

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

## *V*

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

## *W*

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

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

**UNLIMITED RELEASE DISTRIBUTION**

## U.S Department of Energy

U.S. Department of Energy/NNSA (15)
Sandia Site Office (SSO)
Office of Environment, Safety and Health
Attn: Karen Agogino
P.O. Box 5400
Albuquerque, NM 87185-5400

U.S. Department of Energy/HQ (1)
Director, Office of Nuclear Safety and Environment
HS-30/Forrestal Building
Attn: Andrew C. Lawrence
1000 Independence Ave.
Washington, DC 20585

U.S. Department of Energy/HQ (1)
Director, Office of Corporate Safety Programs
HS-31/270CC
Attn: Charles B. Lewis
19901 Germantown Road
Germantown, MD 20874

U.S. Department of Energy/HQ (1)
Director, Office of Independent Oversight
HS-60/Forrestal Building
Attn: Bradley A. Peterson
19901 Germantown Road
Germantown, MD 20874

U.S. Department of Energy/NNSA (1)
Nevada Site Office (NS)
Attn: Bruce Hurley
P.O. Box 98518
Las Vegas, NV 89193-8518

U.S. Department of Energy/HQ (2)
Director, Office of Management Analysis and Process Management (EM-6)
Attn: James Fiore
19901 Germantown Road
Germantown, MD 20874

U.S. Department of Energy/HQ (1)
Immediate Office of the Chief Health, Safety and Security Officer
HS-1/Forrestal Building
Attn: Glenn S. Podonsky
19901 Germantown Road
Germantown, MD 20874

U.S. Department of Energy /HQ (1)
Director Office of Operations Oversight (EM-62)
Attn: Robert Goldsmith
19901 Germantown Road
Germantown, MD 20874

U.S. Department of Energy/HQ (1)
Associate Administrator for Infrastructure and Environment
NA-50/Forrestal Building
Attn: Alice Williams
1000 Independence Ave.
Washington, DC 20585

U.S. Department of Energy/HQ (3)
Office of Analysis (HS-32)
Attn: Ross Natoli
1000 Independence Ave. SW
Washington, DC 20585

U.S. Department of Energy/NNSA (2)
NNSA Service Center (NNSA/SC)
Environmental Safety and Health Department
Attn: Deborah Griswold
P.O. Box 5400
Albuquerque, NM 87185-5400

Environmental Restoration Division (1)
Nevada Site Office (NSO) (EM-3.2)
Attn: Kevin Cabble
P.O. Box 98518
Las Vegas, NV 81913-8518

U.S. Department of Energy/HQ (1)
Director Office of Scientific and Technical Information (SC-44)
Attn: Walter Warnick
19901 Germantown Road
Germantown, MD 20874

Frank Grossman (1)
Nevada Test Site
PO Box 98521
MS NTS 273
Las Vegas, NV 89193

**UNLIMITED RELEASE DISTRIBUTION** *(continued)*

## Other Individuals and Organizations

Margaret Lindeman (1)
Lockheed-Martin Corporation
6801 Rockledge Drive
Mail Point CLE610
Bethesda, MD 20817

John Dietrich (1)
Lockheed-Martin Corporation
6801 Rockledge Drive
Mail Stop DM315
Bethesda, MD 20817

Tim Murphy
Nevada Division of Environmental Protection
2030 E. Flamingo Road
Suite 230
Las Vegas NV 89119

Adeline Sasaki (1)
Kauai District Health Office
3040 Umi Street P.O. Box 671
Lihue, HI 96766

Dan Barkley (1 w/disk)
Government Information Department
Zimmerman Library-UNM
1 University of New Mexico MSC05 3020
Albuquerque, NM 87131-0001

## State and Other Federal Agencies

Environmental Health Administration (1)
Environmental Management Division
Attn: Thomas E. Arizumi
Room 300
919 Ala Moana Blvd.
Honolulu, HI 96814-4920

Environmental Protection Agency (1)
Headquarters Office
Ariel Rios Building
1200 Pennsylvania Ave, NW
Washington, DC 20460

Environmental Protection Agency (1)
Region IX Office
75 Hawthorne Street
San Francisco, CA 94105

Division of Environmental Protection (1)
Attn: Allen Biaggi
333 W. Nye Lane, Room 138
Carson City, NV 89706-0851

## Sandia National Laboratories Distribution

| | | |
|---|---|---|
| 1 | (MS 0124) | P. Newman, 4100 |
| 1 | (MS 0140) | S. J. Ward, 4020 |
| 2 | (MS 0141) | A. Blumberg, 11100* |
| 1 | (MS 0781) | M. Irwin, 6411 |
| 1 | (MS 0434) | J. Harris, 12334 |
| 1 | (MS 0651) | ES&H Customer-Funded Record Center, 4532 |
| 2 | (MS 0899) | Central Technical Files, 8944 |
| 2 | (MS 0899) | Technical Library, 4536 |
| 1 | (MS 1151) | J. Thompson, 4139 |
| 1 | (MS 1172) | A. Lopez, 5419** |
| 1 | (MS 1172) | N. Nitta, 54191* |
| 1 | (MS 1172) | J. Jarry, 5419* |
| 1 | (MS 1183) | D. Manning, 54031* |
| 1 | (MS 1392) | W. Forston, 2915** |
| 1 | (MS 1392) | V. Hermansen, 2915 |
| 1 | (MS 1392) | B. Sherwood, 2915 |
| 1 | (MS 1454) | M. L. Jones, 2712 |
| 1 | (MS 1042) | B. Bailey-White, 4131 |
| 1 | (MS 1042) | L. Bayliss, 4133* |
| 1 | (MS 1042) | J. M. Bonaguidi, 4133 |
| 1 | (MS 1042) | T. Cooper, 4133 |
| 1 | (MS 1042) | M. L. du Mond, 4133 |
| 1 | (MS 1042) | J. L. Eckstein, 4133* |
| 1 | (MS 1042) | T. Fitzgerald, 4131 |
| 1 | (MS 1042) | S. Hwang, 4131 |
| 1 | (MS 1042) | A. K. Jones, 4133 |
| 25 | (MS 1042) | S. Koss, 4131 |
| 1 | (MS 1042) | M. L. Miller, 4133** |
| 1 | (MS 1042) | E. Otto, 4131* |
| 1 | (MS 1042) | J. Payne, 4133 |
| 1 | (MS 1042) | C. Roma, 4133 |
| 1 | (MS 1042) | R. Sanchez, 4131 |
| 1 | (MS 1042) | K. Wagner, 4131 |
| 1 | (MS 1042) | R. Wrons, 4131 |
| 5 | (MS 1043) | ES&H Library, 4133 |

**NOTE:** *Require CD copies of this report.
**Require CD and published copies of this report.

This page intentionally left blank.

# APPENDIX A
## TERRESTRIAL SURVEILLANCE RESULTS AND SAMPLING LOCATION MAPS FOR TTR

*"Fence Lizard" Photo by Steve Cox.*

This page intentionally left blank.

# CONTENTS

## FIGURES



## TABLES

This page intentionally left blank.

**TABLE A-1.** Radiological Results for Off-site Soil Sampling Locations at TTR, 2007

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| C-20 | Americium-241 | pCi/g | 0.0758 ± 0.0427 | 0.0337 | 0.0758 | U |
| | Cesium-137 | pCi/g | 0.202 ± 0.0273 | 0.00945 | 0.0189 | |
| | Potassium-40 | pCi/g | 29.7 ± 1.9 | 0.075 | 0.15 | |
| | Uranium-235 | pCi/g | 0.0405 ± 0.076 | 0.0535 | 0.107 | U |
| | Uranium-238 | pCi/g | 1.44 ± 0.537 | 0.284 | 0.568 | |
| | Uranium | mg/kg | 0.638 | 0.00984 | 0.0394 | |
| C-21 | Americium-241 | pCi/g | 0.0533 ± 0.0217 | 0.0187 | 0.0534 | U |
| | Cesium-137 | pCi/g | 0.0979 ± 0.0229 | 0.0122 | 0.0243 | |
| | Potassium-40 | pCi/g | 28.1 ± 1.69 | 0.0921 | 0.184 | |
| | Uranium-235 | pCi/g | 0.11 ± 0.0807 | 0.0579 | 0.116 | U |
| | Uranium-238 | pCi/g | 0.731 ± 0.355 | 0.179 | 0.358 | |
| | Uranium | mg/kg | 0.605 | 0.00978 | 0.0391 | |
| C-22 | Americium-241 | pCi/g | 0.0534 ± 0.0179 | 0.0154 | 0.0535 | U |
| | Cesium-137 | pCi/g | 0.0666 ± 0.0142 | 0.00945 | 0.0189 | |
| | Potassium-40 | pCi/g | 29 ± 1.85 | 0.0719 | 0.144 | |
| | Uranium-235 | pCi/g | 0.0126 ± 0.0748 | 0.0503 | 0.101 | U |
| | Uranium-238 | pCi/g | 1.14 ± 0.322 | 0.146 | 0.293 | |
| | Uranium | mg/kg | 0.584 | 0.00973 | 0.0389 | |
| C-23 | Americium-241 | pCi/g | -0.00611 ± 0.0513 | 0.0421 | 0.0841 | U |
| | Cesium-137 | pCi/g | 0.127 ± 0.0185 | 0.0105 | 0.0211 | |
| | Potassium-40 | pCi/g | 25.9 ± 1.97 | 0.084 | 0.168 | |
| | Uranium-235 | pCi/g | 0.0905 ± 0.0813 | 0.0486 | 0.0971 | U |
| | Uranium-238 | pCi/g | 1.1 ± 0.691 | 0.338 | 0.676 | |
| | Uranium | mg/kg | 0.467 | 0.00973 | 0.0389 | |
| C-24 | Americium-241 | pCi/g | 0.0803 ± 0.0242 | 0.0203 | 0.0804 | U |
| | Cesium-137 | pCi/g | 0.165 ± 0.0245 | 0.0129 | 0.0257 | |
| | Potassium-40 | pCi/g | 28.1 ± 2.34 | 0.106 | 0.212 | |
| | Uranium-235 | pCi/g | 0.0987 ± 0.109 | 0.0674 | 0.135 | U |
| | Uranium-238 | pCi/g | 1.82 ± 0.502 | 0.194 | 0.388 | |
| | Uranium | mg/kg | 1.09 | 0.00986 | 0.0394 | |
| C-25 | Americium-241 | pCi/g | 0.0625 ± 0.0244 | 0.0202 | 0.0625 | U |
| | Cesium-137 | pCi/g | 0.398 ± 0.0396 | 0.0127 | 0.0254 | |
| | Potassium-40 | pCi/g | 29 ± 2.42 | 0.119 | 0.238 | |
| | Uranium-235 | pCi/g | 0.00909 ± 0.104 | 0.0681 | 0.136 | U |
| | Uranium-238 | pCi/g | 1.38 ± 0.401 | 0.201 | 0.401 | |
| | Uranium | mg/kg | 1.04 | 0.00973 | 0.0389 | |

See notes at end of table

**TABLE A-1.** Radiological Results for Off-site Soil Sampling Locations at TTR, 2007 (continued)

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| C-26 | Americium-241 | pCi/g | 0.0615 ± 0.0539 | 0.0463 | 0.0926 | U |
| | Cesium-137 | pCi/g | 0.747 ± 0.0673 | 0.00725 | 0.0145 | |
| | Potassium-40 | pCi/g | 28.2 ± 1.68 | 0.0625 | 0.125 | |
| | Uranium-235 | pCi/g | 0.0944 ± 0.0736 | 0.0491 | 0.0982 | U |
| | Uranium-238 | pCi/g | 1.11 ± 0.592 | 0.369 | 0.737 | |
| | Uranium | mg/kg | 0.654 | 0.00971 | 0.0388 | |
| C-27 | Americium-241 | pCi/g | 0.0181 ± 0.0223 | 0.0183 | 0.0365 | U |
| | Cesium-137 | pCi/g | 0.216 ± 0.0327 | 0.0123 | 0.0246 | |
| | Potassium-40 | pCi/g | 26.8 ± 1.01 | 0.102 | 0.203 | |
| | Uranium-235 | pCi/g | 0.0567 ± 0.0673 | 0.0582 | 0.116 | U |
| | Uranium-238 | pCi/g | 0.882 ± 0.304 | 0.173 | 0.347 | |
| | Uranium | mg/kg | 0.693 | 0.00988 | 0.0395 | |
| C-28 | Americium-241 | pCi/g | 0.0307 ± 0.0191 | 0.0169 | 0.0337 | U |
| | Cesium-137 | pCi/g | 0.123 ± 0.0252 | 0.0111 | 0.0222 | |
| | Potassium-40 | pCi/g | 26 ± 1.59 | 0.093 | 0.186 | |
| | Uranium-235 | pCi/g | 0.0368 ± 0.0929 | 0.0517 | 0.103 | U |
| | Uranium-238 | pCi/g | 0.793 ± 0.31 | 0.16 | 0.32 | |
| | Uranium | mg/kg | 0.716 | 0.00977 | 0.0391 | |
| C-29 | Americium-241 | pCi/g | 0.111 ± 0.028 | 0.0231 | 0.112 | U |
| | Cesium-137 | pCi/g | 0.25 ± 0.0307 | 0.0134 | 0.0268 | |
| | Potassium-40 | pCi/g | 23.6 ± 1.47 | 0.119 | 0.238 | |
| | Uranium-235 | pCi/g | 0.2 ± 0.128 | 0.0713 | 0.143 | X |
| | Uranium-238 | pCi/g | 1.11 ± 0.452 | 0.22 | 0.439 | |
| | Uranium | mg/kg | 1.12 | 0.00986 | 0.0394 | |
| C-30 | Americium-241 | pCi/g | 0.058 ± 0.0195 | 0.0166 | 0.058 | U |
| | Cesium-137 | pCi/g | 0.191 ± 0.0306 | 0.0112 | 0.0223 | |
| | Potassium-40 | pCi/g | 29 ± 1.03 | 0.0956 | 0.191 | |
| | Uranium-235 | pCi/g | 0.0767 ± 0.0608 | 0.0546 | 0.109 | U |
| | Uranium-238 | pCi/g | 0.682 ± 0.258 | 0.16 | 0.32 | |
| | Uranium | mg/kg | 0.613 | 0.00963 | 0.0385 | |
| C-31 | Americium-241 | pCi/g | 0.0152 ± 0.0552 | 0.043 | 0.0859 | U |
| | Cesium-137 | pCi/g | 0.184 ± 0.0225 | 0.00976 | 0.0195 | |
| | Potassium-40 | pCi/g | 31.9 ± 2.13 | 0.0758 | 0.151 | |
| | Uranium-235 | pCi/g | 0.0622 ± 0.0884 | 0.0579 | 0.116 | U |
| | Uranium-238 | pCi/g | 0.605 ± 0.603 | 0.359 | 0.717 | U |
| | Uranium | mg/kg | 0.843 | 0.00984 | 0.0394 | |

See notes at end of table

**Table A-1.** Radiological Results for Off-site Soil Sampling Locations at TTR, 2007 (concluded)

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| C-32 | Americium-241 | pCi/g | 0.0484 ± 0.04 | 0.0324 | 0.0647 | U |
| | Cesium-137 | pCi/g | 0.174 ± 0.0253 | 0.00912 | 0.0182 | |
| | Potassium-40 | pCi/g | 30.9 ± 1.88 | 0.0757 | 0.151 | |
| | Uranium-235 | pCi/g | 0.0981 ± 0.0801 | 0.0525 | 0.105 | U |
| | Uranium-238 | pCi/g | 0.763 ± 0.468 | 0.277 | 0.553 | |
| | Uranium | mg/kg | 0.594 | 0.0099 | 0.0396 | |
| C-33 | Americium-241 | pCi/g | 0.0563 ± 0.0501 | 0.0413 | 0.0826 | U |
| | Cesium-137 | pCi/g | 0.0687 ± 0.0168 | 0.00896 | 0.0179 | |
| | Potassium-40 | pCi/g | 30.6 ± 2.01 | 0.0768 | 0.154 | |
| | Uranium-235 | pCi/g | 0.126 ± 0.0863 | 0.0537 | 0.107 | X |
| | Uranium-238 | pCi/g | 1.22 ± 0.631 | 0.337 | 0.674 | |
| | Uranium | mg/kg | 0.604 | 0.00975 | 0.039 | |

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

This page intentionally left blank.

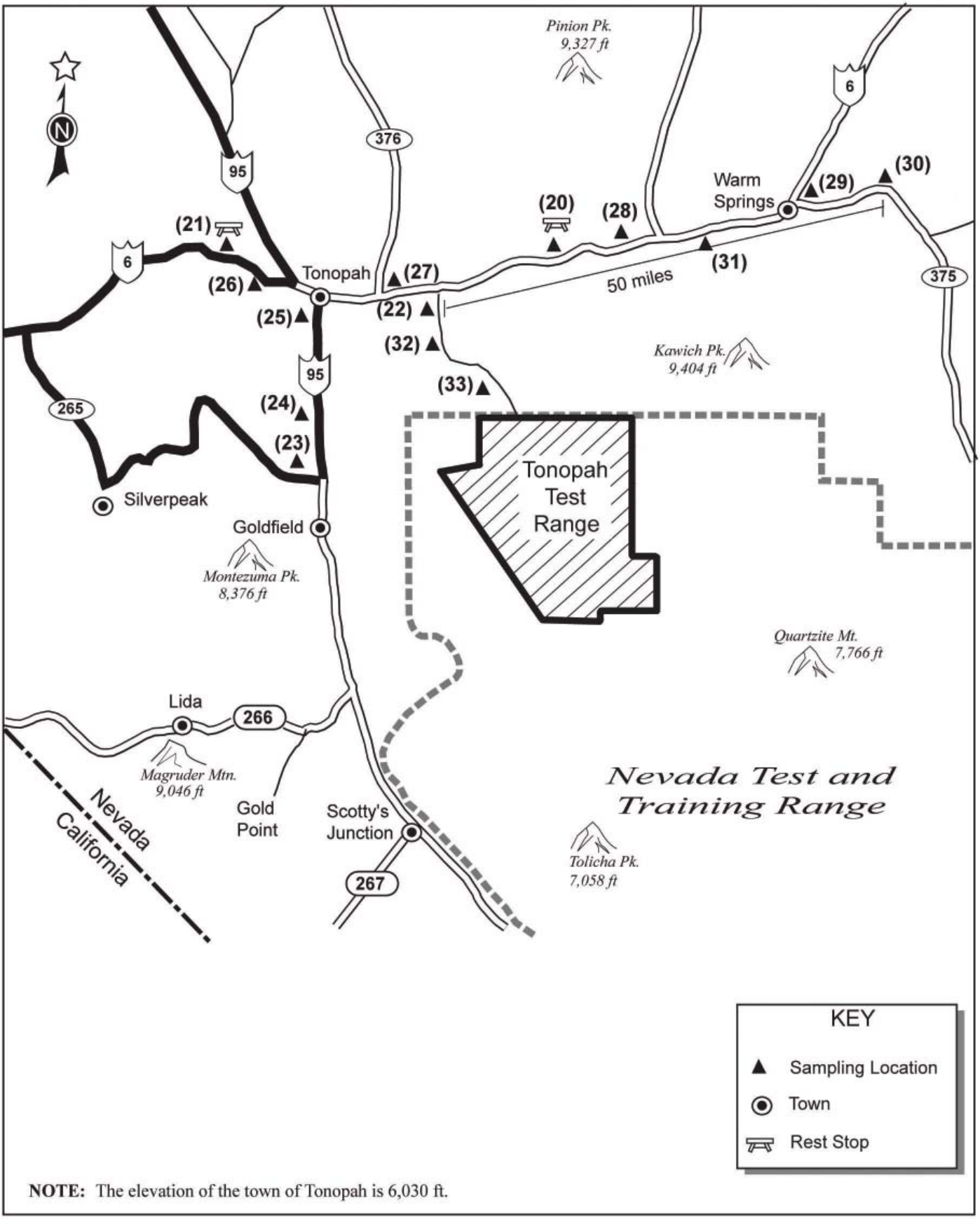



**FIGURE A-1.** Off-site Soil Sampling Locations

This page intentionally left blank.

**TABLE A-2.** Radiological Results for Perimeter Soil Sampling Locations at TTR, 2007

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| P-06 | Americium-241 | pCi/g | 0.0637 ± 0.0458 | 0.0392 | 0.0784 | U |
| | Cesium-137 | pCi/g | 0.22 ± 0.0275 | 0.0112 | 0.0223 | |
| | Potassium-40 | pCi/g | 31 ± 1.89 | 0.0844 | 0.169 | |
| | Uranium-235 | pCi/g | 0.149 ± 0.11 | 0.064 | 0.128 | X |
| | Uranium-238 | pCi/g | 1.14 ± 0.616 | 0.332 | 0.663 | |
| | Uranium | mg/kg | 0.653 | 0.00982 | 0.0393 | |
| P-08 | Americium-241 | pCi/g | 0.112 ± 0.0967 | 0.0624 | 0.125 | U |
| | Cesium-137 | pCi/g | 0.07 ± 0.0152 | 0.00914 | 0.0183 | |
| | Potassium-40 | pCi/g | 32 ± 2.41 | 0.0783 | 0.157 | |
| | Uranium-235 | pCi/g | 0.0226 ± 0.0661 | 0.0532 | 0.106 | U |
| | Uranium-238 | pCi/g | 1.54 ± 0.835 | 0.473 | 0.946 | |
| | Uranium | mg/kg | 0.598 | 0.0098 | 0.0392 | |
| P-11 | Americium-241 | pCi/g | 0.121 ± 0.0728 | 0.0535 | 0.122 | U |
| | Cesium-137 | pCi/g | 0.135 ± 0.0223 | 0.0118 | 0.0236 | |
| | Potassium-40 | pCi/g | 30.5 ± 1.94 | 0.0964 | 0.193 | |
| | Uranium-235 | pCi/g | 0.16 ± 0.0894 | 0.0682 | 0.136 | X |
| | Uranium-238 | pCi/g | 1.67 ± 0.814 | 0.433 | 0.865 | |
| | Uranium | mg/kg | 0.534 | 0.00967 | 0.0387 | |
| P-12 | Americium-241 | pCi/g | 0.0399 ± 0.0637 | 0.0537 | 0.107 | U |
| | Cesium-137 | pCi/g | 0.288 ± 0.0311 | 0.0123 | 0.0247 | |
| | Potassium-40 | pCi/g | 29 ± 2.21 | 0.0979 | 0.196 | |
| | Uranium-235 | pCi/g | 0.0477 ± 0.0867 | 0.0627 | 0.125 | U |
| | Uranium-238 | pCi/g | 0.766 ± 0.778 | 0.42 | 0.84 | U |
| | Uranium | mg/kg | 0.547 | 0.00952 | 0.0381 | |
| P-34 | Americium-241 | pCi/g | 0.105 ± 0.1 | 0.082 | 0.164 | U |
| | Cesium-137 | pCi/g | 0.387 ± 0.0343 | 0.0118 | 0.0235 | |
| | Potassium-40 | pCi/g | 32.2 ± 2.46 | 0.0944 | 0.189 | |
| | Uranium-235 | pCi/g | 0.0696 ± 0.1 | 0.0688 | 0.138 | U |
| | Uranium-238 | pCi/g | 1.68 ± 0.945 | 0.614 | 1.23 | |
| | Uranium | mg/kg | 0.622 | 0.00982 | 0.0393 | |
| P-35 | Americium-241 | pCi/g | 0.12 ± 0.0803 | 0.0673 | 0.134 | U |
| | Cesium-137 | pCi/g | 0.215 ± 0.029 | 0.0133 | 0.0265 | |
| | Potassium-40 | pCi/g | 22.7 ± 1.52 | 0.678 | 22.7 | U |
| | Uranium-235 | pCi/g | 0.0829 ± 0.112 | 0.0737 | 0.147 | U |
| | Uranium-238 | pCi/g | 1.47 ± 0.824 | 0.528 | 1.06 | |
| | Uranium | mg/kg | 0.954 | 0.00988 | 0.0395 | |

See notes at end of table

**TABLE A-2.** Radiological Results for Perimeter Soil Sampling Locations at TTR, 2007 (concluded)

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| P-36 | Americium-241 | pCi/g | 0.0475 ± 0.021 | 0.0184 | 0.0475 | U |
| | Cesium-137 | pCi/g | 0.0235 ± 0.0154 | 0.0113 | 0.0226 | |
| | Potassium-40 | pCi/g | 30.1 ± 2.49 | 0.0936 | 0.187 | |
| | Uranium-235 | pCi/g | 0.0493 ± 0.0854 | 0.0597 | 0.119 | U |
| | Uranium-238 | pCi/g | 0.786 ± 0.322 | 0.176 | 0.351 | |
| | Uranium | mg/kg | 0.756 | 0.0099 | 0.0396 | |
| P-37 | Americium-241 | pCi/g | 0.0086 ± 0.0496 | 0.0435 | 0.0869 | U |
| | Cesium-137 | pCi/g | 0.126 ± 0.024 | 0.00946 | 0.0189 | |
| | Potassium-40 | pCi/g | 29.4 ± 2.02 | 0.0772 | 0.154 | |
| | Uranium-235 | pCi/g | -0.0592 ± 0.0728 | 0.0544 | 0.109 | U |
| | Uranium-238 | pCi/g | 0.696 ± 0.485 | 0.351 | 0.702 | U |
| | Uranium | mg/kg | 0.698 | 0.00973 | 0.0389 | |

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

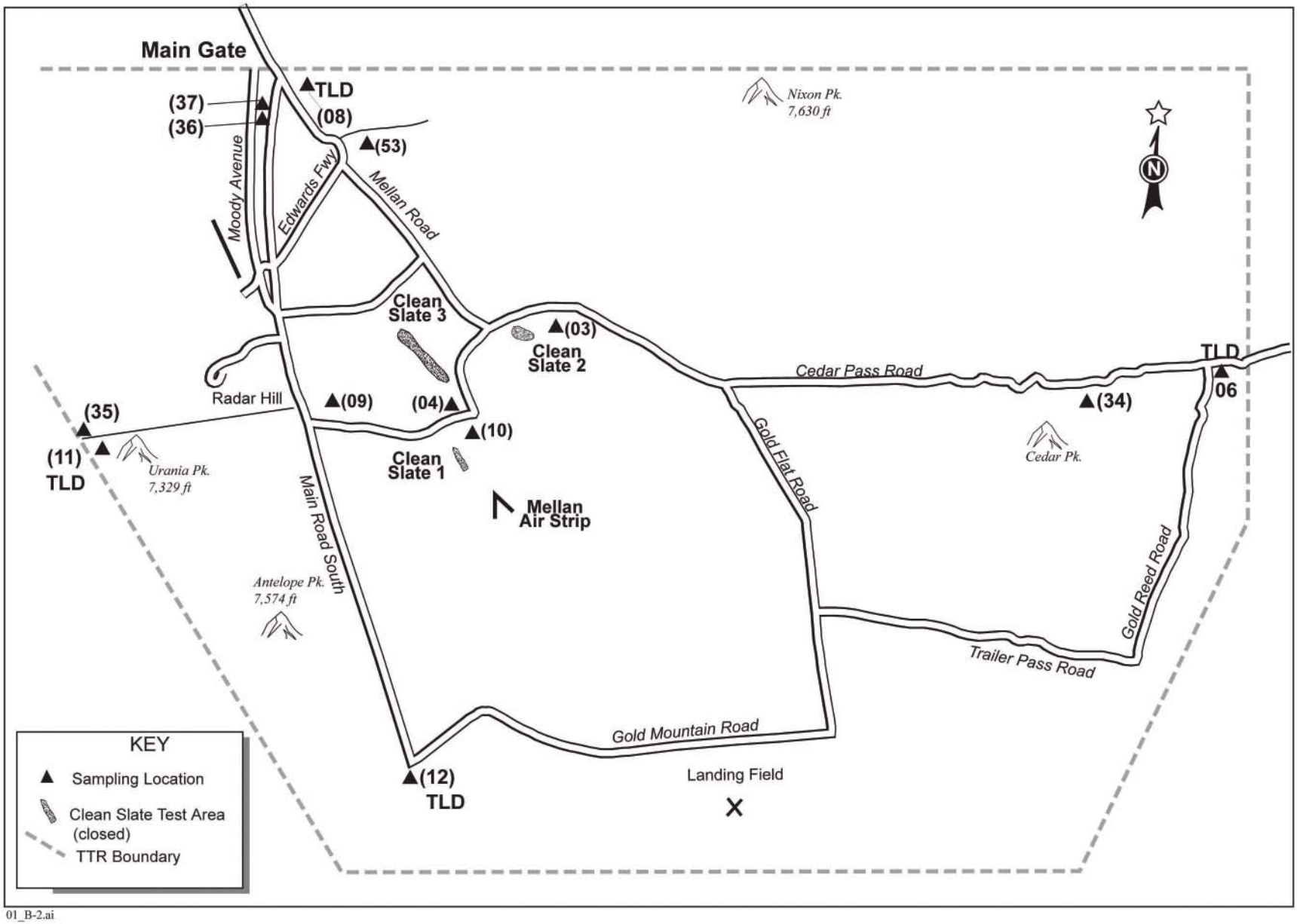



**FIGURE A-2.** Perimeter Soil Sampling Locations

This page intentionally left blank.

**TABLE A-3.** Radiological Results for South Plume Area Soil Sampling Locations at TTR, 2007

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| S-48 | Americium-241 | pCi/g | 0.101 ± 0.0846 | 0.0684 | 0.137 | U |
| | Cesium-137 | pCi/g | 0.44 ± 0.0321 | 0.00992 | 0.0198 | |
| | Potassium-40 | pCi/g | 28.9 ± 2.19 | 0.0854 | 0.171 | |
| | Uranium-235 | pCi/g | 0.0226 ± 0.0796 | 0.0585 | 0.117 | U |
| | Uranium-238 | pCi/g | 0.684 ± 0.854 | 0.505 | 1.01 | U |
| | Uranium | mg/kg | 0.643 | 0.00978 | 0.0391 | |
| S-49 | Americium-241 | pCi/g | 0.559 ± 0.0798 | 0.0425 | 0.0849 | |
| | Cesium-137 | pCi/g | 0.607 ± 0.0578 | 0.0107 | 0.0214 | |
| | Potassium-40 | pCi/g | 31.1 ± 2.01 | 0.0821 | 0.164 | |
| | Uranium-235 | pCi/g | 0.109 ± 0.107 | 0.0664 | 0.133 | U |
| | Uranium-238 | pCi/g | 1.05 ± 0.552 | 0.344 | 0.687 | |
| | Uranium | mg/kg | 0.554 | 0.00982 | 0.0393 | |
| S-50 | Americium-241 | pCi/g | 0.0593 ± 0.061 | 0.0509 | 0.102 | U |
| | Cesium-137 | pCi/g | 0.408 ± 0.0466 | 0.0115 | 0.0231 | |
| | Potassium-40 | pCi/g | 28.4 ± 1.93 | 0.0953 | 0.191 | |
| | Uranium-235 | pCi/g | 0.0223 ± 0.0992 | 0.0689 | 0.138 | U |
| | Uranium-238 | pCi/g | 1.3 ± 0.693 | 0.421 | 0.842 | |
| | Uranium | mg/kg | 0.487 | 0.00963 | 0.0385 | |
| S-51 | Americium-241 | pCi/g | 4.41 ± 0.423 | 0.0744 | 0.149 | |
| | Cesium-137 | pCi/g | 0.32 ± 0.0329 | 0.0122 | 0.0243 | |
| | Potassium-40 | pCi/g | 27.8 ± 2.15 | 0.109 | 0.218 | |
| | Uranium-235 | pCi/g | 0.0431 ± 0.116 | 0.0703 | 0.141 | U |
| | Uranium-238 | pCi/g | 1.23 ± 0.9 | 0.538 | 1.08 | |
| | Uranium | mg/kg | 0.869 | 0.00954 | 0.0382 | |
| S-52 | Americium-241 | pCi/g | 0.0814 ± 0.0697 | 0.0509 | 0.102 | U |
| | Cesium-137 | pCi/g | 0.252 ± 0.0285 | 0.0116 | 0.0231 | |
| | Potassium-40 | pCi/g | 31.4 ± 2.38 | 0.0923 | 0.185 | |
| | Uranium-235 | pCi/g | 0.123 ± 0.0984 | 0.0582 | 0.116 | X |
| | Uranium-238 | pCi/g | 0.371 ± 0.741 | 0.41 | 0.819 | U |
| | Uranium | mg/kg | 0.742 | 0.00998 | 0.0399 | |

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

This page intentionally left blank.

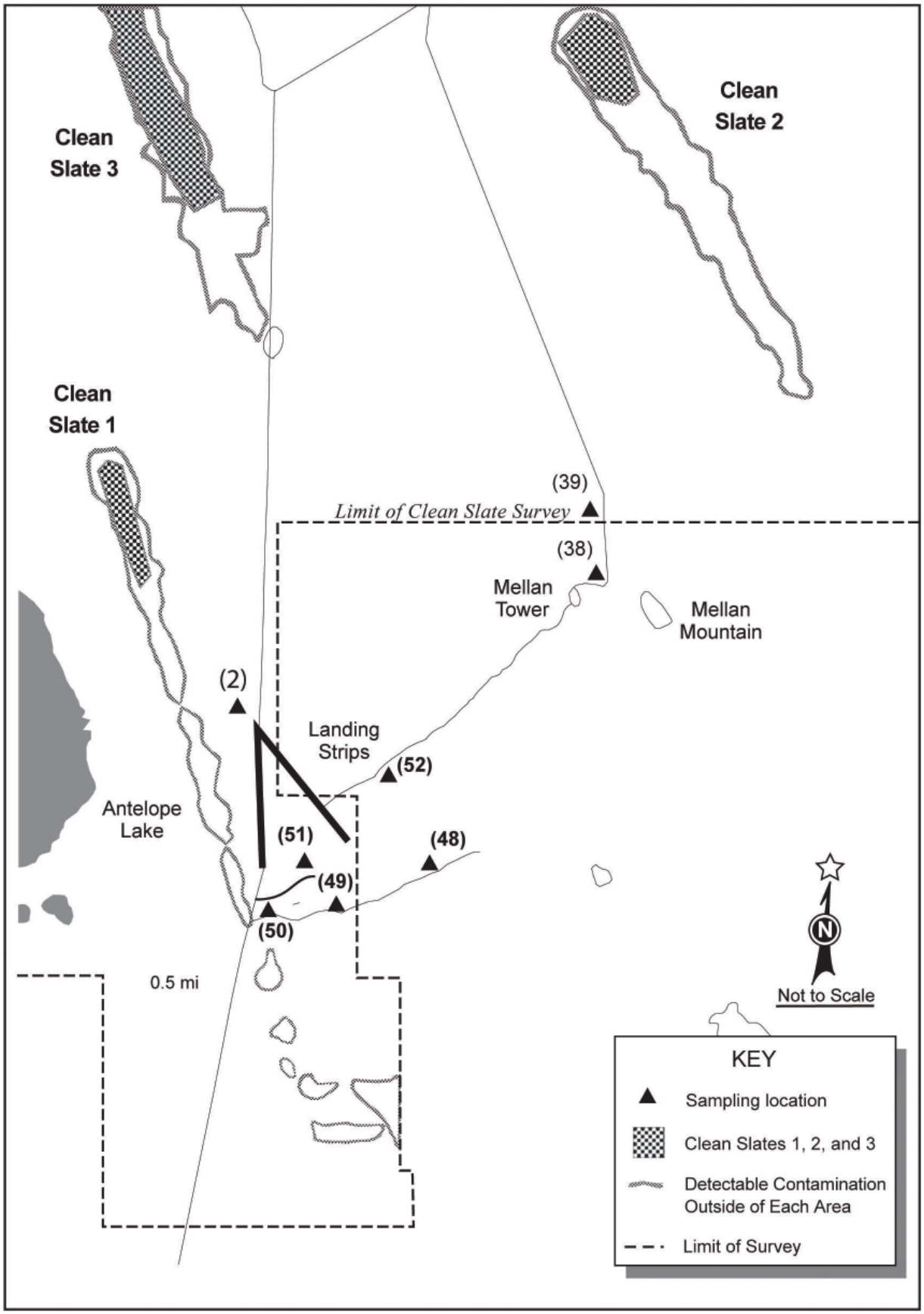



**FIGURE A-3.** Soil Sampling Locations in the South Plume Area (On-site)

This page intentionally left blank.

**TABLE A-4.** Radiological Results for Range Operations Center On-Site Soil Sampling Locations at TTR, 2007

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| S-40 | Americium-241 | pCi/g | 0.0962 ± 0.0519 | 0.0431 | 0.0962 | |
| | Cesium-137 | pCi/g | 0.0945 ± 0.0224 | 0.0114 | 0.0227 | |
| | Potassium-40 | pCi/g | 31.6 ± 2.05 | 0.0992 | 0.198 | |
| | Uranium-235 | pCi/g | 0.0581 ± 0.112 | 0.0679 | 0.136 | U |
| | Uranium-238 | pCi/g | 1.27 ± 0.652 | 0.372 | 0.743 | |
| | Uranium | mg/kg | 0.951 | 0.0099 | 0.0396 | |
| S-41 | Americium-241 | pCi/g | -0.0165 ± 0.0279 | 0.0164 | 0.0329 | U |
| | Cesium-137 | pCi/g | 0.0578 ± 0.0166 | 0.0101 | 0.0203 | |
| | Potassium-40 | pCi/g | 30.9 ± 1.98 | 0.0804 | 0.161 | |
| | Uranium-235 | pCi/g | 0.054 ± 0.0697 | 0.0554 | 0.111 | U |
| | Uranium-238 | pCi/g | 1.11 ± 0.347 | 0.159 | 0.319 | |
| | Uranium | mg/kg | 0.633 | 0.00967 | 0.0387 | |
| S-42 | Americium-241 | pCi/g | 0.0609 ± 0.049 | 0.0398 | 0.0795 | U |
| | Cesium-137 | pCi/g | 0.437 ± 0.0445 | 0.0114 | 0.0227 | |
| | Potassium-40 | pCi/g | 28.1 ± 1.75 | 0.0926 | 0.185 | |
| | Uranium-235 | pCi/g | 0.0665 ± 0.0913 | 0.0656 | 0.131 | U |
| | Uranium-238 | pCi/g | 1.22 ± 0.599 | 0.341 | 0.682 | |
| | Uranium | mg/kg | 0.544 | 0.0099 | 0.0396 | |
| S-43 | Americium-241 | pCi/g | 0.018 ± 0.0209 | 0.0179 | 0.0357 | U |
| | Cesium-137 | pCi/g | 0.029 ± 0.0169 | 0.0121 | 0.0241 | |
| | Potassium-40 | pCi/g | 26.9 ± 1.67 | 0.0945 | 0.189 | |
| | Uranium-235 | pCi/g | 0.084 ± 0.101 | 0.0557 | 0.111 | U |
| | Uranium-238 | pCi/g | 1.2 ± 0.366 | 0.174 | 0.349 | |
| | Uranium | mg/kg | 0.938 | 0.00969 | 0.0388 | |
| S-44 | Americium-241 | pCi/g | 0.0546 ± 0.0609 | 0.0511 | 0.102 | U |
| | Cesium-137 | pCi/g | 0.0902 ± 0.0207 | 0.0114 | 0.0228 | |
| | Potassium-40 | pCi/g | 29 ± 1.96 | 0.0864 | 0.173 | |
| | Uranium-235 | pCi/g | 0.124 ± 0.0998 | 0.0692 | 0.138 | U |
| | Uranium-238 | pCi/g | 1.27 ± 0.747 | 0.425 | 0.85 | |
| | Uranium | mg/kg | 0.765 | 0.0099 | 0.0396 | |
| S-45 | Americium-241 | pCi/g | 0.0532 ± 0.0633 | 0.0541 | 0.108 | U |
| | Cesium-137 | pCi/g | 0.0315 ± 0.0159 | 0.00975 | 0.0195 | |
| | Potassium-40 | pCi/g | 28.5 ± 2.18 | 0.0855 | 0.171 | |
| | Uranium-235 | pCi/g | 0.0858 ± 0.105 | 0.0563 | 0.112 | U |
| | Uranium-238 | pCi/g | 1.61 ± 0.862 | 0.427 | 0.854 | |
| | Uranium | mg/kg | 0.875 | 0.00954 | 0.0382 | |

See notes at end of table

**TABLE A-4.** Radiological Results for Range Operations Center On-Site Soil Sampling Locations at TTR, 2007 (concluded)

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| S-46 | Americium-241 | pCi/g | 0.0799 ± 0.0559 | 0.0479 | 0.0958 | U |
| | Cesium-137 | pCi/g | 0.0766 ± 0.0207 | 0.0107 | 0.0213 | |
| | Potassium-40 | pCi/g | 30.1 ± 1.9 | 0.092 | 0.184 | |
| | Uranium-235 | pCi/g | 0.0128 ± 0.0919 | 0.0625 | 0.125 | U |
| | Uranium-238 | pCi/g | 0.645 ± 0.621 | 0.391 | 0.782 | U |
| | Uranium | mg/kg | 1.51 | 0.00969 | 0.0388 | |
| S-47 | Americium-241 | pCi/g | 0.0322 ± 0.0793 | 0.0648 | 0.13 | U |
| | Cesium-137 | pCi/g | 0.104 ± 0.0184 | 0.0102 | 0.0204 | |
| | Potassium-40 | pCi/g | 31.7 ± 2.13 | 0.0885 | 0.177 | |
| | Uranium-235 | pCi/g | 0.0255 ± 0.0875 | 0.0605 | 0.121 | U |
| | Uranium-238 | pCi/g | 0.88 ± 1.09 | 0.498 | 0.996 | U |
| | Uranium | mg/kg | 0.524 | 0.00956 | 0.0382 | |

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

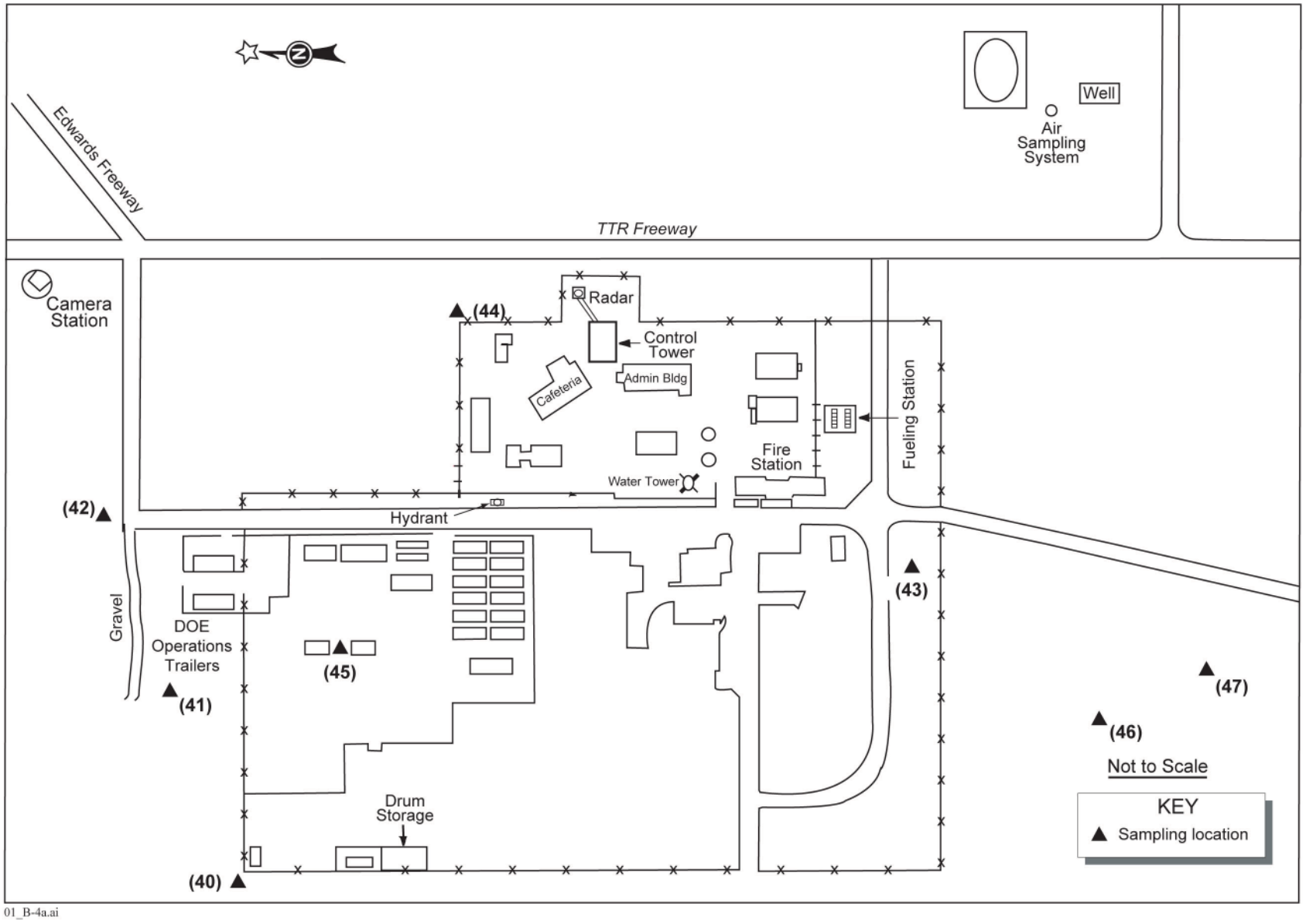



Figure A-4 Soil Sampling Locations in the Range Operations Center and Compound (on-site)

This page intentionally left blank.

**TABLE A-5.** Radiological Results for Various On-Site Soil Sampling Locations atTTR, 2007

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| S-02 | Americium-241 | pCi/g | -0.00755 ± 0.0575 | 0.0467 | 0.0934 | U |
| | Cesium-137 | pCi/g | 0.36 ± 0.0299 | 0.0108 | 0.0216 | |
| | Potassium-40 | pCi/g | 31 ± 2.34 | 0.0918 | 0.184 | |
| | Uranium-235 | pCi/g | 0.044 ± 0.0794 | 0.0539 | 0.108 | U |
| | Uranium-238 | pCi/g | 0.277 ± 0.634 | 0.37 | 0.74 | U |
| | Uranium | mg/kg | 0.807 | 0.00958 | 0.0383 | |
| S-03 | Americium-241 | pCi/g | 0.155 ± 0.0863 | 0.06 | 0.12 | X |
| | Cesium-137 | pCi/g | 0.252 ± 0.0275 | 0.0112 | 0.0224 | |
| | Potassium-40 | pCi/g | 28.7 ± 2.21 | 0.085 | 0.17 | |
| | Uranium-235 | pCi/g | 0.0532 ± 0.0968 | 0.0629 | 0.126 | U |
| | Uranium-238 | pCi/g | 1.37 ± 0.79 | 0.466 | 0.932 | |
| | Uranium | mg/kg | 0.73 | 0.0098 | 0.0392 | |
| S-04 | Americium-241 | pCi/g | 0.0794 ± 0.0612 | 0.0494 | 0.0988 | U |
| | Cesium-137 | pCi/g | 0.302 ± 0.037 | 0.0117 | 0.0234 | |
| | Potassium-40 | pCi/g | 29.7 ± 2.26 | 0.0933 | 0.187 | |
| | Uranium-235 | pCi/g | 0.0617 ± 0.0894 | 0.0566 | 0.113 | U |
| | Uranium-238 | pCi/g | 1.27 ± 0.781 | 0.382 | 0.763 | |
| | Uranium | mg/kg | 0.662 | 0.0099 | 0.0396 | |
| S-09 | Americium-241 | pCi/g | 1.02 ± 0.13 | 0.0465 | 0.093 | |
| | Cesium-137 | pCi/g | 0.0955 ± 0.0192 | 0.0106 | 0.0213 | |
| | Potassium-40 | pCi/g | 27.1 ± 2.05 | 0.0812 | 0.162 | |
| | Uranium-235 | pCi/g | 0.0586 ± 0.0943 | 0.0535 | 0.107 | U |
| | Uranium-238 | pCi/g | 1.04 ± 0.682 | 0.37 | 0.739 | |
| | Uranium | mg/kg | 0.576 | 0.0096 | 0.0384 | |
| S-10 | Americium-241 | pCi/g | 0.0488 ± 0.043 | 0.0342 | 0.0684 | U |
| | Cesium-137 | pCi/g | 0.168 ± 0.021 | 0.00817 | 0.0163 | |
| | Potassium-40 | pCi/g | 27.2 ± 1.71 | 0.473 | 27.2 | U |
| | Uranium-235 | pCi/g | 0.0617 ± 0.0831 | 0.051 | 0.102 | U |
| | Uranium-238 | pCi/g | 0.7 ± 0.575 | 0.287 | 0.574 | |
| | Uranium | mg/kg | 0.708 | 0.00975 | 0.039 | |
| S-38 | Americium-241 | pCi/g | 0.0523 ± 0.0555 | 0.0491 | 0.0981 | U |
| | Cesium-137 | pCi/g | 0.282 ± 0.0337 | 0.011 | 0.0219 | |
| | Potassium-40 | pCi/g | 31 ± 2.06 | 0.0936 | 0.187 | |
| | Uranium-235 | pCi/g | 0.0992 ± 0.0651 | 0.067 | 0.134 | U |
| | Uranium-238 | pCi/g | 0.747 ± 0.607 | 0.422 | 0.844 | U |
| | Uranium | mg/kg | 0.596 | 0.00986 | 0.0394 | |
| S-39 | Americium-241 | pCi/g | 0.103 ± 0.0497 | 0.04 | 0.0799 | X |
| | Cesium-137 | pCi/g | 0.775 ± 0.0657 | 0.0115 | 0.023 | |
| | Potassium-40 | pCi/g | 30.4 ± 1.88 | 0.0931 | 0.186 | |

See notes at end of table

**TABLE A-5.** Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2007 (concluded)

| Location | Analyte | Units | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier |
|---|---|---|---|---|---|---|
| S-39 | Uranium-235 | pCi/g | 0.0878 ± 0.0961 | 0.0682 | 0.136 | U |
| | Uranium-238 | pCi/g | 0.999 ± 0.569 | 0.363 | 0.725 | |
| | Uranium | mg/kg | 0.669 | 0.00994 | 0.0398 | |
| S-53 | Americium-241 | pCi/g | 0.077 ± 0.0398 | 0.0334 | 0.077 | U |
| | Cesium-137 | pCi/g | 0.167 ± 0.0202 | 0.00946 | 0.0189 | |
| | Potassium-40 | pCi/g | 33 ± 1.98 | 0.0796 | 0.159 | |
| | Uranium-235 | pCi/g | 0.0868 ± 0.0941 | 0.0548 | 0.11 | U |
| | Uranium-238 | pCi/g | 0.795 ± 0.494 | 0.283 | 0.566 | |
| | Uranium | mg/kg | 0.538 | 0.01 | 0.04 | |

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

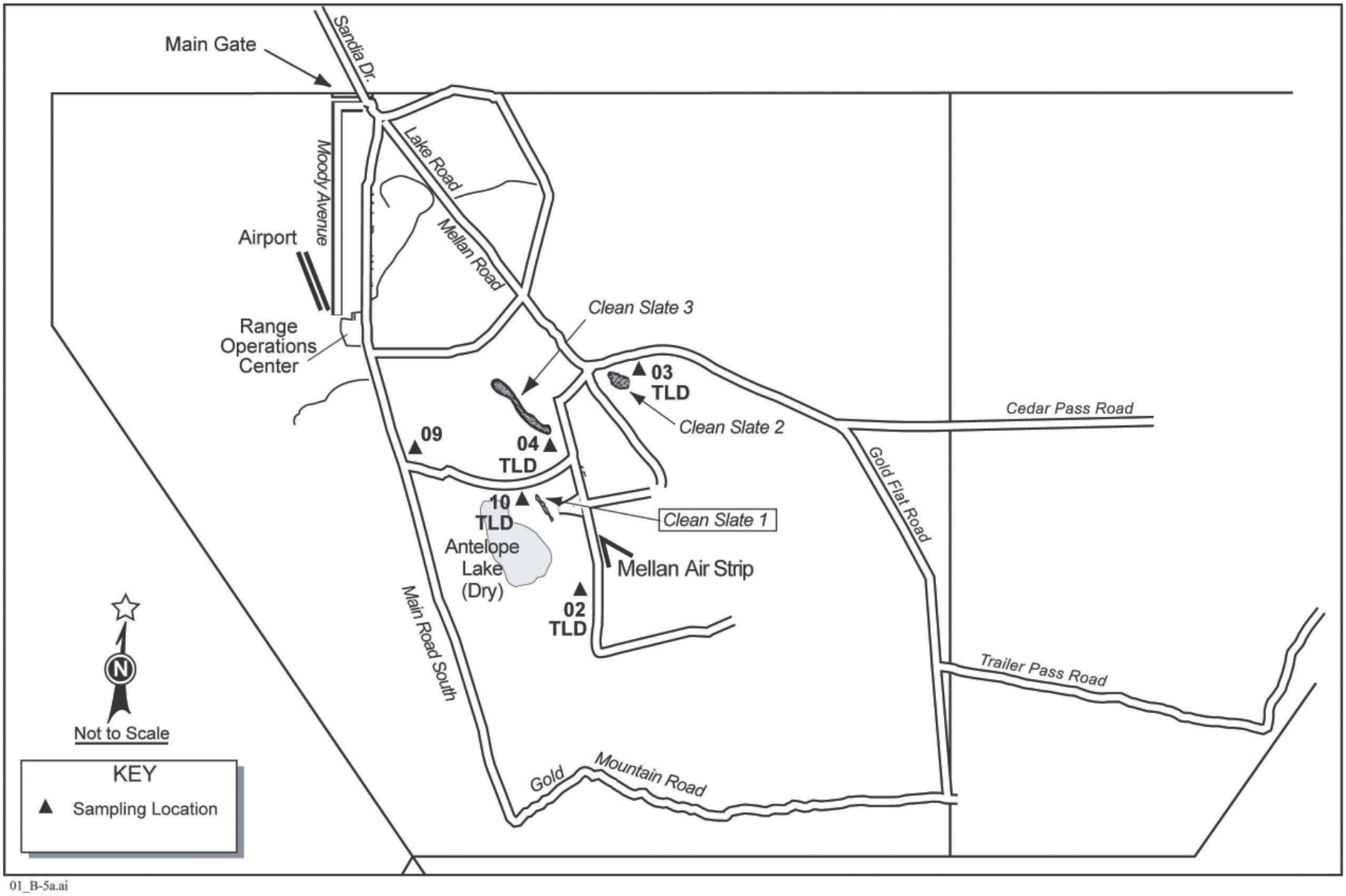



**Figure A-5.** Various On-site Soil Sampling Locations

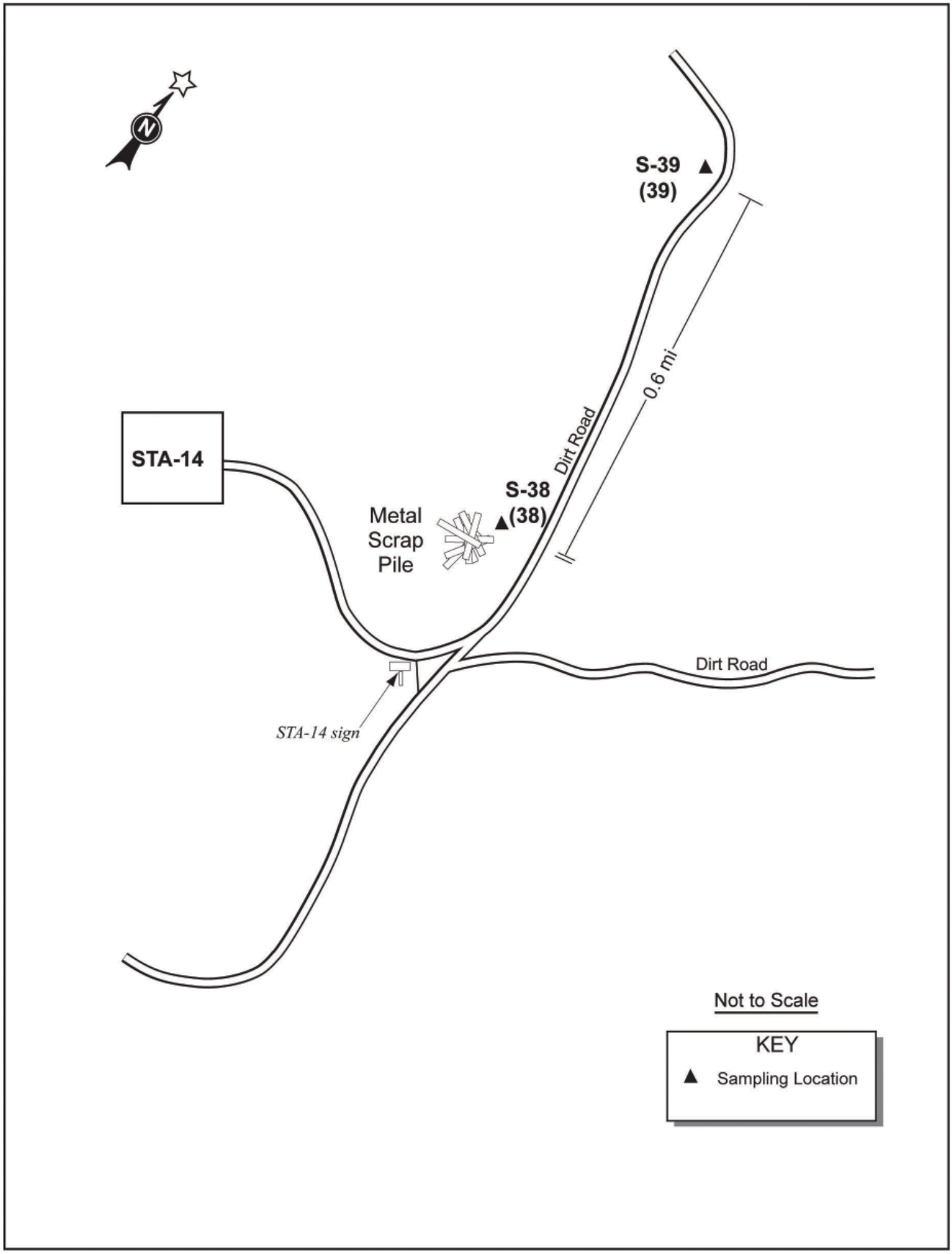



**FIGURE A-6.** Various Soil Sampling Locations at Mellan Hill Area

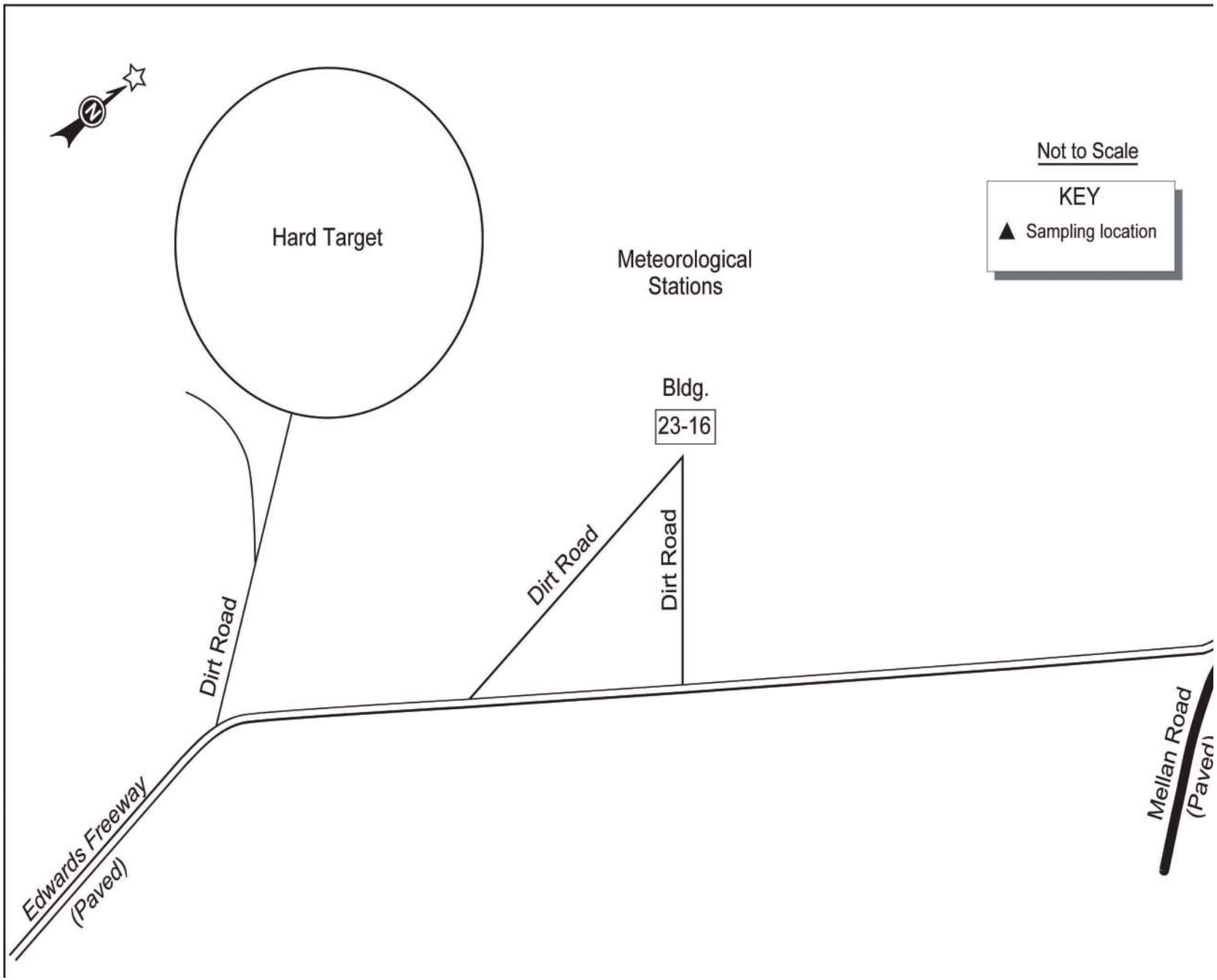



**FIGURE A-7.** Soil Sampling Location Near the Hard Target /Depleted Uranium Area

This page intentionally left blank.

**TABLE A-6.** Radiological Replicate Sampling for Soil Sampling Locations, 2007

| Location | Analyte | Units | Sample ID | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier | Avg | Std Dev | Min | Max | CV% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-29 | Americium-241 | pCi/g | 084321-001 | 0.111 ± 0.028 | 0.0231 | 0.112 | U | 0.04 | 0.06 | 0.00 | 0.11 | 1.36 % |
| | Americium-241 | pCi/g | 084321-002 | 0.0206 ± 0.0581 | 0.0487 | 0.0973 | U | 0.04 | 0.06 | 0.00 | 0.11 | 1.36 % |
| | Americium-241 | pCi/g | 084321-003 | -0.00066 ± 0.06 | 0.0505 | 0.101 | U | 0.04 | 0.06 | 0.00 | 0.11 | 1.36 % |
| | Uranium-235 | pCi/g | 084321-001 | 0.2 ± 0.128 | 0.0713 | 0.143 | X | 0.15 | 0.05 | 0.10 | 0.20 | 0.35 % |
| | Uranium-235 | pCi/g | 084321-002 | 0.0965 ± 0.0861 | 0.0501 | 0.1 | U | 0.15 | 0.05 | 0.10 | 0.20 | 0.35 % |
| | Uranium-235 | pCi/g | 084321-003 | 0.144 ± 0.0891 | 0.0536 | 0.107 | X | 0.15 | 0.05 | 0.10 | 0.20 | 0.35 % |
| | Uranium-238 | pCi/g | 084321-001 | 1.11 ± 0.452 | 0.22 | 0.439 | | 1.13 | 0.02 | 1.11 | 1.15 | 0.02 % |
| | Uranium-238 | pCi/g | 084321-002 | 1.15 ± 0.744 | 0.389 | 0.778 | | 1.13 | 0.02 | 1.11 | 1.15 | 0.02 % |
| | Uranium-238 | pCi/g | 084321-003 | 1.13 ± 0.647 | 0.406 | 0.812 | | 1.13 | 0.02 | 1.11 | 1.15 | 0.02 % |
| | Uranium | mg/kg | 084321-001 | 1.12 | 0.00986 | 0.0394 | | 1.13 | 0.25 | 0.88 | 1.38 | 0.22 % |
| | Uranium | mg/kg | 084321-002 | 1.38 | 0.00973 | 0.0389 | | 1.13 | 0.25 | 0.88 | 1.38 | 0.22 % |
| | Uranium | mg/kg | 084321-003 | 0.884 | 0.00988 | 0.0395 | | 1.13 | 0.25 | 0.88 | 1.38 | 0.22 % |
| P-11 | Americium-241 | pCi/g | 084345-001 | 0.121 ± 0.0728 | 0.0535 | 0.122 | U | 0.06 | 0.06 | 0.01 | 0.12 | 0.89 % |
| | Americium-241 | pCi/g | 084345-002 | 0.00589 ± 0.108 | 0.0845 | 0.169 | U | 0.06 | 0.06 | 0.01 | 0.12 | 0.89 % |
| | Americium-241 | pCi/g | 084345-003 | 0.0667 ± 0.0485 | 0.0409 | 0.0817 | U | 0.06 | 0.06 | 0.01 | 0.12 | 0.89 % |
| | Uranium-235 | pCi/g | 084345-001 | 0.16 ± 0.0894 | 0.0682 | 0.136 | X | 0.11 | 0.04 | 0.08 | 0.16 | 0.37 % |
| | Uranium-235 | pCi/g | 084345-002 | 0.0986 ± 0.119 | 0.074 | 0.148 | U | 0.11 | 0.04 | 0.08 | 0.16 | 0.37 % |
| | Uranium-235 | pCi/g | 084345-003 | 0.0799 ± 0.098 | 0.0677 | 0.135 | U | 0.11 | 0.04 | 0.08 | 0.16 | 0.37 % |
| | Uranium-238 | pCi/g | 084345-001 | 1.67 ± 0.814 | 0.433 | 0.865 | | 1.26 | 0.36 | 1.05 | 1.67 | 0.28 % |
| | Uranium-238 | pCi/g | 084345-002 | 1.05 ± 1.03 | 0.652 | 1.3 | U | 1.26 | 0.36 | 1.05 | 1.67 | 0.28 % |
| | Uranium-238 | pCi/g | 084345-003 | 1.05 ± 0.497 | 0.346 | 0.692 | | 1.26 | 0.36 | 1.05 | 1.67 | 0.28 % |
| | Uranium | mg/kg | 084345-001 | 0.534 | 0.00967 | 0.0387 | | 0.56 | 0.02 | 0.53 | 0.58 | 0.04 % |
| | Uranium | mg/kg | 084345-002 | 0.575 | 0.00975 | 0.039 | | 0.56 | 0.02 | 0.53 | 0.58 | 0.04 % |
| | Uranium | mg/kg | 084345-003 | 0.565 | 0.00954 | 0.0382 | | 0.56 | 0.02 | 0.53 | 0.58 | 0.04 % |
| S-03 | Americium-241 | pCi/g | 084332-001 | 0.155 ± 0.0863 | 0.06 | 0.12 | X | 0.12 | 0.05 | 0.07 | 0.16 | 0.39 % |
| | Americium-241 | pCi/g | 084332-002 | 0.0658 ± 0.0682 | 0.0536 | 0.107 | U | 0.12 | 0.05 | 0.07 | 0.16 | 0.39 % |
| | Americium-241 | pCi/g | 084332-003 | 0.131 ± 0.109 | 0.0611 | 0.122 | X | 0.12 | 0.05 | 0.07 | 0.16 | 0.39 % |
| | Uranium-235 | pCi/g | 084332-001 | 0.0532 ± 0.0968 | 0.0629 | 0.126 | U | 0.04 | 0.02 | 0.01 | 0.05 | 0.57 % |
| | Uranium-235 | pCi/g | 084332-002 | 0.0133 ± 0.0994 | 0.0727 | 0.145 | U | 0.04 | 0.02 | 0.01 | 0.05 | 0.57 % |
| | Uranium-235 | pCi/g | 084332-003 | 0.042 ± 0.0979 | 0.0711 | 0.142 | U | 0.04 | 0.02 | 0.01 | 0.05 | 0.57 % |
| | Uranium-238 | pCi/g | 084332-001 | 1.37 ± 0.79 | 0.466 | 0.932 | | 1.07 | 0.32 | 0.74 | 1.37 | 0.3 % |
| | Uranium-238 | pCi/g | 084332-002 | 1.1 ± 0.689 | 0.461 | 0.922 | | 1.07 | 0.32 | 0.74 | 1.37 | 0.3 % |
| | Uranium-238 | pCi/g | 084332-003 | 0.736 ± 0.705 | 0.478 | 0.956 | U | 1.07 | 0.32 | 0.74 | 1.37 | 0.3 % |

See notes at end of table

**TABLE A-6.** Radiological Replicate Sampling for Soil Sampling Locations, 2007 (concluded)

| Location | Analyte | Units | Sample ID | Activity (± 2 σ) | Decision Level | Detection Limit | Lab Qualifier | Avg | Std Dev | Min | Max | CV% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-03 | Uranium | mg/kg | 084332-001 | 0.73 | 0.0098 | 0.0392 | | 0.75 | 0.05 | 0.71 | 0.81 | 0.07 % |
| | Uranium | mg/kg | 084332-002 | 0.713 | 0.00986 | 0.0394 | | 0.75 | 0.05 | 0.71 | 0.81 | 0.07 % |
| | Uranium | mg/kg | 084332-003 | 0.811 | 0.00965 | 0.0386 | | 0.75 | 0.05 | 0.71 | 0.81 | 0.07 % |
| S-09 | Americium-241 | pCi/g | 084329-001 | 1.02 ± 0.13 | 0.0465 | 0.093 | | 1.51 | 0.46 | 1.02 | 1.93 | 0.3 % |
| | Americium-241 | pCi/g | 084329-002 | 1.57 ± 0.153 | 0.0351 | 0.0701 | | 1.51 | 0.46 | 1.02 | 1.93 | 0.3 % |
| | Americium-241 | pCi/g | 084329-003 | 1.93 ± 0.207 | 0.0522 | 0.104 | | 1.51 | 0.46 | 1.02 | 1.93 | 0.3 % |
| | Uranium-235 | pCi/g | 084329-001 | 0.0586 ± 0.0943 | 0.0535 | 0.107 | U | 0.08 | 0.02 | 0.06 | 0.10 | 0.29 % |
| | Uranium-235 | pCi/g | 084329-002 | 0.102 ± 0.0834 | 0.0506 | 0.101 | X | 0.08 | 0.02 | 0.06 | 0.10 | 0.29 % |
| | Uranium-235 | pCi/g | 084329-003 | 0.0708 ± 0.0782 | 0.0522 | 0.104 | U | 0.08 | 0.02 | 0.06 | 0.10 | 0.29 % |
| | Uranium-238 | pCi/g | 084329-001 | 1.04 ± 0.682 | 0.37 | 0.739 | | 1.16 | 0.10 | 1.04 | 1.24 | 0.09 % |
| | Uranium-238 | pCi/g | 084329-002 | 1.24 ± 0.487 | 0.288 | 0.575 | | 1.16 | 0.10 | 1.04 | 1.24 | 0.09 % |
| | Uranium-238 | pCi/g | 084329-003 | 1.19 ± 0.583 | 0.4 | 0.8 | | 1.16 | 0.10 | 1.04 | 1.24 | 0.09 % |
| | Uranium | mg/kg | 084329-001 | 0.576 | 0.0096 | 0.0384 | | 0.58 | 0.02 | 0.56 | 0.61 | 0.04 % |
| | Uranium | mg/kg | 084329-002 | 0.563 | 0.00994 | 0.0398 | | 0.58 | 0.02 | 0.56 | 0.61 | 0.04 % |
| | Uranium | mg/kg | 084329-003 | 0.605 | 0.00992 | 0.0397 | | 0.58 | 0.02 | 0.56 | 0.61 | 0.04 % |
| S-48 | Americium-241 | pCi/g | 084338-001 | 0.101 ± 0.0846 | 0.0684 | 0.137 | U | 0.08 | 0.02 | 0.06 | 0.10 | 0.25 % |
| | Americium-241 | pCi/g | 084338-002 | 0.0613 ± 0.0378 | 0.0316 | 0.0633 | U | 0.08 | 0.02 | 0.06 | 0.10 | 0.25 % |
| | Americium-241 | pCi/g | 084338-003 | 0.0771 ± 0.0741 | 0.0626 | 0.125 | U | 0.08 | 0.02 | 0.06 | 0.10 | 0.25 % |
| | Uranium-235 | pCi/g | 084338-001 | 0.0226 ± 0.0796 | 0.0585 | 0.117 | U | 0.02 | 0.02 | 0.00 | 0.05 | 0.89 % |
| | Uranium-235 | pCi/g | 084338-002 | 0.00408 ± 0.0696 | 0.0503 | 0.101 | U | 0.02 | 0.02 | 0.00 | 0.05 | 0.89 % |
| | Uranium-235 | pCi/g | 084338-003 | 0.0481 ± 0.0863 | 0.0587 | 0.117 | U | 0.02 | 0.02 | 0.00 | 0.05 | 0.89 % |
| | Uranium-238 | pCi/g | 084338-001 | 0.684 ± 0.854 | 0.505 | 1.01 | U | 0.67 | 0.09 | 0.58 | 0.75 | 0.13 % |
| | Uranium-238 | pCi/g | 084338-002 | 0.754 ± 0.487 | 0.277 | 0.553 | | 0.67 | 0.09 | 0.58 | 0.75 | 0.13 % |
| | Uranium-238 | pCi/g | 084338-003 | 0.584 ± 0.794 | 0.501 | 1 | U | 0.67 | 0.09 | 0.58 | 0.75 | 0.13 % |
| | Uranium | mg/kg | 084338-001 | 0.643 | 0.00978 | 0.0391 | | 0.64 | 0.05 | 0.60 | 0.69 | 0.07 % |
| | Uranium | mg/kg | 084338-002 | 0.598 | 0.00998 | 0.0399 | | 0.64 | 0.05 | 0.60 | 0.69 | 0.07 % |
| | Uranium | mg/kg | 084338-003 | 0.689 | 0.00984 | 0.0394 | | 0.64 | 0.05 | 0.60 | 0.69 | 0.07 % |

**Notes:** pCi/g = picocurie per gram

mg/kg = milligram per kilogram

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

X = Presumptive evidence that analyte is not present.

Std Dev = Standard deviation

CV = Coefficient of variation

**TABLE A-7.** TLD Measurements by Quarter and Location Class for Calendar Year 2007

| Location Class | Location Number | 1st Quarter (92 Days) | | 2nd Quarter (103 Days) | | 3rd Quarter (73 Days) | | 4th Quarter (98 Days) | | Exposure Rate | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Exposure (mR) | Error | Exposure (mR) | Error | Exposure (mR) | Error | Exposure (mR) | Error | uR per hour | Error |
| On-Site | S-01 | 42.4 | 1.5 | 39.2 | 0.9 | 28.2 | 1.9 | 45.5 | 3 | 17.7 | 0.5 |
| | S-02 | 41.2 | 1.4 | 39.6 | 2.6 | 27.6 | 1.5 | 47.8 | 1.9 | 17.8 | 0.4 |
| | S-03 | 42.3 | 2.3 | 40.5 | 1.2 | 28 | 1.6 | 45.8 | 0.5 | 17.8 | 0.4 |
| | S-04 | 42.8 | 0.9 | 41.8 | 1 | 28.2 | 1.2 | 49 | 0.4 | 18.4 | 0.2 |
| | S-09 | 39.9 | 3.9 | 37.7 | 1.2 | 30.5 | 8.5 | 42.5 | 1.6 | 17.1 | 1.1 |
| | S-10 | 46 | 7.7 | 38.7 | 1.3 | 27.9 | 1.5 | 45.8 | 1.9 | 18.0 | 0.9 |
| | S-13 | 40.8 | 4.5 | 37.7 | 1.1 | 26.1 | 0.9 | 47.5 | 4.6 | 17.3 | 0.8 |
| | S-14 | 37.5 | 1.2 | 36 | 0.9 | 25.1 | 0.9 | 41 | 2.1 | 15.9 | 0.3 |
| | S-15 | 41.7 | 0.9 | 39 | 0.9 | 27.2 | 1.5 | 44.7 | 0.5 | 17.4 | 0.2 |
| | S-16 | 41.2 | 0.9 | 38.3 | 1 | 26.8 | 0.9 | 47.3 | 3.1 | 17.5 | 0.4 |
| | S-17 | 41 | 1.8 | 37.5 | 0.8 | 27.2 | 1.2 | 44.8 | 2.7 | 17.1 | 0.4 |
| Perimeter | P-05 | 43.2 | 3.8 | 40.8 | 1.3 | 27.7 | 0.9 | 44.9 | 1.3 | 17.8 | 0.5 |
| | P-06 | 41.9 | 1.8 | 38.1 | 1 | 27.4 | 1 | 43.7 | 1.7 | 17.2 | 0.3 |
| | P-07 | 42.2 | 6.4 | 36 | 0.9 | 25.6 | 1.1 | 45 | 3.1 | 16.9 | 0.8 |
| | P-08 | 37.5 | 1.7 | 35.1 | 0.8 | 25.6 | 1 | 41.1 | 2.4 | 15.9 | 0.4 |
| | P-11 | 47.5 | 2.3 | 45.5 | 1.6 | 31.4 | 0.9 | 49.1 | 2.7 | 19.8 | 0.5 |
| | P-12 | 42.7 | 1 | 39.8 | 2.1 | 27.6 | 1 | 47.4 | 0.6 | 17.9 | 0.3 |
| Off-Site | C-19 | 32.5 | 1.4 | 30.1 | 1.4 | 21 | 1.4 | 49.8 | 26.9 | 15.2 | 3.1 |
| | C-21 | 38.5 | 2.9 | 37.3 | 0.8 | 27.2 | 1.2 | 46 | 1.9 | 17.0 | 0.4 |
| | C-22 | 41.2 | 0.6 | 37.7 | 1.4 | 27.1 | 2.1 | 43.1 | 0.4 | 17.0 | 0.3 |

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

This page intentionally left blank.

**TABLE A-8.** Summary TLD Results for Calendar Year 2007, Tonopah Test Range

| Location Class | Number of Locations | Mean Exposure Rate (uR/hour) | Std Dev. | Minimum | Maximum |
|---|---|---|---|---|---|
| **On-Site** | 11 | 17.5 | 0.7 | 15. 9 | 18.4 |
| **Perimeter** | 6 | 17.6 | 1.3 | 15.9 | 19.8 |
| **Off-Site** | 3 | 16.4 | 1.0 | 15.2 | 17.0 |

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

This page intentionally left blank.

# APPENDIX B
## TERRESTRIAL SURVEILLANCE RESULTS AND SAMPLING LOCATION MAPS FOR KTF

*"NaPali" Photo by Adriana Canavan.*

This page intentionally left blank.

# CONTENTS

## FIGURES



## TABLES

This page intentionally left blank.

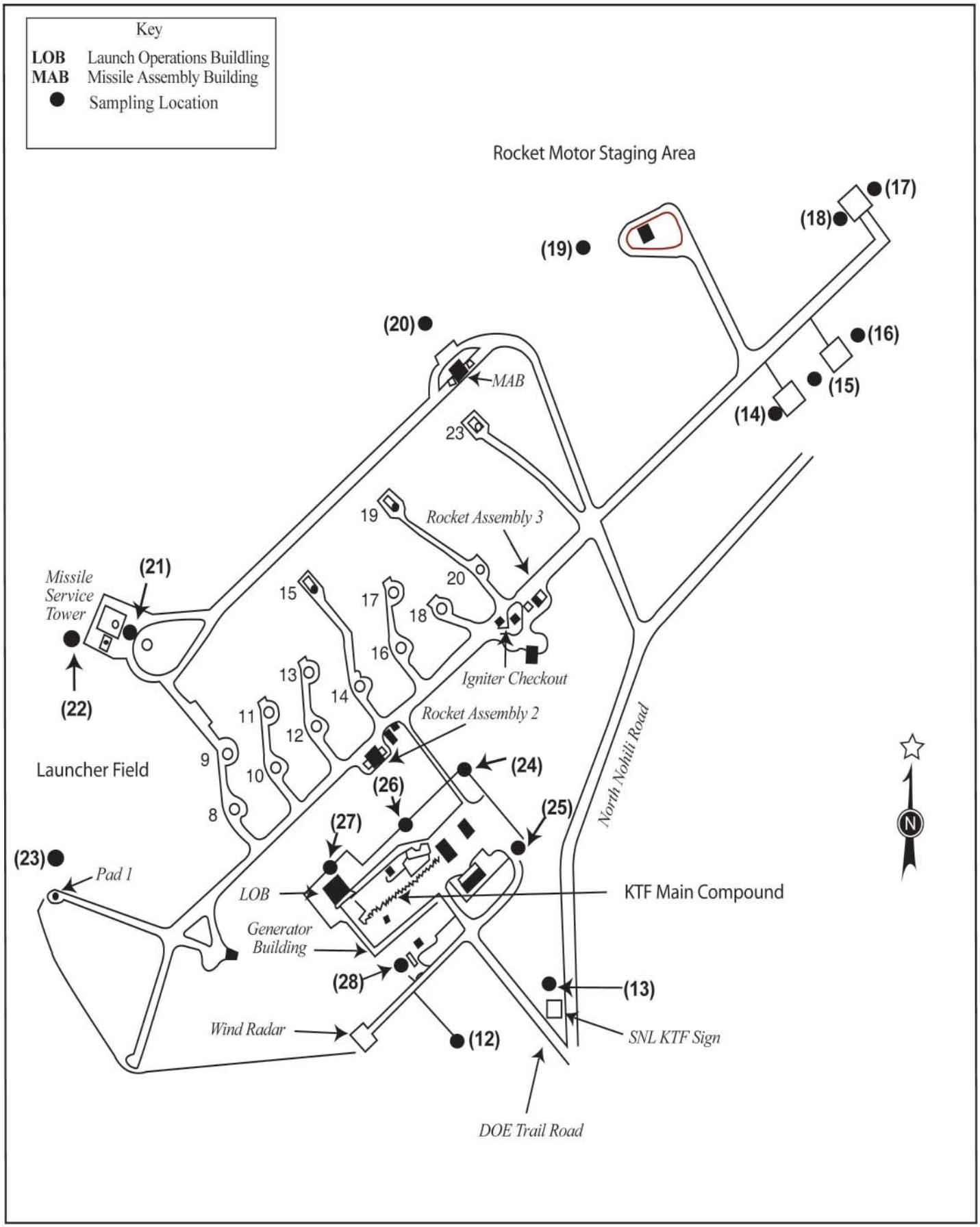



**FIGURE B-1 On-site Sample Locations at the Kauai Test Facility**

This page intentionally left blank.

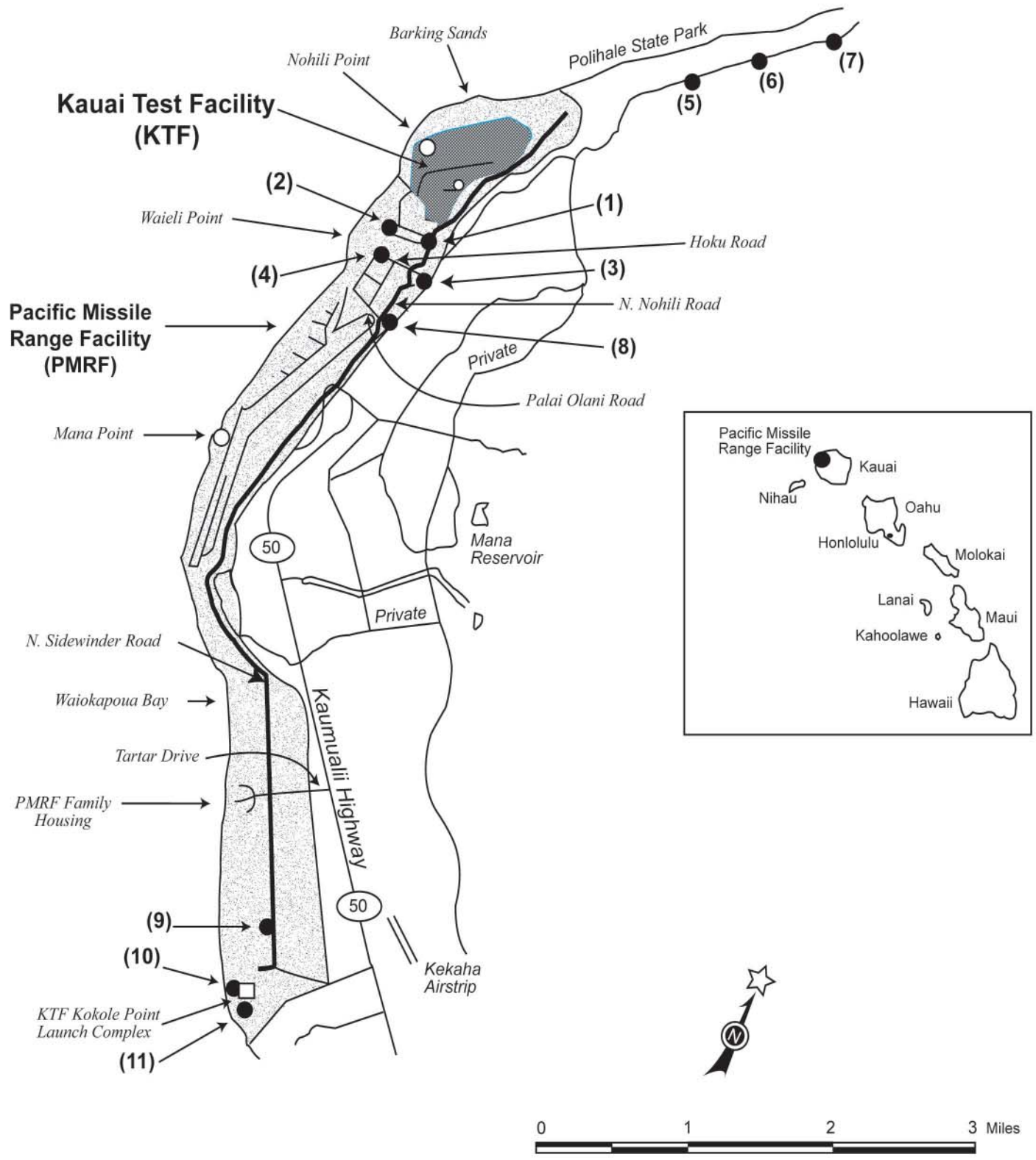



**FIGURE B-2.** Off-site Sampling Locations Near the Kauai Test Facility

This page intentionally left blank.

**TABLE B-1.** Non-radiological Results for Kauai Test Facility for Community Locations for Calendar Year 2007, Soil
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 1 | | | | 2 | | | | 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit |
| **Community** | Aluminum | 9870 | | 4.94 | 14.8 | 1750 | | 4.92 | 14.8 | 6180 | | 4.96 | 14.9 |
| | Antimony | 0.0988 | U | 0.0988 | 0.395 | 0.139 | J | 0.0984 | 0.394 | 0.0992 | U | 0.0992 | 0.397 |
| | Arsenic | 6.41 | | 0.296 | 0.988 | 5.94 | | 0.295 | 0.984 | 5.62 | | 0.298 | 0.992 |
| | Barium | 16.3 | | 0.0988 | 0.395 | 6.06 | | 0.0984 | 0.394 | 8.34 | | 0.0992 | 0.397 |
| | Beryllium | 0.15 | | 0.0198 | 0.0988 | 0.035 | J | 0.0197 | 0.0984 | 0.0966 | J | 0.0198 | 0.0992 |
| | Cadmium | 0.317 | | 0.0198 | 0.198 | 0.167 | J | 0.0197 | 0.197 | 0.22 | | 0.0198 | 0.198 |
| | Calcium | 185000 | | 296 | 988 | 365000 | | 295 | 984 | 278000 | | 298 | 992 |
| | Chromium | 122 | | 0.198 | 0.593 | 22.2 | | 0.197 | 0.591 | 76.3 | | 0.198 | 0.595 |
| | Cobalt | 41.7 | | 0.0198 | 0.198 | 3.25 | | 0.0197 | 0.197 | 25.7 | | 0.0198 | 0.198 |
| | Copper | 16.7 | | 0.0395 | 0.198 | 3.45 | | 0.0394 | 0.197 | 8.73 | | 0.0397 | 0.198 |
| | Iron | 38200 | | 9.88 | 24.7 | 4960 | | 1.97 | 4.92 | 22200 | | 9.92 | 24.8 |
| | Lead | 1.05 | | 0.0988 | 0.395 | 1.18 | | 0.0984 | 0.394 | 0.475 | | 0.0992 | 0.397 |
| | Magnesium | 101000 | B | 49.4 | 148 | 31800 | B | 49.2 | 148 | 62700 | B | 49.6 | 149 |
| | Manganese | 808 | | 0.988 | 4.94 | 86.9 | | 0.197 | 0.984 | 522 | | 0.992 | 4.96 |
| | Mercury | 0.0479 | | 0.00132 | 0.00881 | 0.0016 | J | 0.00142 | 0.00943 | 0.00691 | J | 0.00143 | 0.00955 |
| | Nickel | 670 | | 0.494 | 1.98 | 40.8 | | 0.0984 | 0.394 | 379 | | 0.496 | 1.98 |
| | Potassium | 311 | | 79.1 | 296 | 78.7 | U | 78.7 | 295 | 192 | J | 79.4 | 298 |
| | Selenium | 0.494 | U | 0.494 | 0.988 | 0.492 | U | 0.492 | 0.984 | 0.496 | U | 0.496 | 0.992 |
| | Silver | 0.0729 | J | 0.0395 | 0.198 | 0.0394 | U | 0.0394 | 0.197 | 0.0419 | J | 0.0397 | 0.198 |
| | Sodium | 1800 | | 79.1 | 247 | 2210 | | 78.7 | 246 | 1860 | | 79.4 | 248 |
| | Thallium | 0.0395 | BU | 0.0395 | 0.198 | 0.0394 | BU | 0.0394 | 0.197 | 0.0397 | BU | 0.0397 | 0.198 |
| | Vanadium | 24 | | 1.98 | 9.88 | 6.15 | | 0.394 | 1.97 | 15.2 | | 0.397 | 1.98 |
| | Zinc | 59.9 | B | 0.395 | 1.98 | 16 | B | 0.394 | 1.97 | 22.9 | B | 0.397 | 1.98 |

See notes at end of table

**TABLE B-1.** Non-radiological Results for Kauai Test Facility for Community Locations for Calendar Year 2007, Soil (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 4 | | | | 5 | | | | 6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit |
| **Community** (cont'd) | Aluminum | 1870 | | 4.98 | 14.9 | 3000 | | 4.95 | 14.9 | 3050 | | 4.99 | 15 |
| | Antimony | 0.498 | U | 0.498 | 1.99 | 0.495 | U | 0.495 | 1.98 | 0.499 | U | 0.499 | 2 |
| | Arsenic | 3.84 | J | 1.49 | 4.98 | 10.5 | | 1.49 | 4.95 | 9.03 | | 1.5 | 4.99 |
| | Barium | 4.94 | | 0.498 | 1.99 | 6.39 | | 0.495 | 1.98 | 7.85 | | 0.499 | 2 |
| | Beryllium | 0.0996 | U | 0.0996 | 0.498 | 0.099 | U | 0.099 | 0.495 | 0.0998 | U | 0.0998 | 0.499 |
| | Cadmium | 0.209 | J | 0.0996 | 0.996 | 0.139 | J | 0.099 | 0.99 | 0.157 | J | 0.0998 | 0.998 |
| | Calcium | 374000 | | 299 | 996 | 364000 | | 297 | 990 | 326000 | | 299 | 998 |
| | Chromium | 18 | | 0.996 | 2.99 | 43.8 | | 0.99 | 2.97 | 35.9 | | 0.998 | 2.99 |
| | Cobalt | 2.45 | | 0.0996 | 0.996 | 10.2 | | 0.099 | 0.99 | 7.72 | | 0.0998 | 0.998 |
| | Copper | 2.35 | | 0.199 | 0.996 | 4.14 | | 0.198 | 0.99 | 5.34 | | 0.2 | 0.998 |
| | Iron | 3700 | | 9.96 | 24.9 | 9760 | | 9.9 | 24.8 | 8150 | | 9.98 | 25 |
| | Lead | 1.15 | J | 0.498 | 1.99 | 0.495 | U | 0.495 | 1.98 | 0.602 | J | 0.499 | 2 |
| | Magnesium | 32500 | B | 49.8 | 149 | 43100 | B | 49.5 | 149 | 35200 | B | 49.9 | 150 |
| | Manganese | 96.2 | | 0.996 | 4.98 | 184 | | 0.99 | 4.95 | 154 | | 0.998 | 4.99 |
| | Mercury | 0.00144 | U | 0.00144 | 0.00963 | 0.00562 | J | 0.00149 | 0.0099 | 0.00718 | J | 0.00143 | 0.00955 |
| | Nickel | 25.7 | | 0.498 | 1.99 | 132 | | 0.495 | 1.98 | 95.2 | | 0.499 | 2 |
| | Potassium | 80.6 | J | 79.7 | 299 | 148 | J | 79.2 | 297 | 193 | J | 79.8 | 299 |
| | Selenium | 2.49 | U | 2.49 | 4.98 | 2.48 | U | 2.48 | 4.95 | 2.5 | U | 2.5 | 4.99 |
| | Silver | 0.199 | U | 0.199 | 0.996 | 0.198 | U | 0.198 | 0.99 | 0.2 | U | 0.2 | 0.998 |
| | Sodium | 2280 | | 79.7 | 249 | 2030 | | 79.2 | 248 | 1990 | | 79.8 | 250 |
| | Thallium | 0.199 | BU | 0.199 | 0.996 | 0.198 | BU | 0.198 | 0.99 | 0.2 | BU | 0.2 | 0.998 |
| | Vanadium | 6.15 | J | 1.99 | 9.96 | 7.88 | J | 1.98 | 9.9 | 8.18 | J | 2 | 9.98 |
| | Zinc | 7.94 | BJ | 1.99 | 9.96 | 10.6 | B | 1.98 | 9.9 | 13.4 | B | 2 | 9.98 |

See notes at end of table

**TABLE B-1.** Non-radiological Results for Kauai Test Facility for Community Locations for Calendar Year 2007, **Soil** (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 7 | | | | 8 | | | | 9 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit |
| **Community** (cont'd) | Aluminum | 2120 | | 4.96 | 14.9 | 9410 | | 4.93 | 14.8 | 1410 | | 4.84 | 14.5 |
| | Antimony | 0.496 | U | 0.496 | 1.98 | 0.493 | U | 0.493 | 1.97 | 0.484 | U | 0.484 | 1.94 |
| | Arsenic | 9.34 | | 1.49 | 4.96 | 6.67 | | 1.48 | 4.93 | 7.14 | | 1.45 | 4.84 |
| | Barium | 6.23 | | 0.496 | 1.98 | 16.3 | | 0.493 | 1.97 | 5.15 | | 0.484 | 1.94 |
| | Beryllium | 0.0992 | U | 0.0992 | 0.496 | 0.121 | J | 0.0986 | 0.493 | 0.0969 | U | 0.0969 | 0.484 |
| | Cadmium | 0.117 | J | 0.0992 | 0.992 | 0.23 | J | 0.0986 | 0.986 | 0.0979 | J | 0.0969 | 0.969 |
| | Calcium | 340000 | | 298 | 992 | 283000 | | 296 | 986 | 394000 | | 291 | 969 |
| | Chromium | 46.9 | | 0.992 | 2.98 | 79.7 | | 0.986 | 2.96 | 21.2 | | 0.969 | 2.91 |
| | Cobalt | 13.3 | | 0.0992 | 0.992 | 24.3 | | 0.0986 | 0.986 | 3.13 | | 0.0969 | 0.969 |
| | Copper | 3.6 | | 0.198 | 0.992 | 15.4 | | 0.197 | 0.986 | 1.57 | | 0.194 | 0.969 |
| | Iron | 11000 | | 9.92 | 24.8 | 20700 | | 9.86 | 24.7 | 4480 | | 9.69 | 24.2 |
| | Lead | 0.496 | U | 0.496 | 1.98 | 2.04 | | 0.493 | 1.97 | 0.484 | U | 0.484 | 1.94 |
| | Magnesium | 46700 | B | 49.6 | 149 | 53500 | B | 49.3 | 148 | 35800 | B | 48.4 | 145 |
| | Manganese | 197 | | 0.992 | 4.96 | 583 | | 0.986 | 4.93 | 83.2 | | 0.969 | 4.84 |
| | Mercury | 0.00139 | U | 0.00139 | 0.00929 | 0.00871 | J | 0.00142 | 0.00943 | 0.0014 | U | 0.0014 | 0.00935 |
| | Nickel | 175 | | 0.496 | 1.98 | 287 | | 0.493 | 1.97 | 38.7 | | 0.484 | 1.94 |
| | Potassium | 79.4 | U | 79.4 | 298 | 514 | | 78.9 | 296 | 77.5 | U | 77.5 | 291 |
| | Selenium | 2.48 | U | 2.48 | 4.96 | 2.47 | U | 2.47 | 4.93 | 2.42 | U | 2.42 | 4.84 |
| | Silver | 0.198 | U | 0.198 | 0.992 | 0.197 | U | 0.197 | 0.986 | 0.194 | U | 0.194 | 0.969 |
| | Sodium | 2050 | | 79.4 | 248 | 1940 | | 78.9 | 247 | 2230 | | 77.5 | 242 |
| | Thallium | 0.198 | BU | 0.198 | 0.992 | 0.197 | BU | 0.197 | 0.986 | 0.194 | BU | 0.194 | 0.969 |
| | Vanadium | 7.05 | J | 1.98 | 9.92 | 22.5 | | 1.97 | 9.86 | 5.45 | J | 1.94 | 9.69 |
| | Zinc | 12.4 | B | 1.98 | 9.92 | 40.7 | B | 1.97 | 9.86 | 4.88 | BJ | 1.94 | 9.69 |

See notes at end of table

**TABLE B-1.** Non-radiological Results for Kauai Test Facility for Community Locations for Calendar Year 2007, Soil (concluded). *(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 10 | | | | 11 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit |
| **Community (concluded)** | Aluminum | 2380 | | 4.96 | 14.9 | 1460 | | 4.78 | 14.3 |
| | Antimony | 0.496 | U | 0.496 | 1.98 | 0.478 | U | 0.478 | 1.91 |
| | Arsenic | 6.8 | | 1.49 | 4.96 | 7.19 | | 1.43 | 4.78 |
| | Barium | 16.8 | | 0.496 | 1.98 | 5.79 | | 0.478 | 1.91 |
| | Beryllium | 0.0992 | U | 0.0992 | 0.496 | 0.0956 | U | 0.0956 | 0.478 |
| | Cadmium | 0.159 | J | 0.0992 | 0.992 | 0.107 | J | 0.0956 | 0.956 |
| | Calcium | 344000 | | 298 | 992 | 374000 | | 287 | 956 |
| | Chromium | 23.4 | | 0.992 | 2.98 | 20.5 | | 0.956 | 2.87 |
| | Cobalt | 5.01 | | 0.0992 | 0.992 | 2.69 | | 0.0956 | 0.956 |
| | Copper | 7.13 | | 0.198 | 0.992 | 2.19 | | 0.191 | 0.956 |
| | Iron | 7480 | | 9.92 | 24.8 | 4290 | | 9.56 | 23.9 |
| | Lead | 4.08 | | 0.496 | 1.98 | 0.811 | J | 0.478 | 1.91 |
| | Magnesium | 30100 | B | 49.6 | 149 | 32300 | B | 47.8 | 143 |
| | Manganese | 107 | | 0.992 | 4.96 | 82 | | 0.956 | 4.78 |
| | Mercury | 0.00157 | J | 0.00133 | 0.00888 | 0.00209 | J | 0.00137 | 0.00916 |
| | Nickel | 46.6 | | 0.496 | 1.98 | 30.6 | | 0.478 | 1.91 |
| | Potassium | 140 | J | 79.4 | 298 | 76.5 | U | 76.5 | 287 |
| | Selenium | 2.48 | U | 2.48 | 4.96 | 2.39 | U | 2.39 | 4.78 |
| | Silver | 0.198 | U | 0.198 | 0.992 | 0.191 | U | 0.191 | 0.956 |
| | Sodium | 2070 | | 79.4 | 248 | 2170 | | 76.5 | 239 |
| | Thallium | 0.198 | BU | 0.198 | 0.992 | 0.191 | BU | 0.191 | 0.956 |
| | Vanadium | 7.81 | J | 1.98 | 9.92 | 5.57 | J | 1.91 | 9.56 |
| | Zinc | 808 | B | 1.98 | 9.92 | 61.1 | B | 1.91 | 9.56 |

**NOTES:** B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).
J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective MDL. For radiochemical analytes the result is less than the decision level.

**TABLE B-2** Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2007, Soil
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 12 | | | | 13 | | | | 14 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit |
| **On-Site** | Aluminum | 8560 | B | 4.84 | 14.5 | 8000 | B | 5 | 15 | 11700 | B | 4.97 | 14.9 |
| | Antimony | 0.0967 | U | 0.0967 | 0.387 | 0.1 | U | 0.1 | 0.4 | 0.0994 | U | 0.0994 | 0.398 |
| | Arsenic | 11.2 | | 0.29 | 0.967 | 8.24 | | 0.3 | 1 | 15.8 | | 0.298 | 0.994 |
| | Barium | 8.86 | | 0.0967 | 0.387 | 9.95 | | 0.1 | 0.4 | 43.3 | | 0.0994 | 0.398 |
| | Beryllium | 0.119 | | 0.0193 | 0.0967 | 0.113 | | 0.02 | 0.1 | 0.185 | | 0.0199 | 0.0994 |
| | Cadmium | 0.301 | | 0.0193 | 0.193 | 0.402 | | 0.02 | 0.2 | 0.444 | | 0.0199 | 0.199 |
| | Calcium | 249000 | | 290 | 967 | 213000 | | 150 | 500 | 200000 | | 149 | 497 |
| | Chromium | 58.7 | | 0.193 | 0.58 | 91.8 | | 0.2 | 0.6 | 85.2 | | 0.199 | 0.596 |
| | Cobalt | 21.3 | B | 0.0193 | 0.193 | 31.9 | B | 0.02 | 0.2 | 30.7 | B | 0.0199 | 0.199 |
| | Copper | 11.7 | | 0.0387 | 0.193 | 12.4 | | 0.04 | 0.2 | 18.1 | | 0.0398 | 0.199 |
| | Iron | 22300 | B | 9.67 | 24.2 | 28100 | B | 10 | 25 | 30600 | B | 9.94 | 24.9 |
| | Lead | 20.2 | | 0.484 | 1.93 | 1.2 | | 0.1 | 0.4 | 1.07 | | 0.0994 | 0.398 |
| | Magnesium | 41800 | B | 48.4 | 145 | 76400 | B | 50 | 150 | 70500 | B | 49.7 | 149 |
| | Manganese | 433 | | 0.967 | 4.84 | 491 | | 1 | 5 | 530 | | 0.994 | 4.97 |
| | Mercury | 0.00802 | J | 0.00144 | 0.00958 | 0.00504 | J | 0.00144 | 0.00957 | 0.0063 | J | 0.00146 | 0.00971 |
| | Nickel | 261 | | 0.484 | 1.93 | 443 | | 0.5 | 2 | 419 | | 0.497 | 1.99 |
| | Potassium | 258 | J | 77.4 | 290 | 215 | J | 80 | 300 | 732 | | 79.5 | 298 |
| | Selenium | 0.484 | U | 0.484 | 0.967 | 0.5 | U | 0.5 | 1 | 0.497 | U | 0.497 | 0.994 |
| | Silver | 0.0727 | J | 0.0387 | 0.193 | 0.0816 | J | 0.04 | 0.2 | 0.0777 | J | 0.0398 | 0.199 |
| | Sodium | 2060 | | 77.4 | 242 | 1880 | | 80 | 250 | 3210 | | 79.5 | 249 |
| | Thallium | 0.0642 | BJ | 0.0387 | 0.193 | 0.04 | BU | 0.04 | 0.2 | 0.0398 | BU | 0.0398 | 0.199 |
| | Vanadium | 25.6 | | 1.93 | 9.67 | 21.2 | | 2 | 10 | 22.1 | | 1.99 | 9.94 |
| | Zinc | 40.4 | | 0.387 | 1.93 | 40.3 | | 0.4 | 2 | 47.2 | | 0.398 | 1.99 |

See notes at end of table

**TABLE B-2** Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2007, Soil *(continued)*
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 15 | | | | 16 | | | | 17 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit |
| **On-Site (cont'd)** | Aluminum | 8190 | B | 4.96 | 14.9 | 9020 | B | 4.93 | 14.8 | 6350 | B | 5 | 15 |
| | Antimony | 0.0992 | U | 0.0992 | 0.397 | 0.493 | U | 0.493 | 1.97 | 0.5 | U | 0.5 | 2 |
| | Arsenic | 11.3 | | 0.298 | 0.992 | 9.34 | | 1.48 | 4.93 | 6.09 | | 1.5 | 5 |
| | Barium | 17.3 | | 0.0992 | 0.397 | 12.2 | | 0.493 | 1.97 | 9.22 | | 0.5 | 2 |
| | Beryllium | 0.136 | | 0.0198 | 0.0992 | 0.117 | J | 0.0986 | 0.493 | 0.1 | U | 0.1 | 0.5 |
| | Cadmium | 0.287 | | 0.0198 | 0.198 | 0.442 | J | 0.0986 | 0.986 | 0.305 | J | 0.1 | 1 |
| | Calcium | 220000 | | 149 | 496 | 209000 | | 148 | 493 | 302000 | | 300 | 1000 |
| | Chromium | 98.2 | | 0.198 | 0.595 | 105 | | 0.986 | 2.96 | 51.4 | | 1 | 3 |
| | Cobalt | 35 | B | 0.0198 | 0.198 | 39.3 | B | 0.0986 | 0.986 | 16.2 | B | 0.1 | 1 |
| | Copper | 44.4 | | 0.0397 | 0.198 | 20.5 | | 0.197 | 0.986 | 9.39 | | 0.2 | 1 |
| | Iron | 30800 | B | 9.92 | 24.8 | 30800 | B | 9.86 | 24.7 | 14000 | B | 10 | 25 |
| | Lead | 0.729 | | 0.0992 | 0.397 | 0.81 | J | 0.493 | 1.97 | 0.5 | U | 0.5 | 2 |
| | Magnesium | 78100 | B | 49.6 | 149 | 76800 | B | 49.3 | 148 | 46000 | B | 50 | 150 |
| | Manganese | 555 | | 0.992 | 4.96 | 513 | | 0.986 | 4.93 | 253 | | 1 | 5 |
| | Mercury | 0.0055 | J | 0.00142 | 0.00949 | 0.0108 | | 0.00142 | 0.00949 | 0.0077 | J | 0.00136 | 0.00905 |
| | Nickel | 484 | | 0.496 | 1.98 | 469 | | 0.493 | 1.97 | 201 | | 0.5 | 2 |
| | Potassium | 329 | | 79.4 | 298 | 288 | J | 78.9 | 296 | 271 | J | 80 | 300 |
| | Selenium | 0.496 | U | 0.496 | 0.992 | 2.47 | U | 2.47 | 4.93 | 2.5 | U | 2.5 | 5 |
| | Silver | 0.102 | J | 0.0397 | 0.198 | 0.197 | U | 0.197 | 0.986 | 0.2 | U | 0.2 | 1 |
| | Sodium | 1830 | | 79.4 | 248 | 1850 | | 78.9 | 247 | 2070 | | 80 | 250 |
| | Thallium | 0.0397 | BU | 0.0397 | 0.198 | 0.197 | BU | 0.197 | 0.986 | 0.2 | BU | 0.2 | 1 |
| | Vanadium | 19.5 | | 1.98 | 9.92 | 19.7 | | 1.97 | 9.86 | 16.4 | | 2 | 10 |
| | Zinc | 43 | | 0.397 | 1.98 | 37.4 | | 1.97 | 9.86 | 18 | | 2 | 10 |

See notes at end of table

**TABLE B-2** Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2007, Soil *(continued)*

*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 18 | | | | 19 | | | | 20 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Level | Result | | Decision Level | Detection Level | Result | | Decision Level | Detection Level |
| **On-Site (cont'd)** | Aluminum | 8570 | B | 4.89 | 14.7 | 6610 | B | 4.93 | 14.8 | 6580 | B | 4.95 | 14.9 |
| | Antimony | 0.489 | U | 0.489 | 1.96 | 0.493 | U | 0.493 | 1.97 | 0.495 | U | 0.495 | 1.98 |
| | Arsenic | 6.62 | | 1.47 | 4.89 | 9.25 | | 1.48 | 4.93 | 10.3 | | 1.49 | 4.95 |
| | Barium | 14.8 | | 0.489 | 1.96 | 9.85 | | 0.493 | 1.97 | 20.4 | | 0.495 | 1.98 |
| | Beryllium | 0.0978 | U | 0.0978 | 0.489 | 0.0986 | U | 0.0986 | 0.493 | 0.099 | U | 0.099 | 0.495 |
| | Cadmium | 0.263 | J | 0.0978 | 0.978 | 0.311 | J | 0.0986 | 0.986 | 0.399 | J | 0.099 | 0.99 |
| | Calcium | 226000 | | 147 | 489 | 245000 | | 148 | 493 | 300000 | | 297 | 990 |
| | Chromium | 71.2 | | 0.978 | 2.94 | 82.7 | | 0.986 | 2.96 | 51.4 | | 0.99 | 2.97 |
| | Cobalt | 24.5 | B | 0.0978 | 0.978 | 30.4 | B | 0.0986 | 0.986 | 16.7 | B | 0.099 | 0.99 |
| | Copper | 33.9 | | 0.196 | 0.978 | 11.9 | | 0.197 | 0.986 | 10.5 | | 0.198 | 0.99 |
| | Iron | 21000 | B | 9.78 | 24.5 | 23200 | B | 9.86 | 24.7 | 15800 | B | 9.9 | 24.8 |
| | Lead | 0.489 | U | 0.489 | 1.96 | 0.652 | J | 0.493 | 1.97 | 0.703 | J | 0.495 | 1.98 |
| | Magnesium | 43700 | B | 48.9 | 147 | 51000 | B | 49.3 | 148 | 35900 | B | 49.5 | 149 |
| | Manganese | 377 | | 0.978 | 4.89 | 407 | | 0.986 | 4.93 | 318 | | 0.99 | 4.95 |
| | Mercury | 0.00651 | J | 0.00147 | 0.00979 | 0.00164 | J | 0.0013 | 0.0087 | 0.00148 | U | 0.00148 | 0.00988 |
| | Nickel | 279 | | 0.489 | 1.96 | 354 | | 0.493 | 1.97 | 164 | | 0.495 | 1.98 |
| | Potassium | 306 | | 78.3 | 294 | 173 | J | 78.9 | 296 | 265 | J | 79.2 | 297 |
| | Selenium | 2.45 | U | 2.45 | 4.89 | 2.47 | U | 2.47 | 4.93 | 2.48 | U | 2.48 | 4.95 |
| | Silver | 0.196 | U | 0.196 | 0.978 | 0.197 | U | 0.197 | 0.986 | 0.198 | U | 0.198 | 0.99 |
| | Sodium | 1960 | | 78.3 | 245 | 1880 | | 78.9 | 247 | 2190 | | 79.2 | 248 |
| | Thallium | 0.196 | BU | 0.196 | 0.978 | 0.197 | BU | 0.197 | 0.986 | 0.198 | BU | 0.198 | 0.99 |
| | Vanadium | 19.3 | | 1.96 | 9.78 | 17.9 | | 1.97 | 9.86 | 18.4 | | 1.98 | 9.9 |
| | Zinc | 23.9 | | 1.96 | 9.78 | 26.3 | | 1.97 | 9.86 | 28.6 | | 1.98 | 9.9 |

See notes at end of table

**TABLE B-2** Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2007, Soil (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 21 | | | | 22 | | | | 23 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Level | Result | | Decision Level | Detection Level | Result | | Decision Level | Detection Level |
| **On-Site (cont'd)** | Aluminum | 5980 | B | 4.87 | 14.6 | 2320 | B | 4.88 | 14.6 | 7140 | B | 4.95 | 14.9 |
| | Antimony | 0.487 | U | 0.487 | 1.95 | 0.488 | U | 0.488 | 1.95 | 0.495 | U | 0.495 | 1.98 |
| | Arsenic | 9.54 | | 1.46 | 4.87 | 8.14 | | 1.46 | 4.88 | 20.5 | | 1.49 | 4.95 |
| | Barium | 10.7 | | 0.487 | 1.95 | 7.04 | | 0.488 | 1.95 | 14.7 | | 0.495 | 1.98 |
| | Beryllium | 0.0975 | U | 0.0975 | 0.487 | 0.0977 | U | 0.0977 | 0.488 | 0.107 | J | 0.099 | 0.495 |
| | Cadmium | 0.311 | J | 0.0975 | 0.975 | 0.165 | J | 0.0977 | 0.977 | 0.845 | J | 0.099 | 0.99 |
| | Calcium | 362000 | | 292 | 975 | 348000 | | 293 | 977 | 359000 | | 297 | 990 |
| | Chromium | 31.5 | | 0.975 | 2.92 | 24.6 | | 0.977 | 2.93 | 57.8 | | 0.99 | 2.97 |
| | Cobalt | 9.1 | B | 0.0975 | 0.975 | 4.51 | B | 0.0977 | 0.977 | 18.9 | B | 0.099 | 0.99 |
| | Copper | 29.9 | | 0.195 | 0.975 | 6.05 | | 0.195 | 0.977 | 11.4 | | 0.198 | 0.99 |
| | Iron | 10100 | B | 9.75 | 24.4 | 5580 | B | 9.77 | 24.4 | 18200 | B | 9.9 | 24.8 |
| | Lead | 0.761 | J | 0.487 | 1.95 | 1.77 | J | 0.488 | 1.95 | 10.6 | | 0.495 | 1.98 |
| | Magnesium | 32900 | B | 48.7 | 146 | 34800 | B | 48.8 | 146 | 32700 | B | 49.5 | 149 |
| | Manganese | 218 | | 0.975 | 4.87 | 114 | | 0.977 | 4.88 | 386 | | 0.99 | 4.95 |
| | Mercury | 0.00642 | J | 0.00138 | 0.0092 | 0.00145 | U | 0.00145 | 0.00968 | 0.0175 | | 0.00142 | 0.00948 |
| | Nickel | 76.4 | | 0.487 | 1.95 | 51.4 | | 0.488 | 1.95 | 174 | | 0.495 | 1.98 |
| | Potassium | 234 | J | 78 | 292 | 94.9 | J | 78.1 | 293 | 162 | J | 79.2 | 297 |
| | Selenium | 2.44 | U | 2.44 | 4.87 | 2.44 | U | 2.44 | 4.88 | 2.48 | U | 2.48 | 4.95 |
| | Silver | 0.195 | U | 0.195 | 0.975 | 0.195 | U | 0.195 | 0.977 | 0.198 | U | 0.198 | 0.99 |
| | Sodium | 2390 | | 78 | 244 | 2030 | | 78.1 | 244 | 2440 | | 79.2 | 248 |
| | Thallium | 0.195 | BU | 0.195 | 0.975 | 0.195 | BU | 0.195 | 0.977 | 0.198 | BU | 0.198 | 0.99 |
| | Vanadium | 18.9 | | 1.95 | 9.75 | 7.81 | J | 1.95 | 9.77 | 23.3 | | 1.98 | 9.9 |
| | Zinc | 20.2 | | 1.95 | 9.75 | 11.2 | | 1.95 | 9.77 | 291 | | 1.98 | 9.9 |

See notes at end of table

**TABLE B-2** Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2007, Soil *(continued)*

*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 24 | | | | 25 | | | | 26 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit |
| **On-Site (cont'd)** | Aluminum | 3400 | B | 4.83 | 14.5 | 7230 | B | 4.98 | 14.9 | 9640 | B | 4.96 | 14.9 |
| | Antimony | 0.483 | U | 0.483 | 1.93 | 0.924 | J | 0.498 | 1.99 | 0.616 | J | 0.496 | 1.98 |
| | Arsenic | 6.34 | | 1.45 | 4.83 | 55.7 | | 1.49 | 4.98 | 15.5 | | 1.49 | 4.96 |
| | Barium | 24.8 | | 0.483 | 1.93 | 18.8 | | 0.498 | 1.99 | 161 | | 0.496 | 1.98 |
| | Beryllium | 0.0965 | U | 0.0965 | 0.483 | 0.114 | J | 0.0996 | 0.498 | 0.201 | J | 0.0992 | 0.496 |
| | Cadmium | 0.46 | J | 0.0965 | 0.965 | 1.25 | | 0.0996 | 0.996 | 1 | | 0.0992 | 0.992 |
| | Calcium | 297000 | | 290 | 965 | 285000 | | 299 | 996 | 342000 | | 298 | 992 |
| | Chromium | 25.9 | | 0.965 | 2.9 | 56 | | 0.996 | 2.99 | 49.9 | | 0.992 | 2.98 |
| | Cobalt | 4.7 | B | 0.0965 | 0.965 | 18.7 | B | 0.0996 | 0.996 | 15.9 | B | 0.0992 | 0.992 |
| | Copper | 31.2 | | 0.193 | 0.965 | 11.3 | | 0.199 | 0.996 | 239 | | 0.198 | 0.992 |
| | Iron | 7600 | B | 9.65 | 24.1 | 17100 | B | 9.96 | 24.9 | 26500 | B | 9.92 | 24.8 |
| | Lead | 7.39 | | 0.483 | 1.93 | 27.5 | | 0.498 | 1.99 | 26.7 | | 0.496 | 1.98 |
| | Magnesium | 38000 | B | 48.3 | 145 | 39700 | B | 49.8 | 149 | 36100 | B | 49.6 | 149 |
| | Manganese | 172 | | 0.965 | 4.83 | 337 | | 0.996 | 4.98 | 563 | | 0.992 | 4.96 |
| | Mercury | 0.0033 | J | 0.00136 | 0.00904 | 0.00141 | U | 0.00141 | 0.00938 | 0.0544 | | 0.00141 | 0.00939 |
| | Nickel | 46.9 | | 0.483 | 1.93 | 177 | | 0.498 | 1.99 | 81.1 | | 0.496 | 1.98 |
| | Potassium | 173 | J | 77.2 | 290 | 217 | J | 79.7 | 299 | 671 | | 79.4 | 298 |
| | Selenium | 2.41 | U | 2.41 | 4.83 | 2.49 | U | 2.49 | 4.98 | 2.48 | U | 2.48 | 4.96 |
| | Silver | 0.193 | U | 0.193 | 0.965 | 0.199 | U | 0.199 | 0.996 | 0.278 | J | 0.198 | 0.992 |
| | Sodium | 2010 | | 77.2 | 241 | 2160 | | 79.7 | 249 | 1760 | | 79.4 | 248 |
| | Thallium | 0.193 | BU | 0.193 | 0.965 | 0.199 | BU | 0.199 | 0.996 | 0.198 | BU | 0.198 | 0.992 |
| | Vanadium | 10.2 | | 1.93 | 9.65 | 20.6 | | 1.99 | 9.96 | 29.7 | | 1.98 | 9.92 |
| | Zinc | 79.4 | | 1.93 | 9.65 | 372 | | 1.99 | 9.96 | 238 | | 1.98 | 9.92 |

See notes at end of table.

**TABLE B-2** Non-radiological Results for Kauai Test Facility for On-Site Locations for Calendar Year 2007, Soil *(concluded) (All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Analyte | 27 | | | | 28 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Result | | Decision Level | Detection Limit | Result | | Decision Level | Detection Limit |
| **On-Site (concluded)** | Aluminum | 7170 | B | 4.82 | 14.5 | 31400 | | 4.9 | 14.7 |
| | Antimony | 0.482 | U | 0.482 | 1.93 | 0.261 | J | 0.098 | 0.392 |
| | Arsenic | 20.1 | | 1.45 | 4.82 | 14.9 | | 0.294 | 0.98 |
| | Barium | 11.6 | | 0.482 | 1.93 | 14.8 | | 0.098 | 0.392 |
| | Beryllium | 0.108 | J | 0.0963 | 0.482 | 0.124 | | 0.0196 | 0.098 |
| | Cadmium | 0.341 | J | 0.0963 | 0.963 | 0.363 | | 0.0196 | 0.196 |
| | Calcium | 301000 | | 289 | 963 | 282000 | | 294 | 980 |
| | Chromium | 51.6 | | 0.963 | 2.89 | 48.1 | | 0.196 | 0.588 |
| | Cobalt | 15.8 | B | 0.0963 | 0.963 | 16.8 | | 0.0196 | 0.196 |
| | Copper | 22 | | 0.193 | 0.963 | 17.4 | | 0.196 | 0.98 |
| | Iron | 15900 | B | 9.63 | 24.1 | 18000 | | 9.8 | 24.5 |
| | Lead | 1.54 | J | 0.482 | 1.93 | 7.14 | | 0.098 | 0.392 |
| | Magnesium | 32600 | B | 48.2 | 145 | 32500 | B | 49 | 147 |
| | Manganese | 295 | | 0.963 | 4.82 | 354 | | 0.98 | 4.9 |
| | Mercury | 0.00287 | J | 0.00139 | 0.00927 | 0.0123 | | 0.00149 | 0.0099 |
| | Nickel | 150 | | 0.482 | 1.93 | 158 | | 0.098 | 0.392 |
| | Potassium | 173 | J | 77.1 | 289 | 170 | | 78.4 | 294 |
| | Selenium | 2.41 | U | 2.41 | 4.82 | 0.49 | U | 0.49 | 0.98 |
| | Silver | 0.193 | U | 0.193 | 0.963 | 2.13 | | 0.0392 | 0.196 |
| | Sodium | 2330 | | 77.1 | 241 | 9500 | | 78.4 | 245 |
| | Thallium | 0.193 | BU | 0.193 | 0.963 | 0.106 | BJ | 0.0392 | 0.196 |
| | Vanadium | 21.3 | | 1.93 | 9.63 | 24.6 | | 1.96 | 9.8 |
| | Zinc | 25 | | 1.93 | 9.63 | 32.8 | B | 0.392 | 1.96 |

**NOTES:** B = The analyte was found in the blank above the effective MDL (organics), or the effective PQ (inorganics).
J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective MDL. For radiochemical analytes the result is less than the decision level.

**TABLE B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **Community** | C-07 | 083837-001 | Aluminum | 2120 | | 4.96 | 14.9 | 1967 | 146 | 7.41% |
| | | 083837-002 | Aluminum | 1830 | | 4.98 | 14.9 | | | |
| | | 083837-003 | Aluminum | 1950 | | 4.95 | 14.9 | | | |
| | | 083837-001 | Antimony | 0.496 | U | 0.496 | 1.98 | 0.496 | 0.002 | 0.31% |
| | | 083837-002 | Antimony | 0.498 | U | 0.498 | 1.99 | | | |
| | | 083837-003 | Antimony | 0.495 | U | 0.495 | 1.98 | | | |
| | | 083837-001 | Arsenic | 9.34 | | 1.49 | 4.96 | 9.13 | 0.259 | 2.84% |
| | | 083837-002 | Arsenic | 9.21 | | 1.49 | 4.98 | | | |
| | | 083837-003 | Arsenic | 8.84 | | 1.49 | 4.95 | | | |
| | | 083837-001 | Barium | 6.23 | | 0.496 | 1.98 | 6.11 | 0.157 | 2.57% |
| | | 083837-002 | Barium | 6.16 | | 0.498 | 1.99 | | | |
| | | 083837-003 | Barium | 5.93 | | 0.495 | 1.98 | | | |
| | | 083837-001 | Beryllium | 0.0992 | U | 0.0992 | 0.496 | 0.099 | 0.000 | 0.31% |
| | | 083837-002 | Beryllium | 0.0996 | U | 0.0996 | 0.498 | | | |
| | | 083837-003 | Beryllium | 0.099 | U | 0.099 | 0.495 | | | |
| | | 083837-001 | Cadmium | 0.117 | J | 0.0992 | 0.992 | 0.109 | 0.008 | 7.34% |
| | | 083837-002 | Cadmium | 0.101 | J | 0.0996 | 0.996 | | | |
| | | 083837-003 | Cadmium | 0.109 | J | 0.099 | 0.99 | | | |
| | | 083837-001 | Calcium | 340000 | | 298 | 992 | 352333 | 18824 | 5.34% |
| | | 083837-002 | Calcium | 343000 | | 299 | 996 | | | |
| | | 083837-003 | Calcium | 374000 | | 297 | 990 | | | |
| | | 083837-001 | Chromium | 46.9 | | 0.992 | 2.98 | 45.6 | 1.13 | 2.47% |
| | | 083837-002 | Chromium | 45 | | 0.996 | 2.99 | | | |
| | | 083837-003 | Chromium | 44.9 | | 0.99 | 2.97 | | | |

See notes at end of table

**TABLE B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **Community (cont'd)** | C-07 | 083837-001 | Cobalt | 13.3 | | 0.0992 | 0.992 | 12.5 | 0.751 | 5.99% |
| | | 083837-002 | Cobalt | 11.8 | | 0.0996 | 0.996 | | | |
| | | 083837-003 | Cobalt | 12.5 | | 0.099 | 0.99 | | | |
| | | 083837-001 | Copper | 3.6 | | 0.198 | 0.992 | 3.24 | 0.342 | 10.55% |
| | | 083837-002 | Copper | 2.92 | | 0.199 | 0.996 | | | |
| | | 083837-003 | Copper | 3.2 | | 0.198 | 0.99 | | | |
| | | 083837-001 | Iron | 11000 | | 9.92 | 24.8 | 10477 | 535 | 5.11% |
| | | 083837-002 | Iron | 9930 | | 9.96 | 24.9 | | | |
| | | 083837-003 | Iron | 10500 | | 9.9 | 24.8 | | | |
| | | 083837-001 | Lead | 0.496 | U | 0.496 | 1.98 | 0.496 | 0.002 | 0.31% |
| | | 083837-002 | Lead | 0.498 | U | 0.498 | 1.99 | | | |
| | | 083837-003 | Lead | 0.495 | U | 0.495 | 1.98 | | | |
| | | 083837-001 | Magnesium | 46700 | B | 49.6 | 149 | 49867 | 7565 | 15.17% |
| | | 083837-002 | Magnesium | 44400 | B | 49.8 | 149 | | | |
| | | 083837-003 | Magnesium | 58500 | B | 49.5 | 149 | | | |
| | | 083837-001 | Manganese | 197 | | 0.992 | 4.96 | 199 | 9.17 | 4.61% |
| | | 083837-002 | Manganese | 209 | | 0.996 | 4.98 | | | |
| | | 083837-003 | Manganese | 191 | | 0.99 | 4.95 | | | |
| | | 083837-001 | Mercury | 0.00139 | U | 0.00139 | 0.00929 | 0.001 | 0.000 | 3.66% |
| | | 083837-002 | Mercury | 0.00148 | U | 0.00148 | 0.00984 | | | |
| | | 083837-003 | Mercury | 0.00139 | U | 0.00139 | 0.00926 | | | |
| | | 083837-001 | Nickel | 175 | | 0.496 | 1.98 | 166 | 8.50 | 5.11% |
| | | 083837-002 | Nickel | 158 | | 0.498 | 1.99 | | | |
| | | 083837-003 | Nickel | 166 | | 0.495 | 1.98 | | | |

See notes at end of table

**TABLE B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **Community (cont'd)** | C-07 | 083837-001 | Potassium | 79.4 | U | 79.4 | 298 | 79.4 | 0.252 | 0.32% |
| | | 083837-002 | Potassium | 79.7 | U | 79.7 | 299 | | | |
| | | 083837-003 | Potassium | 79.2 | U | 79.2 | 297 | | | |
| | | 083837-001 | Selenium | 2.48 | U | 2.48 | 4.96 | 2.48 | 0.006 | 0.23% |
| | | 083837-002 | Selenium | 2.49 | U | 2.49 | 4.98 | | | |
| | | 083837-003 | Selenium | 2.48 | U | 2.48 | 4.95 | | | |
| | | 083837-001 | Silver | 0.198 | U | 0.198 | 0.992 | 0.198 | 0.001 | 0.29% |
| | | 083837-002 | Silver | 0.199 | U | 0.199 | 0.996 | | | |
| | | 083837-003 | Silver | 0.198 | U | 0.198 | 0.99 | | | |
| | | 083837-001 | Sodium | 2050 | | 79.4 | 248 | 2050 | 20.0 | 0.98% |
| | | 083837-002 | Sodium | 2030 | | 79.7 | 249 | | | |
| | | 083837-003 | Sodium | 2070 | | 79.2 | 248 | | | |
| | | 083837-001 | Thallium | 0.198 | BU | 0.198 | 0.992 | 0.198 | 0.001 | 0.29% |
| | | 083837-002 | Thallium | 0.199 | BU | 0.199 | 0.996 | | | |
| | | 083837-003 | Thallium | 0.198 | BU | 0.198 | 0.99 | | | |
| | | 083837-001 | Vanadium | 7.05 | J | 1.98 | 9.92 | 6.54 | 0.447 | 6.84% |
| | | 083837-002 | Vanadium | 6.23 | J | 1.99 | 9.96 | | | |
| | | 083837-003 | Vanadium | 6.33 | J | 1.98 | 9.9 | | | |
| | | 083837-001 | Zinc | 12.4 | B | 1.98 | 9.92 | 12.0 | 0.586 | 4.90% |
| | | 083837-002 | Zinc | 12.2 | B | 1.99 | 9.96 | | | |
| | | 083837-003 | Zinc | 11.3 | B | 1.98 | 9.9 | | | |
| **On-Site** | S-21 | 083823-001 | Aluminum | 5980 | B | 4.87 | 14.6 | 5790 | 255 | 4.41% |
| | | 083823-002 | Aluminum | 5890 | B | 4.78 | 14.3 | | | |
| | | 083823-003 | Aluminum | 5500 | B | 4.95 | 14.9 | | | |

See notes at end of table

**TABLE B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **On-Site (cont'd)** | S-21 | 083823-001 | Antimony | 0.487 | U | 0.487 | 1.95 | 0.487 | 0.009 | 1.75% |
| | | 083823-002 | Antimony | 0.478 | U | 0.478 | 1.91 | | | |
| | | 083823-003 | Antimony | 0.495 | U | 0.495 | 1.98 | | | |
| | | 083823-001 | Arsenic | 9.54 | | 1.46 | 4.87 | 10.8 | 1.13 | 10.46% |
| | | 083823-002 | Arsenic | 11.7 | | 1.43 | 4.78 | | | |
| | | 083823-003 | Arsenic | 11.2 | | 1.49 | 4.95 | | | |
| | | 083823-001 | Barium | 10.7 | | 0.487 | 1.95 | 10.7 | 0.153 | 1.42% |
| | | 083823-002 | Barium | 10.6 | | 0.478 | 1.91 | | | |
| | | 083823-003 | Barium | 10.9 | | 0.495 | 1.98 | | | |
| | | 083823-001 | Beryllium | 0.0975 | U | 0.0975 | 0.487 | 0.097 | 0.002 | 1.75% |
| | | 083823-002 | Beryllium | 0.0956 | U | 0.0956 | 0.478 | | | |
| | | 083823-003 | Beryllium | 0.099 | U | 0.099 | 0.495 | | | |
| | | 083823-001 | Cadmium | 0.311 | J | 0.0975 | 0.975 | 0.318 | 0.018 | 5.65% |
| | | 083823-002 | Cadmium | 0.304 | J | 0.0956 | 0.956 | | | |
| | | 083823-003 | Cadmium | 0.338 | J | 0.099 | 0.99 | | | |
| | | 083823-001 | Calcium | 362000 | | 292 | 975 | 340000 | 19157 | 5.63% |
| | | 083823-002 | Calcium | 331000 | | 287 | 956 | | | |
| | | 083823-003 | Calcium | 327000 | | 297 | 990 | | | |
| | | 083823-001 | Chromium | 31.5 | | 0.975 | 2.92 | 35.3 | 3.41 | 9.66% |
| | | 083823-002 | Chromium | 38.1 | | 0.956 | 2.87 | | | |
| | | 083823-003 | Chromium | 36.3 | | 0.99 | 2.97 | | | |
| | | 083823-001 | Cobalt | 9.1 | B | 0.0975 | 0.975 | 10.2 | 1.22 | 11.96% |
| | | 083823-002 | Cobalt | 11.5 | B | 0.0956 | 0.956 | | | |
| | | 083823-003 | Cobalt | 9.94 | B | 0.099 | 0.99 | | | |

See notes at end of table

**Table B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **On-site (cont'd)** | S-21 | 083823-001 | Copper | 29.9 | | 0.195 | 0.975 | 17.6 | 10.7 | 60.54% |
| | | 083823-002 | Copper | 11.7 | | 0.191 | 0.956 | | | |
| | | 083823-003 | Copper | 11.2 | | 0.198 | 0.99 | | | |
| | | 083823-001 | Iron | 10100 | B | 9.75 | 24.4 | 11033 | 950 | 8.61% |
| | | 083823-002 | Iron | 12000 | B | 9.56 | 23.9 | | | |
| | | 083823-003 | Iron | 11000 | B | 9.9 | 24.8 | | | |
| | | 083823-001 | Lead | 0.761 | J | 0.487 | 1.95 | 0.881 | 0.114 | 12.95% |
| | | 083823-002 | Lead | 0.895 | J | 0.478 | 1.91 | | | |
| | | 083823-003 | Lead | 0.988 | J | 0.495 | 1.98 | | | |
| | | 083823-001 | Magnesium | 32900 | B | 48.7 | 146 | 33600 | 1127 | 3.35% |
| | | 083823-002 | Magnesium | 34900 | B | 47.8 | 143 | | | |
| | | 083823-003 | Magnesium | 33000 | B | 49.5 | 149 | | | |
| | | 083823-001 | Manganese | 218 | | 0.975 | 4.87 | 229 | 9.29 | 4.06% |
| | | 083823-002 | Manganese | 233 | | 0.956 | 4.78 | | | |
| | | 083823-003 | Manganese | 235 | | 0.99 | 4.95 | | | |
| | | 083823-001 | Mercury | 0.00642 | J | 0.00138 | 0.0092 | 0.004 | 0.002 | 58.67% |
| | | 083823-002 | Mercury | 0.00234 | J | 0.00146 | 0.00974 | | | |
| | | 083823-003 | Mercury | 0.00274 | J | 0.00136 | 0.00908 | | | |
| | | 083823-001 | Nickel | 76.4 | | 0.487 | 1.95 | 91.7 | 14.8 | 16.17% |
| | | 083823-002 | Nickel | 106 | | 0.478 | 1.91 | | | |
| | | 083823-003 | Nickel | 92.8 | | 0.495 | 1.98 | | | |
| | | 083823-001 | Potassium | 234 | J | 78 | 292 | 207 | 25.0 | 12.09% |
| | | 083823-002 | Potassium | 201 | J | 76.5 | 287 | | | |
| | | 083823-003 | Potassium | 185 | J | 79.2 | 297 | | | |

See notes at end of table

**Table B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **On-site (cont'd)** | S-21 | 083823-001 | Selenium | 2.44 | U | 2.44 | 4.87 | 2.44 | 0.045 | 1.85% |
| | | 083823-002 | Selenium | 2.39 | U | 2.39 | 4.78 | | | |
| | | 083823-003 | Selenium | 2.48 | U | 2.48 | 4.95 | | | |
| | | 083823-001 | Silver | 0.195 | U | 0.195 | 0.975 | 0.195 | 0.004 | 1.80% |
| | | 083823-002 | Silver | 0.191 | U | 0.191 | 0.956 | | | |
| | | 083823-003 | Silver | 0.198 | U | 0.198 | 0.99 | | | |
| | | 083823-001 | Sodium | 2390 | | 78 | 244 | 2200 | 165 | 7.48% |
| | | 083823-002 | Sodium | 2100 | | 76.5 | 239 | | | |
| | | 083823-003 | Sodium | 2110 | | 79.2 | 248 | | | |
| | | 083823-001 | Thallium | 0.195 | BU | 0.195 | 0.975 | 0.195 | 0.004 | 1.80% |
| | | 083823-002 | Thallium | 0.191 | BU | 0.191 | 0.956 | | | |
| | | 083823-003 | Thallium | 0.198 | BU | 0.198 | 0.99 | | | |
| | | 083823-001 | Vanadium | 18.9 | | 1.95 | 9.75 | 16.9 | 1.78 | 10.54% |
| | | 083823-002 | Vanadium | 16.1 | | 1.91 | 9.56 | | | |
| | | 083823-003 | Vanadium | 15.6 | | 1.98 | 9.9 | | | |
| | | 083823-001 | Zinc | 20.2 | | 1.95 | 9.75 | 21.8 | 1.97 | 9.04% |
| | | 083823-002 | Zinc | 21.2 | | 1.91 | 9.56 | | | |
| | | 083823-003 | Zinc | 24 | | 1.98 | 9.9 | | | |
| | S-25 | 083827-001 | Aluminum | 7230 | B | 4.98 | 14.9 | 7160 | 60.8 | 0.85% |
| | | 083827-002 | Aluminum | 7120 | B | 4.85 | 14.6 | | | |
| | | 083827-003 | Aluminum | 7130 | B | 4.93 | 14.8 | | | |
| | | 083827-001 | Antimony | 0.924 | J | 0.498 | 1.99 | 0.787 | 0.131 | 16.60% |
| | | 083827-002 | Antimony | 0.772 | J | 0.485 | 1.94 | | | |
| | | 083827-003 | Antimony | 0.664 | J | 0.493 | 1.97 | | | |

See notes at end of table

**Table B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil (continued)

*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **On-site (cont'd)** | S-25 | 083827-001 | Arsenic | 55.7 | | 1.49 | 4.98 | 48.8 | 6.03 | 12.36% |
| | | 083827-002 | Arsenic | 45.8 | | 1.46 | 4.85 | 48.8 | 6.03 | 12.36% |
| | | 083827-003 | Arsenic | 44.8 | | 1.48 | 4.93 | 48.8 | 6.03 | 12.36% |
| | | 083827-001 | Barium | 18.8 | | 0.498 | 1.99 | 21.8 | 3.23 | 14.82% |
| | | 083827-002 | Barium | 25.2 | | 0.485 | 1.94 | 21.8 | 3.23 | 14.82% |
| | | 083827-003 | Barium | 21.3 | | 0.493 | 1.97 | 21.8 | 3.23 | 14.82% |
| | | 083827-001 | Beryllium | 0.114 | J | 0.0996 | 0.498 | 0.116 | 0.002 | 1.49% |
| | | 083827-002 | Beryllium | 0.117 | J | 0.0971 | 0.485 | 0.116 | 0.002 | 1.49% |
| | | 083827-003 | Beryllium | 0.117 | J | 0.0986 | 0.493 | 0.116 | 0.002 | 1.49% |
| | | 083827-001 | Cadmium | 1.25 | | 0.0996 | 0.996 | 1.02 | 0.206 | 20.25% |
| | | 083827-002 | Cadmium | 0.948 | J | 0.0971 | 0.971 | 1.02 | 0.206 | 20.25% |
| | | 083827-003 | Cadmium | 0.856 | J | 0.0986 | 0.986 | 1.02 | 0.206 | 20.25% |
| | | 083827-001 | Calcium | 285000 | | 299 | 996 | 292667 | 8021 | 2.74% |
| | | 083827-002 | Calcium | 301000 | | 291 | 971 | 292667 | 8021 | 2.74% |
| | | 083827-003 | Calcium | 292000 | | 296 | 986 | 292667 | 8021 | 2.74% |
| | | 083827-001 | Chromium | 56 | | 0.996 | 2.99 | 54.3 | 1.45 | 2.66% |
| | | 083827-002 | Chromium | 53.4 | | 0.971 | 2.91 | 54.3 | 1.45 | 2.66% |
| | | 083827-003 | Chromium | 53.6 | | 0.986 | 2.96 | 54.3 | 1.45 | 2.66% |
| | | 083827-001 | Cobalt | 18.7 | B | 0.0996 | 0.996 | 17.6 | 0.924 | 5.24% |
| | | 083827-002 | Cobalt | 17.1 | B | 0.0971 | 0.971 | 17.6 | 0.924 | 5.24% |
| | | 083827-003 | Cobalt | 17.1 | B | 0.0986 | 0.986 | 17.6 | 0.924 | 5.24% |
| | | 083827-001 | Copper | 11.3 | | 0.199 | 0.996 | 14.0 | 2.46 | 17.54% |
| | | 083827-002 | Copper | 16.1 | | 0.194 | 0.971 | 14.0 | 2.46 | 17.54% |
| | | 083827-003 | Copper | 14.6 | | 0.197 | 0.986 | 14.0 | 2.46 | 17.54% |

See notes at end of table

**Table B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil (continued)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **On-site (cont'd)** | S-25 | 083827-001 | Iron | 17100 | B | 9.96 | 24.9 | 16767 | 351 | 2.09% |
| | | 083827-002 | Iron | 16400 | B | 9.71 | 24.3 | 16767 | 351 | 2.09% |
| | | 083827-003 | Iron | 16800 | B | 9.86 | 24.7 | 16767 | 351 | 2.09% |
| | | 083827-001 | Lead | 27.5 | | 0.498 | 1.99 | 25.2 | 4.10 | 16.25% |
| | | 083827-002 | Lead | 27.7 | | 0.485 | 1.94 | 25.2 | 4.10 | 16.25% |
| | | 083827-003 | Lead | 20.5 | | 0.493 | 1.97 | 25.2 | 4.10 | 16.25% |
| | | 083827-001 | Magnesium | 39700 | B | 49.8 | 149 | 36667 | 2954 | 8.06% |
| | | 083827-002 | Magnesium | 36500 | B | 48.5 | 146 | 36667 | 2954 | 8.06% |
| | | 083827-003 | Magnesium | 33800 | B | 49.3 | 148 | 36667 | 2954 | 8.06% |
| | | 083827-001 | Manganese | 337 | | 0.996 | 4.98 | 338 | 13.1 | 3.86% |
| | | 083827-002 | Manganese | 326 | | 0.971 | 4.85 | 338 | 13.1 | 3.86% |
| | | 083827-003 | Manganese | 352 | | 0.986 | 4.93 | 338 | 13.1 | 3.86% |
| | | 083827-001 | Mercury | 0.00141 | U | 0.00141 | 0.00938 | 0.002 | 0.001 | 46.27% |
| | | 083827-002 | Mercury | 0.00138 | U | 0.00138 | 0.00917 | 0.002 | 0.001 | 46.27% |
| | | 083827-003 | Mercury | 0.00292 | J | 0.00148 | 0.00984 | 0.002 | 0.001 | 46.27% |
| | | 083827-001 | Nickel | 177 | | 0.498 | 1.99 | 168 | 8.08 | 4.82% |
| | | 083827-002 | Nickel | 163 | | 0.485 | 1.94 | 168 | 8.08 | 4.82% |
| | | 083827-003 | Nickel | 163 | | 0.493 | 1.97 | 168 | 8.08 | 4.82% |
| | | 083827-001 | Potassium | 217 | J | 79.7 | 299 | 211 | 13.7 | 6.48% |
| | | 083827-002 | Potassium | 220 | J | 77.7 | 291 | 211 | 13.7 | 6.48% |
| | | 083827-003 | Potassium | 195 | J | 78.9 | 296 | 211 | 13.7 | 6.48% |
| | | 083827-001 | Selenium | 2.49 | U | 2.49 | 4.98 | 2.46 | 0.031 | 1.24% |
| | | 083827-002 | Selenium | 2.43 | U | 2.43 | 4.85 | 2.46 | 0.031 | 1.24% |
| | | 083827-003 | Selenium | 2.47 | U | 2.47 | 4.93 | 2.46 | 0.031 | 1.24% |

See notes at end of table

**TABLE B-3**. Non-radiological Replicate Results for Kauai Test Facility for Calendar Year 2007, Soil (concluded)
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **On-site (concluded)** | S-25 | 083827-001 | Silver | 0.199 | U | 0.199 | 0.996 | 0.197 | 0.003 | 1.28% |
| | | 083827-002 | Silver | 0.194 | U | 0.194 | 0.971 | | | |
| | | 083827-003 | Silver | 0.197 | U | 0.197 | 0.986 | | | |
| | | 083827-001 | Sodium | 2160 | | 79.7 | 249 | 2163 | 75.1 | 3.47% |
| | | 083827-002 | Sodium | 2090 | | 77.7 | 243 | | | |
| | | 083827-003 | Sodium | 2240 | | 78.9 | 247 | | | |
| | | 083827-001 | Thallium | 0.199 | BU | 0.199 | 0.996 | 0.197 | 0.003 | 1.28% |
| | | 083827-002 | Thallium | 0.194 | BU | 0.194 | 0.971 | | | |
| | | 083827-003 | Thallium | 0.197 | BU | 0.197 | 0.986 | | | |
| | | 083827-001 | Vanadium | 20.6 | | 1.99 | 9.96 | 20.5 | 0.208 | 1.01% |
| | | 083827-002 | Vanadium | 20.7 | | 1.94 | 9.71 | | | |
| | | 083827-003 | Vanadium | 20.3 | | 1.97 | 9.86 | | | |
| | | 083827-001 | Zinc | 372 | | 1.99 | 9.96 | 388 | 17.1 | 4.40% |
| | | 083827-002 | Zinc | 386 | | 1.94 | 9.71 | | | |
| | | 083827-003 | Zinc | 406 | | 1.97 | 9.86 | | | |

**NOTES:** B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).
J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective MDL. For radiochemical analytes the result is less than the decision level.

This page intentionally left blank.

**Table B-4.** Perchlorate Results for Kauai Test Facility for Community and On-Site Locations for Calendar Year 2007, Soil
*(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Analyte | Result | | Decision Level | Detection Limit |
|---|---|---|---|---|---|---|
| **Community** | C-05 | Perchlorate | 0.0114 | U | 0.0114 | 0.0399 |
| | C-06 | | 0.011 | U | 0.011 | 0.0385 |
| | C-07 | | 0.0105 | U | 0.0105 | 0.0368 |
| **On-Site** | S-12 | | 0.0111 | U | 0.0111 | 0.039 |
| | S-13 | | 0.0111 | U | 0.0111 | 0.0391 |
| | S-14 | | 0.011 | U | 0.011 | 0.0385 |
| | S-15 | | 0.0113 | U | 0.0113 | 0.0396 |
| | S-16 | | 0.0105 | U | 0.0105 | 0.0368 |
| | S-17 | | 0.0105 | U | 0.0105 | 0.0367 |
| | S-18 | | 0.011 | U | 0.011 | 0.0386 |
| | S-19 | | 0.0111 | U | 0.0111 | 0.039 |
| | S-20 | | 0.0114 | U | 0.0114 | 0.0399 |
| | S-21 | | 0.0111 | U | 0.0111 | 0.0389 |
| | S-22 | | 0.0114 | U | 0.0114 | 0.04 |
| | S-23 | | 0.0108 | U | 0.0108 | 0.0377 |
| | S-24 | | 0.0104 | U | 0.0104 | 0.0366 |
| | S-25 | | 0.0114 | U | 0.0114 | 0.04 |
| | S-26 | | 0.011 | U | 0.011 | 0.0386 |
| | S-27 | | 0.0107 | U | 0.0107 | 0.0376 |
| | S-28 | | 0.0114 | U | 0.0114 | 0.04 |

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

This page intentionally left blank.

**Table B-5**. Perchlorate Replicate Results for Kauai Test Facility for Community and On-Site Locations for Calendar Year 2007, Soil *(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)*

| Location Type | Location | Sample ID | Analyte | Result | | Decision Level | Detection Limit | Average | Std Dev | CV |
|---|---|---|---|---|---|---|---|---|---|---|
| **Community** | C-07 | 083837-001 | Perchlorate | 0.0105 | U | 0.0105 | 0.0368 | 0.0110 | 0.0004 | 3.80% |
| | | 083837-002 | | 0.0111 | U | 0.0111 | 0.0388 | 0.0110 | 0.0004 | 3.80% |
| | | 083837-003 | | 0.0113 | U | 0.0113 | 0.0398 | 0.0110 | 0.0004 | 3.80% |
| **On-Site** | S-21 | 083823-001 | | 0.0111 | U | 0.0111 | 0.0389 | 0.0112 | 0.0001 | 1.03% |
| | | 083823-002 | | 0.0111 | U | 0.0111 | 0.0388 | 0.0112 | 0.0001 | 1.03% |
| | | 083823-003 | | 0.0113 | U | 0.0113 | 0.0395 | 0.0112 | 0.0001 | 1.03% |
| | S-25 | 083827-001 | | 0.0114 | U | 0.0114 | 0.04 | 0.0112 | 0.0003 | 2.25% |
| | | 083827-002 | | 0.0112 | U | 0.0112 | 0.0393 | 0.0112 | 0.0003 | 2.25% |
| | | 083827-003 | | 0.0109 | U | 0.0109 | 0.0384 | 0.0112 | 0.0003 | 2.25% |

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

This page intentionally left blank.