SANDIA REPORT

SAND96–2269 • UC–630
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Printed September 1996

1995 Site Environmental Report Tonopah Test Range Tonopah, Nevada

T. Culp, W. Forston

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550
for the United States Department of Energy
under Contract DE-AC04-94AL85000

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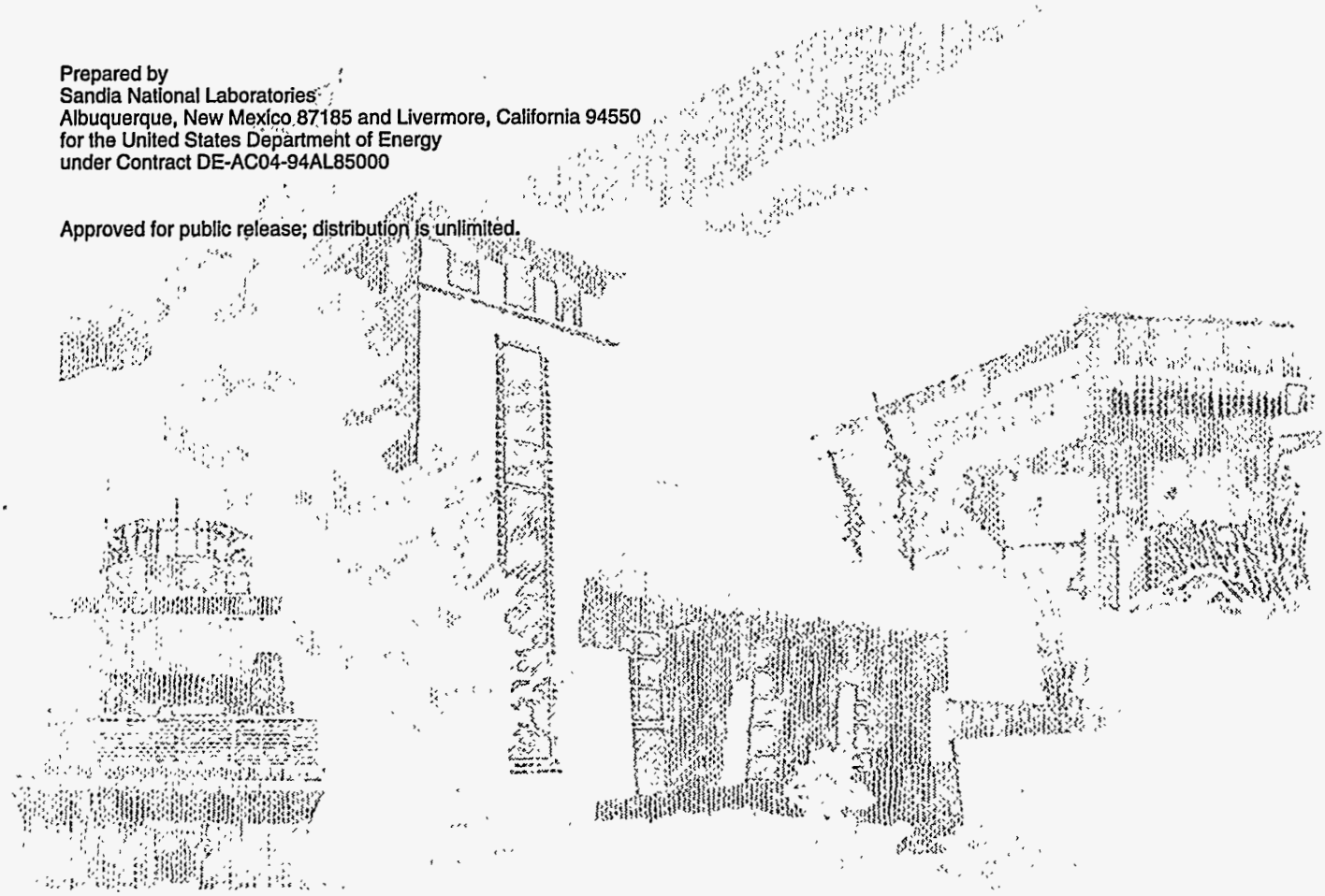

SF2900Q(8-81)

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NTIS price codes
Printed copy: A07
Microfiche copy: A01

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1995 SITE ENVIRONMENTAL REPORT TONOPAH TEST RANGE TONOPAH, NEVADA

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ABSTRACT

This report summarizes the environmental surveillance activities conducted by Sandia National Laboratories, and Kirk-Mayer, Inc., for the Tonopah Test Range operated by Sandia National Laboratories. Sandia National Laboratories' responsibility for environmental surveillance results extends to those activities performed by Sandia National Laboratories or under its direction. Results from other organizations environmental surveillance activities are included to provide a measure of completeness. Other environmental compliance programs such as the National Environmental Policy Act of 1969, environmental permits, and environmental restoration and waste management programs are also included in this report, prepared for the U.S. Department of Energy (DOE) in compliance with DOE Order 5400.1.

ACKNOWLEDGMENTS

The authors thank those people who provided information and analytical data necessary for preparation of this report.

Rebecca Sanchez of InfoMatrix provided technical word processing. Dianne Duncan of GRAM, Inc. provided editorial support, technical editing, and coordinated document production.

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ABBREVIATIONS

Units

°C	Celsius degree
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
°F	Fahrenheit degree
ea.	each
ft	foot
g	gram
gal	gallon
hr	hour
in.	inch
kg	kilogram
km	kilometer
km^2	square kilometer
L	liter
m	meter
m^2	square meter
m^3	cubic meter
mg/m^3	milligrams per cubic meter
mi	mile
mi^2	square mile
m/s	meters per second
ppm	parts per million
sec	second
sec/yr	seconds per year
µm	micron
yr	year
yd^3	cubic yard

ABBREVIATIONS
(Continued)

Frequently Referenced Nuclide Symbols and Components

Al	aluminum
Am-241	americium-241
Ba	barium
Be	beryllium
Be-7	beryllium-7
Cd	cadmium
Co	cobalt
Cr	chromium
Cs-137	cesium-137
Fe	iron
H-3	tritium
K	potassium
Pb	lead
Pu	plutonium
Pu-238	plutonium-238
Pu-239	plutonium-239
Pu-240	plutonium-240
Pu-241	plutonium-241
Pu-242	plutonium-242
Ra-226	radium-226
Si	silica
Th-232	thorium-232
Ti	titanium
U	uranium
U-238	uranium-238
U_{tot}	total uranium
Zn	zinc

Radioactivity Measurements

Ci	curie (unit of radioactivity)
dpm	disintegration per minute
mrem	millirem (unit of radiation dose)
mrem/yr	millirem per year
mR/yr	milliroentgen per year
person-mrem/yr	person-millirem per year
person-rem/yr	person-rem per year
pCi	picocurie
R	roentgen (unit of radiation exposure)
rem	roentgen equivalent man (unit of dose equivalent)
$\mu g/m^2$	microgram per square meter
$\mu g/m^3$	microgram per cubic meter

ABBREVIATIONS

(Continued)

Acronyms

ADM	Action Description Memorandum
AEC	U.S. Atomic Energy Commission
AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resources Protection Act
BLM	Bureau of Land Management
BOD	biochemical oxygen demand
CAA	Clean Air Act
CAU	Corrective Action Unit
CAS	Corrective Action Site
CEM	Certified Environmental Manager
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
CY	calendar year
DAC	derived air concentration
DCG	derived concentration guides
DMR	Discharge Monitoring Report
DOC	U.S. Department of Commerce
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/AL	U.S. Department of Energy/Albuquerque Operations Office
DOE/ERD	U.S. Department of Energy/Environmental Restoration Department
DOE/HQ	U.S. Department of Energy/Headquarters
DOE/KAO	U.S. Department of Energy/Kirtland Area Office
DOE/NV	U.S. Department of Energy/Nevada Operations Office
DOI	U.S. Department of the Interior
DRI	Desert Research Institute, Water Resources Center, University of Nevada System
DU	depleted uranium
EA	Environmental Assessment
ECL	Environmental Checklist
EDE	effective dose equivalent
EG&G	Edgerton, Germeshausen & Grier Corporation
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act

ABBREVIATIONS
(Continued)

EPD	Environmental Programs Departments
ER	Environmental Restoration
ERDA	U.S. Energy Research and Development Administration
ES&H	environment, safety and health
ESA	Endangered Species 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
FY	fiscal year
ICP	inductively coupled plasma (method)
ICRP	International Commission on Radiological Protection
IT	International Technology Corporation
KMI	Kirk-Mayer, Inc. (KMI Services)
MDC	minimum detectable concentrations
MEI	maximum exposed individual
MSDS	Material Safety Data Sheet
MSS	multispectral scanner
MTF	memo-to-file
NA	not applicable, not available
NAEG	Nevada Applied Ecology Group
NAFB	Nellis Air Force Base (Range Complex)
ND	Not detected
NDEP	Nevada Department of Environmental Protection
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NF	None found
NHPA	National Historic Preservation Act
NOS	not otherwise specified
NPDES	National Pollutant Discharge Elimination System
NTS	Nevada Test Site
NV	Nevada
O&M	Operations and Maintenance
PA	Preliminary Assessment
PCB	polychlorinated biphenyl
PIC	pressurized ion chamber
PMS	portable monitoring station
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
REECo	Reynolds Electrical and Engineering Company

ABBREVIATIONS
(Concluded)

RFI	RCRA Facility Investigation
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Office
SNL	Sandia National Laboratories
SNL/NM	Sandia National Laboratories/New Mexico
SNL/NV	Sandia National Laboratories/Nevada
SOP	Standard Operating Procedure
SPCC	Spill Prevention, Control, and Countermeasures
STAR	Stability Array
TCLP	toxicity characteristic leaching procedure
TECR	Tonopah Electronic Combat Range
TFW	Tactical Fighter Wing
TLD	thermoluminescent dosimeter
TPH	total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TSP	total suspended particulates
TTR	Tonopah Test Range
USAF	U.S. Air Force
USGS	U.S. Geological Survey
UXO	unexploded ordance
UST	underground storage tank
VOC	volatile organic compound

Approximate Conversion Factors For Selected Si (Metric) Units

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

1.0 EXECUTIVE SUMMARY

1.1 ASSESSMENT OF POTENTIAL DOSE TO THE PUBLIC

In 1995, no radionuclides were released from the Tonopah Test Range (TTR) from stacks, vents, or other point sources under the administration of Sandia National Laboratories/Nevada (SNL/NV). Based on the types of test activities, such as air drops, gun firing, ground-launched rockets, air-launched rockets, and other explosive tests, the possibility exists that small amounts of material (as part of the test component) could be released to the air or ground because of unusual circumstances (failures) during testing. There were no such failures in 1995.

A large area of transuranic surface contamination located on TTR is a potential diffuse source of airborne radionuclides through the action of wind resuspension of soil particulates. The surface contamination is the result of plutonium dispersal tests performed at the three Clean Slate sites in 1963. A total of 0.39 curies per year (Ci/yr) of contaminated material was calculated to be resuspended from the three Clean Slate sites. The maximum exposed individual (MEI) was determined to be located at the TTR Airport Area. The effective dose equivalent (EDE) calculated to this location was 1.1 millirem per year (mrem/yr), or approximately 11 percent of the 10-mrem/yr dose limit specified by U.S. Department of Energy (DOE) orders and Title 40, *Code of Federal Regulations*, Part 61, Subpart H (40 CFR 61, Subpart H).

1.2 OVERVIEW OF 1995 SURVEILLANCE RESULTS

Environmental Permits

There are several environmental permits in place at TTR: 13 air permits, 4 public water system permits, 7 beneficial use water permits, one NPDES permit for the sewage lagoon facility, and one EPA identification number for hazardous waste disposal tracking through approved hazardous waste disposal contractors. TTR was in full compliance with all SNL controlled permit requirements in 1995. DOE/NV currently holds 6 air quality permits for TTR. Air emissions in 1995 were in compliance with applicable permits. A National Emission Standards for Hazardous Air Pollutants (NESHAP) annual report was prepared for FY95 (SNL 1996). A NESHAP Monitoring Plan was submitted to the EPA and approved in 1995. The Monitoring Plan will be implemented in 1996.

1.2.1 SNL Soil Sampling

Limited soil sampling was performed at TTR as part of the continuing environmental surveillance activities. Soil samples were collected from off-site, the site perimeter, the On-Base Housing Area, the 554th Range Squadron Operations and Maintenance (O&M) Complex, the South Plume Area, the Range Operations Center and Compound, and various additional on-site locations. All samples were analyzed for: 20 standard metals, total uranium (U_{tot}), and by gamma spectroscopy. Elevated concentrations of U_{tot} and various stable metals were found at several sampled locations.

1.2.2 SNL Air Monitoring

Limited air monitoring was performed at TTR in 1995. Air monitoring samples were collected from three separate locations at TTR. Composite samples were analyzed for gross alpha, gross beta, isotopic plutonium, U_{tot}, and 20 metals, and by gamma spectroscopy. Air monitoring results did not indicate significantly elevated concentrations of radiological or nonradiological constituents.

1.2.3 Wastewater Sampling Program

Forty-eight hour composite wastewater samples were collected in the 3rd and 4th quarters of 1995. During 1995, the State of Nevada issued a new NPDES permit to the U.S. Air Force (USAF) for its facultative sewage lagoon. Wastewater from the SNL/NV complex at Area 3 discharges to the USAF Lagoon. The USAF is required to submit a quarterly Discharge Monitoring Report (DMR) to the State of Nevada. Results of SNL's quarterly sampling and flow monitoring of sewage discharged from the Area 3 compound must be provided to the USAF for inclusion in the DMR report as required under the conditions of the permit.

During the third quarter of 1995 quarterly wastewater sampling was implemented to support USAF NPDES reporting requirements for the sewage lagoon.

1.2.4 Drinking Water Sampling Program

Drinking water for the SNL/NV operations at TTR is provided by a well permitted by the State of Nevada in compliance with Public Water Supply Standards. Compliance activities included bacteriological sampling and chlorination testing of the drinking water system in accordance with the *Tonopah Test Range Site Sampling Plan* (DOE 1990). Nitrate and Nitrate levels were analyzed for in the Well 6 drinking water, and results were submitted to the State of Nevada.

1.2.5 Hazardous Waste Program

TTR is classified as a small quantity generator of hazardous waste. Three hazardous waste shipments were made in 1995. Standard operating procedures (SOPs) have been formalized to ensure compliance with the Resource Conservation and Recovery Act (RCRA). In calendar year 1995, 1585 kilograms (kg) of hazardous waste and 4727 kg of regulated non-RCRA waste were disposed of through a permitted off-site treatment, storage, and disposal facility (TSDF), and a total of 4077 kg of hazardous or regulated material was sent to off-site recycling facilities.

In 1995, samples were collected and analyzed from all waste accumulation areas for justification of hazardous waste or non-RCRA waste status.

Waste Minimization

An informal waste minimization program is practiced at TTR. Antifreeze and Freon continue to be recycled with equipment procured in 1994. A total of 4077 kg of material was shipped off-site for energy recovery or recycling in 1995. Only 1585 kg of hazardous waste were shipped off-site for disposal in 1995 compared with 5615 kg in 1994. Approximately 58 boxes of usable fluorescent tubes were sent to SNL/NM for reapplication. Automotive batteries (102 ea.) were returned to the distributor for recycling and core charge recovery.

Training

Thirteen O&M contractor personnel completed 40 hours (hr) of Hazardous Waste Operations Training or have attended the 8-hr refresher training in order to maintain their current certification. Many participated or assisted in extensive environmental clean-up/restoration efforts at TTR in 1995 (Section 4.3).

Underground Storage Tanks (USTs)

Total petroleum hydrocarbon (TPH) samples were collected from approximately 600 cubic yards (yd^3) of petroleum contaminated soil (UST removal remediation effort). Action was taken to procure funding for bioremediation of the soil scheduled for the spring of 1996.

Closure Notices were received from the State of Nevada for UST #5 located near Building (Bldg.) 03-53 and for a tank that did not exist but was reported near Bldg. 03-57.

Closure Plans

Two closure plans were submitted to the State of Nevada Environment Department: (1) an In-situ Closure Plan for the diesel spill location at the generator building in Area 9 and (2) the UST excavation/removal location at Area 3 (four 10,000-gallon (gal) tanks).

1.3 Overview of Compliance Status

National Environmental Policy Act (NEPA)

At TTR, NEPA compliance is a joint effort between SNL, DOE/NV, and the Desert Research Institute (DRI). In 1995, a categorical exclusion was applied for by Bechtel and granted by DOE/NV to install solar powered air monitoring stations at Bunker 2. This monitoring equipment is intended to monitor resuspension of material from the Clean Slate sites.

DRI accomplished one cultural resource survey for SNL operations near Bill's Hill.

Reportable Spills

There were no reportable spills in 1995 caused by DOE or SNL activities. The USAF had one reportable oil spill on DOE controlled property near Mellan Air Strip. The spill was caused by leaking smoke generators.

Environmental Occurrences

There were no environmental occurrence reports in 1995 from SNL activities. However, the use of Zap Rocket Motors to flash an ordinance pit under remediation did result in a warning letter from the State of Nevada's Division of Environmental Protection, to Department of Energy, Nevada (DOE/NV) and Department of Energy, Kirtland Area Office (DOE/KAO).

2.0 INTRODUCTION

As required in DOE Order 5400.1 (DOE 1988), this site environmental report has been prepared for the TTR to summarize environmental data that characterize site environmental management performance, confirm compliance with Federal, state, and local environmental standards and requirements, and highlight significant programs and efforts. This report represents a key component of the DOE's effort to keep the public informed about environmental conditions at DOE facilities that conduct significant environmental protection programs. The report contains summary information about the radiological and nonradiological conditions of the site environment and identifies trends with regard to effluent releases and environmental conditions.

2.1 TTR HISTORY & OPERATIONS

SNL/NV operates TTR for DOE's nuclear ordnance programs. SNL operations at TTR in Nevada date from 1957, when TTR came into limited use after similar facilities at the Salton Sea Test Base in California and at Yucca Flat on Nevada Test Site (NTS) became inadequate.

TTR was originally designed and equipped to gather raw data on aircraft-delivered inert test vehicles under U.S. Atomic Energy Commission (AEC) cognizance and was used as a bombing range during World War II. Over the years, the facilities and capabilities at TTR have been expanded to accommodate tests related to the AEC (later, DOE) weapons development program. Tests conducted vary from simple tests of hardware components and systems needing only limited support to rocket launches and air drops of test vehicles requiring full range support.

The seven categories of test activities at TTR are: (1) air drops, (2) gun firings, (3) ground-launched rockets, (4) air-launched rockets, (5) explosive effects, (6) static rocket tests, and (7) earth penetrator tests. Most of these activities require a remote range for safety and security reasons. The 1994 SNL/NV and USAF activities included flying sorties, rocket/missile flights, and air drops.

2.2 LOCATION & POPULATION

TTR is located approximately 140 miles (mi) northwest of Las Vegas, NV and covers 624 square miles (mi^2) within the boundaries of the Nellis Air Force Base (NAFB) Range Complex (Figure 2-1). It is bordered on three sides by the NAFB Range Complex and on the north by sparsely populated public lands administered by the Bureau of Land Management (BLM) and the U.S. Forest Service. The nearest population centers are Goldfield, population 659, located approximately 25 mi west of TTR, and Tonopah,

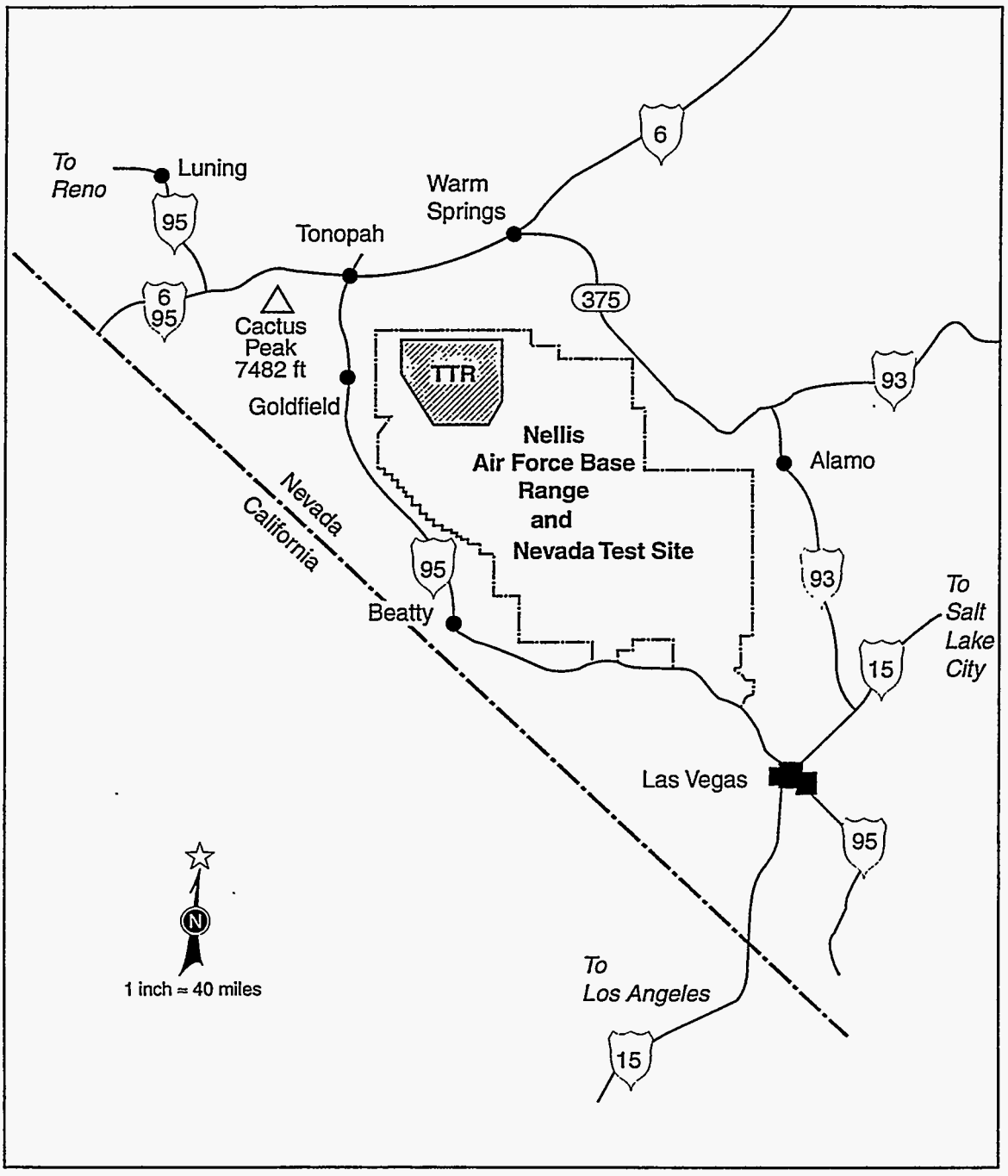

Figure 2-1. Location of Tonopah Test Range, Nevada.

population 4400, located 30 mi northwest of TTR (DOC 1991). The total population within a 50-mi region around TTR is 9299. This number includes a population of 1000 which accounts for base housing and on-site and contractor (non-SNL) personnel.

2.3 GEOLOGY, CLIMATOLOGY, & BIOLOGY

TTR is situated in a high-desert environment and consists of broad valleys bordered by north/south-trending mountain ranges in the western part of the Basin-and-Range geophysical province. TTR lies northeast of a zone of transcurrent faulting and shear, termed the Walker Lane, and the Las Vegas Valley shear zone to the southeast (Sinnock 1982). Cactus Flat, which constitutes the basic working area of TTR, is a basin surrounded by the Cactus Range. The Cactus Range is a northwest-trending, raised structural block, one of at least five that lie along the Las Vegas Valley-Walker Lane lineaments (ERDA 1975).

All the working areas of TTR lie within an area of approximately 400 mi^2. The streams in and near TTR are intermittent and end in closed basins. There are three springs within TTR: Cactus, Antelope, and Silverbow Springs. Water from these springs does not travel far; it disappears rapidly through evaporation and infiltration, and its effect on the landscape is purely local. Water used in TTR facilities comes from wells tapping underlying groundwater in alluvium derived from the surrounding mountains. Well depth to groundwater varies from 21 ft (Antelope Mine) to 454 ft (EH2). The depth to groundwater at Area 9 is approximately 131 ft, and depth to groundwater at Area 3 is 361 ft to 394 ft (provided by the U.S. Geological Survey [USGS]).

The climate is mild and usually dry, but, as is typical of high deserts, it is subject to large diurnal and seasonal changes in temperature, from a record high of 102 degrees Fahrenheit (°F) to a record low of -24 °F (Schaeffer 1982). Clear, sunny days with light to moderate winds are usual. Average rainfall is approximately 5 inches (in.) per year in the valley, with most precipitation occurring in August (ERDA 1975; Schaeffer 1982). Winds are mostly from the west-northwest and from the south-southeast. Dust storms are common in the spring, and dust devils are common in the summer.

Because of the temperature extremes and arid conditions at TTR, the valley in which most TTR activities occur is sparsely covered with range grasses and low shrubs (ERDA 1975; EG&G 1979a). Joshua trees grow in the foothills and juniper trees grow in the foothills and mountains. Hundreds of wild horses graze freely throughout TTR and their exposure to TTR activities has apparently had little effect on their population and grazing habits.

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2.4 PROJECT ROLLER COASTER TESTS

Project Roller Coaster included a series of four plutonium (Pu) dispersal tests (three at TTR and one at the NAFB Gunnery Range) executed in May and June of 1963. The locations of the three Project Roller Coaster tests at TTR are referred to as Clean Slates 1, 2, and 3; the fourth site is referred to as the Double Tracks site (Figure 2-2). Table 2-1 summarizes test information related to the four Project Roller Coaster sites. Through agreement with DOE's Albuquerque Operations Office (DOE/AL), DOE's Nevada Operations Office (DOE/NV) has the Environmental Restoration (ER) responsibilities for the Clean Slate sites; SNL maintains the environmental surveillance responsibilities.

Table 2-1. Project Roller Coaster test information.

Test:	Clean Slate 1	Clean Slate 2	Clean Slate 3	Double Tracks
Date:	May 25, 1963	May 31, 1963	June 9, 1963	May 15, 1963
Location:	Tonopah Test	TTR	TTR	Nellis Air
Plutonium Inventory (curies [Ci]):	5.2 ± 1.6	29 ± 6.2	30 ± 4.9	5.0 ± 1.4

Source: Annual Site Environmental Report provided by the U.S. Department of Energy Nevada Operations Office.

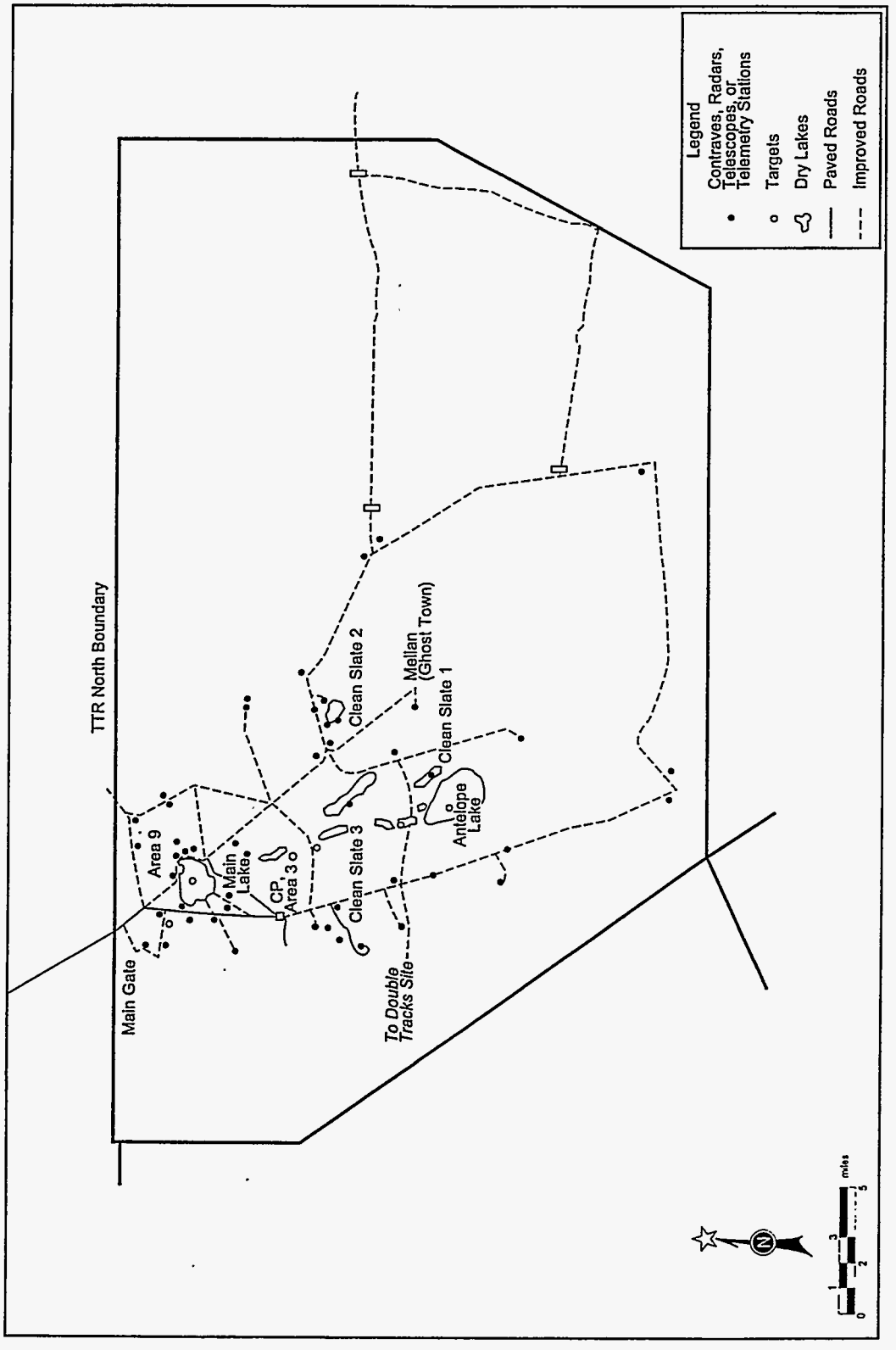

Figure 2-2. Locations of facilities operated by Sandia National Laboratories at the Tonopah Test Range.

The initial cleanup of each Clean Slate site was conducted shortly after each test and consisted of blading the test-related debris into a hole at test ground-zero. Each hole was then backfilled with dirt and a fence was erected around each test area. The fenced boundaries were set at approximately 1000 micrograms plutonium per square meter ($\mu g/m^2$) as determined using hand-held survey meters (Rarrick 1993). In 1973, additional outer fences were built, set at 40 picocuries plutonium per gram (pCi/g) of soil as determined using hand-held survey meters (Rarrick 1993). This survey was conducted with a field instrument for the detection of low-energy radiation (FIDLER) using 61-meter (m) grids. Surface soil has been sampled intermittently at the Clean Slate sites. An aerial radiologic survey was performed by Edgerton, Germeshausen & Grier Corporation (EG&G) for the Nevada Applied Ecology Group (NAEG) in 1977 using the 1973 grid. The objective of the aerial survey was to determine the surficial distribution of Pu and other transuranic elements dispersed during the Project Roller Coaster tests. The aerial surveys were undertaken to supplement the FIDLER and previous soil sample measurements of Americium-241 (Am-241), a Plutonium-241 (Pu-241) decay product present in the Pu of the test device). Radiation isopleths showing soil activity caused by Am-241, Plutonium-239 (Pu-239), and Plutonium-240 (Pu-240) were drawn for each area (EG&G 1979b). This survey showed the extent of the transuranic contamination, both inside and outside the two control fences, of the Clean Slate sites. The test areas are examined visually twice a year to determine whether any fence repairs are required. When discovered, horses that may have wandered inside the fenced areas are promptly removed.

3.0 COMPLIANCE SUMMARY

Sandia National Laboratories (SNL) strives to operate in full compliance with environmental and other requirements established by federal and state regulations, executive orders, and U.S. Department of Energy (DOE) orders. The following sections summarize the status of the Tonopah Test Range (TTR) in complying with major environmental statutes.

3.1 ENVIRONMENTAL RESTORATION ACTIVITIES

In late 1992 and early 1993 an agreement was reached between DOE Headquarters (DOE/HQ), DOE/KAO, and DOE/NV on the management of the TTR Environmental Restoration (ER) activities. Since ER activities at TTR would be the first performed in the State of Nevada by the DOE, it was felt that one field office should develop the remediation and closure plans for all sites in Nevada. It was agreed that DOE/NV will manage all of the DOE/KAO and DOE/NV ER activities at TTR . ER activities in fiscal year 1995 (FY95) were conducted by the DOE/NV Environmental Restoration Project through an interim agreement with DOE/AL and DOE/KAO. This agreement provided funding to the ER Project with DOE/KAO oversight.

Presently, ER sites at the TTR are included in the draft Federal Facilities Agreement and Consent Order (FFACO), between the State of Nevada and the DOE. A summary of these sites can be found in Section 4.3 and Table 4-4 of this report. The list of sites has been modified for consistency with NDEP requirements and grouped into Corrective Action Units (CAUs) and listed by Corrective Action Site (CAS) numbers. Each of these CAUs is listed in Appendices II (inactive CAUs) and III (active CAUs) of the FFACO and presented at Table X.

Two underground storage tank sites (CAS Nos. 03-02-001-03053 and 03-02-003-03-57) were approved for closure by the NDEP in CY95 and have been removed from the ER list. These sites will remain in Appendix IV (closed sites) of the FFACO.

3.2 COMPLIANCE REGULATIONS

3.2.1 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) & Super-fund Amendments and Reauthorization Act (SARA)

As required under CERCLA/SARA, Section 120(d), a Preliminary Assessment (PA) was submitted for all facilities listed on the *Federal Agency Hazardous Waste Compliance* docket in 1988.

TTR is not on the National Priorities List, an ordered ranking of top priority CERCLA sites. A CERCLA site is placed on this list if the site is above a certain threshold level established by the U.S. Environmental Protection Agency (EPA).

3.2.2 Resource Conservation and Recovery Act (RCRA)

TTR is permitted as a "less than 180 day storage area" small quantity generator due to a reduction in operations during 1994. A small quantity generator accumulates more than 100 kg but less than 1000 kg of hazardous waste per month. Before 180 days of storage (270 days if the TSDF is located more than 200 mi from the generators location), the waste must be shipped to an EPA permitted TSDF.

Hazardous waste shipments are scheduled to occur two to three times per year. During 1995 , there were three hazardous waste shipments. (Safety Kleen shipments were not included in this count.

Hazardous chemical wastes are collected, packaged, and shipped off-site to an EPA-permitted treatment, storage, and disposal facility (TSDF). Standard Operating Procedure (SOPs) have been written to ensure continued compliance with RCRA.

Currently, one Class II sanitary landfill is in operation at TTR. This unit is operated by the USAF O&M contractor and cooperatively used by all organizations on TTR. SNL/NV removed five USTs from TTR in 1994. Currently, there are no USTs managed by SNL/NV on TTR. The Environmental Restoration Group is investigating some potentially undocumented/historical UST sites during their activities. Additional information should be available in 1996.

3.2.3 Clean Air Act (CAA)

TTR is regulated by the CAA and State of Nevada air quality regulations, published in the Nevada Revised Statutes, Title 40, *Public Health and Safety*, Chapter 445 (Appendix

A, Table A-1). The State of Nevada issued CAA permits for the following activities:

- Aboveground storage tanks—USAF
- Concrete batch plants—DOE/NV
- Vapor extraction unit—USAF
- Incinerator—USAF
- Disturbance land use greater than 5 acres—DOE/NV
- Crusher/screen—DOE/NV

Air emissions in 1994 were in compliance with applicable permits. A NESHAP annual report was prepared for CY94 (SNL 1995a).

3.2.4 Clean Water Act (CWA)

TTR is regulated by the CWA and State of Nevada water pollution and sanitary waste systems regulations (Appendix A, Table A-1). The State does not have a permitting process for septic tanks.

The sewage systems in Area 3, (the main industrial area) is connected to the USAF facultative sewage lagoon facility. Composite samples (over 48 hr) are obtained on a quarterly basis by SNL/NV, as required in wastewater permit NEV20001. The minimum reportable parameters are flow, total petroleum hydrocarbon (TPH), volatile organic compound (VOC), and eight RCRA metals. Results must be reported to the USAF for inclusion in their DMR to the State of Nevada at the end of each quarter.

The 13 septic tanks that served TA-3 until 1990, (when the consolidated sewage system was installed), will require further testing to ensure that no hazardous constituents are present before disposing of the waste and closing the tanks in conformance with State of Nevada regulations.

The remote locations on TTR are serviced by septic tank systems. These septic systems are maintained by the TTR facilities group.

3.2.5 Safe Drinking Water Act (SDWA)

TTR is regulated by the SDWA and State of Nevada public water supply and public water systems regulations. Drinking water for SNL/NV operations at TTR is provided by a well permitted by the State of Nevada in compliance with the public water supply standards. Compliance activities include bacteriological sampling of the drinking water system in accordance with the *Tonopah Test Range Site Sampling Plan* (DOE 1990). A state-certified water distribution operator is employed on the support contractor staff in fulfillment of state requirements for a certified water distribution operator for community systems. The *Water Conservation Plan for the TTR* complies with State Water Resources

Division regulations requiring a water conservation plan for permitted water systems and major water users in Nevada (DOE 1992).

3.2.6 Toxic Substances Control Act (TSCA)

All transformers on TTR owned by DOE/KAO were sampled and analyzed in 1993 (IT 1993) for polychlorinated biphenyls (PCBs). This information was consolidated into a SNL/New Mexico (SNL/NM) database and into the SNL/NV inventory database. None of the samples contained more than 50 parts per billion of PCBs.

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

Only EPA-registered pesticides are applied at SNL facilities. These pesticides are applied by an EPA-certified applicator. SNL retains records of the quantities and types of pesticides that are used as well as Material Safety Data Sheets (MSDSs) for each pesticide.

3.2.8 Endangered Species Act (ESA)

The DOE must comply with the ESA when planning Federal actions or major construction activities. The key provision of the ESA for federal activities is Section 7, "Consultation," which states that Federal agencies must consult with the U.S. Fish and Wildlife Service to ensure that any agency actions are "not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species." There has not been a recent Environmental Assessment (EA) to detail the current situation in regard to sensitive species, though some of these species are known to occur in the area (ERDA 1975; EG&G 1979a). SNL assists the DOE in complying with the ESA at TTR.

3.2.9 Cultural Resources Acts

TTR holds responsibilities for cultural resources management, including those responsibilities applicable under the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act (ARPA), and the American Indian Religious Freedom Act (AIRFA). SNL integrates cultural resources management into the National Environmental Policy Act (NEPA) program. DOE requires NEPA review for all DOE actions potentially affecting the environment; thus, even actions that may be categorically excluded are reviewed for impacts on cultural resources, among other things. (See Section 4.4 for further information on NEPA activities.)

3.2.10 Executive Orders

Executive Order 11988, *Floodplain Management*, and Executive Order 11990, *Protection of Wetlands*, require evaluation of the potential effects of actions taken in floodplains and wetlands. There are no floodplains or wetlands at TTR.

3.3 1995 AUDITS

The following Audits or visits by the State of Nevada or DOE officials occurred in 1995:

1/19/95	Hazardous Materials Spill Exercise/Evaluation by SNL/NM
2/28/95	State of Nevada Federal Facilities Division Environmental Restoration Site Evaluation: 5-Points, Rollercoaster, and Area 9 Landfills. Visited Area 3 UST removal site and Area 9 diesel spill location. Observed Bomblet Pit robotic unit operation.
3/13/95	Hazardous waste activities pre-state inspection audit, SNL Generator Interface Dept.
3/21/95	Nevada Dept. of Environmental Protection (NDEP) RCRA Audit. No significant findings, no report provided.
3/22/95	Post NDEP evaluation SNL, DOE/NV.
12/13-14/95	RCRA Audit, SNL Generator Interface Dept.
12/13-14/95	TSCA Audit (PCB), SNL Generator Interface Dept.

3.4 CURRENT ISSUES & ACTIONS FOR TTR

Ongoing self-assessments of compliance status continue to identify compliance issues. Resolution of these issues is coordinated with regulatory agencies to ensure that they are addressed. The following sections highlight the issues of concern at TTR:

Septic Tanks/Sewage Line

The facility group performed sampling of the septic tanks in FY90 using procedures that met Federal and state requirements. Since FY90, federal and state regulations imposed more stringent testing parameters, including the requirement for analytical testing using the toxicity characteristic leaching procedure (TCLP). Septic tank sampling was also

performed in 1993. Inactive septic tanks will be sampled again during future ER activities.

Underground Storage Tanks

The last known USTs that DOE or SNL are responsible for on the TTR site were removed in August 1994. Four 10,000-gallon, fiberglass tanks (two diesel and two gasoline), that provided fuel to the former gas station in Area 3; and one 1,000-gallon steel tank (diesel), for a generator in Area 9, were removed by a Certified Environmental Manager (CEM) and a State of Nevada licensed contracting firm. Certificates of destruction for these five tanks are on file.

3.5 ENVIRONMENTAL PERMITS

As part of the DOE complex, the SNL-operated TTR is committed to full compliance with all applicable environmental laws and regulations and to protection of the environment. TTR is regulated by Federal laws and State of Nevada regulations for the applicable activities. (See Table A-1 in Appendix A for the state regulations and the corresponding activities.)

The permit application and registration of SNL/NV activities at TTR are administered by Kirk-Mayer, Inc. (KMI Services). There are a total of 14 air permits (eight permits owned by the USAF, five by DOE/NV, and one by DOE/KAO), four public water system permits (one owned by DOE/KAO, three by the USAF), one NPDES permit for the sewage lagoon facility (owned by the USAF), and one EPA identification number for chemical hazardous waste on TTR (owned by DOE/KAO) (Table 3-1). The State of Nevada has not made a determination on permitting for the storm water program. TTR has no waters of the United States within its boundaries; thus, following best management practices, SNL/NV activities on TTR may be permitted by SNL itself. Table A-2 of Appendix A includes detailed permit listings with expiration dates, issuing agencies, and responsible parties. TTR was in full compliance with all permit requirements for 1995.

Table 3-1. Summary of Permit ownership at the TTR.

Permit Type and Location	Permit No.	Ownership
Air Quality		
Petro Storage	2449	U.S. Air Force (USAF)
Petro Storage	2448	USAF
Petro Storage	2447	USAF
Petro Storage	2446	USAF
Petro Storage	2445	USAF
Petro Storage	1661	USAF
Batch Plant (Ross)	2229	DOE/NV
Batch Plant (Johnson)	2231	DOE/NV
Crushers	2456, 2457	DOE/NV
Screens	2455	DOE/NV
Incinerator	2450	USAF
Surface Disturbance	2844	DOE/KAO
Vapor Extraction*	3172	USAF
Public Water System		
Mancamp	NY-4068-12C	USAF
Industrial Area	NY-5001-12NC	USAF
Sandia Compound	NY-3014-12NC	DOE/Kirtland Area Office (DOE/KAO)
Tonopah Electronic Combat Range (TECR) Compound	NY-5002-12NC	USAF
National Pollutant Discharge Elimination System (NPDES)		
Sewage System	NEV20001	USAF
Hazardous Waste		
SNL/EPA Generator ID No.	NV1890011991	Activated/DOE/KAO
Beneficial Use Water Permits		
Well EH-1	50166	DOE/NV for USAF Well
Well EH-2	50169	DOE/NV for USAF Well
Well 1-A	50168	DOE/NV for USAF Well
Well EH-7	53885	DOE/NV for USAF Well
Well BLM	56916	DOE/NV for USAF Well
Well 3 B	58149	DOE/NV for USAF Well
Well 3 A	58150	DOE/NV for USAF Well

*Permit to construct.

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4.0 OTHER ENVIRONMENTAL PROGRAMS

It is the policy of the DOE and SNL to conduct operations in an environmentally responsible manner and in compliance with applicable environmental standards. SNL maintains a variety of environmental programs to implement these laws and regulations and protect the quality of the environment. This chapter describes SNL activities conducted in 1995 at TTR to remediate sites contaminated in the past, to manage hazardous, radioactive, mixed, and other wastes, to comply with environmental protection requirements, and to respond to releases and environmental incidents. Other environmental programs at TTR include terrestrial surveillance, air quality surveillance, and wastewater monitoring. These environmental surveillance programs are addressed in Chapter 5.

4.1 SPILL PREVENTION CONTROL & COUNTERMEASURES PLAN

The *Spill Prevention Control and Countermeasures (SPCC) Plan* for TTR was completed by SNL in 1990 (SNL 1990), updated in June 1994 (SNL 1994) and completely implemented in 1995. This plan was prepared in accordance with 40 CFR 112, Oil Pollution Prevention. The SPCC Plan for SNL/NV at TTR documents 29 locations for secondary containment upgrades, including transformers, aboveground storage tanks, and three bulk storage areas. Construction of the secondary containment areas was completed in FY93. The SPCC plan was completely implemented in 1995.

4.2 WASTE MANAGEMENT PROGRAMS

Waste management is the safe and effective management of active and standby facilities and the treatment, storage, and disposal of radioactive, hazardous, and mixed wastes. The following sections include summary descriptions of major waste management programs and activities at TTR.

4.2.1 Chemical & Hazardous Waste Management

Chemical wastes generated by SNL/NV activities at TTR during calendar year 1995 (CY95) were managed by KMI Services, the facilities support contractor.

In CY95, 1585 kg of RCRA regulated hazardous waste and 4727 kg of regulated non-RCRA waste were shipped off the TTR for disposal at a permitted TSDF. Table 4-1 shows a breakdown of the waste categories and quantities for RCRA regulated waste (1585 kg). Table 4-2 lists regulated non-RCRA waste and quantities shipped off-site for treatment and disposal (4727 kg). Table 4-3 lists waste transported off-site for recycling or alternative fuel use (4077 kg).

Table 4-1. All RCRA regulated chemical and hazardous waste shipped off-site in 1995 for disposal.

Shipping Name	Waste Codes	Weight (kilograms)
Waste flammable liquids, NOS, petroleum naphtha, petroleum distillates	D001	194
Waste diethyl ether	D001	48
Waste aerosols flammable	D001	236
Hazardous waste solid NOS rags with methylene chloride	F002	248
Hazardous waste solid NOS sodium vapor lamps	D005	17
Waste environmentally hazardous substances, solid, NOS, nicads	D006	38
Hazardous waste solid NOS Lead	D008	4
Waste, battery wet filled with acid, sulfuric acid, lead	D002, D008	217
Waste environmentally hazardous substances, solid, NOS oily rags acetone mek	D035, F003, F005	81
Waste paint related material, lacquer thinner, mek	D001, D035, F003, F005	384
Hazardous waste liquid NOS oil with selenium, endrin	D018, D019, D010, D012 D023, D020, D031, D032 D033, D034, D013, D036 D027, D028, D037, D038 D015, D040, D041, D042 D043, D025	118
Total		1,585

Note: NOS = not otherwise specified

Table 4-2. Regulated waste, other than RCRA Waste, shipped off-site for treatment and disposal.

Waste Material	Weight (kilograms)
Waste antifreeze (non-recyclable)	563
Sealed capacitors possible PCB	518
Batteries non-regulated Alakaline	489
Petroleum contaminated soil, rags, filters, etc.	2,772
Expired/outdated materials	325
Possible asbestos containing material	60
Total	4,727

Table 4-3. Hazardous and regulated non-RCRA waste shipped off-site in 1995 for recycling.

Waste Material	Weight (kilograms)
Used oil	2,307
Contaminated gasoline	94
Safety Kleen solvent (petroleum maphtha)	1,042
Safety Kleen immersion cleaner (monoethanolamine)	172
Fluorescent light bulbs (mercury recovery)	398
Mercury containing equipment (thermostats, etc.)	4
Sodium light bulbs	100
Automotive batteries	102 ea.
Total	4,077

4.2.2 Waste Minimization Program

An informal waste minimization program is practiced at TTR. TTR is committed to achieving significant reductions in the amount of both hazardous and non-RCRA wastes. In 1994, antifreeze recycling and Freon recovery units were procured. Waste minimization includes recycling and recovery of the following materials:

- Solvents
- Fuels
- Oil
- Antifreeze (on-site recycling unit)
- Lead acid battery
- Freon recovery (on-site recovery unit)
- Fluorescent and sodium bulb
- Mercury containing component

4.3 ENVIRONMENTAL RESTORATION PROJECT

The ER Project is a phased DOE program to identify, assess, and correct past spill, release, or disposal sites at all owned and operated sites including the SNL-operated TTR. The method parallels the EPA's CERCLA program to identify, characterize, and clean up inactive waste sites and past release sites. Table 4-4 summarizes the ER Project sites at TTR planned for investigation by SNL/NV. DOE/NV is responsible for the three Clean Slate sites.

The waste listed in Table 4-2 was shipped to the following facilities for disposal and/or recycling:

- Ensco West (Wilmington, CA)
- Safety Kleen Corp. (Las Vegas, NV)
- Sales Co (Phoenix, AZ)
- Romic Environmental Technologies (Chandler, AZ)

The initial identification, description, and listing of the ER waste sites was derived from the Preliminary Assessment (PA) and the Federal Facility Preliminary Assessment Review. In 1993, IT Corporation obtained additional information related to these previously identified ER sites and identified new ER sites through the ER sites inventory process, geophysical surveys, and aerial radiological and multispectral surveys. These newly identified sites were included and listed based upon joint efforts of the DOE/NV and SNL in the form of interviews with former site workers, archive reviews, and site visits.

ER Activities at TTR in 1995

A Voluntary Corrective Action work plan (DOE 1995) was finalized and on February 3, 1995, DOE/NV received a permit exclusion for corrective action at the Tonopah Test Range from the Nevada Division of Environmental Protection (NDEP). The implementation of the corrective action work plan involved the removal and processing of unexploded ordnance (UXO) and other debris at five Corrective Action Sites (CAS). These sites are:

- Bomblet Pit, CAS No. TA-55-001-TA-B2
- Five Points Landfill, CAS No. TA-19-001-05-PT
- Area 9 Landfill, CAS No. 09-10-001-09-52

- Area 9 Construction Debris Area, CAS No. 09-08-001-TA-09
- Roller Coaster Sewage Lagoons, CAS No. TA-03-001-TA-RC
- These 5 sites contained construction debris, UXO, practice ordnance, scrap metal, and some items containing hydrocarbons, hazardous, or radioactive constituents. Items were identified, removed, and segregated on each site.

Table 4-4. Department of Energy Environmental Restoration Division Tonopah Test Range Corrective Action units and sites (Continues).

Corrective Action Unit 407

DOE/Industrial - DOE/ERD Radioactive Contamination Sites, Surface/Near Surface, Tonopah Test, FFACO.

Corrective Action Site Number	Corrective Action Site Description	General Location
TA-23-001-TARC	Roller Coaster Rad Safe Area	NW of Antelope Lake
TA-39-001-TAGR	Cactus Spring Ranch, Soil Contam.	West of Target Areas
TA-52-001-TANL	Rocket Propellant Burn Area	NEDS Lake
TA-52-002-TAML	Depleted Uranium Impact Site	Main Lake
TA-52-003-0960	Depleted Uranium Artillery Round	South of Area 9
TA-52-004-TAAL	Metal Particle Dispersion Test	Antelope Lake
TA-52-005-TAAL	Joint Test Assembly DU Sites	Antelope Lake

Corrective Action Units 400

DOE/Industrial - DOE/ERD Closed Ordnance Disposal Pits; Bomblet Pit and Five Points Landfill, Tonopah, FFACO.

Corrective Action Site Number	Corrective Action Site Description	General Location
TA-19-001-05PT	Ordnance Disposal Pit	Five Points Intersection
TA-55-001-TAB2	Ordnance Disposal Pit	Bunker 2 Road

Table 4-4. Department of Energy Environmental Restoration Division Tonopah Test Range Corrective Action units and sites (Continued).

Corrective Action Unit 401 DOE/ERD Closed Underground Storage Tank Site, Gas Station, Area 3 Tonopah Test Range, FFACO.		
Corrective Action Site (CAS) Number	Corrective Action Site Description	General Location
03-02-003-0357	Underground Storage Tank, Gas	First Gas Station, Area 3

Corrective Action Unit 402 DOE/Industrial - DOE/ERD Closed Underground Storage Tank Site, Building 0353, Area 3 Tonopah Test, FFACO.		
Corrective Action Site (CAS) Number	Corrective Action Site Description	General Location
03-02-001-0353	Underground Storage Tank, Diesel	Building 0353

Corrective Action Unit 403 DOE/Industrial - DOE/ERD Closed Underground Storage Tank Sites, Area 3 Tonopah Test, FFACO.		
Corrective Action Site (CAS) Number	Corrective Action Site Description	General Location
03-02-004-0360	Underground Storage Tanks	Second Gas Station

Table 4-4. Department of Energy Environmental Restoration Division Tonopah Test Range Corrective Action units and sites (Concluded).

Corrective Action Unit 404 DOE/Industrial - DOE/ERD Roller Coaster Lagoons and Trench, Tonopah Test, FFACO.		
Corrective Action Site (CAS) Number	Corrective Action Site Description	General Location
TA-03-001-TARC	Roller Coaster Lagoons	NW of Antelope Lake
TA-03-001-TARC	Roller Coaster N. Disposal Trench	NW of Antelope Lake
Corrective Action Unit 405 DOE/Industrial - DOE/ERD Septic Waste Systems, Area 3, Tonopah Test, FFACO.		
Corrective Action Site (CAS) Number	Corrective Action Site Description	General Location
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
Corrective Action Unit 406 DOE/Industrial - DOE/ERD Underground Discharge Points, Areas 3, 9, Tonopah Test, FFACO.		
Corrective Action Site (CAS) Number	Corrective Action Site Description	General Location
03-52-002-0374	Heavy Duty Shop UDP, Sumps	Building 0374
03-52-003-0358	UPS Building UDP	UPS Building, Area 3

- The items were segregated by waste type and dispositioned accordingly. Waste types were segregated by (1) UXO requiring processing (i.e. detonation), and (2) UXO not requiring processing.
- Potentially hazardous debris/soil,
- Radiologically contaminated debris/soil,
- Recyclable scrap,
- Nonrecyclable, nonhazardous, nonradioactive debris.

UXO requiring processing was explosively processed at a designated area at the Bomblet Pit. After processing, UXO was "demilitarized" either through additional detonations, or cutting. After demilitarization, the remaining metal was recycled as scrap. Other debris was also recycled as scrap metal which resulted in a total of approximately 120 tons of recycled steel and 15 tons of recycled aluminum. In addition, one 55-gallon drum of radiologically-contaminated soil and approximately 2 yd^3 of radiologically contaminated metal debris were removed from the Five Points Landfill. These items are stored at TTR and await disposal at NTS. A small quantity of hazardous waste was discovered at the Roller Coaster Sewage Lagoons site. This waste was packaged and shipped to a commercial TSD facility. Approximately 350 yd^3 of nonhazardous, nonradioactive, nonrecyclable debris remain at the sites. This debris awaits approval for disposal at the TTR landfill.

At the conclusion of the Voluntary Corrective Action activities, the Bomblet Pit and Five Points Landfill were considered free of contamination or UXO and a plan is in preparation to provide verification sampling data for clean closure. The other three sites require additional assessment activities, and will be included in subsequent planning efforts.

4.4 1994 National Environmental Policy Act Compliance Activities & Documentation

The National Environmental Policy Act (NEPA), the nation's most comprehensive legislative and public policy statement on environmental protection, applies to all agencies of the federal government.

The Council on Environmental Quality (CEQ) was created in the Executive Office of the President under the authority of NEPA. CEQ regulations were formally adopted by DOE in August 1979 (10 CFR 1021). DOE NEPA guidelines were last published in full in the *Federal Register* on December 15, 1987. On April 24, 1992, DOE codified its existing rule of compliance with NEPA (10 CFR 1021). The proposed rule incorporates certain policy initiatives instituted by the Secretary of Energy.

Although only DOE has the authority to decide the appropriate level of NEPA documentation, SNL assists DOE by drafting appropriate documentation, such as Environmental Checklists (ECLs), Action Description Memoranda (ADMs), and EAs for DOE approval. Such environmental documents serve as vehicles for assessing potential environmental impacts of proposed Federal actions and disclosing federal activities.

At SNL, the Risk Management & NEPA Department carries out various NEPA-related activities, including consulting and training line-organization personnel in NEPA compliance, coordinating document preparation, maintaining a corporate NEPA document file, and reviewing NEPA documents before submittal to DOE. These responsibilities are documented in the SNL NEPA program (SNL 1991).

4.4.1 Compliance Summary

The Secretary of Energy's February 5, 1990, NEPA Notice, SEN-15-90 (Secretary of Energy 1990), with directives intended to bring DOE into full compliance with NEPA, set in motion events that led to a major increase in commitment to comply with the principles and practices underlying NEPA. At TTR, NEPA compliance is a joint effort by SNL with DOE/NV and the Water Resources Center, Desert Research Institute (DRI), University of Nevada System. DRI and EG&G prepare archaeological and biological surveys and reports. Final reports are submitted to SNL and DOE/NV for transmittal to the State of Nevada, State Historic Preservation Office, (SHPO) for review and decision making.

4.4.2 Environmental Checklist (ECL)

An ECL serves to document the use of a categorical exclusion (a category of actions for which neither an EA or an Environmental Impact Statement [EIS] is required).

4.4.3 Action Description Memorandum (ADM)

An ADM is a document containing a concise description of a proposed action and a brief discussion of relevant potential environmental issues. DOE uses ADMs to determine the appropriate level of NEPA documentation for proposed actions. In the past, ADMs were also used to document categorical exclusions and to support memo-to-file (MTF) reviews.

The MTF was a unique DOE mechanism established in 1980 to justify not preparing EAs on insignificant actions that had not yet been added to the DOE published list of categorical exclusions. This procedure was followed because the categorical exclusions list was not well defined. The MTF system to exclude actions that are clearly insignificant, but not specifically categorically excluded from detailed NEPA documentation,

ended on September 30, 1990. At present, actions that are not categorically excluded or covered in approved NEPA documents require preparation of EAs or EISs.

4.4.4 Environmental Assessment (EA)

An EA is intended to be a "concise public document" which provides sufficient evidence and analysis to determine whether to prepare an EIS or a Finding of No Significant Impact (FONSI). The EA also aids in the compliance with NEPA when no EIS is required and facilitates preparation of an EIS when one is necessary. A categorical exclusion was applied for in 1995 by DOE/NV and granted by DOE/NV to install solar powered air monitoring equipment at Bunker 2 at TTR.

4.5 Overview of Non-SNL Environmental Monitoring Programs at TTR

The TTR landowner is the Bureau of Land Management (BLM). The USAF maintains a use permit with BLM that is renewed every 5 years. BLM must approve any new construction, such as roads. In addition to SNL, other agencies and contractors perform environmental monitoring activities at TTR under memoranda of understanding with DOE as follows:

- **U.S. Environmental Protection Agency.** The EPA Environmental Monitoring Systems Laboratory in Las Vegas, NV, under an interagency agreement with DOE, monitors background radiation at TTR as part of its Off-Site Radiation Monitoring Program. Reports are available through the EPA upon request.

- **Water Resources Center, Desert Research Institute, (DRI) University of Nevada System.** DRI is under contract with DOE to provide services that include public information activities and radiation monitoring support.

- **DRI.** Provides and trains station managers to run EPA community monitoring stations at such remote locations as Tonopah and Goldfield. These managers generally are local science teachers. The EPA laboratory in Las Vegas, NV, provides equipment and performs the analysis and reporting. DRI also provides external quality assurance (QA) on field measurements taken by EPA at community monitoring stations. Selected locations are monitored concurrently by DRI with a portable monitoring station (PMS) and Thermoluminescent dosimeters (TLDs). EPA monitoring results are compared to DRI results.

The QA results that summarize EPA and DRI data at the selected locations are reported annually by DRI. DRI also performs other monitoring, primarily hydrological, for DOE as requested. This may include evaluating environmental impacts due to road construction.

- **KMI Services.** As part of its TTR support activities, KMI Services personnel perform environmental monitoring activities at TTR. These activities include: water and wastewater sampling, air quality monitoring (PM_{10} and Total Suspended Particulates [TSP]) for SNL and DOE/NV, soil sampling radiation monitoring (470,000 lb. or 31 truckloads of excess salvage was radiation-surveyed prior to shipment to NTS for release for reapplication or auction), preparing local data sections of the annual environmental report and completing the Biannual Hazardous Waste Generation Report for the State of Nevada. KMI Services also manages all hazardous and regulated waste generated by DOE controlled activities at TTR. KMI Services has 13 personnel certified with 40-hour Hazardous Waste Operations and Emergency Response training. This has enabled DOE/NV to use local personnel in environmental clean-up and restoration activities.

Other agencies also prepare reports that may include information on TTR. These reports, described in Volumes 1 through 4 of the *Sandia National Laboratories/Nevada Environmental Compliance Summary Report* (TTR 1992), are available from the respective agencies. Reports that are prepared on a regular basis include the following:

- *Annual Permits/Registration Certificates for Sandia National Laboratories/Nevada*— KMI Services.

- *Off-site Monitoring Report-Nevada Test Site and Other Test Areas, Quarterly Report*—EPA, Dose Assessment Branch, Nuclear Radiation Assessment Division.

- *Environmental Monitoring Report: Radiation Monitoring Around United States Nuclear Test Areas, Calendar Year Report*—EPA, Dose Assessment Branch, Nuclear Radiation Assessment Division (also published as part of the NTS Annual Site Environmental Report).

- *Community Radiation Monitoring Program, Annual Report*—DRI.

4.6 1995 Reportable Releases

There were no reportable releases caused by DOE or SNL activities in 1995. The USAF had one reportable oil spill on DOE controlled property near the Mellan Air Strip. The spill was caused by leaking smoke generators.

4.7 Occurrence Reporting

There were no SNL caused environmentally related occurrence reports in 1995. The use of Zap Rocket Motors to flash an ordnance pit under remediation resulted in a warning letter from NDEP to DOE/NV and DOE/KAO.

Due to the decline of activities at TTR, it was determined in September of 1994 that seven ZAP Rocket Motors were not likely to be used in a test program at TTR and therefore should be evaluated for reapplication. SNL made inquiries to several Department of Defense (DoD) installations to see if the rocket motors could be reapplied. The most promising reapplication possibility was with the Holloman Air Force Base in New Mexico. After numerous discussions with Holloman it was determined that since there were only seven rocket motors it would not be cost-effective to transport them to Holloman. Another alternative for the rocket motors was to use them as donor explosives in an approved environmental restoration project at TTR. This alternative was evaluated and believed to be a valid reuse of the rocket motors at TTR as indicated in a memorandum dated April 16, 1995, from DOE/KAO to SNL.

While reapplication and reuse activities were being pursued for the rocket motors, the SNL/NM waste management organization began to investigate treatment and disposal options for the rocket motors in the event that they might become waste if no reapplication or reuse could be found. As a contingency, SNL/NM began planning for materials that might become waste prior to being declared waste. However, due to the possibility and promise of reapplication of the rocket motors, at no time were the rocket motors ever declared waste.

DOE/KAO contacted the NDEP on November 9, 1994, to inquire about the process for obtaining an emergency permit under 40 CFR 270.61 in the event that the rocket motors were declared waste. This inquiry was made because there was some concern that the rocket motors would be determined to be unsafe to transport over public roads. Again, this activity was being pursued as a proactive measure to investigate all opportunities for treatment and disposal of the rocket motors.

On September 6, 1995, the NDEP issued a warning letter to DOE/NV and DOE/KAO. The State of Nevada's concern were the disposition of seven ZAP Rocket Motors that were in the custody of SNL TTR. NDEP's position was that these rocket motors had been identified for disposal and their use in a regulated activity without concurrence from NDEP constituted a unauthorized treatment/disposal of a waste without a permit.

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5.0 ENVIRONMENTAL SURVEILLANCE AT TTR IN 1995

5.1 1995 SNL ENVIRONMENTAL SURVEILLANCE

In August 1995, staff from SNL's Air Quality Department Environmental Surveillance program collected soil samples at TTR. Limited air monitoring samples were collected from May to December in 1995. The overall objectives of the environmental surveillance program are to detect the potential migration of contaminated material related to on-site operations and also to determine the potential impact (if any) of site-related activities to the population and the surrounding environment. The specific objectives include the annual sampling of the long-term, routine, environmental surveillance locations and supplementing the environmental baseline data collected in 1992 (SNL 1992a). Additional baseline-related sampling was performed in 1994 in areas where SNL has had a long-term or continued presence at TTR. The annual sampling of the routine surveillance locations provides information related to the long-term environmental conditions and trends of the site.

To support the objectives of the Environmental Surveillance program, soil samples were collected in three distinct areas: off-site, site perimeter, and on-site. The off-site locations provide a sampling of environmental conditions unrelated to SNL activities at TTR. Data collected at these locations serve as a reference point to compare data collected at perimeter and on-site locations. The perimeter locations are used to monitor the site boundary for potential contamination migrating either onto or off of TTR. On-site locations are near areas of known contamination or potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate. All samples collected in 1995 were from areas of uncontrolled access (outside of the on-site controlled areas).

Most routine environmental surveillance locations remain essentially the same from year to year. Long-Term locations are added as necessary to monitor new operations or to supplement data from existing locations. Due to limited resources, the sampling locations, number of samples, and analyses performed were prioritized based on the following: (1) contaminants believed to be present, (2) contamination considered readily dispersible by environmental factors (e.g., wind or rain), and (3) areas with the greatest potential for impact the public, workers, and the environment.

A long-term thermoluminescent dosimeter (TLD) network was established in January 1994. Environmental TLDs have been placed at various locations off-site, at the site perimeter, and on-site to measure gamma radiation.

Sample Collection and Analysis

Soil samples were gathered in accordance with *Environmental Sampling Procedure* (SNL 1992b), the activity-specific environment, safety, and health (ES&H) Standard Operating Procedure (SOP). In cases of replicate sampling, only the first sample collected (sample A) was used in summary calculations to avoid skewing summary data toward replicate sample data.

As part of the 1995 surveillance activities, 54 locations were sampled: 14 from off-site, five from the site perimeter, five from around the On-Base Housing Area, six from the South Plume Area, three from the 554th Range Squadron O&M Complex, 10 from the Range Operations Center, and 11 from various on-site locations. All soil samples were analyzed for 20 metals by the inductively coupled plasma (ICP) method, total uranium (U_{tot}), and by gamma spectroscopy. Samples collected in 1995 were analyzed by a different analytical laboratory than who performed the analysis in the past. Some minor variation in analytical results is expected when changing analytical laboratories.

For samples collected from on-site or the site perimeter, total uranium (U_{tot}) cesium- 137 (Cs-137), and non-radiological metal concentrations were compared to the upper 95 percent (mean plus two standard deviations) confidence limit and the range of values from those samples collected off-site. Individual samples with values greater than the upper 95 percent confidence interval and greater than the range of observed values were considered potentially contaminated.

PM_{10} air monitors sample air particulates of 10 microns (μm) or less. This size of particulate is considered respirable. PM_{10} air monitoring was conducted at three locations on TTR: the 554th Range Squadron O&M Complex, Station 14 (STA-14), and Well 6. The 554th Range Squadron O&M Complex was monitored because it is the closest on-site work location of non-SNL employees and to the contaminated Clean Slate sites. STA-14 is located in the general vicinity between Clean Slates 1 and 3 (the potential sources of airborne contamination) and the SNL/NV-occupied portions of TTR. Well 6 is the main TTR water well located near the Range Operations Center where the majority of SNL/NV personnel work. Samples were gathered in accordance with TOP-94-07 (Culp 1994).

Air filters were exchanged weekly and analyzed samples consisted of monthly composites. All composite samples were analyzed for gross alpha, gross beta, isotopic plutonium, U_{tot}, and 20 ICP non-radiological metals, and by gamma spectroscopy.

5.2 1995 SNL RADIOLOGICAL SURVEILLANCE RESULTS

5.2.1 Soil Sampling

Figure B-1 through B-11 of Appendix B shows the 1995 environmental surveillance soil sampling locations. Table B-1 through B-11 of Appendix B list the individual radiological sample results. Table 5-1 summarizes the radiological soil sampling data. The summary includes the mean, standard deviation, and range of values for the off-site samples, as well as the range of values for the on-site sampled areas.

The sample analysis scheme used for soil samples required U_{tot} and gamma spectral analysis for all samples. If the gamma spectral analysis detected Am-241 in concentrations greater than the detection limit for Am-241, then isotopic plutonium analysis would be performed. No soil samples had Am-241 concentrations reported as greater than the analytical detection limit, therefore no isotopic plutonium analysis was performed.

Table 5-1. Radiological summary data for soil samples collected at TTR in 1995.

Location	Number of Samples	U_{tot} (ug/g)	Cs-137 (pCi/g)
Off-Site	14	15.4 - 3.25	0.00 - 1.43
Mean		2.43	0.46
Standard Deviation		0.53	0.44
554th Range O&M	3	2.35 - 2.63	0.00 - 0.25
On-Base Housing	5	1.23 - 2.44	0.00 - 0.32
Site Perimeter	5	1.06 - 2.08	0.02 - 0.58
Range Operations Center	10	1.58 - 4.01	0.00 - 0.25
South Plume Area	6	1.55 - 2.52	0.37 - 0.85
Various On-Site Locations	11	1.73 - 4.30	0.03 - 0.62

Note: ug/g = micrograms per gram; pCi/g = picocurie per gram; Americium-241 not detected in any sample, follow-up isotopic plutonium analysis was therefore not performed.

5.2.2 Off-site Soil Sampling

Results from the 14 off-site soil sampling locations were consistent with previous years' results and are believed to represent the normal, expected range of values (see Figure B-1 and Table B-1).

5.2.3 On-site Soil Sampling

Site Perimeter- Five samples were collected from the TTR site perimeter (see Figure B-2 and Table B-2). All Cs-137 and U_{tot} results were indistinguishable from off-site concentrations.

On-Base Housing Area- Five samples were collected from near the On-Base Housing Area (see Figure B-3 and Table B-3). All Cs-137 and U_{tot} results were indistinguishable from off-site concentrations.

South Plume Area- Six samples were collected from the South Plume Area (see Figure B-4 and Table B-4). All Cs-137 and U_{tot} results were indistinguishable from off-site concentrations.

554th Range Squadron O&M Complex- Three samples were collected from the area around the 554th Range Squadron O&M Complex (see Figure B-5 and Table B-5). All Cs-137 and U_{tot} results were indistinguishable from off-site concentrations.

Range Operations Center- Ten samples were collected from the area around the Range Operations Center (see Figure B-6, B-7, & B-8 and Table B-6). All Cs-137 results were indistinguishable from off-site concentrations. The sample collected from location OC-19 showed elevated concentration of U_{tot}. All other locations were indistinguishable from off-site concentrations.

Various On-Site Locations- Eleven samples were collected from various locations on-site (see Figure B-9, B-10 & B-11 and Table B-7). All Cs-137 results were indistinguishable from off-site concentrations. The sample collected from location T-20 showed elevated concentration of U_{tot}. Location T-20 is in the vicinity of the Hard Target near a fenced area suspected of being contaminated with DU. All other locations were indistinguishable from off-site concentrations.

The off-site distribution of sample concentrations serves as a reference to compare on-site samples. Due to the limited size of the off-site sampling (14 samples) this comparison should not be considered as exact in the identification of potential contamination. Some locations which appear to be marginally elevated above off-site concentrations may not be contaminated, but rather show the normal, expected, variation in sample concentration. Also, some differences are to be expected when switching analytical laboratories. The

laboratory that performed the 1995 analyses is not believed to perform as sensitive of measurements as the previously used laboratory.

5.2.4 Results of Radiological Air Sampling

Tables 5-2 through 5-4 provide results from the routine radiological the PM_{10} monitoring conducted at the 554th Range Squadron O&M Complex, STA-14, and Well 6, respectively. Measured results are listed for gross alpha, gross beta, isotopic plutonium, and U_{tot}. Reported results are net radionuclide concentrations (laboratory reported values minus filter blanks). The U_{tot} concentrations were converted into the isotopic uranium constituents assuming the uranium isotopes were present in their natural abundance. Analysis was performed for U_{tot}, Am-241, and isotopic plutonium because these radionuclides are potential contaminants at TTR. Gross alpha and gross beta analysis was performed as a general indication of the radionuclide air quality.

The measured radionuclide concentrations are all believed to be small and consistent with previously measured values at TTR and consistent between sampling locations. The error term associated with the measured values (with the exception of U_{tot} which was measured based on its non-radiological properties) are relatively large when compared to the base value. Americium-241 results were always less than the associated detection limit for this radionuclide for analysis by gamma spectroscopy.

5.2.5 Results of the TLD Program Sampling

As part of the long-term, routine, environmental surveillance program at TTR, SNL began an ambient gamma-radiation program in January 1994. This program includes a TLD monitoring network to measure radiation exposure at five community (off-site) locations, four perimeter locations, and 13 on-site locations. Table 5-5 summarizes the TLD measurements of annual radiation exposure off-site, at the site perimeter, and on-site. Table B-8 of Appendix B lists the TLD locations and results. Exposure results include contributions from natural background and man-made radiation (if any).

The average annual exposure for the perimeter and off-site locations were 143 ± 19 milliroentgen per year (mR/yr) and 120 ± 14 mR/yr, respectively. The average on-site exposure was 144 ± 22 mR/yr. Individual on-site values ranged from 122 ± 13 mR/yr to 210 ± 26 mR/yr.

Table 5-2. 1995 PM_{10} radiological air monitoring results for the 554th Range Squadron O&M Complex (Continues).

Composite Period	Analyte	Concentration (pCi/m^3)	Error (pCi/m^3)
May	Gross Alpha	3.28E-02	1.87E-02
	Gross Beta	4.15E-02	1.81E-02
	Plutonium-238	7.98E-05	1.02E-03
	Plutonium-239+240	5.98E-04	4.79E-04
	Uranium, total (ug/m3)	1.64E-02	
	U-238	5.43E-03	
	U-234	5.84E-03	
	U-235	2.54E-04	
June	Gross Alpha	3.30E-02	2.59E-02
	Gross Beta	6.85E-02	2.62E-02
	Plutonium-238	8.19E-04	8.19E-04
	Plutonium-239+240	1.18E-03	1.18E-03
	Uranium, total	1.54E-02	
	U-238	5.10E-03	
	U-234	5.48E-03	
	U-235	2.39E-04	
August	Gross Alpha	4.63E-02	1.95E-02
	Gross Beta	7.69E-02	1.76E-02
	Plutonium-238	2.70E-04	1.93E-04
	Plutonium-239+240	1.79E-04	3.63E-04
	Uranium, total	1.45E-02	
	U-238	4.80E-03	
	U-234	5.16E-03	
	U-235	2.25E-04	
September	Gross Alpha	2.10E-02	1.23E-02
	Gross Beta	6.37E-02	1.05E-02
	Plutonium-238	-3.65E-05	3.44E-04
	Plutonium-239+240	7.47E-05	1.15E-04
	Uranium, total	-6.20E-04	
	U-238	-2.05E-04	
	U-234	-2.21E-04	
	U-235	-9.61E-06	

Table 5-2. PM_{10} radiological air monitoring results for the 554th Range Squadron O&M Complex (Concluded).

Composite Period	Analyte	Concentration (pCi/m^3)	Error (pCi/m^3)
October	Gross Alpha	3.68E-03	9.64E-03
	Gross Beta	2.36E-02	9.22E-03
	Plutonium-238	-2.87E-04	6.46E-04
	Plutonium-239+240	3.35E-04	2.29E-04
	Uranium, total	-5.04E-04	
	U-238	-1.67E-03	
	U-234	-1.79E-03	
	U-235	-7.81E-05	
November	Gross Alpha	-2.07E-02	1.11E-02
	Gross Beta	5.61E-02	1.31E-02
	Plutonium-238	4.74E-05	2.53E-04
	Plutonium-239+240	-3.16E-05	7.90E-05
	Uranium, total	7.49E-04	
	U-238	2.48E-04	
	U-234	2.67E-04	
	U-235	1.16E-05	
December	Gross Alpha	6.04E-03	7.61E-03
	Gross Beta	7.16E-03	1.21E-02
	Uranium, total	-2.17E-03	
	U-238	-7.18E-04	
	U-234	-7.73E-04	
	U-235	-3.36E-05	

Note: pCi/m^3 = picocuries per cubic meter; $\mu g/m^3$ = micrograms per cubic meter; Americium-241 not detected.

Table 5-3. 1995 PM_{10} radiological air monitoring results for Station 14 (Continues).

Composite Period	Analyte	Concentration (pCi/m^3)	Error (pCi/m^3)
May	Gross Alpha	1.68E-02	1.67E-02
	Gross Beta	5.20E-02	1.68E-02
	Plutonium-238	-3.76E-04	1.02E-03
	Plutonium-239+240	2.31E-05	4.79E-04
	Uranium, total	1.57E-02	
	U-238	5.20E-03	
	U-234	5.59E-03	
	U-235	2.43E-04	
August	Gross Alpha	9.02E-03	1.87E-02
	Gross Beta	8.41E-02	1.89E-02
	Plutonium-238	-6.87E-05	1.93E-04
	Plutonium-239+240	5.01E-05	3.63E-04
	Uranium, total	1.27E-02	
	U-238	4.20E-03	
	U-234	4.52E-03	
	U-235	1.97E-04	
September	Gross Alpha	2.05E-02	1.71E-02
	Gross Beta	6.46E-02	1.54E-02
	Plutonium-238	1.38E-04	5.71E-04
	Plutonium-239+240	3.89E-04	2.25E-04
	Uranium, total	-6.22E-04	
	U-238	-2.06E-04	
	U-234	-2.21E-04	
	U-235	-9.64E-06	
October	Gross Alpha	9.87E-03	1.11E-02
	Gross Beta	3.01E-02	9.28E-03
	Plutonium-238	-1.53E-05	6.72E-04
	Plutonium-239+240	3.28E-04	2.24E-04
	Uranium, total	-4.93E-04	
	U-238	-1.63E-04	
	U-234	-1.76E-04	
	U-235	-7.64E-06	

Table 5-3. 1995 PM_{10} radiological air monitoring results for Station 14 (Concluded).

Composite Period	Analyte	Concentration (pCi/m^3)	Error (pCi/m^3)
November	Gross Alpha	-3.90E-03	1.52E-02
	Gross Beta	2.97E-02	1.47E-02
	Plutonium-238	-9.13E-05	3.39E-04
	Plutonium-239+240	1.41E-04	1.27E-04
	Uranium, total	1.84E-03	
	U-238	6.09E-04	
	U-234	6.55E-04	
	U-235	2.58E-05	
December	Gross Alpha	3.14E-03	9.08E-03
	Gross Beta	-1.47E-02	1.75E-02
	Uranium, total	-2.31E-03	
	U-238	-7.65E-04	
	U-234	-8.22E-04	
	U-235	-3.58E-05	

Note: pCi/m^3 = picocuries per cubic meter; $\mu g/m^3$ = micrograms per cubic meter; Americium-241 not detected.

Table 5-4. 1995 PM_{10} radiological air monitoring results for Well 6 (Continues).

Composite Period	Analyte	Concentration (pCi/m^3)	Error (pCi/m^3)
May	Gross Alpha	3.48E-02	2.56E-02
	Gross Beta	1.33E-01	2.64E-02
	Plutonium-238	7.34E-04	2.20E-03
	Plutonium-239+240	1.17E-03	7.98E-04
	Uranium, total	6.90E-03	
	U-238	2.28E-03	
	U-234	2.46E-03	
	U-235	1.07E-04	
June	Gross Alpha	2.63E-02	1.84E-02
	Gross Beta	6.13E-02	1.78E-02
	Plutonium-238	1.93E-04	1.93E-04
	Plutonium-239+240	3.63E-04	3.63E-04
	Uranium, total	1.61E-02	
	U-238	5.33E-03	
	U-234	5.73E-03	
	U-235	2.50E-04	
August	Gross Alpha	8.39E-03	1.58E-02
	Gross Beta	6.43E-02	1.75E-02
	Plutonium-238	-9.62E-05	1.28E-03
	Plutonium-239+240	-5.63E-05	5.48E-04
	Uranium, total	1.37E-02	
	U-238	4.53E-03	
	U-234	4.88E-03	
	U-235	2.12E-04	
September	Gross Alpha	1.64E-02	1.13E-02
	Gross Beta	2.81E-02	9.78E-03
	Plutonium-238	-2.63E-05	3.36E-04
	Plutonium-239+240	1.49E-04	1.37E-04
	Uranium, total	-6.25E-04	
	U-238	-2.07E-04	
	U-234	-2.23E-04	
	U-235	-9.69E-06	

Table 5-4. 1995PM_{10} radiological air monitoring results for Well 6 (Concluded).

Composite Period	Analyte	Concentration (pCi/m^3)	Error (pCi/m^3)
October	Gross Alpha	9.49E-03	1.01E-02
	Gross Beta	2.25E-02	8.59E-03
	Plutonium-238	2.88E-04	6.87E-04
	Plutonium-239+240	6.23E-05	2.02E-04
	Uranium, total	1.76E-03	
	U-238	5.83E-04	
	U-234	6.27E-04	
	U-235	2.73E-05	
November	Gross Alpha	8.23E-04	1.41E-02
	Gross Beta	4.82E-02	1.33E-02
	Plutonium-238	6.67E-05	6.87E-04
	Plutonium-239+240	2.51E-04	2.02E-04
	Uranium, total	3.27E-03	
	U-238	1.08E-03	
	U-234	1.16E-03	
	U-235	5.07E-05	
December	Gross Alpha	7.65E-03	1.01E-02
	Gross Beta	-1.81E-02	1.77E-02
	Uranium, total	-2.29E-03	
	U-238	-7.58E-04	
	U-234	-8.15E-04	
	U-235	-3.55E-05	

Note: pCi/m^3 = picocuries per cubic meter; $\mu g/m^3$ = micrograms per cubic meter; Americium-241 not detected.

Table 5-5. Summary of Thermoluminescent Dosimeter Measurements for 1995.

Location	Number of Measurements	Annual Exposure (mR/yr) Mean	Standard Deviation	Range
Community (C) (off-site)	5	120	14	96.0 to 130
Perimeter (P)	4	143	19	127 to 169
On-Site (S)	13	144	22	122 to 210

Note: mR/yr = milliroentgen per year.

5.3 1995 SNL NON-RADIOLOGICAL SURVEILLANCE RESULTS

5.3.1 Soil Sampling

Figures B-1 through B-11 of Appendix B show the 1995 environmental surveillance soil sampling locations. Tables C-1 through C-7 of Appendix C list the individual non-radiological sample results for the soil sampling.

5.3.2 Off-Site Soil Sampling

Non-radiological results from the 14 off-site soil sampling locations were consistent with previous years' results and are believed to represent the normal, expected range of values for the 20 analyzed metals (see Figure B-1 and Table C-1).

5.3.3 On-Site Soil Sampling

Site Perimeter - Five samples were collected from the TTR site perimeter (see Figure B-2 and Table C-2). Sample T-08 contained elevated concentrations of cadmium (Cd); sample T-11 contained elevated concentrations of Cd, iron (Fe), manganese (Mn), molybdenum (Mo), vanadium (V), and zinc (Zn); and sample T-13 contained elevated concentrations of Zn. All other analyses performed on samples collected from the site perimeter were indistinguishable from off-site concentrations.

On-Base Housing Area - Five samples were collected from near the On-Base Housing Area (see Figure B-3 and Table C-3). Sample T-36 contained elevated concentrations of Cr. All other analyses performed on sampled collected from the On-Base Housing Area were indistinguishable from off-site concentrations.

South Plume Area - Six samples were collected from the South Plume Area (see Figure B-4 and Table C-4). Sample T-14 contained elevated concentrations of barium (Ba) and silver (Ag); sample T-18 was found to be elevated in Ag; and sample T-19 was found to be elevated in nickel (Ni), and silicon dioxide ($Si0_2$). All other analyses performed on samples collected from the South Plume Area were indistinguishable from off-site concentrations.

554th Range Squadron O&M Complex - Three samples were collected from that area around the 554th Range Squadron O&M Complex (see Figure B-5 and Table C-5). Sample OM-03 was found to be elevated in Cd. All other analyses performed on samples collected from the area around the 554th Range Squadron O&M Complex were indistinguishable from off-site concentrations.

Range Operations Center - Ten samples were collected from the area around the Range Operations Center (see Figure B-6, B-7, & B-8 and Table C-6). Sample OC-03 was found to be elevated in beryllium (Be) and Cd; OC-10 was elevated in Cd; OC-19 was found to be elevated in CD and Zn; OC-13 and OC-22 were elevated in Zn; and OC-23 was elevated in Thallium (Th). All other analyses performed on samples collected from the area around the Range Operations Center were indistinguishable from off-site concentrations.

Various On-Site Locations - Eleven samples were collected from various locations on-site (see Figure B-9, B-10, & B-11 and Table C-7). Sample T-20 was found to be elevated in $Si0_2$; and T-21 was found to be elevated in aluminum (Al), Be, Fe, Mg, manganese (Mn), Ni, Potassium (K), $Si0_2$, Ag, Sodium (Na), and V. All other analyses performed on samples collected from the various locations on-site were indistinguishable from off-site concentrations.

The off-site distribution of sample concentrations serves as a reference to compare with on-site samples. Due to the limited size of the off-site sampling (14 samples), the wide range of concentrations of some constituents, and the potential differences in the geological makeup of some of the sample collections areas, this comparison should not be considered as exact in the identification of contamination. Some locations with metal concentrations marginally elevated above off-site may in fact not be contaminated, but rather show the normal, expected, variation in sample concentration. Where sample concentrations are considerably greater than off-site, and greater than the range of off-site values, it was assumed that contamination is potentially present.

5.3.4 Results of Non-radiological Air Sampling

Tables 5-6 through 5-9 provide the results from the routine nonradiological PM_{10} air monitoring conducted at the 554th Range Squadron O&M Complex, STA-14 and Well 6, respectively. Analysis was performed by the ICP technique which reports 20 metals. The table results exclude those metals which are major constituents of the glass fiber filters used in PM_{10} air monitoring (i.e., Al, Ca, Fe, Mg, Si, Na, K).

The measured metal concentrations are all believed to be consistent at each location and between locations as well as consistent with previous years measurements. Some of the variation in measured concentrations are believed to be related to environmental factors (i.e., wind and dust loading of filters) and to the change in analytical laboratories performing the analysis. In either case, these differences are not considered indicative of environmental contamination.

5.4 Environmental Perspective

It is generally accepted that once Pu comes in contact with soil in the environment, it becomes firmly attached to the host particle. Previous studies (Tamura 1974, 1975, 1976) of soil samples from safety-shot areas at the NTS showed Pu particle-size association was primarily with coarse silts (50 to 20 μm) and fine sands (125 to 50 μm). Whereas the inhalation of finer sizes (<7 μm diameter at a density of 1 gram per cubic centimeter [g/cm^3]) is considered most hazardous (Tamura 1976), the coarser soil particles should not be ignored with regard to environmental transport, as these particle sizes are readily subjected to movement by wind (Leavitt 1980). Leavitt (1976) studied five safety-shot areas in Nevada and reported that the wind had a dominant influence on the surface texture of the desert soil by depositing soil fines around the base of brush or vegetation. Another study (Tamura 1977) discussed the occurrence of sandy mounds formed under desert shrubbery. These mounds were formed by the filtering action of the desert vegetation in intercepting saltation and creeping particles. The vegetation intercepts the material being moved through the environment by wind. This study and additional studies found that in Pu-contaminated areas, the Pu activity levels were higher in the desert mounds than in the contiguous desert pavement (areas without vegetation). This demonstrates the effect of wind erosion in dispersal of contaminated material. The Tamura (1977) study also discussed evidence of Pu migration downward into the soil profile.

Table 5-6. 1995 PM_{10} non-radiological air monitoring results for the 554th Range Squadron O&M Complex (Continues).

Composite Period	Analyte (total)	Concentration (mg/m^3)
May	Arsenic	1.35E-03
	Barium	<9.23E-03
	Beryllium	2.75E-04
	Cadmium	1.38E-04
	Lead	1.32E-03
	Manganese	3.88E-03
	Molybdenum	1.38E-03
	Nickel	2.71E-03
	Silver	9.84E-04
	Thallium	2.64E-03
	Vanadium	1.39E-03
	Zinc	1.60E-02
June	Arsenic	2.84E-03
	Barium	<7.41E-03
	Beryllium	2.81E-04
	Cadmium	5.78E-04
	Lead	2.81E-03
	Manganese	8.04E-03
	Molybdenum	2.87E-03
	Nickel	2.78E-03
	Silver	1.44E-03
	Thallium	5.61E-03
	Vanadium	2.87E-03
	Zinc	1.52E-02
August	Arsenic	1.38E-03
	Barium	3.48E-03
	Beryllium	1.36E-04
	Cadmium	2.86E-04
	Lead	1.35E-03
	Manganese	1.16E-02
	Molybdenum	1.41E-03
	Nickel	1.32E-03
	Silver	2.75E-03
	Thallium	2.70E-03
	Vanadium	1.42E-03
	Zinc	2.49E-02

Table 5-6. 1995 PM_{10} non-radiological air monitoring results for the 554th Range Squadron O&M Complex (Continued).

Composite Period	Analyte (total)	Concentration (mg/m^3)
September	Arsenic	<4.00E-05
	Barium	<1.53E-02
	Beryllium	<6.74E-06
	Cadmium	<1.32E-06
	Lead	<7.16E-05
	Manganese	<4.48E-05
	Molybdenum	<1.05E-05
	Nickel	<1.03E-04
	Silver	<4.10E-06
	Thallium	<1.48E-04
	Vanadium	<8.40E-06
	Zinc	<7.62E-04
October	Arsenic	2.59E-03
	Barium	5.86E-02
	Beryllium	6.60E-05
	Cadmium	3.77E-06
	Lead	2.26E-03
	Manganese	5.65E-03
	Molybdenum	1.27E-05
	Nickel	1.71E-03
	Silver	2.83E-05
	Thallium	7.32E-04
	Vanadium	1.48E-05
	Zinc	3.16E-02
November	Arsenic	<2.87E-05
	Barium	2.86E-02
	Beryllium	<5.64E-06
	Cadmium	<1.66E-07
	Lead	<6.06E-05
	Manganese	2.80E-03
	Molybdenum	2.75E-04
	Nickel	4.40E-04
	Silver	8.25E-05
	Thallium	2.68E-03
	Vanadium	3.22E-06
	Zinc	8.38E-03

Table 5-6. 1995 PM_{10} non-radiological air monitoring results for the 554th Range Squadron O&M Complex (Concluded).

Composite Period	Analyte (total)	Concentration (mg/m^3)
December	Arsenic	<8.96E-03
	Barium	<3.20E-01
	Beryllium	<8.96E-04
	Cadmium	<8.96E-04
	Lead	<8.96E-03
	Manganese	3.72E-03
	Molybdenum	<1.79E-03
	Nickel	<3.58E-03
	Silver	<8.96E-04
	Thallium	<1.79E-02
	Vanadium	<8.96E-04
	Zinc	<5.82E-02

Note: mg/m^3 = milligrams per cubic meter.

Table 5-7. 1995 PM_{10} non-radiological air monitoring results for Station 14 (Continues).

Composite Period	Analyte (total)	Concentration (mg/m3)
May	Arsenic, Total	2.78E-03
	Barium, Total	<1.03E-02
	Beryllium, Total	2.76E-04
	Cadmium, Total	1.39E-04
	Lead, Total	1.33E-03
	Manganese, Total	1.75E-03
	Molybdenum, Total	1.39E-03
	Nickel, Total	2.72E-03
	Silver, Total	2.76E-04
	Thallium, Total	5.50E-03
	Vanadium, Total	1.39E-03
	Zinc, Total	2.89E-02
August	Arsenic, Total	4.39E-03
	Barium, Total	<1.78E-03
	Beryllium, Total	1.39E-04
	Cadmium, Total	1.45E-04
	Lead, Total	2.87E-03
	Manganese, Total	5.84E-03
	Molybdenum, Total	1.45E-03
	Nickel, Total	2.84E-03
	Silver, Total	2.88E-04
	Thallium, Total	2.76E-03
	Vanadium, Total	1.45E-03
	Zinc, Total	1.67E-02
September	Arsenic, total	<3.14E-05
	Barium, total	<1.66E-02
	Beryllium, total	<6.18E-06
	Cadmium, total	<1.82E-07
	Lead, total	<6.64E-05
	Manganese, total	<2.91E-05
	Molybdenum, total	1.23E-06
	Nickel, total	<1.03E-04
	Silver, total	<1.98E-06
	Thallium, total	<1.39E-04
	Vanadium, total	3.53E-06
	Zinc, total	<8.15E-04

Table 5-7. 1995 PM_{10} non-radiological air monitoring results for Station 14 (Concluded).

Composite Period	Analyte (total)	Concentration (mg/m3)
October	Arsenic, Total	1.20E-03
	Barium, Total	6.07E-02
	Beryllium, Total	6.63E-05
	Cadmium, Total	8.22E-06
	Lead, Total	5.39E-03
	Manganese, Total	2.46E-03
	Molybdenum, Total	1.24E-05
	Nickel, Total	1.19E-03
	Silver, Total	5.19E-07
	Thallium, Total	<9.96E-05
	Vanadium, Total	1.44E-05
	Zinc, Total	9.95E-02
November	Arsenic, Total	8.03E-04
	Barium, Total	6.47E-02
	Beryllium, Total	<4.49E-06
	Cadmium, Total	1.01E-06
	Lead, Total	<4.92E-05
	Manganese, Total	1.34E-03
	Molybdenum, Total	3.71E-04
	Nickel, Total	<8.54E-05
	Silver, Total	1.80E-04
	Thallium, Total	1.69E-03
	Vanadium, Total	1.50E-05
	Zinc, Total	1.99E-02
December	Arsenic, total	<6.99E-03
	Barium, total	<3.32E-01
	Beryllium, total	<6.99E-04
	Cadmium, total	<6.99E-04
	Lead, total	<6.99E-03
	Manganese, total	8.38E-04
	Molybdenum, total	<1.40E-03
	Nickel, total	<2.79E-03
	Silver, total	<6.99E-04
	Thallium, total	<1.40E-02
	Vanadium, total	<6.99E-04
	Zinc, total	<8.59E-02

Note: mg/m^3 = milligrams per cubic meter.

Table 5-8. 1995 PM_{10} non-radiological air monitoring results for Well 6 (Continues).

Composite Period	Analyte (total)	Concentration (mg/m3)
May	Arsenic, Total	2.71E-03
	Barium, Total	<7.64E-03
	Beryllium, Total	5.46E-04
	Cadmium, Total	2.74E-04
	Lead, Total	5.46E-03
	Manganese, Total	3.51E-03
	Molybdenum, Total	2.74E-03
	Nickel, Total	2.65E-03
	Silver, Total	5.46E-04
	Thallium, Total	8.13E-03
	Vanadium, Total	2.74E-03
	Zinc, Total	1.98E-02
June	Arsenic, Total	1.38E-03
	Barium, Total	<1.88E-03
	Beryllium, Total	1.35E-04
	Cadmium, Total	1.41E-04
	Lead, Total	2.79E-03
	Manganese, Total	1.78E-03
	Molybdenum, Total	1.41E-03
	Nickel, Total	2.76E-03
	Silver, Total	2.80E-04
	Thallium, Total	2.68E-03
	Vanadium, Total	1.41E-03
	Zinc, Total	2.19E-02
August	Arsenic, Total	1.39E-03
	Barium, Total	<3.34E-03
	Beryllium, Total	2.81E-04
	Cadmium, Total	1.41E-04
	Lead, Total	1.35E-03
	Manganese, Total	1.79E-03
	Molybdenum, Total	1.42E-03
	Nickel, Total	1.33E-03
	Silver, Total	2.81E-04
	Thallium, Total	2.70E-03
	Vanadium, Total	1.42E-03
	Zinc, Total	2.72E-02

Table 5-8. PM_{10} non-radiological air monitoring results for well 6 (Continues).

Composite Period	Analyte (total)	Concentration (mg/m3)
September	Arsenic, total	<4.03E-05
	Barium, total	<1.55E-02
	Beryllium, total	<6.79E-06
	Cadmium, total	<1.33E-06
	Lead, total	<6.75E-05
	Manganese, total	<7.79E-05
	Molybdenum, total	<1.06E-05
	Nickel, total	<1.03E-04
	Silver, total	<4.14E-06
	Thallium, total	<1.50E-04
	Vanadium, total	<8.47E-06
	Zinc, total	<8.05E-04
October	Arsenic, Total	3.66E-03
	Barium, Total	1.21E-02
	Beryllium, Total	6.76E-05
	Cadmium, Total	9.05E-06
	Lead, Total	2.44E-03
	Manganese, Total	3.03E-03
	Molybdenum, Total	4.80E-04
	Nickel, Total	8.80E-04
	Silver, Total	5.15E-07
	Thallium, Total	<9.89E-05
	Vanadium, Total	1.43E-05
	Zinc, Total	7.50E-02
November	Arsenic, Total	6.61E-06
	Barium, Total	1.45E-01
	Beryllium, Total	<2.18E-06
	Cadmium, Total	3.44E-06
	Lead, Total	2.35E-03
	Manganese, Total	3.22E-03
	Molybdenum, Total	6.00E-04
	Nickel, Total	7.83E-04
	Silver, Total	8.27E-04
	Thallium, Total	5.13E-03
	Vanadium, Total	3.94E-05
	Zinc, Total	3.24E-02

Table 5-8. 1995 PM_{10} non-radiological air monitoring results for Well 6 (Concluded).

Composite Period	Analyte (total)	Concentration (mg/m^3)
December	Arsenic, total	<6.95E-03
	Barium, total	<3.62E-01
	Beryllium, total	<6.95E-04
	Cadmium, total	<6.95E-04
	Lead, total	<6.95E-03
	Manganese, total	1.39E-04
	Molybdenum, total	<1.39E-03
	Nickel, total	<2.78E-03
	Silver, total	<6.95E-04
	Thallium, total	<1.39E-02
	Vanadium, total	<6.95E-04
	Zinc, total	<8.62E-02

Note: mg/m^3 = milligrams per cubic meter.

Evidence of water erosion has been observed within the outer control fence at Clean Slate 2. The erosive effects of water may pose another mechanism for transport of the contaminated material. Essington and Fowler (1976) observed the ability of Pu to migrate to deeper layers of soil with time. Vertical transport of contaminants into the soil column may allow greater exposure of roots and a potential for root uptake of contaminants by the plants. Soil profiles from the safety-shot areas at TTR indicate a decrease in the Pu-to-Am ratio with depth (Romney et al. 1975), suggesting greater vertical movement of Am-241 relative to Pu-239 and Pu-240. This same report also stated that there is evidence showing that Am is much more readily available to plants through roots than is Pu. Gilbert et al. (1975) stated that erosive processes and penetration into the soil would eventually flatten out peak contaminant concentrations, and that there was a need for long-term hazard evaluation to determine the change in contaminant concentrations over time at the safety-shot areas.

5.5 KMI Services Monitoring Program

KMI Services routine environmental monitoring activities at TTR include water and wastewater monitoring, operating air monitoring equipment for SNL and DOE/NV, radiological surveillance, soil sampling, management of the long-term environmental TLD network at TTR and adjacent off-site locations, and hazardous waste sampling.

Environmental compliance permits for TTR include those for the potable water supply, sewage, and air quality. These permits are updated annually, or as necessary. Table A-2 of Appendix A shows the current permit list.

In addition, KMI Services assists SNL in meeting two other annual requirements: the SARA, Title III (the Emergency Planning and Community Right-to-Know Act [EPCRA]), reporting requirements for all TTR activities and the State of Nevada extremely hazardous material reporting requirements.

5.5.1 Water

Using preserved sample bottles supplied by a state-certified laboratory, KMI Services staff collected water samples quarterly from the Well 6 distribution system that services Technical Area 3 (TA-3) and transported the samples to the laboratory in Las Vegas, NV for bacteriological analysis (Table 5-9). All analyses met the requirements of the total coliform rule. Monthly samples were collected in 1995.

Table 5-9 summarizes water sampling of the public water systems at TTR and the frequency and type of analysis and results. Waste water is sampled quarterly by the U.S. Air Force (USAF) at the headwater end of the facultative sewage lagoon (Table 5-10).

Well 6 is also sampled by the EPA to provide a radiological analysis survey for the Long-Term Hydrologic Monitoring Program. Sampling sites are based on the *Tonopah Test Range Site Sampling Plan* (DOE 1990) for compliance with the Safe Drinking Water Act.

Table 5-9. Summary of 1995 SNL/NV public water systems sampling.

Public Water System	Frequency/Analysis	Results
NY3014 12*	Monthly/bacteriologic, total coliform	All analyses were negative for coliform.

*TTR Well 6.

Table 5-10. Summary of 1995 SNL/NV wastewater sampling program.

Location	Number of Samples	Frequency	Analysis	Analytical Laboratory
Area 3 Waste Water Monitoring Station	48 hour composite sample	Quarterly	Inorganic (metals) Inorganic (general) Organic (EPA Method 608) Volatile Organics (EPA Method 624) Semi-Volatile Organics (EPA Method 625)	Environmental Control Technology
			Gross Alpha/Beta Gamma Scan Tritium	TMA Eberline

The permit for Well 6 is renewed annually by the State of Nevada Bureau of Health Protection Services. Permit updates are obtained annually DOE/KAO and copies are forwarded to SNL/NV.

5.5.2 Sewage System

Sewage from SNL facilities at TA-3 of TTR goes to the USAF facultative sewage lagoon. The NDPES permit was held by DOE/NV through July 1992 when it was transferred to the USAF Nellis Air Force Base (NAFB) Range Complex. The sewage from locations in remote areas flows into septic tanks and associated drain fields. These discharges fall primarily under the statutory authority of the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA) as amended. These discharges are regulated under Nevada Administrative Code, Chapters 444-445 (Appendix A, Table A-1), and are administered by the State of Nevada, Bureau of Health Protection Services, and the NDEP. The wastewater samples from the headworks and sewage lagoons are analyzed quarterly for biochemical oxygen demand (BODs), TPH, VOCs, and RCRA 8 metals. Additionally, flow into the lagoon is limited to a 30-day average of 30,000 gal per day, with a daily maximum of 75,000 gal per day. Quarterly Discharge Monitoring Reports (DMRs) are prepared and submitted by the USAF to the Nevada Division of Environmental

Protection. Sandia National Laboratories is subject to the same monitoring requirements as the USAF. SNL must provide monitoring data to the USAF at the end of each quarter for inclusion in the DMR.

5.6 Assessment of Potential Dose to the Public

The three Clean Slate sites are considered a potential source of airborne radionuclide contamination through the process of wind resuspension of the transuranic-contaminated surface soils associated with each site. A radiation dose was calculated based on the re-suspension of this material. The dose assessment was performed for on-site and off-site receptors where non-SNL/NV personnel abide or reside. The concept of "on-site receptors" is conservatively assumed to include members of the military, military contractors, and other non-SNL/NV personnel who work at TTR but over whom SNL/NV has little or no operational control. This definition is believed to be consistent with current EPA and DOE guidance.

The dose calculation results summarized in this section were performed to document NESHAP (40 CFR 61, Subpart H) compliance using the EPA CAP88-PC computer code (EPA 1991). More detailed information pertaining to this calculation may be found in the *NESHAP Annual Report for CY 1995, Sandia National Laboratories, Nevada* (SNL 1996a), *Radiological Dose Calculations for NESHAP Compliance for Sandia National Laboratories, Nevada, 1995* (SNL 1996b), and *Supplemental Dose Assessment Data for Sandia National Laboratories, Nevada, 1995* (SNL 1996c).

5.6.1 Receptor Locations

For determination of potential dose to the public, receptor locations were divided into on-site and off-site. The TTR on-site receptor locations consist of the On-Base Housing Area, the TTR Airport Area, the South Perimeter, and the 554th Range Squadron O&M Complex (Figure 5-1). The TTR off-site region includes distinct populations of seasonal workers and permanent residents. Zones for these two sets of public receptors are shown in Figure 5-2. The first zone shows the permanent public-receptor zone and the second zone shows the seasonal public-receptor zone.

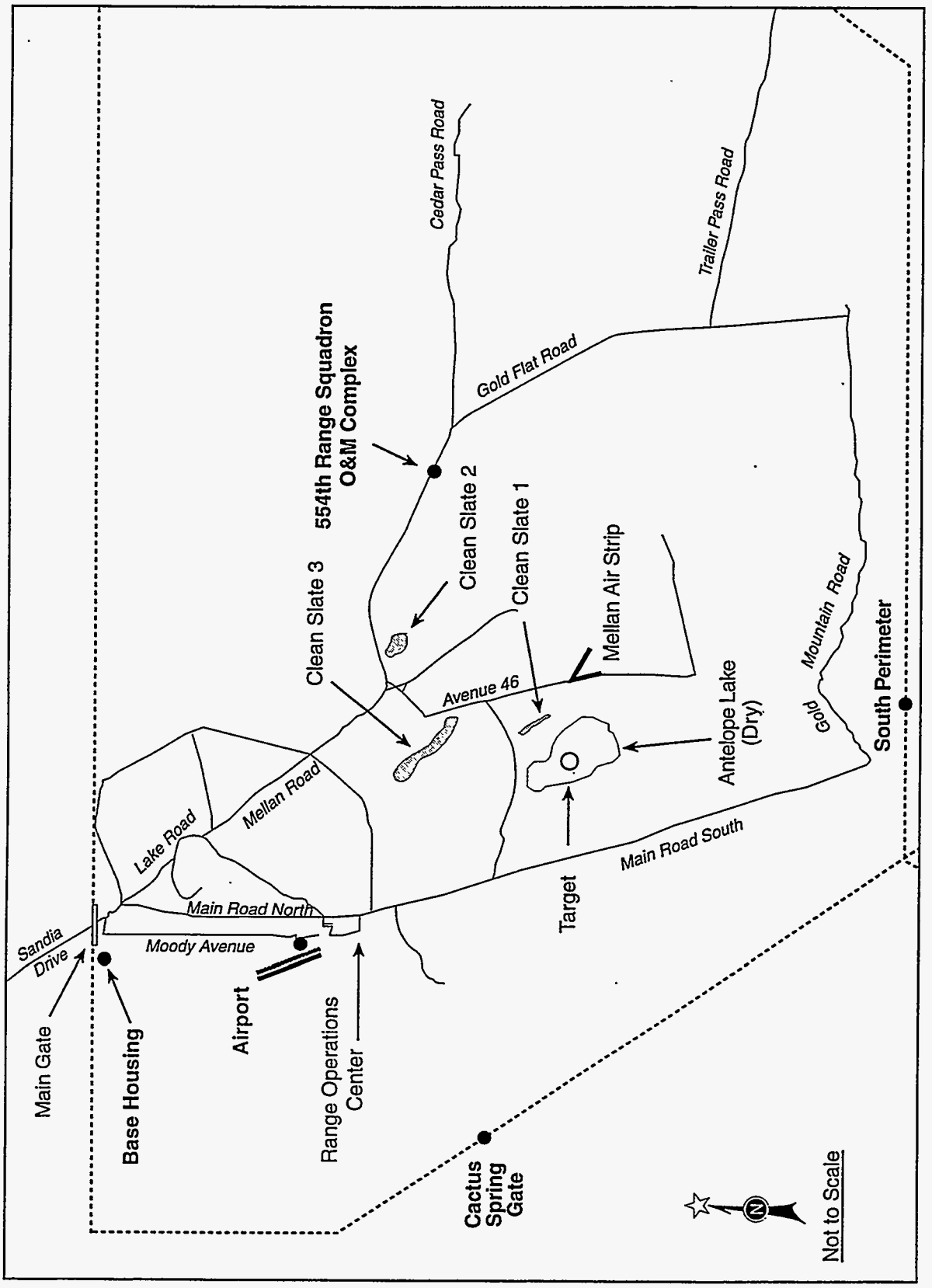

Figure 5-1. Tonopah Test Range On-site receptor locations.

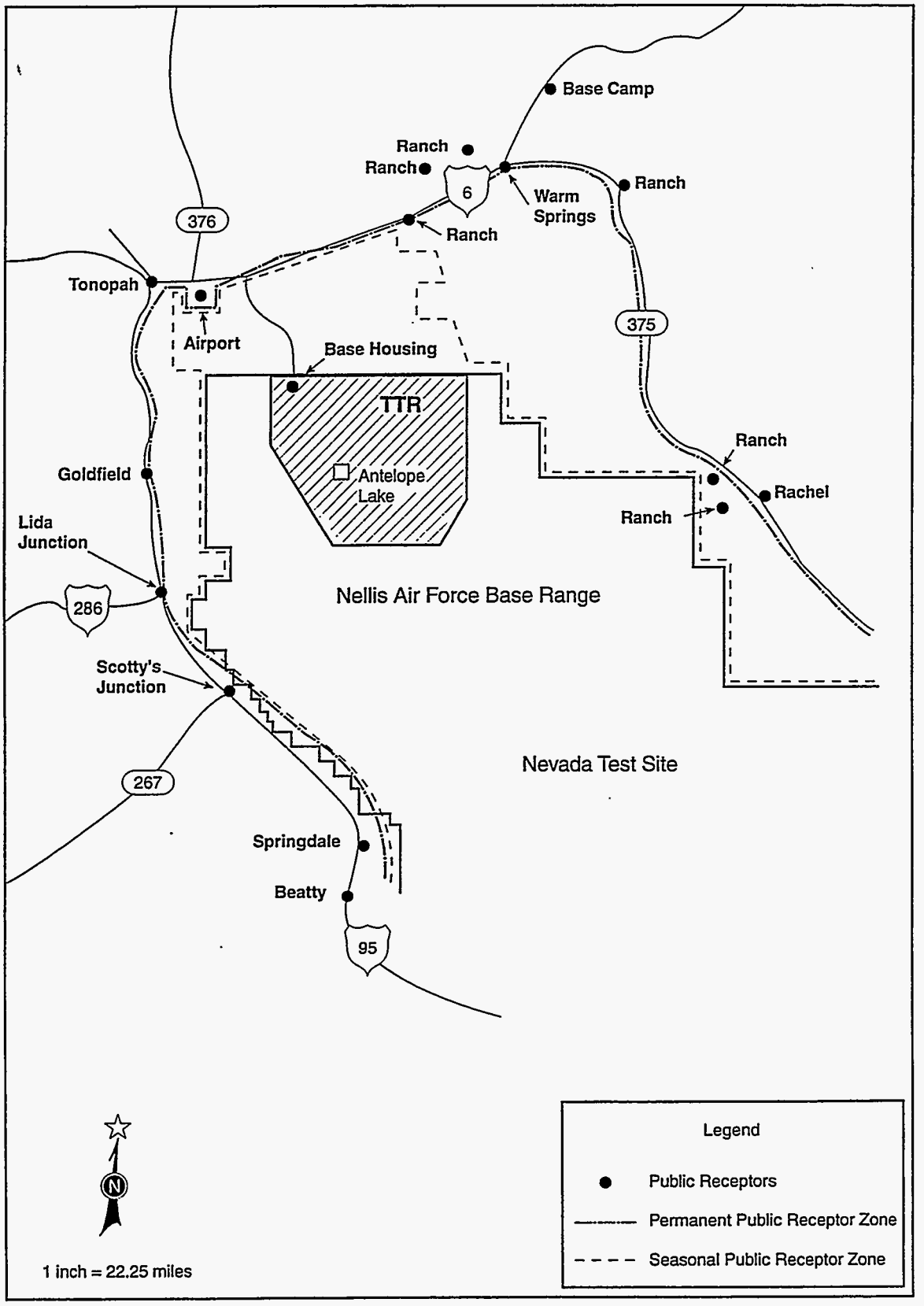

Figure 5-2. Public receptor zone around the Tonopah Test Range.

5.6.2 Meteorological Data

A composite meteorological data set for the TTR area was developed based on information from two sources: Tonopah Municipal Airport and on-site at TTR. The Tonopah Municipal Airport is located approximately 65 km north of TTR (DOC 1994) and an on-site meteorological station is located in the northern portion of TTR (DOC 1993). The composite data set includes hourly meteorological observations of wind direction, wind speed, and stability class (inferred from wind and solar insolence).

5.6.3 Release Sources

During 1995, no radiological point-source releases occurred as a result of TTR operations. The potential releases associated with the Clean Slate sites occur as a result of the wind re-suspension of soil particulates (fugitive dust) contaminated with transuranic radionuclides. The 1977 EG&G aerial radiological survey of Clean Slates 1, 2, and 3 documented the level of residual surface-soil activity in the form of radiation isopleths showing the soil activity of Am-241, Pu-239, and Pu-240 (EG&G 1979b). The study concluded that the contaminated area associated with the Clean Slate sites is approximately 20 million square meters.

The annual diffuse source term associated with the Clean Slate sites was calculated using a wind resuspension model which calculates the rate at which soil particulates become airborne. This model uses site-specific information (e.g., wind speed, wind direction, and contaminant source term) whenever appropriate.

A release of 0.39 curies per year (Ci/yr) of total activity (Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, and Am-241) was calculated as the re-suspended source term associated with the Clean Slate sites. This re-suspended source term is for particulate matter which is 10 μm or less in diameter, and is assumed to be entirely respirable.

5.6.4 Radiological Dose Assessment

The diffuse emissions associated with the three Clean Slate sites were the focus of the dose assessment because there were no point-source radionuclide emissions. The regional population dose was calculated to be 0.90 person-rem per year (person-rem/yr). The dose to the MEI was calculated to be 1.1 mrem/yr. The MEI is located at the TTR Airport Area. The MEI dose is a factor of approximately eight below the NESHAP dose standard of 10 mrem/yr.

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APPENDIX A

STATE OF NEVADA REGULATIONS AND PERMIT LISTINGS

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Table A-1. State of Nevada Regulations Applicable to the Tonopah Test Range.

Regulation	Applicable Activity
Nevada Wildlife Regulations Nevada Revised Statute, Title 45, Chapter 501. NRS 501.010-501.243 Wildlife Regulations NAC 504.510-504.550	- Diversion of surface drainage channels - Clearing, leveling, and grading of site - Road construction - Highway improvement - Installation of water lines - Installation of water reservoirs - Installation of fuel storage tanks - Construction of sanitary landfill - Construction of explosives bunkers
Nevada Air Quality Regulations Nevada Revised Statutes, Title 40, Public Health and Safety, Chapter 445. NRS 445.401-445.601 NAC 445.430-445.995	- Diversion of surface drainage channels - Clearing, leveling, and grading of site - Road construction - Highway improvement - Installation of water lines - Installation of water reservoirs - Installation of fuel storage tanks - Construction of sanitary landfill - Construction of explosives bunkers - Construction of support buildings - Incinerator - Diesel-powered emergency generator
Nevada Water Pollution Nevada Revised Statutes, Title 40, Public Health and Safety, Chapter 445. NRS 445.131-445.354 NAC 445.070-445.194	- Construction of operation of Control Regulations sewage treatment plant - Disposal of drilling fluids - Water treatment plant

Table A-1. State of Nevada Regulations Applicable to the Tonopah Test Range (Continued).

Regulation	Applicable Activity
Nevada Regulations Solid Waste Management Nevada Revised Statutes, Title 40, Public Health and Safety, Chapter 444. NRS 444.510-444.610 Regulations Governing Solid Waste Management	- Clearing, leveling, and grading of site - Construction of support buildings - Construction and operation of sanitary landfill - Daily sanitary wastes - Disposal of sewage sludge
Nevada Regulations Governing Individual Sewage Systems Nevada Revised Statutes, Title 40, Public Health and Safety, Chapter 444. NRS 444.650 NAC 444.750-444.840	- Construction of sewage collection systems
Nevada Public Water Supply and Public Water Systems Regulations Nevada Revised Statutes, Title 40, Public Health and Safety, Chapter 445. NRS 445.030 NAC 445.370-445.420	- Installation of water lines - Installation of water reservoirs

Table A-1. State of Nevada Regulations Applicable to the Tonopah Test Range (Concluded).

Regulation	Applicable Activity
Nevada Water Resources Nevada Revised Statutes, Underground Water and Wells, Chapters 533 and 534. NRS 534.010-534.190 Regulations for Drilling Wells	- Installation of water lines - Installation of water reservoirs
Radiation Control Nevada Revised Statutes, Title 40, Public Health and Safety, Chapter 459. NRS 459.010-459.290 Nevada Regulations for Radiation Control	- Use of radioactive sources

Table A-2. Tonopah Test Range Permits and Registrations.

	Type of Activity	Permit Expiration Date	Report to Agency Due by	Comments
Air Quality*				
1.	Petro Storage JP-4	09/15/97		State of Nevada (NV) to U.S. Air Force (USAF) Permit #2449
2.	Petro Storage JP-4	03/26/97		State of NV to USAF Permit #2448
3.	Petro Storage JP-4	03/26/97		State of NV to USAF Permit #2447
4.	Petro Storage JP-4	03/26/97		State of NV to USAF Permit #2446
5.	Petro Storage Diesel #1	03/26/97		State of NV to USAF Permit #2445
6.	Petro Storage Diesel #1	09/15/93 (in process of being renewed)		State of NV to USAF Permit #1661
7.	Large Batch Plant (Ross)	02/12/96	04/15/93†	State of NV to U.S. Department of Energy/ Nevada Operations Office (DOE/NV) Permit #2229

*Air Quality Activities 1 to 6 apply to the surface tanks in Technical Area 10 (Industrial Area).

†Annual Summary Report transmitted through the DOE/NV/Environmental Programs Departments (EPD) Office to Nevada Division of Environmental Protection.

‡National Pollutant Discharge Elimination System (NPDES) permit renewal application has been transmitted to the State of Nevada. The State is presently renewing the application and design modification. Expected renewal date is unknown.

Table A-2. Tonopah Test Range Permits and Registrations (Continued).

	Type of Activity	Permit Expiration Date	Report to Agency Due by	Comments
8.	Small Batch Plant (S. C. Johnson)	02/19/96	04/15/93†	State of NV to DOE/NV Permit #2231
9.	Crusher Cedarapids Mdl #2416		04/15/93†	State of NV to DOE/NV Permit to Operate #2456
10.	Crusher Cedarapids Mdl #1524		04/15/93†	State of NV to DOE/NV Permit to Operate #2457
11.	Screen Cedarapids Mdl #2416		04/15/93†	State of NV to DOE/NV Permit to Operate #2455
12.	Surface Disturbance	09/15/98	04/15/93†	State of NV to DOE/Kirtland Area Office (DOE/KAO) Air Quality Permit #2844
13.	Incinerator (MDL 500CA)	03/26/98	04/15/93†	State of NV to USAF Permit #2450
14.	Vapor Extraction (Fire Training Pit)	03/28/05		State of NV to USAF Air Quality Permit #AP9999-0547

*Air Quality Activities 1 to 6 apply to the surface tanks in Technical Area 10 (Industrial Area).

†Annual Summary Report transmitted through the DOE/NV/Environmental Programs Departments (EPD) Office to Nevada Division of Environmental Protection.

‡National Pollutant Discharge Elimination System (NPDES) permit renewal application has been transmitted to the State of Nevada. The State is presently renewing the application and design modification. Expected renewal date is unknown.

Table A-2. Tonopah Test Range Permits and Registrations (Concluded).

	Type of Activity	Permit Expiration Date	Report to Agency Due by	Comments
Water Systems				
1.	Mancamp Area Well 1A Bureau of Land Management (BLM) Well	09/30/95	Monthly	State of NV to USAF Permit #NY-4068-12C
2.	Industrial Area Well 3A Well 3B Well EH-2	09/30/95	Monthly	State of NV to USAF Permit #NY-5001-12NC
3.	SNL Compound Well 6	09/30/95	Monthly	State of NV to DOE/KAO Permit #NY-3014-12NC
4.	Tonopah Electric Combat Range (TECR) (Operations and Maintenance [O&M]) Well	09/30/95	Monthly	State of NV to USAF Permit #NY-5002-12NC
Sewage System				
1.	Tonopah Integrated Air Defense System (TIADS) Mancamp Industrial Area	08/20/92‡	Quarterly	State of NV to USAF Permit #NEV20001
Hazardous Waste				
1.	EPA Waste ID Number TTR	N/A	Yearly	EPA to DOE/KAO EPA I.D. #NV1890011991

*Air Quality Activities 1 to 6 apply to the surface tanks in Technical Area 10 (Industrial Area).
†Annual Summary Report transmitted through the DOE/NV/Environmental Programs Departments (EPD) Office to Nevada Division of Environmental Protection.
‡National Pollutant Discharge Elimination System (NPDES) permit renewal application has been transmitted to the State of Nevada. The State is presently renewing the application and design modification. Expected renewal date is unknown.

APPENDIX B

RADIOLOGICAL SAMPLING LOCATIONS AND RESULTS

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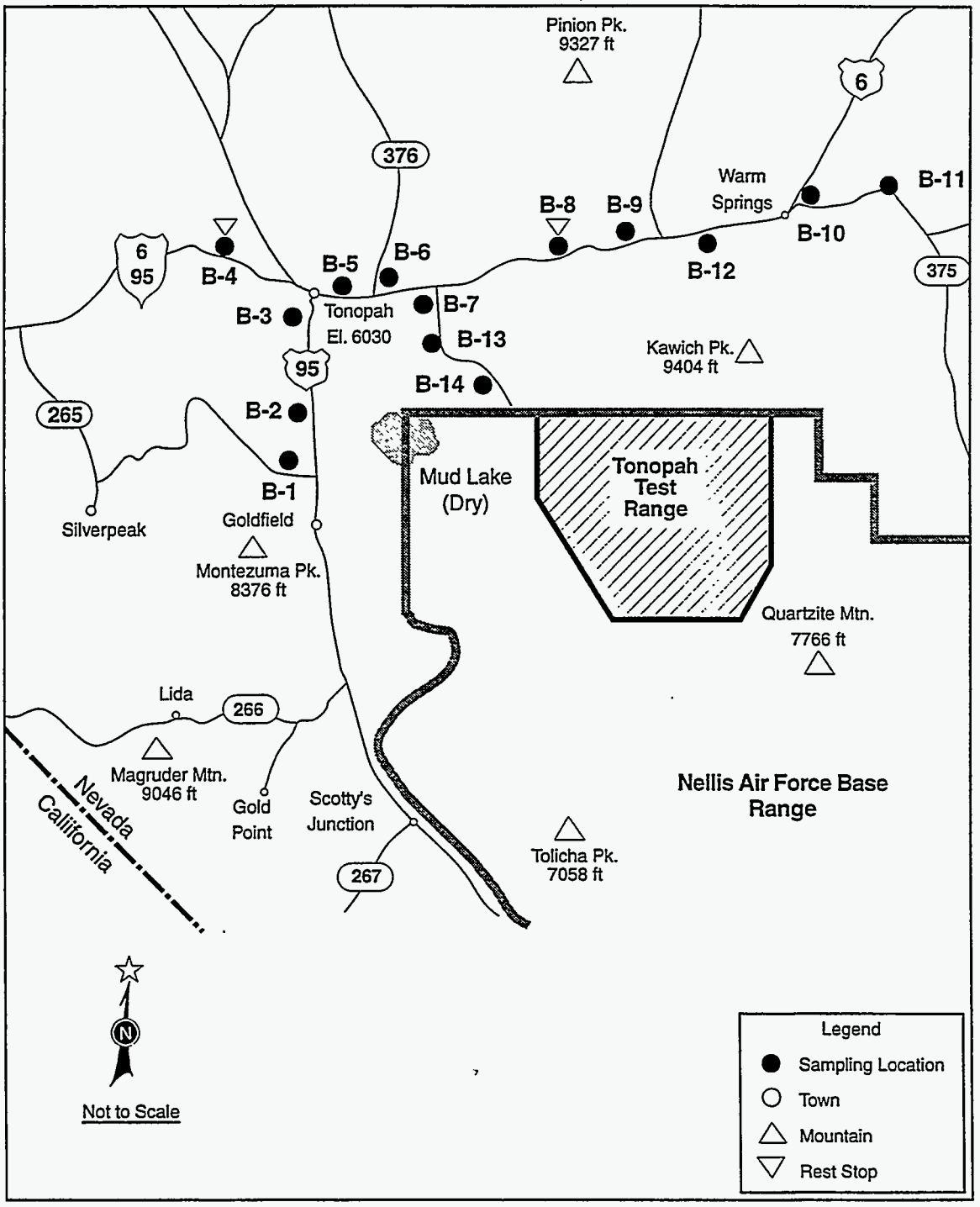

Figure B-1. Off-Site Soil Sampling Locations

Table B-1. Radiological Results of Off-Site Soil Sampling, 1995.

Location	U_{tot} (µg/g)	Cesium-137 (pCi/g)	Error Cesium-137 (pCi/g)
B-01	2.72	0.24	0.15
B-02	2.94	1.21	0.23
B-03	3.09	1.43	0.33
B-04	2.52	0.49	0.18
B-05	3.25	0.82	0.18
B-06	2.82	0.59	0.19
B-07	1.63	0.05	0.22
B-08	2.70	0.45	0.12
B-09	1.93	0.51	0.17
B-10	2.04	0.02	0.03
B-11	1.54	0.24	0.13
B-12	2.16	0.00	0.19
B-13	2.19	0.24	0.10
B-14	2.49	0.11	0.11

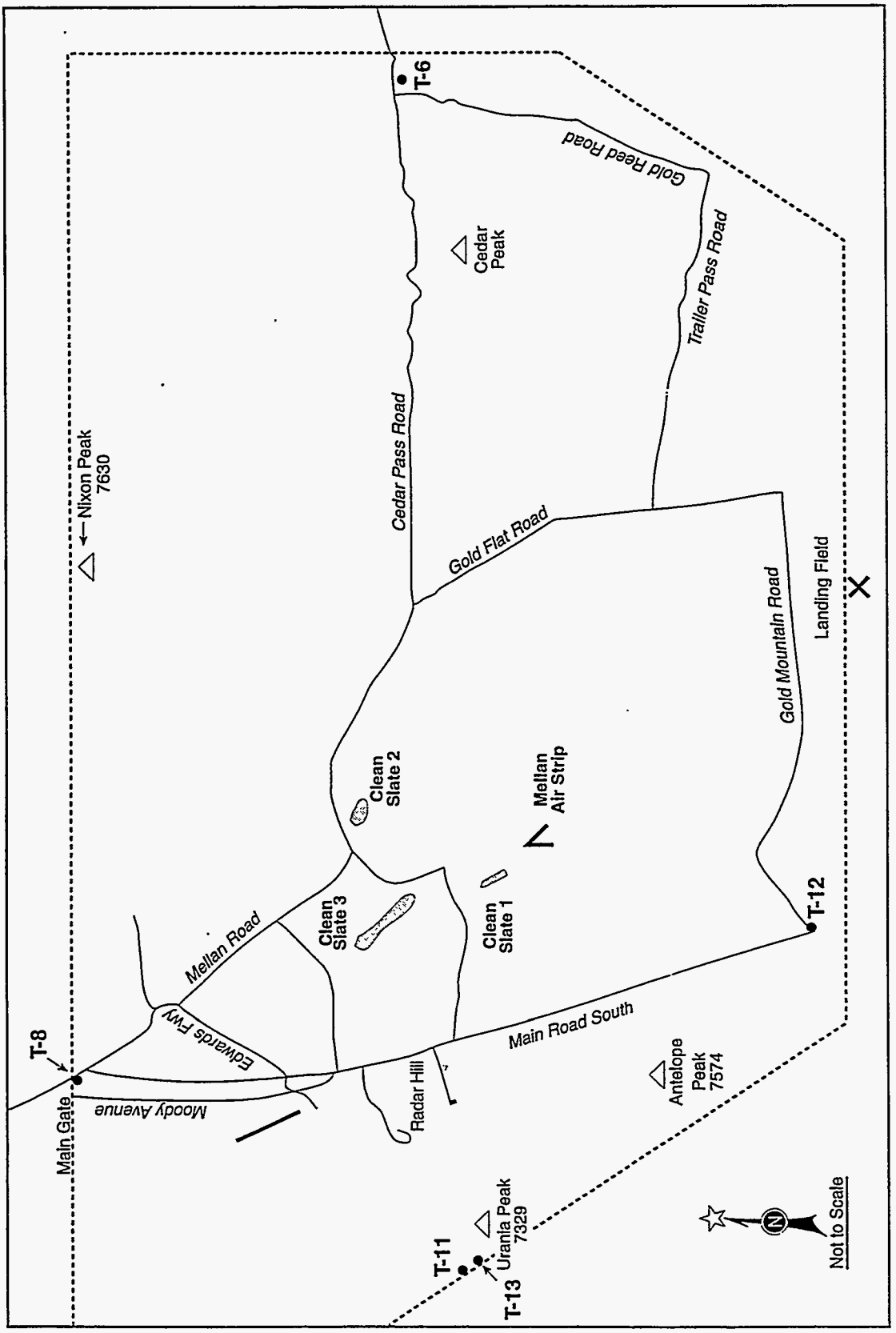

Figure B-2. Perimeter Soil Sampling Locations.

Table B-2. Radiological Results of Perimeter Soil Sampling, 1995.

Location	Utot (µg/g)	Cesium-137 (pCi/g)	Error Cesium-137 (pCi/g)
T-06	2.08	0.17	0.11
T-08	1.22	0.02	0.03
T-11	1.84	0.14	0.14
T-12	2.06	0.58	0.15
T-13	1.06	0.20	0.17

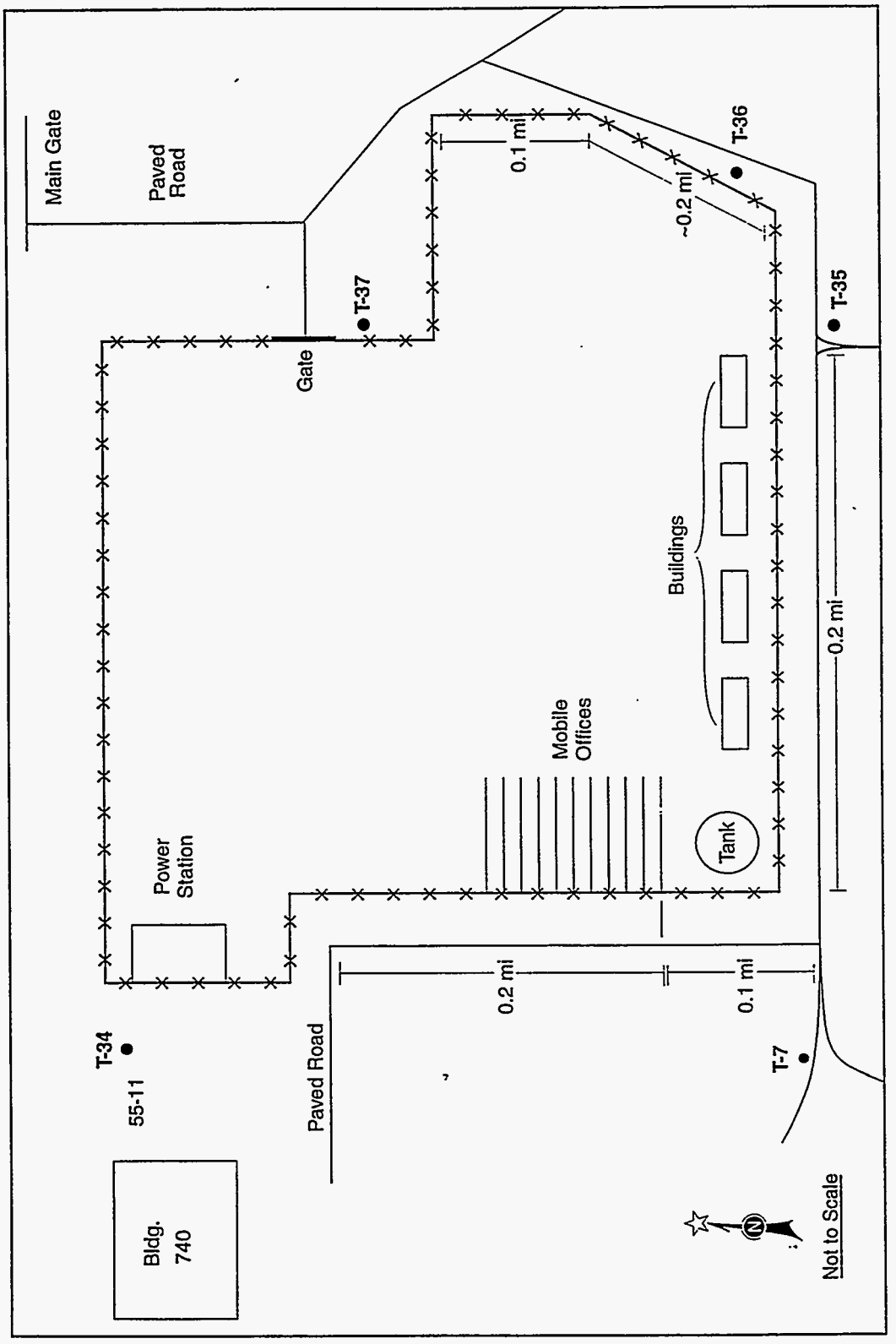

Figure B-3. Soil Sampling Locations Near the On-Base Housing Area.

Table B-3. Radiological Results of On-Base Housing Soil Sampling, 1995.

Location	Utot (µg/g)	Cesium-137 (pCi/g)	Error Cesium-137 (pCi/g)
T-07	2.02	0.00	0.05
T-34	1.55	0.32	0.11
T-35	1.23	0.19	0.12
T-36	1.65	0.25	0.13
T-37	2.44	0.19	0.08

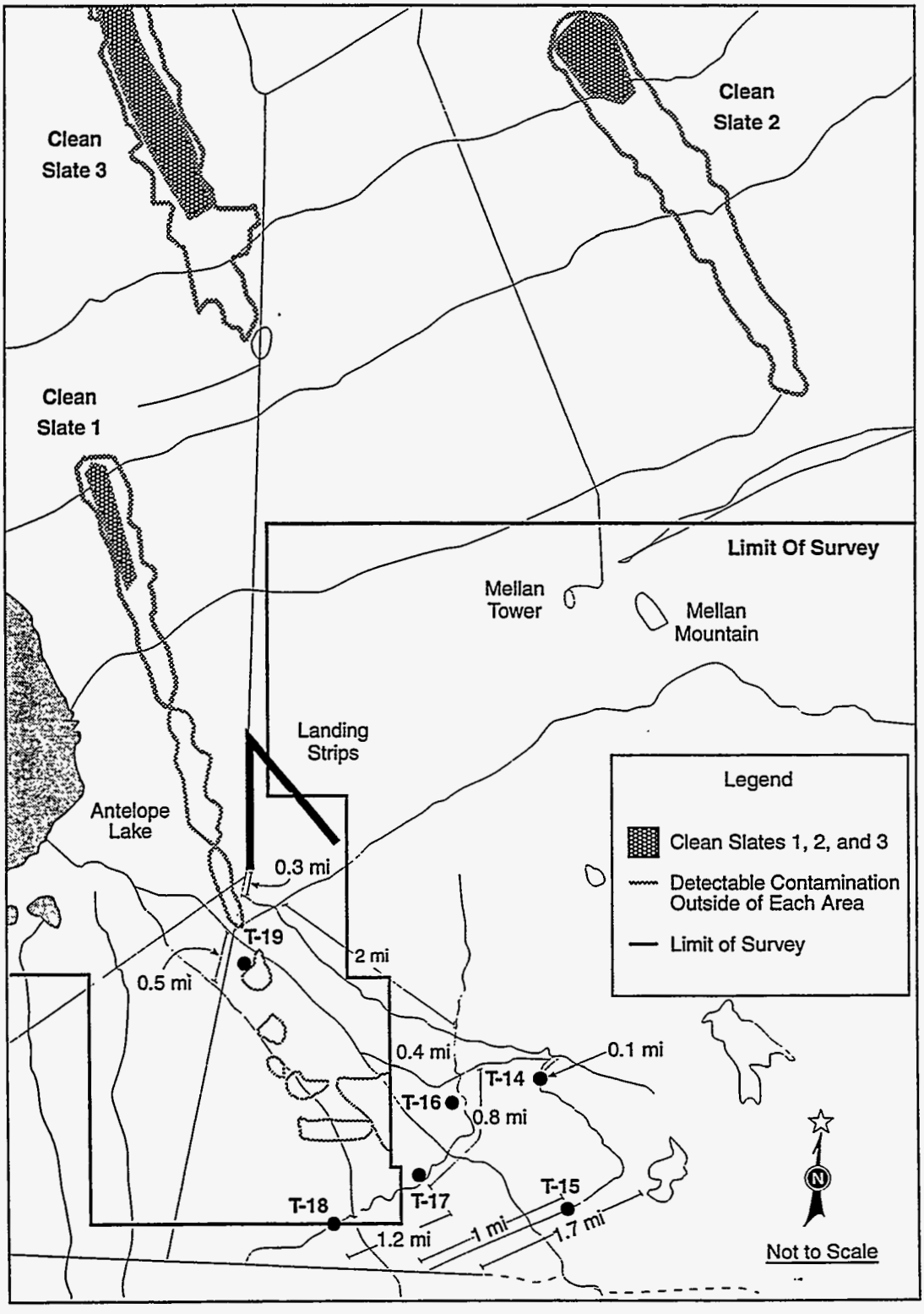

Figure B-4. Soil Sampling Locations in the South Plume Area

Table B-4. Radiological Results of South Plume Area Soil Sampling, 1995.

Location	Utot (µg/g)	Cesium-137 (pCi/g)	Error Cesium-137 (pCi/g)
T-14	1.60	0.60	0.21
T-15	1.55	0.85	0.19
T-16	1.84	0.54	0.14
T-17	1.91	0.70	0.23
T-18	1.91	0.37	0.12
T-19	2.52	0.48	0.14

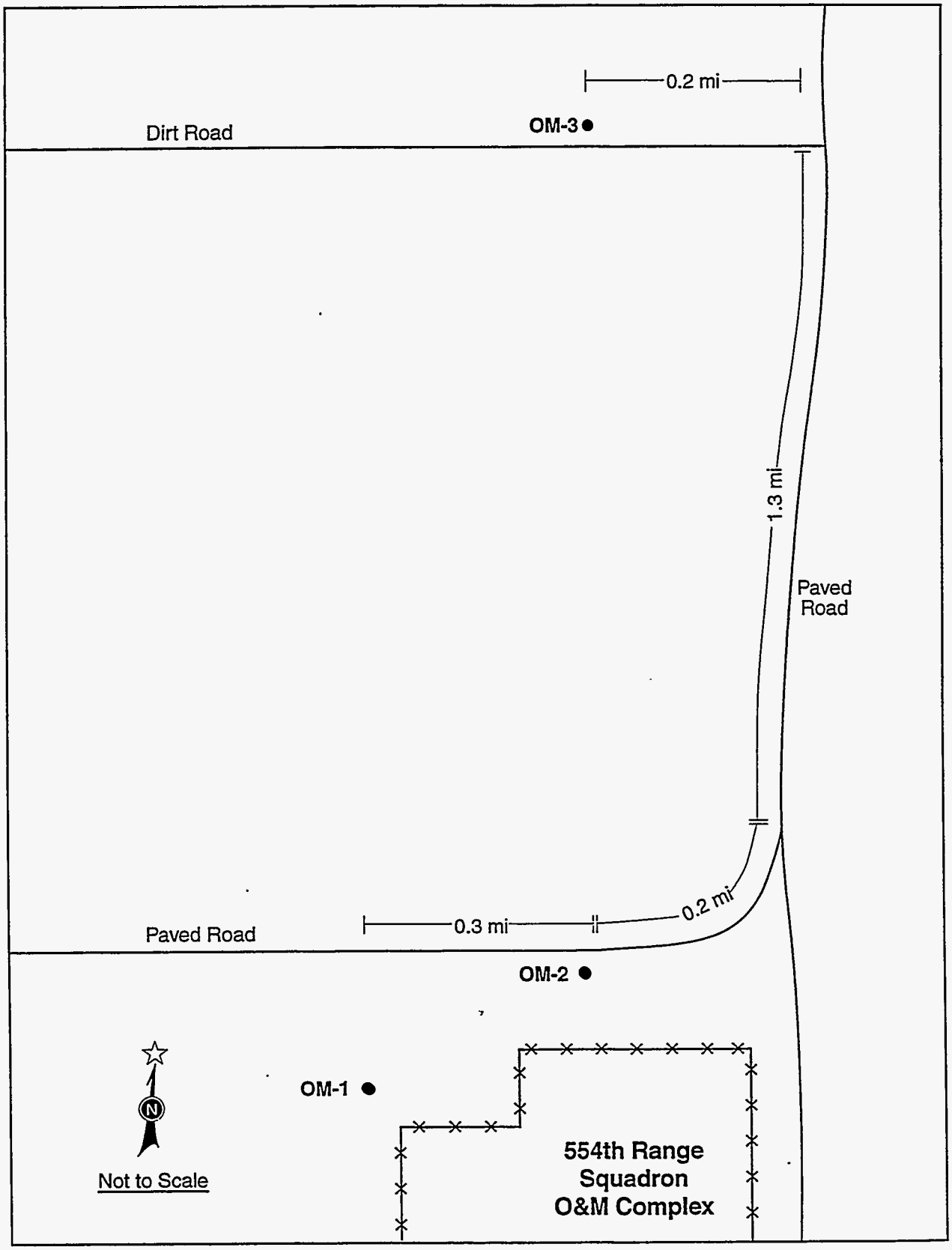

Figure B-5. Soil Sampling Locations Near the 554th Range Squadron O&M Complex.

Table B-5. Radiological Results of 554th Range Squadron O&M Complex Soil Sampling, 1995.

Location	Utot (µg/g)	Cesium-137 (pCi/g)	Error Cesium-137 (pCi/g)
OM-01	2.35	0.11	0.11
OM-02	2.61	0.25	0.09
OM-03	2.63	0.00	0.18

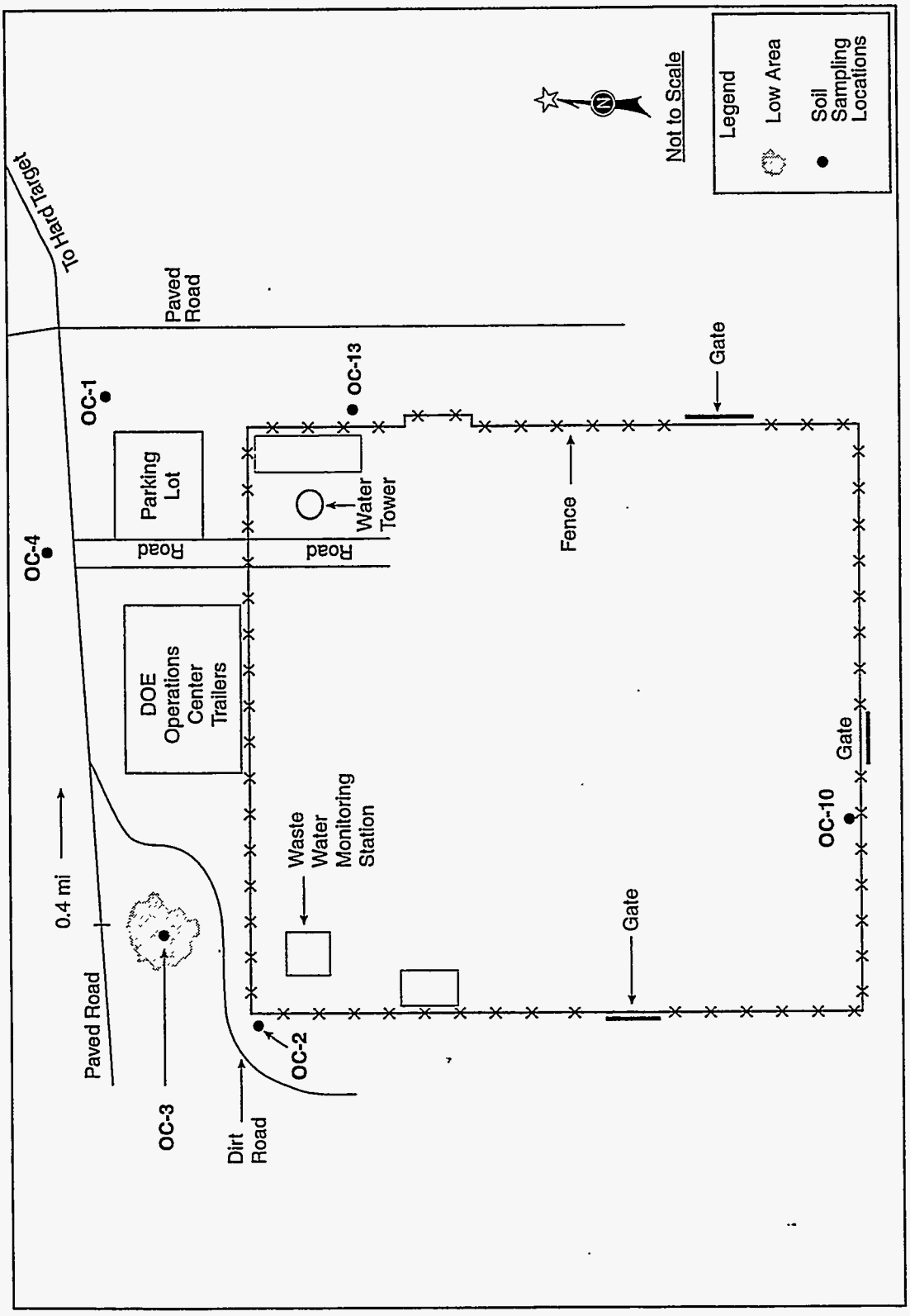

Figure B-6. Soil Sampling Locations Around the Range Operations Center.

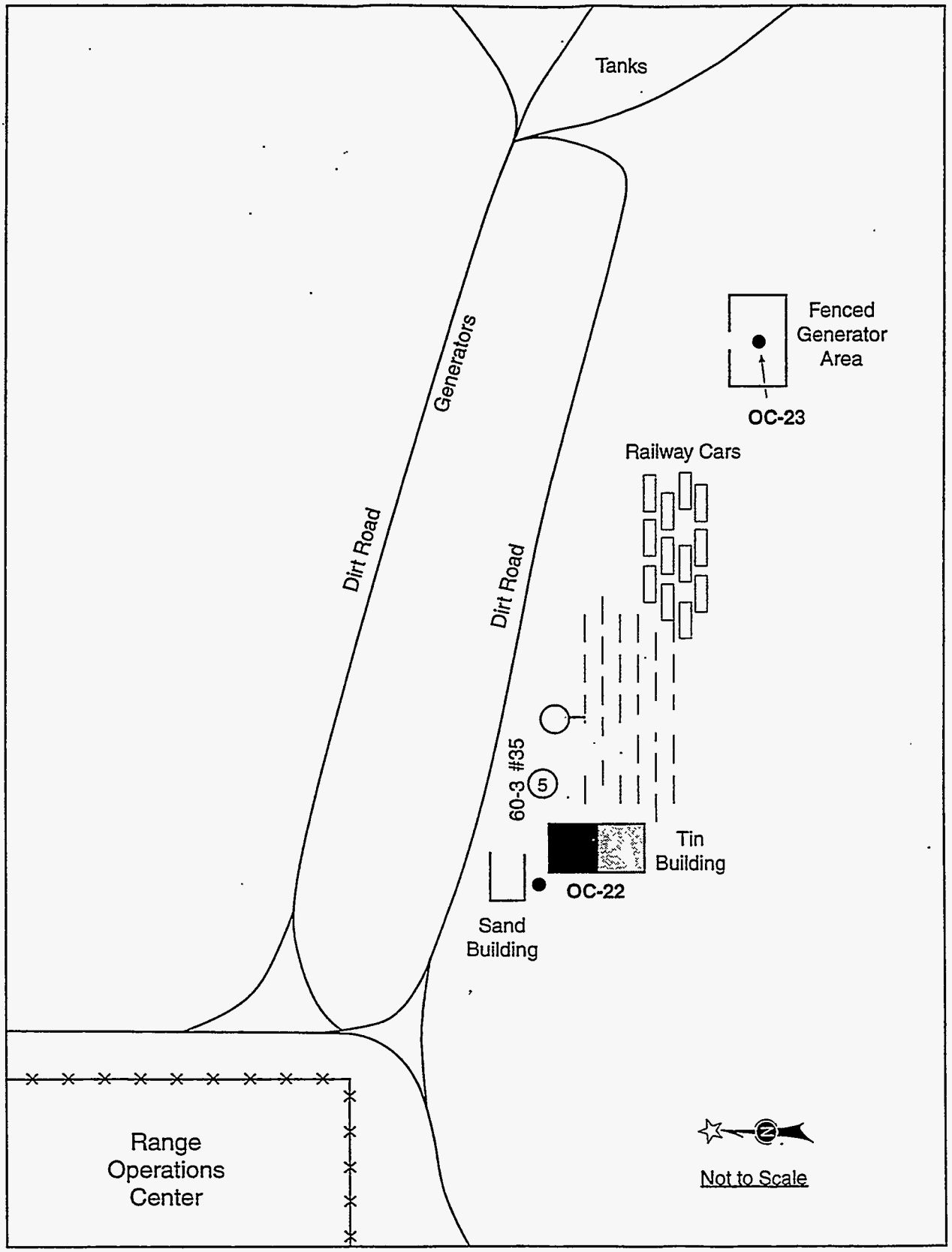

Figure B-7. Soil Sampling Locations Around the Range Operations Center Storage Yard.

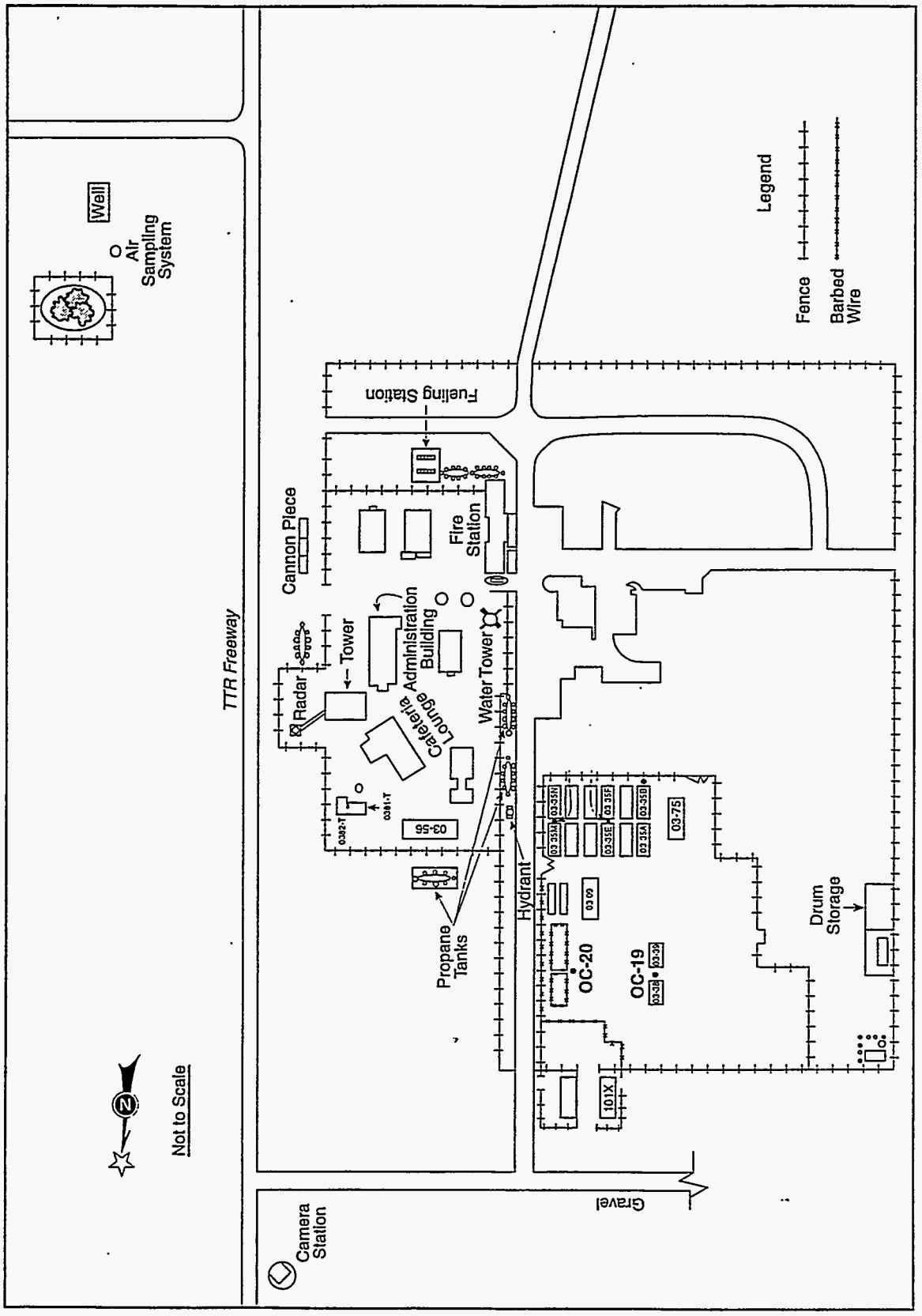

Figure B-8. Soil Sampling Locations in the Range Operations Center and Compound.

Table B-6. Radiological Results of Range Operations Center Soil Sampling, 1995.

Location	Utot (µg/g)	Cesium-137 (pCi/g)	Error Cesium-137 (pCi/g)
OC-01	2.52	0.00	0.07
OC-02	1.76	0.00	0.08
OC-03	1.58	0.15	0.10
OC-04	2.48	0.04	0.08
OC-10	2.21	0.01	0.03
OC-13	4.01	0.03	0.07
OC-19	1.76	0.02	0.03
OC-20	2.80	0.07	0.08
OC-22	2.06	0.16	0.17
OC-23	2.05	0.25	0.17

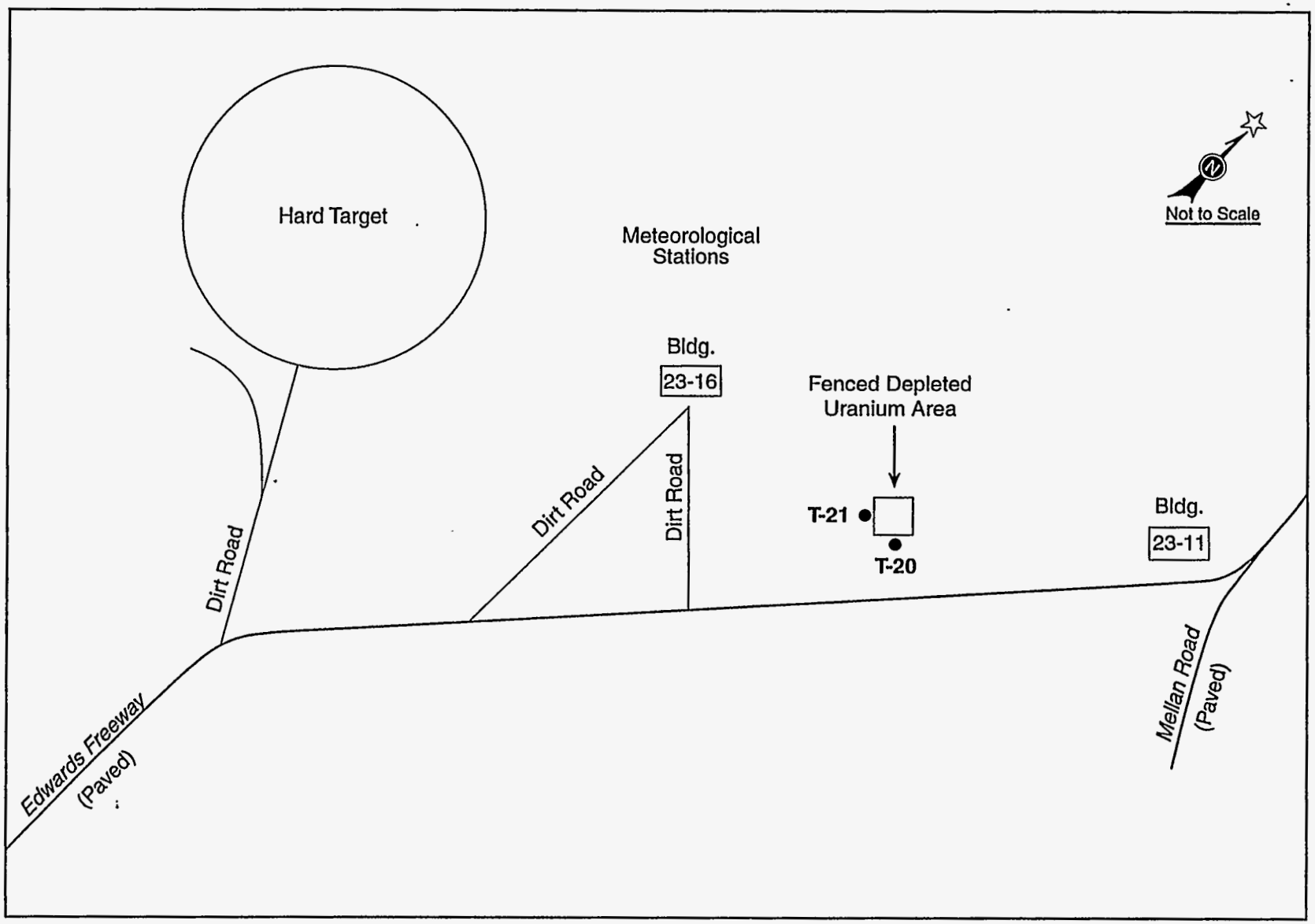

Figure B-9. Soil Sampling Locations Near the Hard Target/Depleted Uranium Area.

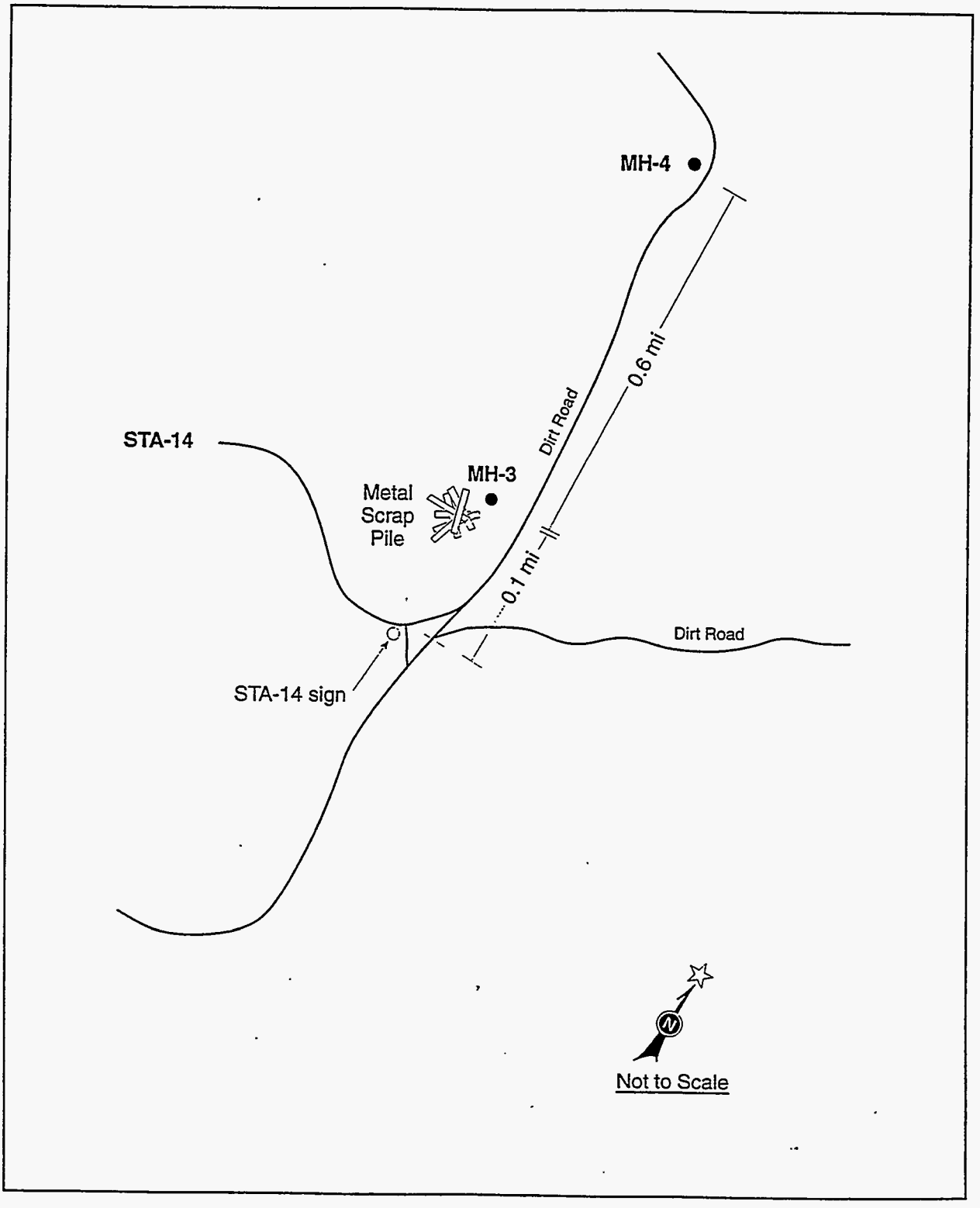

Figure B-10. Soil Sampling Locations at the Mellan Hill Area.

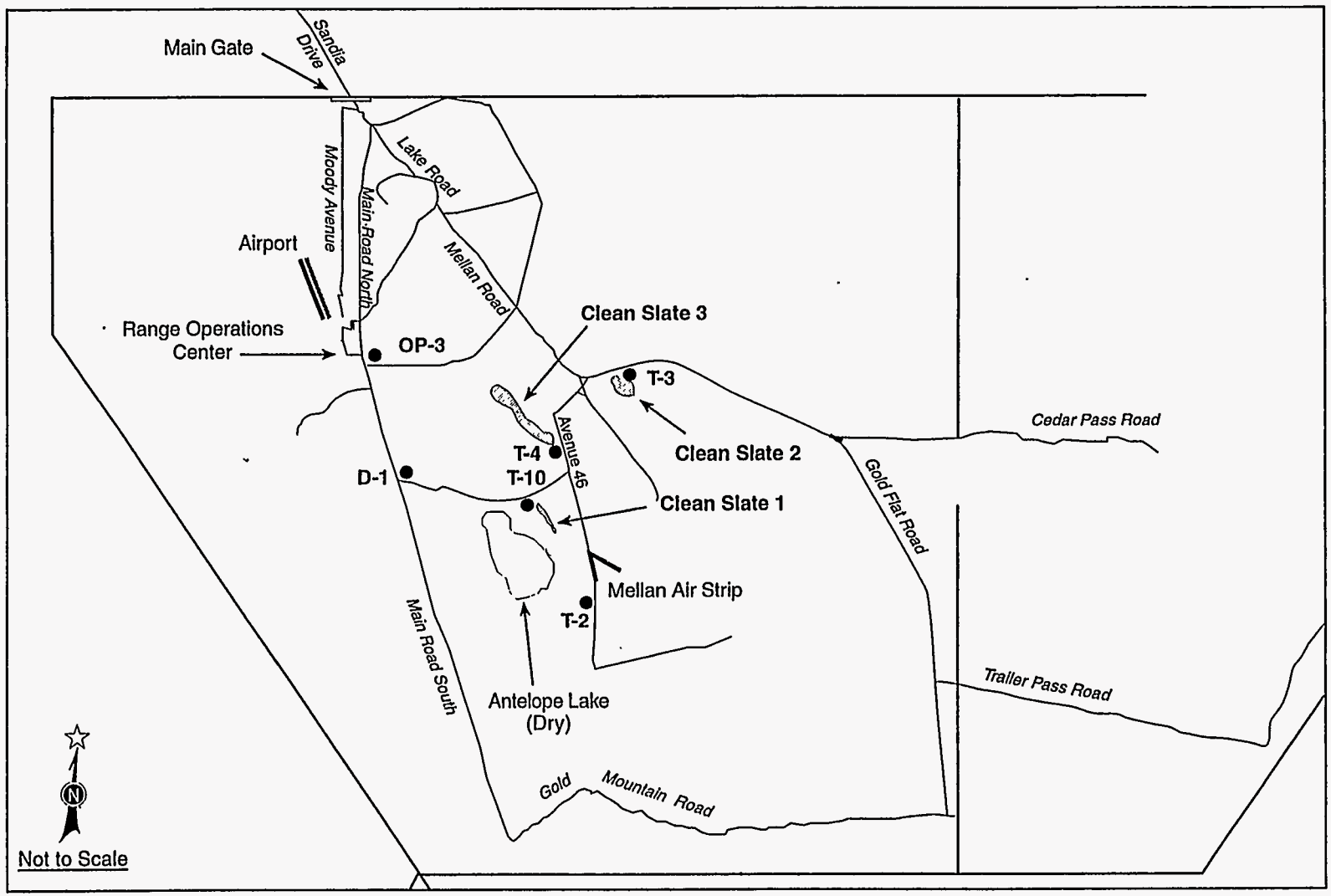

Figure B-11. Various On-Site Soil Sampling Locations.

Table B-7. Radiological Results of Various On-Site Soil Sampling Locations, 1995.

Location	Utot (µg/g)	Cesium-137 (pCi/g)	Error Cesium-137 (pCi/g)
D-01	1.73	0.03	0.08
MH-03	1.95	0.54	0.15
MH-04	2.95	0.62	0.15
OP-03	2.37	0.31	0.15
STA-14	2.75	0.27	0.10
T-02	2.70	0.22	0.11
T-03	3.02	0.54	0.22
T-04	2.54	0.36	0.13
T-10	2.49	0.39	0.12
T-20	4.30	0.49	0.17
T-21	3.06	0.55	0.17

Table B-8. Thermoluminescent Dosimeter Results for the Tonopah Test Range.

Location	Description	Type*	First Period Days	First Period (mR)	Second Period Days	Second Period (mR)	Third Period Days	Third Period (mR)	Annual Exposure (mR/yr)
T-1	Antelope Lake/ Target Area	S	189	62.9 ± 4.2	89	30.1 ± 3.9	102	42.7 ± 2.8	135.7 ± 10.9
T-2	Mellan Airstrip	S	189	69.8 ± 5.7	89	33.9 ± 1.8	102	42.6 ± 5.2	146.3 ± 12.7
T-3	Clean Site 2	S	189	71.7 ± 3.6	89	32.1 ± 2.0	102	40.9 ± 2.2	144.7 ± 7.8
T-4	Clean Slate 3, 2.3 mi south on Gaven Rd. (Ave. 46)	S	189	74.0 ± 3.2	89	32.2 ± 2.6	102	40.2 ± 3.3	146.4 ± 9.1
T-5	Gate 1	S	189	72.3 ± 4.3	89	34.3 ± 1.3	102	39.3 ± 4.5	145.9 ± 10.1
T-6	Cedar Gare	P	189	62.0 ± 7.2	89	32.3 ± 1.5	102	36.8 ± 3.6	131.1 ± 12.3
T-7	On-Site Housing	S	189	65.3 ± 6.0	89	28.8 ± 2.9	102	32.7 ± 1.8	126.8 ± 10.7
T-8	Main Gate	P	189	62.7 ± 8.6	89	31.3 ± 1.4	102	33.4 ± 4.9	127.4 ± 14.9
T-9	Project Roller Coaster Decon-tamination Area	S	189	66.4 ± 4.9	89	29.5 ± 1.8	102	32.2 ± 7.3	128.1 ± 14
T-10	Intersection of Denton Freeway and Brownes Lake Rd.	S	189	72.2 ± 3.6	89	35.3 ± 1.8	102	42.0 ± 2.6	149.5 ± 8
T-11	Cactus Springs Gate	P	189	85.5 ± 6.7	89	40.8 ± 1.4	102	43.1 ± 5.5	169.4 ± 13.6

*Site = on-site; P= perimeter; C= community (off-site).
Note: mR = milliroentgen; mR/yr = milliroentgen per year; NA = not applicable due to less than three periods of data.

Table B-8. Thermoluminescent Dosimeter Results for the Tonopah Test Range (Concluded).

Location	Description	Type*	First Period		Second Period		Third Period		Annual Exposure
			Days	(mR)	Days	(mR)	Days	(mR)	(mR/yr)
T-12	South Perimeter	P	189	69.6 ± 5.1	89	32.8 ± 5.3	102	42.3 ± 3.5	144.7 ± 13.9
T-13	Operations Center, northeast corner	S	189	65.6 ± 12.5	89	102.5 ± 11.0	102	41.6 ± 2.9	209.7 ± 26.3
T-14	Operations Center, northwest corner	S	189	58.3 ± 8.6	89	30.2 ± 1.5	102	33.9 ± 2.5	122.4 ± 12.6
T-15	Airport	S	189	71.3 ± 3.3	89	32.7 ± 4.3	102	39.7 ± 6.2	143.7 ± 13.8
T-16	Area 9	S	189	67.3 ± 3.9	89	30.8 ± 2.8	102	38.5 ± 6.1	136.6 ± 12.8
T-17	Hard Target	S	189	67.0 ± 6.1	89	32.1 ± 2.3	102	37.9 ± 3.2	137.0 ± 11.6
T-18	Town of Tonopah	C	189	59.0 ± 8.9	89	29.6 ± 3.8	102	35.6 ± 2.0	124.2 ± 14.7
T-19	Town of Goldfield	C	189	45.7 ± 13.7	89	23.5 ± 3.7	102	26.8 ± 1.9	96.0 ± 19.3
T-20	Roadside rest located on Hwy 95, west of the town of Tonopah	C	189	56.9 ± 3.4	89	28.1 ± 1.3	102	33.7 ± 1.7	118.7 ± 6.4
T-21	Roadside rest located on Hwy 6, east of the town of Tonopah	C	189	61.5 ± 2.8	89	30.2 ± 3.9	102	38.8 ± 2.5	130.5 ± 9.2
T-22	Intersection of TTR entrance and Hwy 6, Junction	C	189	61.1 ± 8.6	89	33.3 ± 2.5	102	34.5 ± 3.0	128.9 ± 14.1

*S = on-site; P = perimeter; C= community (off-site).
Note: mR = milliroentgen; mR/yr = milliroentgen per year; NA = not applicable to less than three periods of data.

APPENDIX C

NON-RADIOLOGICAL ANALYTICAL DATA

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Table C-1. Concentrations (in µg/g) of metals in off-site soil samples.

Location	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium
B-01	10400	28	129	0.5	0.5	18500	6	13700	20	4020
B-02	8820	26	116	0.5	0.5	17700	6	12000	23	4180
B-03	11400	14	154	0.5	0.5	13100	6	13000	34	4560
B-04	5250	13	73	0.5	0.5	6430	4	7410	16	3180
B-05	12700	26	164	0.5	0.5	31800	11	16800	21	7680
B-06	7850	5	173	0.5	0.5	23000	4	3820	13	2100
B-07	6980	5	121	0.5	0.5	6070	5	9170	17	3080
B-08	4500	6	104	0.5	0.5	2200	4	6060	15	1730
B-09	4880	5	97	0.5	0.5	1720	3	5930	16	1680
B-10	4290	6	109	0.5	0.5	31000	5	8250	7	3280
B-11	6820	14	137	0.5	0.5	21800	5	8320	10	3810
B-12	7880	5	155	0.7	0.5	5600	4	7450	11	2960
B-13	6360	5	113	0.5	0.5	3020	3	7100	10	2330
B-14	5320	5	85	0.5	0.5	1810	3	6290	7	1870

Location	Manganese	Molybdenum	Nickel	Potassium	Silica Dioxide	Silver	Sodium	Thallium	Vanadium	Zinc
B-01	412	5	5	2800	410	2	700	20	20	43
B-02	392	5	8	2600	400	2	600	10	17	43
B-03	551	5	6	3800	310	2	1900	10	23	57
B-04	244	5	4	1700	430	2	400	10	11	37
B-05	426	5	8	4000	360	3	1000	20	25	56
B-06	139	5	4	3400	390	3	500	10	5	18
B-07	361	5	6	3500	660	1	500	20	11	43
B-08	270	5	6	1300	460	1	400	10	12	29
B-09	224	5	4	500	440	1	400	10	6	25
B-10	193	5	4	1000	310	1	400	10	15	35
B-11	285	5	4	3900	430	1	1600	10	16	25
B-12	468	5	4	3000	410	2	1000	10	5	28
B-13	214	5	4	3300	320	1	400	10	12	26
B-14	140	5	4	2800	370	1	300	10	10	26

Table C-2. Concentrations (in µg/g) of metals in perimeter soil samples.

Location	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium
T-06	8970	14	96	0.5	0.5	3180	5	9230	13	3090
T-08	4650	5	61	0.5	0.7	1780	3	5650	5	1620
T-11	11800	27	139	0.8	0.7	5660	9	23800	20	5790
T-12	7420	14	121	0.5	0.5	8070	5	9880	15	3150
T-13	4310	14	107	0.5	0.5	2420	2	11100	11	1660

Location	Manganese	Molybdenum	Nickel	Potassium	Silica Dioxide	Silver	Sodium	Thallium	Vanadium	Zinc
T-06	375	5	5	2800	480	2	400	10	12	38
T-08	154	5	4	1600	460	1	300	10	7	21
T-11	1060	19	15	2500	340	2	400	10	39	80
T-12	454	5	5	2200	80	2	400	10	14	43
T-13	326	5	4	1900	50	1	300	10	9	81

Table C-3. Concentrations (in µg/g) of metals in On-Base Housing Area soil samples.

Location	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium
T-07	5370	12	106	0.5	0.5	8730	3	5990	6	2130
T-34	4060	5	68	0.5	0.5	1760	2	5030	5	1530
T-35	4270	5	69	0.5	0.5	2600	2	5460	6	1650
T-36	4140	10	59	0.5	0.5	1570	13	4920	5	1460
T-37	6410	10	98	0.6	0.5	8600	4	7160	5	2820

Location	Manganese	Molybdenum	Nickel	Potassium	Silica Dioxide	Silver	Sodium	Thallium	Vanadium	Zinc
T-07	158	5	4	2000	490	1	500	10	5	2
T-34	162	5	4	1700	450	1	300	10	6	1
T-35	162	5	4	1800	450	1	400	10	6	1
T-36	143	5	4	1700	470	1	300	10	6	2
T-37	171	5	4	2200	540	3	500	10	12	27

Table C-4. Concentrations (in μg/g) of metals in South Plume Area soil samples.

Location	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium
T-14	9870	16	192	0.5	0.5	5690	6	12400	10	3930
T-15	8150	8	129	0.5	0.5	7810	6	10200	8	3760
T-16	8420	13	148	0.5	0.5	4470	5	10700	11	3430
T-17	7500	8	166	0.5	0.5	4450	4	9020	14	3140
T-18	10200	17	147	0.5	0.5	4530	6	11300	16	3720
T-19	7310	5	100	0.5	0.5	3450	5	8540	10	2920

Location	Manganese	Molybdenum	Nickel	Potassium	Silica Dioxide	Silver	Sodium	Thallium	Vanadium	Zinc
T-14	399	5	6	4500	70	5	700	10	17	50
T-15	334	5	5	2900	70	1	500	10	16	40
T-16	412	5	5	3000	100	2	500	10	17	44
T-17	408	5	4	3300	130	2	500	20	14	37
T-18	408	5	5	4600	150	5	700	20	16	43
T-19	363	5	9	3000	960	1	600	20	13	35

Table C-5. Concentrations (in µg/g) of metals in the 554th Range Squadron O&M soil samples.

Location	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium
OM-01	5910	8	60	0.5	0.5	1520	2	5460	8	1430
OM-02	9710	13	84	0.5	0.5	3130	4	8750	13	2740
OM-03	6380	8	86	0.5	0.7	2520	3	7120	12	2220

Location	Manganese	Molybdenum	Nickel	Potassium	Silica Dioxide	Silver	Sodium	Thiallium	Vanadium	Zinc
OM-01	180	5	4	2000	290	1	400	10	5	21
OM-02	281	5	4	3500	360	2	400	10	11	31
OM-03	317	5	4	1900	260	2	300	10	10	27

Table C-6. Concentrations (in μg/g) of metals in the Range Operations Center and Compound soil samples.

Location	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium
OC-01	8240	12	137	0.5	0.5	13000	6	9430	10	3550
OC-02	12000	15	149	0.6	0.5	16600	8	12800	15	6040
OC-03	6390	5	90	1.2	1.4	6690	6	9180	17	3060
OC-04	6410	11	119	0.5	0.5	9870	7	9230	14	3100
OC-10	6370	10	93	0.5	0.7	20300	5	8510	9	2590
OC-13	7350	17	103	0.5	0.5	11300	4	9060	9	2960
OC-19	6560	10	77	0.6	1.2	7060	5	9570	13	2810
OC-20	8080	13	82	0.6	0.5	16600	5	7650	8	2950
OC-22	6810	7	97	0.5	0.5	8670	7	9660	19	3270
OC-23	9290	11	126	0.6	0.6	6010	6	11100	9	4110

Location	Manganese	Molybdenum	Nickel	Potassium	Silica Dioxide	Silver	Sodium	Thallium	Vanadium	Zinc
OC-01	321	5	4	2800	480	1	600	10	17	29
OC-02	414	5	6	4300	470	1	600	10	17	57
OC-03	316	5	7	2500	460	2	500	10	15	38
OC-04	292	5	4	2400	540	1	600	10	16	35
OC-10	201	5	4	1800	440	1	900	10	16	35
OC-13	242	5	4	2300	500	1	600	10	18	115
OC-19	289	5	6	2000	610	1	700	10	15	58
OC-20	247	5	4	2000	600	1	600	10	13	31
OC-22	318	5	4	3200	510	1	700	10	15	65
OC-23	453	5	6	3500	550	2	800	30	18	36

Table C-7. Concentrations (in µg/g) of metals in soil samples from various on-site locations.

Location	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium
D-1	8190	10	143	0.5	0.5	6080	5	14700	12	4090
MH-03	10300	20	99	0.5	0.5	5060	7	11300	11	4030
MH-04	9670	14	117	0.5	0.6	4570	5	12100	13	3750
OP-03	8080	17	88	0.5	0.5	18300	5	9880	9	3440
STA-14	7990	13	106	0.5	0.5	8800	6	12000	16	3360
T-02	8970	12	87	0.5	0.5	3450	4	8420	11	3000
T-03	8010	14	88	0.5	0.5	2230	4	8640	13	2450
T-04	6070	9	92	0.5	0.5	2900	3	7560	11	2630
T-10	9950	5	118	0.5	0.5	6280	6	10800	9	4160
T-20	11900	17	125	0.5	0.5	10800	7	11400	14	5660
T-21	21600	18	172	1	0.5	20500	11	19400	18	10600

Location	Manganese	Molybdenum	Nickel	Potassium	Silica Dioxide	Silver	Sodium	Thallium	Vanadium	Zinc
D-1	530	5	7	2600	640	1	400	20	17	44
MH-03	290	5	4	4100	370	2	400	10	17	47
MH-04	457	5	6	3100	500	2	600	10	16	42
OP-03	284	5	4	2600	520	1	600	10	14	31
STA-14	398	5	5	2900	440	2	600	10	17	38
T-02	272	5	6	3200	450	1	400	10	11	38
T-03	317	5	4	1800	390	2	400	10	12	27
T-04	356	5	4	2000	380	1	400	10	10	27
T-10	444	5	6	4000	630	2	600	10	15	43
T-20	338	5	7	3900	670	2	600	10	17	36
T-21	577	5	12	7800	980	4	2000	10	29	71

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