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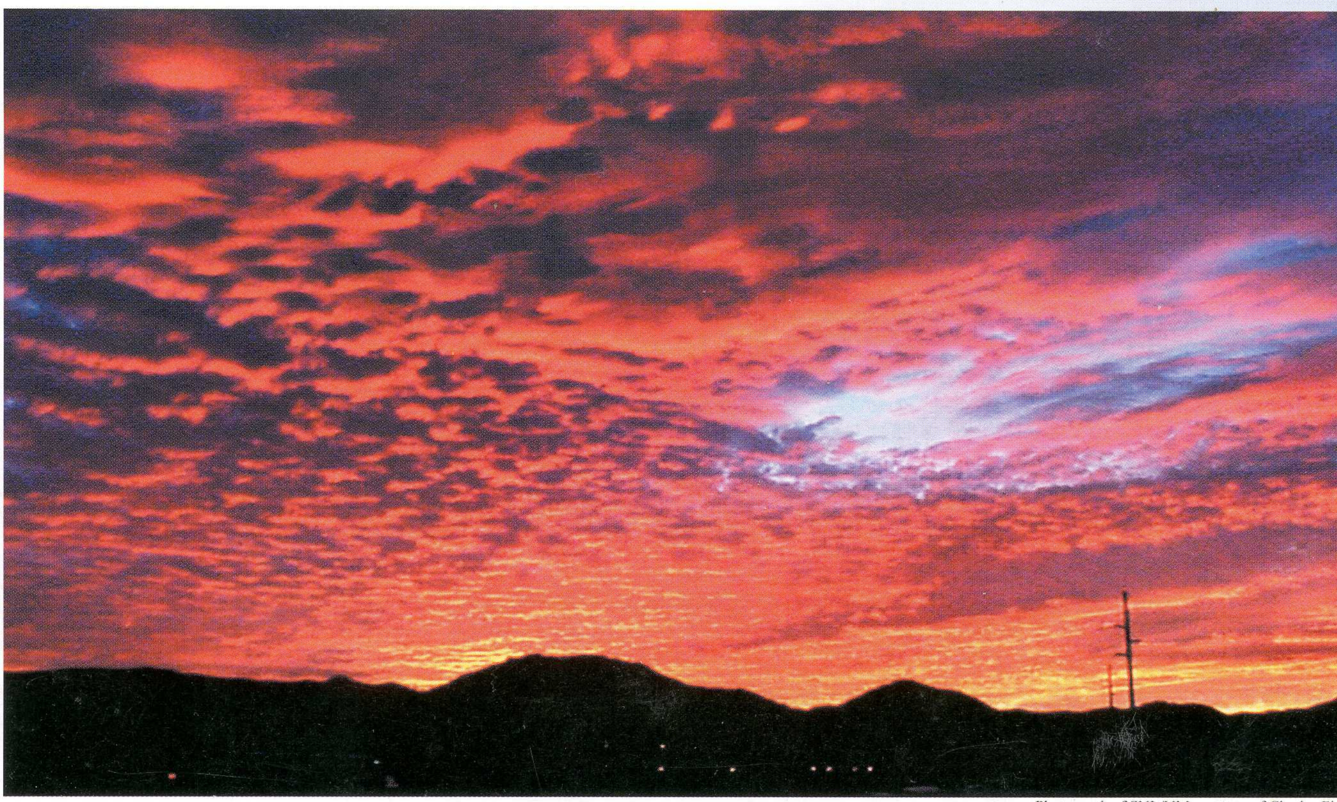

Photograph of SNL/NM courtesy of Charles Fink

Rebecca Sanchez, Katrina Wagner, Francine Vigil, and Lucie Mayeux

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Sandia National Laboratories, Albuquerque, New Mexico

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ABSTRACT

Sandia National Laboratories, New Mexico (SNL/NM) is a government-owned, contractor-operated facility overseen by the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) through the Albuquerque Operations Office (AL), Office of Kirtland Site Operations (OKSO). Sandia Corporation, a wholly-owned subsidiary of Lockheed Martin Corporation, operates SNL/NM. Work performed at SNL/NM is in support of the DOE and Sandia Corporation's mission to provide weapon component technology and hardware for the needs of the nation's security. Sandia Corporation also conducts fundamental research and development (R&D) to advance technology in energy research, computer science, waste management, microelectronics, materials science, and transportation safety for hazardous and nuclear components. In support of Sandia Corporation's mission, the Integrated Safety and Security (ISS) Center and the Environmental Restoration (ER) Project at SNL/NM have established extensive environmental programs to assist Sandia Corporation's line organizations in meeting all applicable local, state, and federal environmental regulations and DOE requirements. This annual report summarizes data and the compliance status of Sandia Corporation's environmental protection and monitoring programs through December 31, 2001. Major environmental programs include air quality, water quality, groundwater protection, terrestrial surveillance, waste management, pollution prevention (P2), environmental remediation, oil and chemical spill prevention, and the National Environmental Policy Act (NEPA). Environmental monitoring and surveillance programs are required by DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990) and DOE Order 231.1, *Environment, Safety, and Health Reporting* (DOE 1996).

Calendar Year 2001 Annual Site Environmental Report
Sandia National Laboratories, Albuquerque, New Mexico
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FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

A	ABC/AQCB	Albuquerque-Bernalillo County/Air Quality Control Board
	ACRR	Annular Core Research Reactor
	ACE	Army Corps of Engineers
	AEA	Atomic Energy Act
	AEC	Atomic Energy Commission
	AIRFA	American Indian Religious Freedom Act
	AL	Albuquerque Operations Office
	ALARA	as low as reasonably achievable
	AMP	Analytical Management Program
	AMPL	Advanced Manufacturing Process Laboratory
	AOC	area of concern
	AQC	Air Quality Compliance
	AR	annual review
	ARCOC	Analysis Request and Chain-of-Custody
	ARPA	Archaeological Resources Protection Act
	ASER	Annual Site Environmental Report
	AST	above-ground storage tank
	AT&T	American Telephone and Telegraph Company
	AWN	Acid Waste Neutralization
B	BMP	Best Management Practice
	BWSA	bulk waste staging area
C	CAA	Clean Air Act
	CAAA	Clean Air Act Amendments
	CAMU	Corrective Action Management Unit
	CAN	Clean Air Network
	CAP88	Clean Air Act Assessment Package-1988
	CAS	Chemical Abstract Service
	CCCL	Cleaning and Contamination Control Laboratory
	CEARP	Comprehensive Environmental Assessment and Response Program
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFR	Code of Federal Regulations
	COD	chemical oxygen demand
	CPAP	Contractor Performance Assessment Program
	CPMS	Criteria Pollutant Monitoring Station
	CRADA	Cooperative Research and Development Agreements
	CSRL	Compound Semi-Conductor Research Laboratory
	CTF	Coyote Test Field
	CVAA	Cold Vapor Atomic Absorption
	CWA	Clean Water Act
	CWDR	Chemical Waste Disposal Request
	CWL	Chemical Waste Landfill
	CY	Calendar Year
D	D&D	decontamination and demolition
	DCG	derived concentration guide
	DoD	U.S. Department of Defense
	DOE	U.S. Department of Energy
	DOT	U.S. Department of Transportation
	DP	Discharge Plan
	DQO	data quality objective
	DR	disposal request

E	EA	Environmental Assessment
	ECF	Explosive Components Facility
	EDE	effective dose equivalent
	EDP	Experiment Development Plan
	EHS	extremely hazardous substance
	EID	Environmental Information Document
	EIS	Environmental Impact Statement
	EM	Environmental Management
	EMS	Environmental Management System
	EMSL	Environmental Monitoring Systems Laboratory
	EO	Executive Order
	EOD	Explosive Ordnance Disposal
	EPA	U.S. Environmental Protection Agency
	EPCRA	Emergency Planning and Community Right-to-Know Act
	EPP	Environmentally Preferable Purchasing
	ER	Environmental Restoration
	ERCL	Environmental Restoration Chemical Laboratory
	ERDA	Energy Research and Development Administration
	ER/WM	Environmental Restoration and Waste Management
	ES&H	Environment, Safety, and Health
	ESA	Endangered Species Act
F	FFCA	Federal Facilities Compliance Act
	FFCO	Federal Facility Compliance Order
	FGR	flue gas recirculation
	FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
	FMOC	Facilities Management & Operations Center
	FONSI	Finding of No Significant Impact
	FY	Fiscal Year
G	GEL	General Engineering Laboratories
	GIF	Gamma Irradiation Facility
	GPMPP	Groundwater Protection Management Program Plan
	GSA	General Services Administration
	GWPP	Groundwater Protection Program
H	HA	Hazard Analyses
	HAP	hazardous air pollutant
	HAZMAT	hazardous materials
	HBWSF	High-Bay Waste Storage Facility
	HCF	Hot Cell Facility
	HDRV	Historical Disposal Requests Validation
	HE	high explosives
	HERMES-III	High Energy Radiation Megavolt Electron Source-III
	HLW	high-level radioactive waste
	HQ	headquarters
	HSWA	Hazardous and Solid Waste Amendments
	HWMF	Hazardous Waste Management Facility
I	ICP	Inductively Coupled Plasma
	ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectrum
	ILMS	Integrated Laboratory Management System
	IRP	Installation Restoration Program
	ISMS	Integrated Safety Management System
	ISS	Integrated Safety & Security Center
	ISS	Interim Status Storage

J	JCEL	Joint Computational Engineering Laboratory
	JIT	Just-In-Time
K	KAFB	Kirtland Air Force Base
	KTF	Kauai Test Facility
L	LANL	Los Alamos National Laboratory
	LCBS	Lurance Canyon Burn Site
	LECS	Liquid Effluent Control System
	LLW	low-level waste
	LMF	Large-scale Melt Facility
	LRRI	Lovelace Respiratory Research Institute
	LTES	Long-Term Environmental Stewardship
	LTTD	Low-Temperature Thermal Desorption
	LWDS	Liquid Waste Disposal System
M	MAC	maximum allowable concentration
	MAPEP	Mixed Analyte Performance Evaluation Program
	MBTA	Migratory Bird Treaty Act
	MCL	maximum contaminant level
	MDA	minimum detectable activity
	MDL	minimum detection limit
	MDL	Microelectronics Development Laboratory
	MEI	maximally exposed individual
	MESA	Microsystems and Engineering Sciences Application
	MIPP	Medical Isotope Production Project
	MLLW	mixed low-level waste
	MOC	Management and Operating Contract
	MP	monitoring point
	MSB	Manzano storage bunkers
	MSDS	Material Safety Data Sheet
	MSL	Melting and Solidification Laboratory
	MVF	Model Validation Facility
	MW	mixed waste
	MWL	Mixed Waste Landfill
N	N/A	not available or not applicable
	NAAQS	National Ambient Air Quality Standards
	ND	not detected
	NEPA	National Environmental Policy Act
	NESHAP	National Emission Standards for Hazardous Air Pollutants
	NFA	No Further Action
	NGF	Neutron Generator Facility
	NHPA	National Historic Preservation Act
	NMAC	New Mexico Administrative Code
	NMAAQS	New Mexico Ambient Air Quality Standards
	NMED	New Mexico Environment Department
	NMHWA	New Mexico Hazardous Waste Act
	NMSBA	New Mexico Small Business Assistance Program
	NMWQCC	New Mexico Water Quality Control Commission
	NNSA	National Nuclear Security Administration
	NON	notification of noncompliance
	NOV	Notice of Violation
	NPDES	National Pollutant Discharge Elimination System
	NPL	National Priorities List
	NPN	nitrate plus nitrite
	NRC	U.S. National Response Center

	NRC	U.S. Nuclear Regulatory Commission
	NSPS	New Source Performance Standards
O	ODS	Ozone-depleting substance
	OKSO	Office of Kirtland Site Operations
	ORPS	Occurrence Reporting Processing System
P	P2	Pollution Prevention
	PAAA	Price-Anderson Amendments Act
	PA/SI	Preliminary Assessment/Site Inspection
	PBFA-II	Particle Beam Fusion Accelerator
	PBT	Persistent Bioaccumulative Toxics
	PCB	polychlorinated biphenyl
	PETL	Processing and Environmental Technology Laboratory
	PG	Program Document (Sandia Corporation program overview document)
	PHS	Primary Hazard Screen
	PM	particulate matter
	PM_{10}	respirable particulate matter (diameter equal to or less than 10 microns)
	$PM_{2.5}$	respirable particulate matter (diameter equal to or less than 2.5 microns)
	POTW	Publicly-owned Treatment Works
	PPE	personal protective equipment
	PQL	Practical quantitation limit
Q	QA	quality assurance
	QAP	Quality Assurance Program
	QAPjP	Quality Assurance Project Plan
	QC	quality control
R	RCRA	Resource Conservation and Recovery Act
	R&D	research and development
	RHEPP	Repetitive High Energy Pulsed Power (an accelerator facility)
	RMP	Risk Management Plan
	RMWMF	Radioactive and Mixed Waste Management Facility
	ROD	Record of Decision
	RQ	reportable quantity
S	SABRE	Sandia Accelerator and Beam Research Experiment
	SAP	Sampling and Analysis Plan
	SARA	Superfund Amendments and Reauthorization Act
	SATURN	(an accelerator facility)
	SD	sustainable design
	SDWA	Safe Drinking Water Act
	SHPO	State Historic Preservation Officer
	SIC	Standard Industrial Classification
	SMO	Sample Management Office
	SNL/CA	Sandia National Laboratories, California
	SNL/NM	Sandia National Laboratories, New Mexico
	SOW	statement of work
	SPCC	Spill Prevention Control and Countermeasures (plan)
	SPHINX	Short Pulse High Intensity Nanosecond X-Radiator (an accelerator facility)
	SPR	Sandia Pulsed Reactor
	SSL	soil screeening level
	SSWM	Storm Drain, Sanitary Sewer, and Domestic Water System Modernization
	START	Sandia Tomography and Radionuclide Transport Laboratory
	STEL	short-term exposure limit
	STP	Site Treatment Plan
	SURF	Sandia Underground Reactor Facility

	SUWCO	Sewer Use and Wastewater Control Ordinance
	SVOC	Semi Volatile Organic Compound
	SWEIS	Site-Wide Environmental Impact Statement
	SWISH	Small WInd SHield (facility)
	SWMU	Solid Waste Management Unit
	SWP3	Storm Water Pollution Prevention Plan
	SWTF	Solid Waste Transfer Facility
T	TA	Technical Area
	TAG	Tijeras Arroyo Groundwater
	TCE	trichloroethylene or trichloroethene
	TLD	thermoluminescent dosimeter
	TLV	threshold limit value
	TNMHC	total non-methane hydrocarbon
	TOC	total organic carbon
	TOX	total halogenated organics
	TPH	Total extractable petroleum hydrocarbons
	TQ	threshold quantity
	TRI	Toxic Release Inventory
	TRU	transuranic (radioactive waste)
	TSCA	Toxic Substances Control Act
	TSD	treatment, storage, and disposal
	TSS	total suspended solids
	TTF	Thermal Treatment Facility
	TTR	Tonopah Test Range
	TU	Temporary Unit
	TWA	time-weighted average
U	UNM	University of New Mexico
	USAF	U.S. Air Force
	USFS	U.S. Forest Service
	USGS	U.S. Geological Survey
	UST	underground storage tank
V	VCA	Voluntary Corrective Action
	VCM	Voluntary Corrective Measure
	VEP	Vapor Extraction Project
	VOC	volatile organic compound
W	WA	Weapons Assembly
	WIPP	Waste Isolation Pilot Plant
	WQG	Water Quality Group

UNITS OF MEASURE

°C	degree centigrade
cm	centimeter
°F	degrees fahrenheit
ft	feet
ft^3	cubic feet
gal	gallon
hr	hour
in.	inch
g	kilogram
km	kilometer
Km^3	cubic kilometer
kW	kilowatt
L	liter
lb	pound
m	meter
m/s	miles per second
m^3	cubic meter
mg	milligram
mi	mile
mL	milliliter
mph	miles per hour
ppb	parts per billion
ppbv	parts per billion by volume
ppm	parts per million
scf	standard cubic feet
sq ft	square feet
sq km	square kilometer
sq mi	square mile
tpy	tons per year
yd^3	cubic yard
yr	year

RADIOACTIVITY MEASUREMENTS

rem	roentgen equivalent man
mrem	millirem (unit of radiation dose)
person-Sv	person-Sievert (unit of radiation dosage)
person-rem	radiation dose to population (also man-rem)
mSv	millisievert (unit of radiation dosage)
Sv	Sievert
Ci	curie
pCi	picocurie
µg	microgram
mR	milliroentgen

CHEMICAL ABBREVIATIONS

CO	carbon monoxide
Eh	redox
H^3	tritium
$_1H^1$	hydrogen
HCl	hydrochloric acid
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
1,1,1,-TCA	1,1,1,-trichloroethane
O_3	ozone
pH	potential of hydrogen (acidity)
SO_2	sulfur dioxide
TCE	trichloroethylene or trichloroethene
TCA	trichloroethane
U_{tot}	total uranium

APPROXIMATE CONVERSION FACTORS FOR SELECTED SI (METRIC) UNITS

Multiply SI (Metric) Unit	By	To Obtain U.S. Customary Unit
Cubic meters (m^3)	35.32	Cubic feet (ft^3)
Centimeters (cm)	0.39	Inches (in.)
Meters (m)	3.28	Feet (ft)
Kilometers (km)	0.61	Miles (mi)
Square kilometers (km^2)	0.39	Square miles (mi^2)
Hectares (ha)	2.47	Acres
Liters (L)	0.26	Gallons (gal)
Grams (g)	0.035	Ounces (oz)
Kilograms (kg)	2.20	Pounds (lb)
Micrograms per gram (mg/g)	1	Parts per million (ppm)
Milligrams per liter (mg/L)	1	Parts per million (ppm)
Celsius (°C)	°F = 9/5 °C+ 32	Fahrenheit (°F)
Sievert (Sv)	100	roentgen equivalent man (rem)

Executive Summary

In this Chapter ...

Sandia Corporation, a wholly-owned subsidiary of the Lockheed Martin Corporation, manages operations at Sandia National Laboratories, New Mexico (SNL/NM). SNL/NM operations are overseen by the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) through its Office of Kirtland Site Operations (OKSO), which in turn reports to the Albuquerque Operations Office (AL). This Annual Site Environmental Report (ASER) was prepared in accordance with and as required by DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990) and DOE Order 231.1, *Environment, Safety, and Health Reporting* (DOE 1996).

This ASER summarizes environmental protection, restoration, and monitoring programs in place at SNL/NM through December 31, 2001. It also discusses Sandia Corporation's compliance with environmental statutes, regulations, DOE Orders, permit provisions, and highlights significant environmental program efforts and accomplishments. This ASER is a key component of the DOE's effort to keep the public informed about environmental conditions throughout the DOE/NNSA's Nuclear Weapons Complex.

Site Characteristics

SNL/NM is located on Kirtland Air Force Base (KAFB), a 51,559-acre military installation including the 20,486 acres withdrawn from the U.S. Forest Service (USFS) on the east side of KAFB (DOE 1999). The topography within the land withdrawn area generally consists of mountains and canyons vegetated with juniper, piñon, cactus, and drought-tolerant shrubs and grasses. The highest elevation within the land withdrawn area is just under 8,000 ft. To the west, the area grades into rolling hills and alluvial fans cut by arroyos. Further west, the topography is mostly flat-lying, except for the significant channel cut by the Tijeras Arroyo, which is up to 108 ft deep and 4,264 ft wide. The arroyo flows approximately 8.7 miles from its western exit point at KAFB to its discharge point at the Rio Grande River.

Sandia Corporation's Mission

Sandia Corporation conducts its operations within five technical areas (TAs) and several remote test areas. Total DOE/NNSA-owned property that is dedicated to SNL/NM facilities and operational areas is approximately 8,824 acres (DOE 1999). SNL/NM is one of the nation's premier national laboratories within the DOE/NNSA Nuclear Weapons Complex. Sandia Corporation's primary mission is to conduct research and development (R&D) for nuclear weapon system components and to ensure the integrity and reliability of the nation's nuclear defense systems. This mission has greatly expanded in recent years to include non-military applications for microelectronics, micro-machines, computer technology, accelerator and pulsed power energy research, robotics, and material sciences and in the past year for Homeland Security issues.

Environmental Programs

Sandia Corporation's strategy for managing and implementing its Environment, Safety, and Health (ES&H) Program is described in the Integrated Safey Managment System (ISMS). The ISMS program is structured around five safety management functions and provides the processes to assist line management in identifying and controlling hazards. A formal Environmental Management System (EMS) is in the process of being defined and implemented through the ISMS structure, incorporating existing processes when appropriate. It will serve as a framework to manage environmental compliance, controls, improvements, and pollution prevention (P2) goals. In 2001, Sandia Corporation developed gap analyses comparing the current ISMS with environmental standards. The gaps will be used to identify system improvements to an EMS. Full implementation of the EMS is directed by an executive order (EO) to be in place by the year 2005.

The primary environmental programs in place at SNL/NM are:

- Waste management and P2 programs
- Environmental Restoration (ER) Project

- Terrestrial Surveillance Program
- Water quality programs
- Groundwater Protection Program (GWPP)
- Air quality programs
- National Environmental Policy Act (NEPA) Program

All 2001 program activities are performed continuously, but reported in this ASER on a Calendar Year (CY) basis, unless otherwise noted.

Waste Management and P2

Three primary waste handling facilities conduct waste management activities at SNL/NM: the Hazardous Waste Management Facility (HWMF), the Radioactive and Mixed Waste Management Facility (RMWMF), and the Solid Waste Transfer Facility (SWTF). In addition, representatives from SNL/NM's waste minimization and P2 programs confer with Sandia Corporation line organizations to implement waste minimization technologies and recycling, wherever feasible.

- **HWMF** – The HWMF operates under a Resource Conservation and Recovery Act (RCRA) Part B Operating Permit administered by the New Mexico Environment Department (NMED). All non-radioactive, non-explosive, chemical waste, including RCRA-hazardous waste, asbestos, polychlorinated biphenyls (PCBs), and biohazardous waste are handled at this facility. A total of 11,219 individual items were collected in 2001. The HWMF shipped out the following waste categories:

	Weight	
Category	**kg**	**lbs**
RCRA waste	44,341	97,755
Asbestos	59,827	131,896
PCBs (recycled & waste)	12,768	28,737
Biohazardous waste	338	745
Other recycled and chemical waste	1,292,248	2,848,918
Total	1,409,522	3,107,464

- **SWTF** – The SWTF accepts non-hazardous solid waste generated from SNL/NM consisting primarily of office and laboratory trash. The waste is inspected, compacted, baled, and stored for shipment for disposal at local area landfills. Recyclable material handling makes up a large portion of the facility's activities. The SWTF recycles paper and cardboard contributed from SNL/NM, KAFB, DOE/NNSA field offices, and Los Alamos National Laboratory (LANL). In 2001, a total of 2,249,271 lbs (1,020,252 kg) of solid waste was handled at the facility and an additional 783,824 lbs (355,537 kg) of paper, cardboard, newsprint, and aluminum was recycled.

- **RMWMF** – The RMWMF currently administers low-level waste (LLW), mixed waste (MW), and transuranic (TRU) waste. In 2001, the RMWMF shipped the following quantities of radioactive waste:

	Weight	
Category	**kg**	**lbs**
LLW	310,149	683,761
Mixed Waste	53,108	117,082
TRU	0	0
Total	438,218	966,105

ER Project

The assessment and remediation of past and potential release sites due to activities performed at Sandia Corporation continue to be addressed by the ER Project according to the Hazardous and Solid Waste Amendments (HSWA) Module 4 of the RCRA Part B Operating Permit. During 2001, eight ER sites were being remediated at SNL/NM, 11 sites were completed, and 30 sites were proposed for No Further Action (NFA). NFA approval was granted by NMED in November 2001. NFA status is granted by the NMED once a site has been cleaned up or it has been determined that contamination levels are below regulatory concern. Additionally, DOE approves the release of any site with radiological contamination issues once it has been determined that contamination levels are non-existent or negligible. These sites are then proposed for NFA and must be approved by NMED in order to be removed from the permit. At the end of 2001, there were 158 ER sites remaining to be addressed at SNL/NM.

Remediation activities continued at the Chemical Waste Landfill (CWL) and the Classified Waste Landfill in 2001. Remediation of all SNL/NM ER sites is expected to be complete by 2009.

Terrestrial Surveillance

Sandia Corporation conducts annual terrestrial surveillance sampling at various sites near SNL/NM facilities or in areas where contaminants could be expected to accumulate as well as at sites from the surrounding community. Currently, soil, sediment, and vegetation are collected from on-site, perimeter, and off-site (community locations outside KAFB boundaries) locations. The terrestrial surveillance sampling objectives are to detect any potential releases or migration of contaminated material to off-site locations. In 2001, results were consistent with past years' sampling results. There were some sites that showed statistically increasing trends for some analytes, but the results for all of these sites were below average community concentrations. Other sites in areas of known contamination (usually associated with an ER site) were above off-site values, but none of these sites showed an increasing trend.

Water Quality

Water Quality at SNL/NM includes programs that address wastewater, surface discharge, and storm water runoff.

- **Wastewater** – Wastewater from SNL/NM is discharged from five on-site outfalls permitted by the City of Albuquerque. Four of these stations connect directly to the public sewer at the Tijeras Arroyo Intercept and one station monitors wastewater discharged from the Acid Waste Neutralization (AWN) System at the Microelectronics Development Laboratory (MDL). Wastewater monitoring is conducted to ensure that all discharges meet the standards set by the City of Albuquerque's publicly-owned treatment works (POTW). In 2001, one permit violation occurred after SNL/NM Environmental Restoration Chemical Laboratory (ERCL) personnel poured volatile organic compounds (VOCs) down a drain. There were no penalties assessed for this violation.

- **Surface Discharge** – All water to be discharged to the ground surface, either directly or to lined containments, must meet State of New Mexico surface discharge standards. There were 28 one-time requests made for individual discharges to the ground surface in 2001. Surface discharges are only made with the approval of the Surface Discharge Program within the Environmental Management (EM) Department. In 2001, all requests met NMED New Mexico Water Quality Control Commission (NMWQCC) standards and were approved. Additionally, routine surface discharges are made to two evaporation lagoons servicing the Pulsed Power Facility under an existing discharge permit. A renewal application was submitted to NMED in 1999 and was approved in 2001. All permit requirements for both lagoons were met in 2001.

  In 2001, there were four surface releases reported as occurrences and reviewed by the Surface Discharge Program. A surface discharge is defined as the spilling, leaking, pumping, pouring, emitting, or dumping into water or in a location and manner where there is a reasonable probability that the discharged substance will reach surface or subsurface water in such quantity as may with reasonable probability injure human health, animal or plant life, or degrade the environment. There was no discernable impact to the environment due to any of these surface discharges.

- **Storm Water Runoff** – In 2001, no analytical monitoring was required under the National Pollutant Discharge Elimination System (NPDES) Multi-Sector General Permit for Stormwater discharges. The NPDES Permit requires quarterly analytical sampling to be conducted in the second and fourth year of the five-year permit, weather permitting. The permit was renewed in January 2001. The next required analytical sampling will occur in Fiscal Year (FY) 2002 beginning in October 2001. However, quarterly visual samples were collected at five monitoring points (MPs) and inspected as described under "wet weather inspections" in Section 6.3.3. No unusual characteristics were noted. The permit is due for renewal again in 2005. Six additional storm water monitoring stations were added in 2001.

Groundwater Protection

Groundwater monitoring activities reported are those associated with Sandia Corporation's ER Project and the GWPP.

- **GWPP** – The GWPP conducts general surveillance of water quality from a network of wells not associated with the ER Project. During May and June 2001, 13 wells and one perennial spring were sampled during annual groundwater surveillance monitoring. An off-site laboratory using U.S. Environmental Protection Agency (EPA) guidelines analyzed samples. Groundwater concentration trends are shown in Appendix D. No metal analytes were detected above the maximum contaminant level (MCL) for drinking water. Uranium-234 activity for EOD Hill and TRE-1 exceeded the DOE drinking water guideline of 20 pCi/L. These wells are located east of the Tijeras fault zone where high levels of uranium-234 occur naturally in groundwater. The results are consistent with prior data and are considered to be within background values. Additional details are provided in section 7.2.1 and Appendix D.

- **ER** – The ER Project collects groundwater samples at five general project areas: the CWL, the MWL, Technical Area V (TA-V), Tijeras Arroyo Groundwater (TAG), and the Canyons Area. Water quality results reported by the ER Project were consistent with past years' results. In areas of known contamination, levels remained consistent except for the CWL, which has shown a decreasing trend in detected trichloroethylene (TCE) since completion of the Vapor Extraction Project (VEP). This project successfully removed up to 5,000 lb of VOCs from the vadose zone (unsaturated soil above the water table). TA-V wells have shown an increase in TCE levels up to 26 μg/L as compared to the MCL of 5 μg/L. Recent 2001 data indicate that TCE levels in TA-V wells are leveling off and are no longer increasing. There have been no contaminants detected in groundwater at the MWL with the exception of nickel (attributed to well screen corrosion). Nitrates are a contaminant of concern at TAG, TA-V, and the Canyons Area near the Lurance Canyon Burn Site (LCBS). Nitrate levels are highest in TAG wells. There is no indication that contaminants are migrating from any ER sites at SNL/NM.

Air Quality

- **Ambient Air Monitoring** – Sandia Corporation measures ambient air quality at five stations throughout SNL/NM and compares results with National Ambient Air Quality Standards (NAAQS) and local ambient air standards. The network monitors criteria pollutants and VOCs. There were no exceedences in ambient air quality standards at any of SNL/NM's stations in 2001.

- **Air Quality Compliance** – The City of Albuquerque has yet to issue DOE a Title V Operating Permit for SNL/NM as required under the Clean Air Act Amendments (CAAA) of 1990. Since 1997, source owners were able to submit an inventory of their actual emissions or fuel throughput for the year and pay an annual fee based on this amount. Effective July 1, 2001, a modification to the City of Albuquerque's 20 NMAC 11.02, "Permit Fees," eliminated this fee reduction provision. Annual fees are now based on an assessed value of a source's maximum allowable to emit regardless of actual emissions, thereby increasing SNL/NM's fees from $2,290 for 2000 to potentially $78,430 for 2001.

- **National Emission Standards for Hazardous Air Pollutants (NESHAP) Compliance** – Subpart H of NESHAP regulates radionuclide air emissions from DOE/NNSA facilities with the exception of naturally-occurring radon. In 2001, there were 18 SNL/NM facilities reporting NESHAP-regulated emissions. Of these 18 sources, 16 were point sources and two were diffuse sources. In 2001, the primary radionuclides released were tritium and argon-41. The results of the dose assessment showed that the on-site maximally exposed individual (MEI) received an effective dose equivalent (EDE) of 0.0030 millirem per year (mrem/yr). The off-site MEI received an EDE of 0.0008 mrem/yr. Both doses are below the EPA standard of 10 mrem/yr. By comparison, the average person in the Albuquerque area receives 330 to 530 mrem/yr resulting primarily from radon emanating from earth materials, medical procedures, consumer products, and cosmic radiation (Brookins 1992).

NEPA Activities

During 2001, NEPA compliance activities at SNL/NM included support to DOE/NNSA/OKSO for the preparation of a Supplement Analysis to the Site-Wide Environmental Impact Statement (SWEIS) that analyzed and approved resumption of pulse-mode operations at the Annular Core Research Reactor (ACRR) in TA-V. The NEPA team also coordinated information and data collection to support the Final Environmental Assessment for the Sandia Underground Reactor Facility (SURF) prepared by DOE/NNSA/OKSO (DOE 2001c). In February 2001, the ISMS NEPA Module software, an electronic system for performing NEPA compliance reviews, was deployed for laboratory-wide use, while the software was revised and upgraded throughout the year. The *SWEIS Annual Review-FY 2000* (SNL 2001i) was compiled and published in September 2001; the SWEIS Annual Review provides a yearly summary of facilities and operational changes at SNL/NM in comparison with the environmental conditions used in the SWEIS analysis (finalized in 1999). In 2001, SNL/NM NEPA staff performed a total of 326 NEPA compliance reviews, sending 62 NEPA checklists to DOE/NNSA/OKSO for review and determination. Table 2-3 provides summary details of SNL/NM NEPA review activities.

Chapter 1

Introduction

In this Chapter ...

Chapter Summary

This Annual Site Environmental Report (ASER) describes environmental protection programs currently in place at Sandia National Laboratories, New Mexico (SNL/NM) and summarizes the compliance status with major environmental laws and regulations during Calendar Year (CY) 2001.

SNL/NM is situated on Kirtland Air Force Base (KAFB) in Albuquerque, New Mexico. The regional setting of SNL/NM provides a diverse range of geological, hydrological, climatic, and ecological settings. The Sandia, named for the watermelon color seen on the mountains at sunset, and Manzanita Mountains provide a beautiful setting at SNL/NM.

Sandia Corporation (a wholly-owned subsidiary of Lockheed Martin Corporation) continues to provide technological innovations since its inception in 1945. The mission of Sandia Corporation is to provide science and engineering support for the nuclear weapons stockpile and stewardship. Most of SNL/NM's activities are conducted within five technical areas (TAs) and several remote locations.

Environmental Snapshot

- *Between the months of July and October, KAFB receives approximately 8.3 in. of precipitation. During the winter, the average precipitation is 1.6 in.*
- *KAFB is home to at least 267 plant species and 195 animal species.*

In support of Sandia Corporation's mission, Environment, Safety, and Health (ES&H) issues are addressed through environmental management programs. These programs include effluent monitoring, environmental surveillance, environmental restoration (ER), pollution prevention (P2), chemical inventory management, oil spill prevention, and quality assurance (QA).

Cottonwoods set against the Manzanita Mountains.

SNL/NM is one of the nation's premier multi-program security laboratories within the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA). SNL/NM is managed by Sandia Corporation (a wholly-owned subsidiary of Lockheed Martin Corporation) and overseen by the DOE/NNSA through its Albuquerque Operations Office (AL), Office of Kirtland Site Operations (OKSO).

This ASER describes environmental protection programs currently in place at SNL/NM and summarizes the compliance status with major environmental laws and regulations during CY 2001. This report was prepared in accordance with the requirements set forth for all large DOE/NNSA facilities and represents a key component of DOE's effort to keep the public informed about environmental conditions at DOE/NNSA sites.

General Site Location and Characteristics

SNL/NM is located on the east side of KAFB, a 51,559-acre military installation, including 20,486 acres withdrawn from the Cibola National Forest through agreement with the U.S. Forest Service (USFS) (Figure 1-1). The total area of DOE/NNSA-owned property that is dedicated to SNL/NM facilities and operations is approximately 8,784 acres. Of these, Sandia Corporation conducts its operations within 2,841 acres (five TAs and several remote test areas). An additional 8,397 acres in remote areas are provided to DOE through land-use agreements with the U.S. Air Force (USAF) and Isleta Pueblo. There are an additional 9,000 acres of buffer zone near the southwest boundary of KAFB. The buffer zone provides margins of safety and sound buffers for SNL/NM testing activities. The ownership of the land is divided between the Pueblo of Isleta and the State of New Mexico. During CY 2001, SNL/NM successfully negotiated a lease of the area administered by the State of New Mexico Land Office. Negotiations with the Pueblo of Isleta are ongoing. KAFB is host to over 150 tenant groups including the Air Force Research Laboratory (Phillips Laboratory), Air Force Operations Wing, Defense Nuclear Agency's Field Command, DOE/NNSA field offices, and SNL/NM.

KAFB is located at the foot of the Manzanita Mountains and encompasses parts of these ranges within the land withdrawn area. The topography within the land withdrawn area consists mostly of vegetation consisting of juniper, piñon, cactus, and drought-tolerant shrubs and grasses. The topography on the western section of KAFB is mostly flat lying except for the significant channel cut by the Tijeras Arroyo, which dissects KAFB east to west. KAFB and SNL/NM are located adjacent to the City of Albuquerque, which surrounds KAFB on the north, northeast, west, and southwest boundaries. Isleta Pueblo borders KAFB on the south. Additional information on local geology, hydrology, and ecology is presented at the end of this chapter.

ASER Scope

This chapter describes Sandia Corporation's history, mission, operational areas, and site characteristics of the surrounding region. Subsequent chapters in this ASER describe Sandia Corporation's specific environmental programs related to effluent monitoring, environmental surveillance, ER, waste management, P2, chemical inventory management, oil spill prevention, and QA. Ongoing and new activities, changes in program direction, corrective actions, and special awards and commendations are also discussed.

Operations Contract

Sandia Corporation, like all regulated industries, complies with specific environmental regulations promulgated by local, state, and federal agencies. The Management and Operating Contract (MOC) between Sandia Corporation and DOE defines the primary contractual obligations for operating SNL/NM. This contract also drives Sandia Corporation's ES&H standards and requirements. Additionally, as stated in the MOC, Sandia Corporation must comply with DOE Orders and directives that establish specific requirements for environmental programs. There are six primary DOE directives on the contract baseline that pertain to the environment:

- DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990);
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993);
- DOE Order 231.1, *Environment, Safety, and Health Reporting*, Attachment 1, "Contractor Requirements Document" (DOE 1996);
- DOE Manual 231.1-1, *Environment, Safety, and Health Reporting Manual*, as amended by DOE Order 470.2A (DOE 2000a);
- DOE Order 435.1, *Radioactive Waste Management* (DOE 2001b); and
- DOE Order 5400.2A, *Environmental Compliance Issue Coordination* (DOE 1993a).

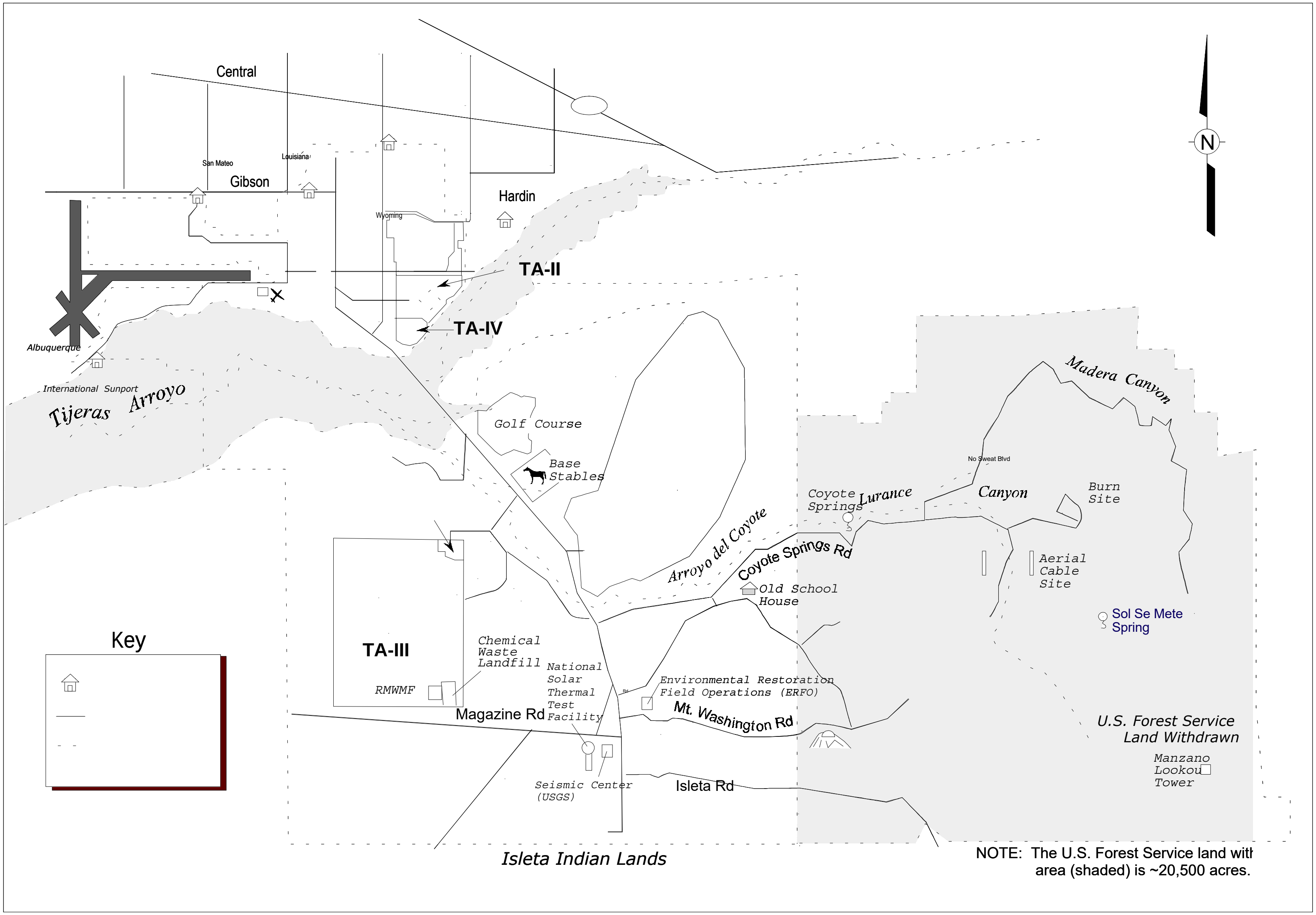

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FIGURE 1-1. Facilities Located on KAFB Showing SNL/NM Technical Areas and the U.S. Forest Service Land Withdrawn Area

1.1 SANDIA CORPORATION'S HISTORY AND MISSION

History
SNL/NM got its start in 1945 as part of the Manhattan Project, which produced the first nuclear weapon. In 1949, President Harry Truman wrote American Telephone & Telegraph (AT&T) Corporation offering the company *"an opportunity to render an exceptional service in the national interest"* by managing Sandia Corporation. AT&T managed Sandia Corporation for 44 years. Today, Sandia Corporation is managed by Lockheed Martin Corporation for the DOE/NNSA.

Mission
Sandia Corporation's enduring mission is to provide science and engineering support for the nuclear weapons stockpile. Today, the mission includes other aspects of national security, such as preventing the spread of nuclear, chemical, and biological weapons; developing technologies and strategies for responding to emerging threats such as terrorism; and preventing disruption of critical infrastructures such as energy supply and financial networks. Sandia Corporation collaborates with industry, universities, and other government agencies to commercialize new technologies. Recent technologies developed at SNL/NM can be found at the following website:

http://www.sandia.gov/LabNews

Evolution of ES&H at SNL/NM
During the war era when the primary concern was to manufacture components for the nation's defense, very little consideration was given to environmental impacts resulting from weapons research and development (R&D). Even after World War II ended, cold war mission-driven tasks took priority over environmental concerns. Waste management practices and environmental management programs during that time were inadequate throughout the DOE. In 1984, DOE began assessing its sites of past releases nationwide, spurring major changes in improving the management of the environment around DOE sites. In 1987, the initial assessment of SNL/NM sites was completed. Significant environmental problems were identified at SNL/NM that included diesel fuel leaks, contaminated landfills, and various chemical discharge sites.

Sandia Vision
Helping our nation secure a peaceful and free world through technology.

Sandia Mission
The primary mission of Sandia Corporation is to ensure the safety, security, and reliability of the nation's nuclear weapons.

Highest Goal
Our highest goal is to become the laboratory that the U.S. turns to first for technology solutions to the most challenging problems that threaten peace and freedom for our nation and the globe.

Managing a Legacy of Contamination
In 1989, DOE established the Office of Environmental Restoration and Waste Management (ER/WM) to remediate areas of past contamination and establish sound waste management practices for the future. Innovative technologies continue to be developed to address ER sites throughout the DOE/NNSA Nuclear Weapons Complex. In a ranking of DOE sites, however, SNL/NM was one of the least contaminated facilities. The cleanup and remediation of all SNL/NM sites is expected to be complete by 2009. Some sites will require long-term monitoring to ensure that any remaining contamination does not migrate from the site. Detailed information about ER/WM cleanup efforts throughout DOE can be found at DOE's website:

http://www.em.doe.gov/index4.html

DOE's Tiger Teams
In 1989, an initiative by the Secretary of Energy to conduct rigorous ES&H appraisals at DOE facilities formulated what became known as "Tiger Teams." The appraisal at SNL/NM was conducted from April 15, 1991 to May 24, 1991 and identified 382 findings in areas of worker safety, fire protection, emergency response, and material accountability. Sandia Corporation has since completed all corrective actions resulting from this appraisal and is subject to routine self-assessments and ongoing external audits.

A History of Progress
Over the past eleven years, Sandia Corporation has made tremendous progress in building a comprehensive ES&H Program. The ES&H Manual (SNL 2002a), a dynamic online resource available to all personnel at SNL/NM, clearly describes ES&H requirements for all levels of work conducted at SNL/NM. Improved waste management practices have been implemented and state-of-the-art waste handling facilities have been constructed to handle and properly dispose of hazardous, radioactive, and solid waste. Recycling programs, P2, and other waste minimization practices have been very successful at SNL/NM. Audits conducted over recent years by the U.S. Environmental Protection Agency (EPA), various DOE/NNSA field offices, the City of Albuquerque, and the State of New Mexico have been testimony to Sandia Corporation's significant ES&H progress over the last 11 years.

Sandia Corporation's strategy for managing and implementing its ES&H Program is described in the Integrated Safety Management System (ISMS). The ISMS Program is structured around five safety management functions: (1) plan work, (2) analyze hazards, (3) control hazards, (4) perform work, and (5) feedback and improvement. ISMS provides the processes to assist line management in identifying and controlling hazards.

Environmental Management System (EMS)
Sandia Corporation is working to define and implement an EMS as an improvement of the environmental elements of ISMS. In 2001, Sandia Corporation developed gap analyses comparing the current ISMS with environmental standards. The gap analyses will be used to determine system improvements to an EMS. It will serve as the basis to manage environmental compliance, controls, and improvements. Additionally, P2 goals will be incorporated into the EMS. This strategy ensures that ES&H considerations are incorporated into each element of all work processes being conducted at Sandia Corporation.

Sandia Corporation ES&H Policy

The policy of Sandia Corporation is to protect and preserve the environment, safety, and health of its personnel, contractors, visitors, and the public. Sandia Corporation shall make deliberate efforts to reduce hazardous exposures and releases to as low as reasonably achievable (ALARA) considering technical, economic, and social factors.

Concern and conduct in matters pertaining to ES&H are the responsibility of all Sandia Corporation employees, contractors, and visitors. ***No job is more important than your health, your safety, and the protection of our environment.***

Sandia Corporation's ES&H program mandates compliance with all applicable laws, regulations, and DOE directives (included in MOC) and adheres to the principles of line management responsibility for ES&H as described in Sandia Corporation's ISMS.

1.2 SNL/NM OPERATIONAL AREAS

Technical Area I (TA-I)
TA-I is the focus of SNL/NM's operations housing the main administrative center and a close grouping of laboratories and offices. Although the majority of TA-I is located within the fenced area, several facilities and buildings are located just beyond the main compound. A majority of activities performed in TA-I are dedicated to the design, and R&D of weapon systems; limited production of weapon system components; and energy research programs. Facilities in TA-I include the main technical library, several assembly/manufacturing areas, the steam plant, the Advanced Manufacturing Process Laboratory (AMPL), the Microelectronics Development Laboratory (MDL), and the Neutron Generator Facility (NGF).

Technical Area II (TA-II)
TA-II includes the diamond-shaped compound south of TA-I and several facilities south of Hardin Road. TA-II is primarily used to test explosive components. Research includes studies to develop techniques for measuring fractures in geologic strata. TA-II facilities within the main fenced area include the Explosive Components Facility (ECF) and the Classified Waste Landfill. Other TA-II facilities include the Facilities Command Center, the Solid Waste Transfer Facility (SWTF), and the Hazardous Waste Management Facility (HWMF).

Technical Area III (TA-III)
TA-III is the largest and most remote area of all technical areas. It contains facilities mostly separated by large undeveloped areas. TA-III is used to accommodate large-scale engineering test activities, that require large safety and/or security area buffers, such as sled tracks used for collision testing, centrifuges, and a radiant heat facility. Facilities include the Radioactive and Mixed Waste

Management Facility (RMWMF), the Mixed Waste Landfill (MWL), the Chemical Waste Landfill (CWL), the Large-Scale Melt Facility (LMF), the Melting and Solidification Laboratory (MSL), and the Solar Tower Facility.

Technical Area IV (TA-IV)
TA-IV is a compound located just south of TA-I and TA-II. This area is used to conduct R&D activities in inertial-confinement fusion, pulsed power, and nuclear particle acceleration. The two primary facilities in TA-IV are the Z-Machine Accelerator and the High Energy Radiation Megavolt Electron Source-III (HERMES-III) including several small or nonactive accelerators such as the SATURN accelerator, the Sandia Accelerator Beam Research Experiment (SABRE), the Repetitive High Energy Pulsed Power (RHEPP-I and RHEPP-II) accelerators, the High Power Microwave Laboratory, and the Short Pulse High Intensity Nanosecond X-Radiator (SPHINX).

Technical Area V (TA-V)
TA-V is located adjacent to and on the northeast end of TA-III. Facilities in TA-V routinely handle radioactive materials used in experimental research for nuclear fuel. TA-V houses the Sandia Pulsed Reactor (SPR), the Gamma Irradiation Facility (GIF), the Annular Core Research Reactor (ACRR), and the Hot Cell Facility (HCF).

Remote Test Areas
Several remote test areas are located south of TA-III and within the canyons and foothills of the land withdrawal (e.g., Lurance Canyon and Coyote Canyon). These areas are used for explosive ordnance testing, rocket firing experiments, and open burn thermal tests.

Sandia Corporation's Science and Technology Capabilities

- *Advanced Manufacturing*
- *Biotechnology*
- *Computational and Information Sciences*
- *Electronics*
- *Engineering Sciences*
- *Materials and Process Sciences*
- *Microelectronics and Photonics*
- *Modeling and Simulation*
- *Nanotechnology*
- *Pulsed Power Sciences*
- *Surety Sciences*

1.3 SITE SETTING

Regional Topography and Layout
KAFB has widely varied topography from rugged mountains on the east to nearly flat plains on the west. As shown in Figure 1-1, the land withdrawn area backs up to and encompasses a portion of the Manzanita Mountains within the Cibola National Forest. The remainder of KAFB, with the exception of Manzano Base, is situated on gently west-sloping foothill terrain that grades to widespread flat areas where the majority of USAF and SNL/NM facilities are located.

The Mountains
The most prominent topographic feature in the Albuquerque area is the impressive west face of the Sandia Mountains. The Sandia Mountains form a 13-mi long escarpment distinguished by steep cliffs, pinnacles, and narrow canyons. Sandia Crest at 10,768 ft is the highest point in the region. Tijeras Canyon divides the Sandia Mountains to the north from the Manzanita and Manzano Mountains to the south. Sediments transported from the canyons and draws of these mountains have formed coalescing alluvial fans called bajadas. These broad alluvial plains slope west across KAFB and are dissected by the Tijeras Arroyo, smaller arroyos, and washes.

Tijeras Arroyo
Tijeras Arroyo is 4,265 ft wide and 108 ft deep forming a significant topographic feature across KAFB. The watershed drained by Tijeras Arroyo includes the southern Sandia Mountains, the Manzanita Mountains, and the north end of the Manzano Mountains. The arroyo is dry except during heavy downpours, which can cause significant flash floods. The arroyo originates out of Tijeras Canyon and runs coincident with the Tijeras fault for several miles before deviating to the southwest, where it discharges to the Rio Grande.

The Rio Grande
The Rio Grande (Great River) is 1,800 mi long and extends from Stony Pass in the San Juan Mountains of Colorado to the Gulf of Mexico. In North America, it is second only in length to the Mississippi/Missouri River system. It is flanked by a narrow riparian forest ecosystem (bosque). The middle Rio Grande bosque has the largest stands of cottonwoods in the world. The cottonwoods depend on the natural flood cycles of the river for seedling propagation. However, flooding of the river has since been managed and contained by the construction of the Cochiti Dam

and an extensive system of flood control ditches built by the U.S. Army Corps of Engineers. As a result, the cottonwoods have been declining. A Bosque Ecosystem Monitoring Program in conjunction with the University of New Mexico (UNM) is studying the problem and working to preserve the bosque.

Today, water from the Rio Grande is primarily used for agricultural irrigation; however, plans are underway to build a water treatment plant by 2005 that will use water from the river to supplement Albuquerque's drinking water supply.

Regional Elevations
Elevations in the Albuquerque metropolitan area range from 4,898 ft at the Rio Grande, near the intersection of Interstate-40 and Interstate-25, to approximately 5,797 ft at the base of the Sandia Mountains. Albuquerque's average elevation of 5,312 ft makes it the highest large metropolitan city in America (AED 2002). The KAFB military reservation has a mean elevation of 5,384 ft. The maximum elevation at KAFB is 7,986 ft within the land withdrawn area.

Counties and Population
New Mexico is the fifth largest state in the U.S. with 121,666 sq mi in area and a total population of approximately 1.5 million. A recent count of the population within an 80-km (50-mi) radius of SNL/NM was 695,406 residents (DOC 2002). The Albuquerque metropolitan area alone has approximately 678,820 residents (DOC 2002). There are nine counties contained in all or part of this radius (Table 1-1 and Figure 1-2).

1.4 GEOLOGY

1.4.1 Regional Setting

The regional geologic setting in which SNL/NM and KAFB are situated is an area that has been subjected to relatively recent episodes of basaltic volcanism and ongoing intercontinental rifting (crustal extension). The Rio Grande rift has formed a series of connected down-dropped basins in which vast amounts of sediments have been deposited. The Rio Grande rift extends for about 450 mi from Leadville, Colorado to southern New Mexico and is one of the greatest troughs on earth.

1.4.2 Albuquerque Basin

The Albuquerque Basin is one of several north-south trending sediment-filled basins formed by the Rio Grande rift. This major structural feature is approximately 30 mi wide and 100 mi long and 3,000 sq mi in area (Grant 1982) (Figure 1-3). On the east, uplifted fault blocks, reflected by the Sandia, Manzanita, and Manzano Mountains are bound by the basin. The western side of the basin is bound by the Lucero uplift to the south, the Rio Puerco fault belt, and the Nacimiento uplift at the northern end. There is relatively little topographic relief along the Rio Puerco fault belt on the northwestern side of the basin. Two south-flowing rivers drain the basin: the Rio Puerco to the west and the Rio Grande to the east.

During the Miocene and Pliocene epochs, the basin filled with as much as 14,961 ft of sediments derived from the erosion of the surrounding highlands and material transported into the basin by the ancestral Rio Grande. This sequence of unconsolidated sediments (primarily the Santa Fe Group) thins toward the edge of the basin and is

TABLE 1-1. Counties Within a 50-mi Radius of SNL/NM

County	Primary Population Centers
Bernalillo	Albuquerque, KAFB, and east mountain residents (Sandia, Manzanita, and Manzano Mountains)
Sandoval	Corrales, Rio Rancho, Bernalillo, and several Indian Pueblos
Valencia	Bosque Farms, Los Lunas, and Belen
Santa Fe	Edgewood and suburbs of Santa Fe
Torrance	Moriarty and small villages east of the Manzano Mountains
McKinley	Sparsely populated northwest edge of the county
San Miguel	Sparsely populated southwest edge of the county
Cibola	Laguna Pueblo
Socorro	Several small villages on the north edge of the county

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FIGURE 1-2. State of New Mexico Map

The overlay shows major roads, cities, county lines, and the 50-mi radius from SNL/NM facilities (dashed circle).

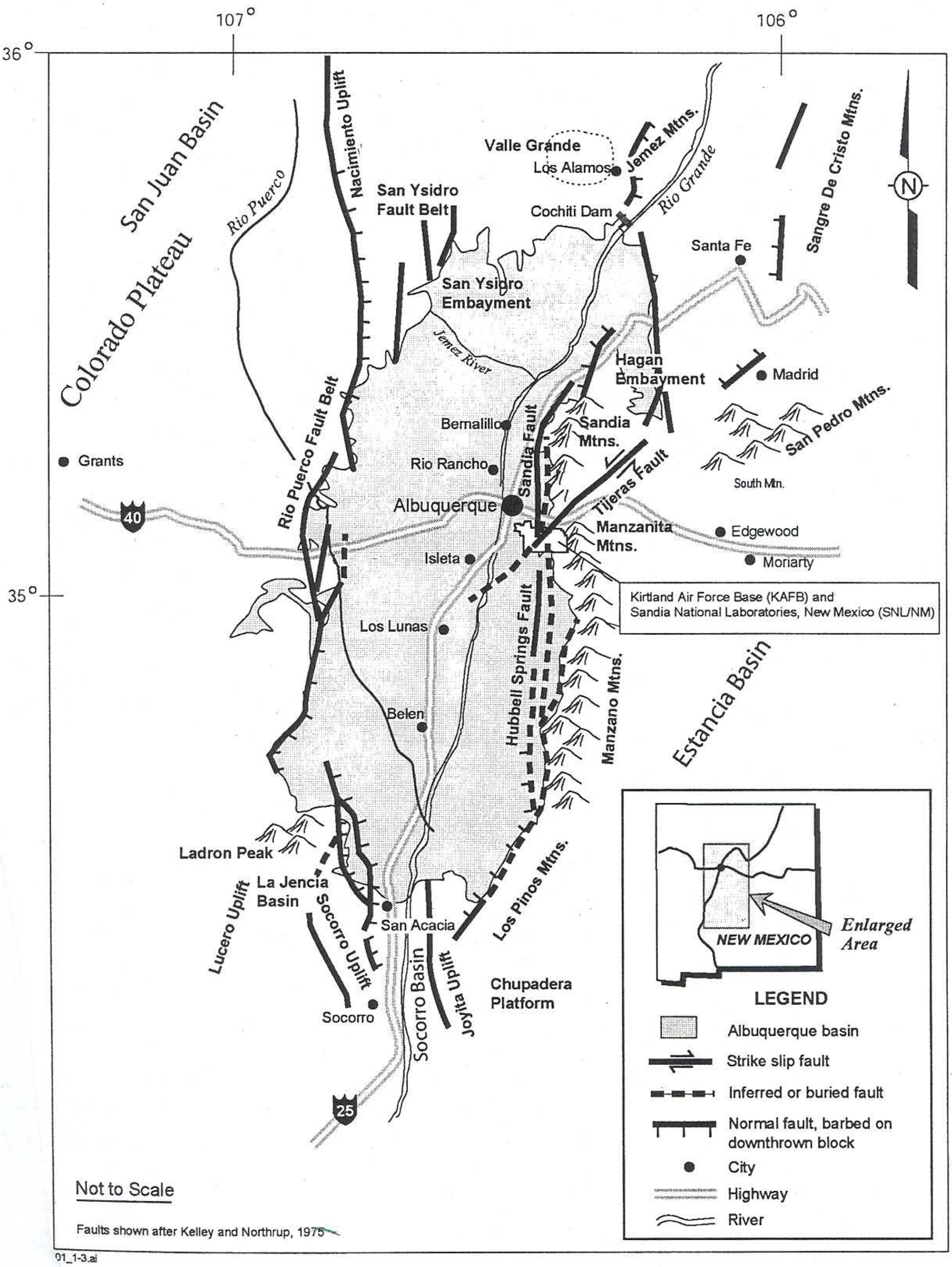

FIGURE 1-3. The Albuquerque Basin, North Central New Mexico, Showing Bounding Faults and Uplifts

truncated by normal faults at the bounding uplifts. The Santa Fe Group is overlain in places by Pliocene Ortiz gravel and Rio Grande fluvial deposits, which are interbedded with Tertiary and Quaternary basaltic and pyroclastic materials. The Santa Fe Group consists of channels, debris flow, floodplain deposits, and includes eolian and playa deposits toward the center of the basin (in the lower units). Most of the bedding is thought to be lenticular with limited lateral extent, although buried channels or debris flows can extend for miles. These subsurface features are of major importance in controlling the movement of groundwater within the basin.

Regional Fault Systems

As shown in Figure 1-4, several major faults are located on KAFB. The Tijeras fault, which has been traced as far north as Madrid, New Mexico, trends southwesterly through Tijeras Canyon and across KAFB. The Tijeras Canyon was formed by preferential erosion along the fault. The Tijeras fault is a strike-slip fault of Paleozoic (and younger) age expressed by southwesterly movement of the northern block (left lateral). The system of faults connecting with the Tijeras fault on KAFB is collectively referred to as the Tijeras fault complex. The Tijeras fault complex marks a distinct geologic boundary between the uplifted blocks on the east and the sediment-filled basin to the west. This geologic boundary also forms a boundary between the two groundwater regimes at KAFB.

The Sandia fault is thought to be the primary boundary between the Sandia Mountains and the Albuquerque Basin and shows evidence of Quaternary motion (Kelley 1977). The Sandia fault converges with the Tijeras fault and the Hubble Springs fault. The Hubble Springs fault has created the Hubbell Bench (at the south end of KAFB) with offsets of 15 to 100 ft and is one of the most clearly visible fault scarps on the edge of the basin (Machette et al. 1982). Both the Sandia fault and Hubble Springs fault are north-south trending, down-to-the-west, en-echelon normal faults, which are Tertiary in age (Lozinsky et al. 1991; Woodward 1982; Kelley and Northrup 1975).

1.5 HYDROLOGICAL SETTING

Because of the structurally complex terrain, the groundwater hydrology at KAFB is difficult to understand. In general, hydrogeological characterization is divided into two areas separated by the Tijeras fault complex, which marks a distinct geological boundary. To the east of the Tijeras fault complex, the geology is characterized by fractured and faulted bedrock covered by a thin layer of alluvium and shallow groundwater 49 to 98 ft deep. On the west side of the Tijeras fault complex within the basin, groundwater levels occur from 295 to 492 ft below the surface.

Natural Springs

There are two perennial springs present on KAFB: Coyote Springs and Sol Se Mete Spring. Additionally, there is one perennial spring (Hubbel Spring) located immediately south of the KAFB boundary on Isleta Pueblo.

Groundwater Yields

The primary regional aquifer in the basin is within the upper unit and, to a lesser degree, the middle unit of the Santa Fe Group. Most of the City of Albuquerque's water supply wells are located on the east side of the Rio Grande. The highest yield wells are screened in the sediments associated with the ancestral river channel. Prior to extensive urban development in the Albuquerque area beginning in the 1950s, the direction of regional groundwater flow was primarily to the southwest. As a result of groundwater withdrawal, the water table has dropped by as much as 141 ft (Thorn et al. 1993). Groundwater withdrawal from KAFB and City of Albuquerque wells at the north end of KAFB has created a trough-like depression in the water table causing flow to be diverted northeast in the direction of the well fields.

1.6 REGIONAL CLIMATE

Wide diurnal temperature extremes, monsoons, and frequent drying winds are characteristic of the Albuquerque Basin climate.

Air temperatures are characteristic of high-altitude and dry continental climates. Temperature averages are as follows:

Season	Daytime High (avg.)	Nighttime Low (avg.)
Summer	32.7 °C 90.8 °F	16.6 °C 61.8 °F
Winter	9.6 °C 49.2 °F	-4.6 °C 23.7 °F

Source: NOAA 2002

The monthly average relative humidity varies from a low of 30 percent in early summer to 56 percent in early winter.

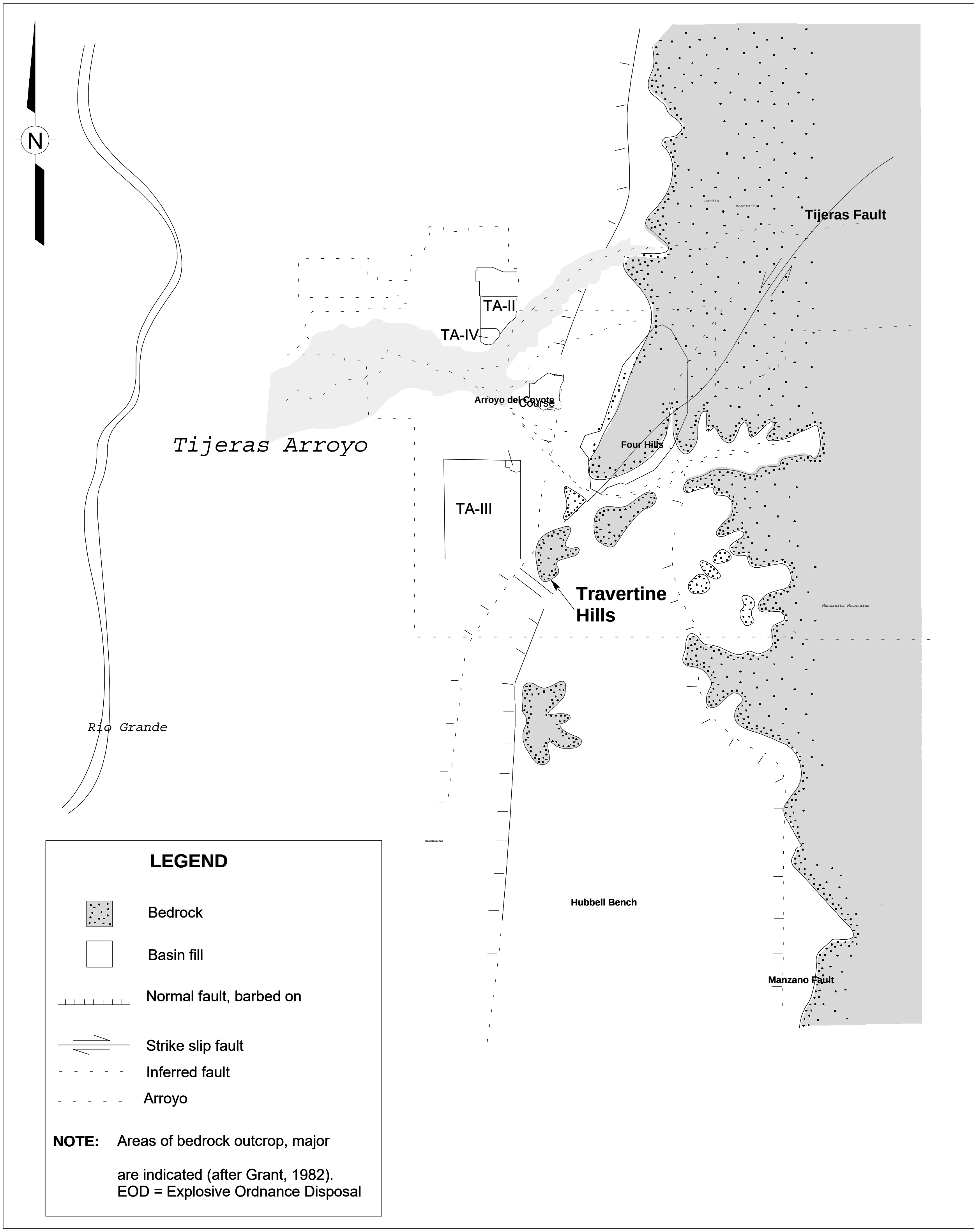

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FIGURE 1-4. Generalized Geology in the Vicinity of SNL/NM and KAFB

Annual precipitation, most of which occurs between July and October, averages approximately 8.3 in. on KAFB. In the higher elevations of the Sandia and Manzano Mountains, annual precipitation is between 12 to 35 in. The winter season is typically dry with less than 1.6 in. of precipitation recorded.

While the regional climate is described by the atmospheric state variables of temperature and humidity, site-specific meteorology at SNL/NM is influenced by the proximity to topographic features such as mountains, canyons, and arroyos. These features influence local wind patterns across the site; canyons and arroyos tend to channel or funnel wind, whereas mountains create upslope-downslope diurnal/nocturnal (day/night) wind flows. Duirnal winds tend to blow toward the mountains during the day and nocturnal winds tend to blow down the mountain towards the Rio Grande Valley. These topographically induced wind flows can be enhanced or negated by weather systems that move across the southwest part of the U.S. The strongest winds occur in the spring when monthly wind speeds average 10.3 mph. Wind gusts can commonly reach up to 50 mph.

1.7 REGIONAL ECOLOGY

The regional area within an 50-mi radius of SNL/NM facilities is situated at the junction of four major physiographic provinces:

- ***Great Plains Grassland Prairie*** (east of the Rocky Mountains);
- ***Great Basin Desert*** (west of the Rocky Mountains);
- ***Chihuahuan Desert*** (south of Albuquerque); and
- ***Rocky Mountains*** (the Sandia and Manzano Mountains form the southern extension of the Rockies).

Each province has an influence on the typical landforms, flora, and fauna predominant within the region. The Albuquerque area is perhaps most influenced by the Great Basin Desert ecosystem. With the topography at KAFB ranging from mountainous to flat grasslands, and much of the reservation remaining undeveloped, there is much diversity in plant and animal communities living on KAFB. At least 267 plant species and 195 animal species occur on KAFB (DOE 1999). Table 1-2 lists some of the birds, mammals, reptiles, and amphibians that have been identified on-site. Table 1-3 lists some of the plants identified on-site.

Prairie Dog Towns Enhance Local Ecology

KAFB is home to a vast array of prairie dog colonies. The Gunnison's prairie dog (Cynomys gunnisoni) is a social animal that provides ecological nourishment to the grasslands on KAFB. The prairie dog does a remarkable job of aerating soil, maintaining grassland vegetation, and providing shelter for other wildlife. Prairie dog burrows are often used by other rodents, reptiles, and birds. The Western burrowing owl (Athena cunicularia hypugaea) uses the prairie dog burrows during nesting season and is currently protected under the Migratory Bird Treaty Act (MBTA). KAFB, in cooperation with Hawks Aloft, Inc., conducts research on reproductive success and nest usage of the Western burrowing owl.

1.7.1 Regional Life Zones

The Canadian Life Zone occurs from 8,000 to 11,500 ft; the highest elevations in the Sandia and Manzano Mountains are just over 10,000 ft.

The Ponderosa Pine or Transition Zone occurs in the higher elevations of the land withdrawn area on KAFB. In the Albuquerque region, ponderosas generally occur between 7,000 and 8,000 ft.

The Piñon Juniper Zone generally occurs from 6,000 to 7,000 ft within canyons, foothills, and mesas. This zone makes up much of the rolling terrain located on the KAFB land withdrawn area.

The Upper Sonoran Life Zone occurs below 6,000 ft and supports scrubby semi-desert vegetation.

The Rio Grande and Bosque in the Albuquerque area occurs below 6,000 ft. The river is approximately seven miles from the western boundary of KAFB.

TABLE 1-2. A Partial List of Animals Identified at KAFB

BIRDS			
American robin	*Turdus migratorius*	Gray vireo	*Vireo vicinior*
American kestrel	*Falco sparverius*	Golden eagle	*Aquila chrysaetos*
Ash-throated flycatcher	*Myiarchus cinerascens*	Great horned owl	*Bubo virginianus*
Canyon towhee	*Pipilo fuscus*	Great-tailed grackle	*Quiscalus mexicanus*
Barn owl	*Tyto alba*	Grace's warbler	*Dendroica graciae*
Bushtit	*Psaltriparus minimus*	Gambel's quail	*Callipepla gambelii*
Black-chinned hummingbird	*Archilochus alexandris*	Hairy woodpecker	*Picoides villosus*
Black-throated sparrow	*Ampohispiza bilineata*	Horned lark	*Eremophila alpestris*
Black-headed grosbeak	*Pheucticus melanocephalus*	Dark-eyed junco	*Junco hyemalis*
Brown-headed cowbird	*Molothrus ater*	Killdeer	*Charadrius vociferus*
Broad-tailed hummingbird	*Selasphorus platycercus*	Lark bunting	*Caramopiza melanocorys*
Bank swallow	*Riparia riparia*	Loggerhead shrike	*Lanius ludovicianus*
Barn swallow	*Hirundo rustica*	Mountain bluebird	*Sialia currucoides*
Black-throated gray warbler	*Dendroica nigrescens*	Northern flicker	*Colaptes auratus*
Bewick's wren	*Thryomanes bewickii*	Piñon jay	*Gymnorhinus cyanocephalus*
Cooper's hawk	*Accipter cooperi*	Red-tailed hawk	*Buteo jamaicensis*
Common raven	*Corvus corax*	Rufous-sided towhee	*Pipiloerythro melanocephalus*
Chirping sparrow	*Spizella passerina*	Scrub jay	*Aphelocoma coerulescens*
Cassin's kingbird	*Tyrannus vociferans*	Turkey vulture	*Cathartes aura*
Crissal thrasher	*Toxostoma dorsale*	Western burrowing owl	*Athena cunicularia hypugaea*
Dark-eyed junco	*Junco hyemalis*	Western meadowlark	*Sturnella neglecta*
European starling	*Sturnus vulgaris*		
Greater roadrunner	*Geococcyx californianus*		
MAMMALS			
Black bear	*Ursus americanus*	Desert cottontail	*Sylvilagus audubonii*
Bobcat	*Felis rufus*	Deer mouse	*Peromyscus maniculatus*
Big brown bat	*Eptesicus fuscus*	Gunnison's prairie dog	*Cynomys gunnisoni*
Banner-tailed kangaroo rat	*Dipodomys spectabilis*	Gray fox	*Urocyon cinereoargenteus*
Brush mouse	*Peromyscus boylii*	Mountain lion	*Felis concolor*
Black-tailed jackrabbit	*Lepus californicus*	Mule deer	*Odocoileus hemionus*
Common porcupine	*Erethizon dorsatum*	Rock squirrel	*Spermophilus variegatus*
Common raccoon	*Procyon lotor*	Striped skunk	*Mephitis mephitis*
Coyote	*Canis latrans*		
REPTILES AND AMPHIBIANS			
Collared lizard	*Crotaphytus collaris*	Leopard lizard	*Gambelia wislizenii*
Chihuahuan spotted whiptail	*Cnemidophorus exsanguis*	Tiger salamander	*Ambystoma tigrinum*
Desert horned lizard	*Phrynosoma platyrhinos*	Western diamondback rattlesnake	*Crotalus atrox*
Eastern fence lizard	*Sceloporus undulatus*	Side-blotched lizard	*Uta stansburiana*
Gopher snake	*Pituophis melanoleucus*	Striped whip snake	*Masticophus taeniatus*
Great plains skink	*Eumeces obsoletus*	Short-horned lizard	*Phrynosoma douglassi*
Great plains toad	*Bufo cognatus*		

TABLE 1-3. A Partial List of Plants Identified at KAFB

PLANTS			
Apache plume	*Fallugia paradoxa*	Goathead	*Tribulus terrestris*
One-seed juniper	*Juniperus monosperma*	India ricegrass	*Oryzopsis hymenoides*
New Mexico porcupine grass	*Stipa neomexicana*	Ring muhly	*Muhlenbergia torreyi*
Purple three-awn	*Aristida purpurea*	Bush muhly	*Muhlenbergia porteri*
Shrub live oak	*Quercus turbinella*	Soapweed yucca	*Yucca glauca*
Spectacle pod	*Ditheryrea wislizenii*	Blue locoweed	*Astragalus lentiginosus*
Annual goldenweed	*Machaeranthera gracilis*	Globemallow	*Sphaeralcea incana*
Western blue flax	*Linum lewisii*	Beakpod milkvetch	*Astragalus lentigenous*
Four-wing saltbush	*Atriplex canescens*	Paperdaisy	*Psilostrophe tagetina*
Colorado piñon	*Pinus edulis*	Prickly pear cactus	*Opuntia polyacantha*
Desert marigold	*Baileya multiradiata*		

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Chapter 2

Compliance Summary

In this Chapter ...

Chapter Summary

Sandia Corporation conducts operations based on environmental regulations, statutes, and U.S. Department of Energy (DOE) Orders. A variety of programs at Sandia National Laboratories, New Mexico (SNL/NM) work together to strive for 100 percent compliance with applicable regulations. As a part of these federal, state, and locally mandated regulations, SNL/NM must adhere to strict reporting and permitting requirements.

External audits and appraisals are conducted at SNL/NM to identify any issues that may arise from operations. SNL/NM also conducts internal audits and appraisals as a part of quality assurance (QA). In 2001, four external audits and five inspections or sampling activities were conducted.

Six environmental occurences (i.e., problems, concerns, failures, malfunctions or deficiency in a process, procedure, or program) were reported in 2001. Occurences are categorized based on the severity of the event. All reportable occurences are tracked through the Occurence Reporting Processing System (ORPS).

Environmental Snapshot

- The "National Nuclear Security Administration FY 2001 Multi-Program Laboratory Appraisal of Sandia National Laboratories" report indicated that "Overall performance in Operations and Administration Support was Outstanding" (NNSA 2001).
- Sandia Corporation reviewed a total of 326 activities related to the National Environmental Policy Act (NEPA) in 2001, and submitted 62 NEPA checklists to the DOE for review.

SNL/NM tracks environmental progress through environmental performance measures that help to track trends in compliance status. Performance measures were included in ten areas of Environment, Safety, and Health (ES&H) and Environmental Restoration/Waste Management (ER/WM) in 2001.

Gunnison's prairie dog (*Cynomys gunnisoni*) looking out at the Manzanita foothills.

This chapter summarizes Sandia Corporation's compliance status with major environmental regulations, statutes, and DOE Orders applicable to operations conducted at SNL/NM (see shaded box on page 2-3). Environmental compliance specifically falls under the guidance of six primary DOE Orders as described under section 2.1.16. Specific environmental programs responsible for meeting compliance with these regulations are discussed in subsequent chapters of this Annual Site Environmental Report (ASER).

Current permits held by Sandia Corporation and DOE, National Nuclear Security Administration (NNSA), Office of Kirtland Site Operations (OKSO) for air, water, and waste are listed in Appendix B. Ongoing compliance issues and corrective actions, environmental occurrences, and environmental audits and appraisals are also discussed in this chapter.

2.1 COMPLIANCE STATUS WITH FEDERAL REGULATIONS

This section summarizes DOE and Sandia Corporation's compliance status with major environmental regulations, statutes, executive orders (EOs), and DOE Orders that pertain to the environment.

2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

CERCLA, commonly known as "Superfund," provides cleanup funds and/or assessment requirements for inactive waste sites at all federal facilities. CERCLA requirements are implemented under 40 CFR 302, "Designation, Reportable Quantities, and Notification." CERCLA was amended by SARA in 1986 to address significant hazardous waste sites.

A Preliminary Assessment/Site Inspection (PA/SI), as required by CERCLA Section 120 (DOE 1995), was performed at SNL/NM in 1988. This inspection confirmed that Sandia Corporation does not own any sites that would qualify for listing on the National Priorities List (NPL). The NPL lists the nation's high priority cleanup sites or "Superfund sites." Therefore, with respect to inactive hazardous waste sites, Sandia Corporation has no CERCLA reporting requirements. Other CERCLA reporting requirements are invoked in the case of a reportable quantity (RQ) release. CERCLA requires that any release to the environment (in any 24-hour period) of any pollutant or hazardous substance in a quantity greater than or equal to the RQ, must be reported immediately to the U.S. National Response Center (NRC). There were no RQ releases in 2001. If the release is "federally permitted" under CERCLA Section 101(10)H, it is exempted from CERCLA reporting. This reporting exemption also applies to any "federally permitted" release under SARA Title III. Sandia Corporation was in full compliance with CERCLA and SARA in 2001. NRC information can be found at the following website:

www.nrc.uscg.mil

Additional CERCLA reporting requirements defined under SARA Title III are discussed in the following section.

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

EPCRA, also known as SARA Title III, establishes emergency planning requirements for federal, state, and local governments and industry. EPCRA, passed in 1986, is implemented by:

- 40 CFR 355, "Emergency Planning and Notification" (EPCRA, Section 302-304);
- 40 CFR 370, "Hazardous Chemical Reporting: Community Right-to-Know" (EPCRA, Section 311-312); and
- 40 CFR 372, "Toxic Chemical Release Reporting: Community Right-to-Know" (EPCRA, Section 313).

EPCRA applies to all facilities in which there is a presence of a threshold quantity (TQ) of an extremely hazardous substance (EHS) equal to or greater than the threshold planning quantities or in specifically designated amounts as determined by the local community. EO 13148, Greening the Government Through Leadership in Environmental Management, strengthens and reiterates the goals of pollution prevention (P2) and reporting under EPCRA.

EPCRA requires that the community be informed of potential hazards, such as the type and location of large quantities of toxic chemicals used and stored by facilities in the community. EPCRA specifically mandates that chemical information be made

Major Environmental Regulations & Statutes Applicable to SNL/NM

Atomic Energy Act (AEA)
Directs U.S. Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission (NRC) in the management of nuclear materials and radioactive waste

Clean Air Act (CAA) and CAA Amendments (CAAA)
Provides standards to protect the nation's air quality

Clean Water Act (CWA)
Provides general water quality standards to protect the nation's water sources and byways

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances

Cultural resources acts
Includes various acts that protect archeological, historical, religious sites, and resources

Endangered Species Act (ESA)
Provides special protection status for federally-listed endangered or threatened species

Executive Orders (EOs)
Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and greening the government through leadership in environmental management

Federal Facility Compliance Act (FFCA)
Directs federal agencies regarding environmental compliance

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
Controls the distribution and use of various pesticides

Migratory Bird Treaty Act (MBTA) of 1918
Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests

National Emission Standards for Hazardous Air Pollutants (NESHAP)
Specifies standards for radionuclide air emissions and other hazardous air releases

National Environmental Policy Act (NEPA)
Ensures that federal agencies review all proposed activities and include environmental consideration in agency decision-making

Resource Conservation and Recovery Act (RCRA)
Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (USTs)

Safe Drinking Water Act (SDWA)
Provides specific standards used for drinking water sources

Superfund Amendments and Reauthorization Act (SARA) SARA,Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community

Toxic Substance Control Act (TSCA)
Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs)

available to local emergency response organizations, such as fire departments and hospitals. Any inadvertent release must be reported to appropriate state and local authorities and all subsequent reports must be made accessible to the public. The four major reporting requirements designated by specific sections of SARA Title III (or EPCRA) are shown in Table 2-1.

On October 29, 1999, the U.S. Environmental Protection Agency (EPA) published a final rule under section 313 of the EPCRA, which lowers the Toxic Release Inventory (TRI) reporting thresholds for persistent bioaccumulative toxic (PBT) chemicals and adds certain other PBT chemicals to the TRI. Other rulings related to PBTs have since been finalized. Relatively small releases of PBT chemicals can pose human and environmental health threats. PBT chemicals, such as lead and lead compounds are of concern not only because they are toxic, but because they remain in the environment for long periods of time, are not readily destroyed, and build up or accumulate in body tissue.

There were no reportable releases at SNL/NM under EPCRA or CERCLA in 2001. Information on EPCRA can be found at the following EPA website:

http://www.epa.gov/swercepp/crtk.html

TRI Reporting

EPCRA regulations (40 CFR 372) require that facilities with activities described in the Standard Industrial Classification (SIC) Code 20 through 39 that use toxic chemicals listed in SARA Title III over a threshold value must submit a TRI report. A TRI report is also required by EO 13148. The threshold value for listed chemicals for which a TRI report is required is 10,000 lb/yr, unless otherwise specified.

Sandia Corporation began submitting TRI reports to the EPA and the DOE in 1991. In 1995, chemical use at SNL/NM fell below the reporting threshold. However, Sandia Corporation continues to document its toxic chemical use in the Chemical Purchase Inventory Report, Calendar Year 2001 (SNL/URS Corporation 2002), which lists all purchases of chemicals (even though the quantities are below the threshold quantities).

Hazardous Chemical Inventory

Sandia Corporation conducts an annual hazardous chemical purchase inventory from both purchase data and Material Safety Data Sheets (MSDSs). The assumption is that chemicals purchased are equivalent to chemicals used; therefore, the actual chemical inventory at any given time may be different from the purchase inventory.

This purchase inventory supports compliance with SARA Title III as well as Title V of the Clean Air Act Amendments (CAAA) of 1990. Table 2-2 lists chemicals over 1,000 lb purchased in 2001 that are on the SARA Title III toxic chemical list and compares them to 1999 and 2000 purchases.

2.1.3 Resource Conservation and Recovery Act (RCRA)

RCRA regulates the generation, transportation, treatment, storage, and disposal of hazardous chemical wastes, non-hazardous solid wastes, and hazardous or petroleum products stored in underground storage tanks (USTs).

Under the authority of the New Mexico Hazardous Waste Act (NMHWA), the New Mexico Environment Department (NMED) administers regulatory programs in place of the EPA. Hazardous waste management activities at SNL/NM are conducted under NMED regulations. Some additional RCRA requirements and regulations of the EPA also apply. Applicable regulations are listed in Appendix C.

The hazardous component of mixed hazardous/radioactive waste is regulated as hazardous waste and is subject to the requirements of state and federal regulations. The radioactive component of mixed waste is regulated under the Atomic Energy Act (AEA) of 1946.

Sandia Corporation generates hazardous and mixed waste through normal operations. Sandia Corporation also generates hazardous and mixed waste through the ongoing environmental restoration (ER) project involving cleanup of sites that were formerly used for operations such as testing and disposal. Sandia Corporation has an active and successful program to minimize hazardous and mixed waste through product substitutions, process changes, material re-use, and recycling.

TABLE 2-1. 2001 SARA Title III (or EPCRA) Reporting Requirements Applicable to SNL/NM

Section	SARA Title III Section Title	Requires Reporting?		Description
		Yes	No	
302 - 303	Notification/ Plans	✓		Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/OKSO, which distributes it to the required entities.
304	Emergency Notification		✓	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2001.
311-312	MSDSs/ Chemical Purchase Inventory Report	✓		There are two "Community Right-to-Know" reporting requirements: (a) SNL/NM completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) SNL/NM provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA's alternative MSDS reporting, which is detailed in 40 CFR Part 370.21.
313	Toxic Chemical Release Forms		✓	Sandia Corporation is below the reporting threshold in 2001 for submitting a TRI Report for SNL/NM operations. SNL/NM has been below the reporting threshold for a TRI report since 1995.

NOTE: MSDS = Material Safety Data Sheets (gives relevant chemical information)
RQ = reportable quantity
EHS = extremely hazardous substance
TRI = Toxic Release Inventory
DOE = U.S. Department of Energy
OKSO = Office of Kirtland Site Operations
EPA = U.S. Environmental Protection Agency
NNSA = National Nuclear Security Administration
SNL/NM = Sandia National Laboratories, New Mexico

TABLE 2-2. 2001 Summary of SARA Title III (or EPCRA) Toxic Chemical Purchases at SNL/NM

Chemical Name	CAS Number	1999 Usage (lb/yr)	2000 Usage (lb/yr)	2001 Usage (lb/yr)
Acetone	*67-64-1*	7,021	8,533	6,068
Isopropyl alcohol (manufacturing - strong process, no supplier notification)	*67-63-0*	3,439	3,080	2,837
Methanol	*67-56-1*	2,028	1,732	1,912
Nitric acid	*7697-37-2*	4,186	2,907	1,317
Sulfuric acid (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size)	*7664-93-9*	52	30	3,131
TOTAL		16,726	16,282	15,265

NOTE: CAS = Chemical Abstract Service
lb/yr = pound per year

The following summarizes Sandia Corporation's hazardous waste management activities during 2001:

- Hazardous Waste - Much of the hazardous waste generated at SNL/NM is managed at the Hazardous Waste Management Facility (HWMF). The HWMF operates under a 10-year RCRA Part B Operating Permit issued by the EPA in August 1993 (active permits are listed in Appendix B). In 2001, the HWMF shipped a total of 97,755 lbs (44,341 kg) of RCRA-regulated hazardous wastes, including recycled hazardous materials. Details related to the HWMF operations are contained in Chapter 3.

- Explosive Waste – Explosive waste generated at SNL/NM is usually managed at the point of generation until it can be shipped to a treatment facility. In 2001, 864 lbs (392 kg) were sent to the Explosive Ordnance Disposal (EOD) and four large rocket motors totalling 29,844 lbs (13,537 kg) were sent to Hill Air Force Base for treatment.

  Sandia Corporation also has a permitted Thermal Treatment Facility (TTF) for treating certain explosive waste. The TTF operates under a 10-year Part B Operating Permit issued by the EPA in November 1994 (as listed in Appendix B). During 2001, Sandia Corporation did not use the TTF for waste treatment.

- Mixed Waste – Much of the mixed waste (MW) generated at SNL/NM is managed at the High-Bay Waste Storage Facility (HBWSF), the Manzano Storage Bunkers (MSB), and the Radioactive and Mixed Waste Management Facility (RMWMF). All three units are currently operating under interim status and have not yet received final operating permits. Sandia Corporation and DOE applied for a Part B Operating Permit most recently in 1996. In 2001, SNL/NM shipped 117,082 lbs (53,108 kg) of MW to off-site facilities. An additional 1,166 lbs (529 kg) of MW was treated at the RMWMF and rendered non-hazardous. Due to the significant weight of some containers, MW is reported in volume instead of weight. Details related to these facilities are contained in Chapter 3.

- ER Project – Sandia Corporation and DOE continued ER activities in 2001, assessing and remediating sites according to the Hazardous and Solid Waste Amendments (HSWA) Module 4 of the Part B Operating Permit, issued by EPA in September 1993. At the end of 2001, 158 sites and areas of concern (AOC) remained to be addressed at SNL/NM. During 2001, Sandia Corporation and DOE completed 11 ER sites and removed 30 from the permit. The ER project generated 311,888 lbs (141,470 kg) of RCRA-regulated waste in 2001.

  The Corrective Action Management Unit (CAMU), designed to process, store, treat, and contain waste (primarily contaminated soil) generated from ER Project site closures, operates under a 5-year authorization that expires in September 2002. Most of the waste in the CAMU is soil excavated from the Chemical Waste Landfill (CWL).

  Two treatment processes will be used as needed to treat soils before they are placed in the containment cell. The first is stabilization at the CAMU Temporary Unit (TU). Cement and other additives will be mixed with soil containing metals in the TU to stabilize the metals and moisture in the soil. In June 1998, the EPA issued authorization to operate the TU for a 12-month period that begins when Sandia Corporation and DOE certifies that the TU is ready for operation. Sandia Corporation and DOE did not use the TU in 2001, but expect to use it in 2002.

  The second CAMU treatment system is Low-Temperature Thermal Desorption (LTTD) Unit. It will be set up to remove certain organic compounds from some of the soils before they are placed in the containment cell. In August 1998, NMED issued a temporary authorization to operate the LTTD that will expire six months after the start of operation. Sandia Corporation and DOE did not use the LTTD in 2001, but expect to use it in 2002.

- USTs – USTs are regulated under the New Mexico Administrative Code (NMAC) as indicated in Appendix B. Sandia Corporation currently has three registered USTs at SNL/NM and complied with all regulatory requirements in 2001.

- Solid Waste – Non-hazardous solid waste is regulated under New Mexico Solid Waste Management Regulations administered by the NMED. Personnel at the Solid Waste Transfer Facility (SWTF) screen, bale, and ship non-hazardous solid waste generated from SNL/NM.

The SWIF also serves as SNL/NM's central recycling center. In 2001, the SWIF handled 2,249,271 lbs (4,958,794 kg) of solid waste and 783,824 lbs (1,728,036 kg) of cardboard, paper, newsprint, aluminum, and plastic for recycling. Additionally, 52,580 lbs (115,919 kg) of computers and electronic equipment were shredded and recycled. The SWIF processed 566,280 lbs (1,248,434 kg) of solid waste and 652,022 lbs (1,437,462 kg) of cardboard, paper, newsprint, aluminum, and plastic from cooperating agencies, including Kirtland Air Force Base (KAFB), Los Alamos National Laboratory (LANL), DOE/NNSA field offices, and Lovelace Respiratory Research Institute (LRRI).

- Permits - During 2001, Sandia Corporation held Part B (final) Operating Permits or authorization for five units used for hazardous waste management. Sandia Corporation operated three additional units under interim status while awaiting final permits. Two of the Part B Operating Permits will expire in 2002. In order to continue operations, Sandia Corporation and DOE are required to submit a request for renewing the permit for the HWMF on or before February 6, 2002. Sandia Corporation, DOE, and the NMED determined that the best approach was to combine the existing permits into a single comprehensive permit. During 2001, Sandia Corporation began to prepare a comprehensive Part B Operating Permit request that includes nine units used for management of RCRA-regulated hazardous and mixed waste. Eight of these units are discussed above: the HWMF, the TTF, the RMWMF, the HBWSF, the MSB, the CAMU, the TU, and the LTTD at the CAMU.

  The ninth unit that will be included in the comprehensive Part B Operating Permit request is the Auxiliary Hot Cell Facility (AHCF). The AHCF was built by refurbishing an existing facility. Sandia Corporation plans to use it to process waste that does not meet the waste acceptance criteria for the RMWMF or HBWSF. Sandia Corporation and DOE will request permission from NMED to use the AHCF under interim status before the final Part B Operating Permit is issued.

- Closures – During 2001, Sandia Corporation continued closure activities for hazardous waste management units that were operated under interim status and are no longer used as follows:

  CWL - The CWL was used for hazardous waste disposal under interim status until 1985. Sandia Corporation and DOE are closing the landfill under the terms of a plan approved by NMED. During 2001, Sandia Corporation and DOE continued to excavate waste and waste constituents from the CWL and underlying soil as part of a voluntary corrective measure (VCM). Much of the excavated soil will be placed in the CAMU containment cell.

  Interim Status Storage (ISS) unit - The ISS unit was used for container storage. In 2001, Sandia Corporation completed cleanup and sampling and will submit a report to NMED in early 2002.

2.1.4 Federal Facility Compliance Act (FFCA)

In October 1992, Congress passed the FFCA, establishing that federal facilities are required to comply with all federal, state, and local requirements for hazardous and solid waste. Because of the limited options for treatment and disposal of MW, Sandia Corporation had stored MW on-site longer than the one-year period allowed under the state and federal hazardous waste regulations. On October 4, 1995, the NMED, the DOE, and Sandia Corporation entered into a Federal Facility Compliance Order (FFCO) for management of MW at SNL/NM. Sandia Corporation developed an inventory of MW in storage. Sandia Corporation also developed a general Site Treatment Plan (STP), and a schedule for processing the waste.

In 2001, Sandia Corporation continued to characterize and treat MW, and to package them for shipment to permitted off-site treatment, storage, and disposal (TSD) facilities. Sandia Corporation met all milestones in the STP.

2.1.5 Atomic Energy Act (AEA)

In 1946, the AEA was passed to encourage the development and use of nuclear energy for general welfare, common defense, and security. The purpose of the AEA is to assure the proper management of nuclear materials and radioactive waste. The AEA, as amended, delegates the control of nuclear energy and nuclear materials primarily to the DOE, the NRC, and the EPA. Although federal regulations control radioactive emissions and the transport of nuclear materials, there are no federal regulations controlling radioactive waste. At SNL/NM, this authority is retained by the DOE and is governed by DOE Orders. In 1999, DOE Order 435.1, Radioactive Waste Management, Change 1 (DOE 2001b) replaced DOE Order 5820.2A.

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

The objectives of the CAA and the CAAA are to protect and enhance the quality of the nation's air. The EPA is responsible for describing and regulating air pollutants from stationary and mobile sources and for setting ambient air quality standards. The City of Albuquerque locally administers these standards as well as specific air emission permits and registrations as shown in Appendix B, Table B-1.

Ambient Air Quality

The City of Albuquerque announces air quality alerts requesting voluntary or mandatory compliance. Yellow alerts request voluntary cooperation to limit driving and open burning. Red alerts are mandatory no-burn days and request a voluntary non-driving day. Sandia Corporation honors these notices by not performing any open burns or detonations during yellow or red alerts. In 2001, Sandia Corporation was 100 percent compliant with CAA and CAAA as determined by monitoring records at its six ambient air quality surveillance stations.

National Emission Standards for Hazardous Air Pollutants (NESHAP)

NESHAP regulates releases of hazardous air pollutants to the air. Subpart H of 40 CFR 61 specifically regulates radionuclide emissions, other than radon, from DOE facilities. As required by the regulation, Sandia Corporation calculates an annual dose to potentially exposed members of the public. The regulation requires that Sandia Corporation determine the maximum possible dose that could be delivered to an individual residing at a nearby location 24 hours per day. The result is the effective dose equivalent (EDE) to the maximally exposed individual (MEI). The dose is compared to the EPA standard of 10 millirem per year (mrem/yr) allowed from radioactive air emissions from a DOE facility.

In 2001, the MEI was located at a KAFB facility just north of Technical Area V (TA-V). The dose at this location was 0.003 mrem/yr. The off-site MEI was located at Tijeras Arroyo (West). The dose at this location was 0.0012 mrem/yr. Both doses are below the EPA standard. Sandia Corporation met all NESHAP compliance requirements in 2001.

2.1.7 Clean Water Act (CWA)

The CWA sets forth goals to protect "Waters of the U.S." by controlling the discharge of pollutants. At SNL/NM, the CWA applies to sanitary and septic system wastewater effluents, storm water runoff, and surface water discharges. The CWA is implemented through local, state, and federal water quality standards as follows: (1) the City of Albuquerque administers sanitary sewer discharges based on federal pretreatment standards; (2) the NMED administers regulations concerning surface discharges; and (3) the EPA retains oversight over storm water discharges and mandates requirements for oil storage and secondary containment.

New Mexico Stream Standards

New Mexico has not been delegated authority to regulate discharges under the National Pollutant Discharge Elimination System (NPDES). However, New Mexico has enacted 20 NMAC 6.4 "Standards for Interstate and Intrastate Surface Waters" to protect the quality of surface waters in the State. Due to the hydrologic conditions at SNL/NM, Sandia Corporation does not specifically monitor for compliance with these standards. In order to determine compliance, SNL/NM compares analytical results from NPDES sampling with the stream standards. Some constituents of concern in New Mexico's Stream Standards that are not on the NPDES analyte list have been added to SNL/NM's analyte list to confirm compliance.

City of Albuquerque Sewer Discharge Regulations

There are five wastewater monitoring stations, or outfalls, at SNL/NM permitted by the City of Albuquerque. Four of these stations discharge directly to the City of Albuquerque public sewer and one is a categorical pretreatment station that is located upstream of the general outfalls.

There was one exceedence of permit limits in 2001. Details related to this exceedence is discussed in Section 2.4.

National Pollutant Discharge Elimination System (NPDES)

NPDES implements the requirements that are specific to all discharges made to "Waters of the U.S." as defined in the CWA. At SNL/NM, this is applicable to storm water runoff from any point that can drain to the Tijeras Arroyo. In 1999, five storm water samples were collected from two permitted stations. Storm water sampling was not required in 2000 or 2001. Analysis results indicated that several metals were over the benchmark values listed in the general permit.

However, results do not indicate SNL/NM operations are contributing to this condition. The small number of data points collected over the last several years (one storm water event in both 1997 and 1998) as well as the contribution of naturally-occurring metals in the sediment (total sample) indicate this result is not significant. The igneous and metamorphic rocks comprising the mountains to the east of KAFB are made up of minerals that are naturally high in metals such as magnesium, iron, zinc, and aluminum. As additional data becomes available, meaningful results will become more apparent. Section 6.3 discusses Sandia Corporation's 1999 storm water results. As stated in SNL/NM's storm water discharge permit, the next analytical samples will be collected in Fiscal Year (FY) 2002.

The EPA conducted an inspection of the Storm Water Monitoring Program at SNL/NM on June 4, 2001. The recommendations generated from this inspection are also discussed in Section 6.3.

Surface Water Discharge

Surface discharges made to the ground or to containment areas must be first evaluated for compliance with regulations implemented through the New Mexico Water Quality Control Commission (NMWQCC). Sandia Corporation issued 28 one-time surface discharge permits in 2001. Additionally, two evaporation lagoons in TA-IV are permitted by the NMED due to the routine nature of the discharges. The lagoons are used to contain and evaporate accumulated storm water pumped from the secondary containment areas around seven oil tanks, which support the pulsed power accelerators. All permit conditions for the two lagoons were met in 2001.

In 2001, there were four reportable surface releases that were reported as occurrences and reviewed by the Surface Discharge Program (Section 2.4).

2.1.8 Safe Drinking Water Act (SDWA)

The SDWA, passed in 1974 and amended several times since, sets national drinking water standards, surface water sources, and includes a few provisions for groundwater. SDWA standards are designed to protect human health by regulating the allowable amount of chemicals, metals, radionuclides, bacteria, and other potential pollutants in potable water sources. Discharges from residential, municipal, and industrial sources are closely monitored and regulated to prevent contamination of drinking water sources. All drinking water systems in the U.S. must be routinely tested to ensure that the water meets the EPA's National Drinking Water Standards.

The SDWA addresses the following areas:

- Threshold contaminant levels,
- Treatment techniques to remove certain contaminants, and
- Monitoring and reporting requirements.

Drinking Water Supply at SNL/NM

Potable water for most facilities on KAFB (including SNL/NM) is provided by the KAFB Water System. The system derives its water from deep groundwater wells (discussed in Chapter 7). KAFB's water utility operates under EPA identification number NM3567701 and serves approximately 30,000 people who live and work on KAFB. KAFB routinely samples its water for trihalomethanes, coliforms, volatile organic compounds (VOCs), gross alpha and gross beta radioactivity, and various inorganic chemicals.

Information on the KAFB Water System is located at EPA's SDWA website, which details the compliance status for all drinking water systems in the U.S.:

http://www.epa.gov/safewater

NOTE: Although it is KAFB's responsibility to meet regulatory monitoring and reporting requirements for potable water, SNL/NM's Industrial Hygiene Program routinely collects potable water samples in response to potable water concerns.

2.1.9 Toxic Substances Control Act (TSCA)

TSCA addresses the import, export, use, and disposal of specifically listed toxic chemicals. At SNL/NM, compliance with TSCA primarily involves the handling and disposal of polychlorinated biphenyls (PCBs) and asbestos. Sandia Corporation was in full compliance with the TSCA in 2001.

Asbestos – In 2001, the HWMF shipped 131,896 lbs (59,827 kg) of asbestos waste for disposal. Asbestos waste increased in 2001 due to facility renovation projects.

PCB – In 2001, the HWMF shipped 21,290 lbs (9,657 kg) of PCB waste for disposal and 7,447 lbs (3,378 kg) of PCB waste for recycling.

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

FIFRA regulates the use of pesticides and is enforced under the New Mexico State Pesticide Control Act. Sandia Corporation's Biological Control Activity includes compiling information on pesticide use at SNL/NM, including the use of herbicides for weed control, rodenticides for control of mice and other rodents, and insecticides for control of insect pests. Copies of product labels and MSDSs are maintained for all pesticide products applied at SNL/NM. Sandia Corporation contracts with commercial certified pest control agencies when applying EPA-registered pesticides. SNL/NM maintains copies of certified pest control agency credentials. Sandia Corporation was in full compliance with FIFRA in 2001.

2.1.11 National Environmental Policy Act (NEPA)

NEPA requires federal agencies and private entities that perform federally-sponsored projects, including DOE, to analyze potential impacts to the environment during the early planning of proposed actions. If the proposed action is determined to be environmentally "significant," the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before an irretrievable commitment of resources or funding occurs. Although a major objective of NEPA is to preserve the environment for future generations, the law does require an agency to select the proposed action alternative with the least environmental impacts. One of the major intents of the law is to ensure that federal agencies are aware of the potential environmental impacts associated with their operations and are able to make informed decisions based on this information. NEPA also mandates that the decision process be open for public review.

2001 NEPA Documentation

During 2001, Sandia Corporation performed a total of 326 NEPA reviews, including the preparation and submission of 62 NEPA checklists for DOE/NNSA/OKSO review and determination. A total of 124 citations were made against the SNL/NM Site-Wide Environmental Impact Statement (SWEIS) (DOE 1999). Table 2-3 provides a summary of SNL/NM NEPA reviews performed in 2001. SNL/NM NEPA staff also supported DOE in the preparation of the Final Environmental Assessment for the proposed "Sandia Underground Reactor Facility (SURF) in TA-V," issued in November 2001 (DOE 2001c).

> **SWEIS Maintenance**
>
> The SWEIS analyzed SNL/NM's operations, processes, site characteristics, and potential operational impacts for 1996 and 1997 baseline conditions and for projected expanded operations of selected facilities. In 2001, the SWEIS Annual Review (AR) - FY 2000 (SNL 2001i) provided an updated summary of SNL/NM operational activities compared to the environmental analysis in the SWEIS. Preparation of the SWEIS AR will support both ongoing NEPA compliance at SNL/NM and preparation of an expected supplement analysis by DOE in 2004. Preparation of a supplement analysis is a process used to determine whether the SWEIS continues to represent the environmental impacts of SNL/NM operations, or whether a supplemental or new SWEIS should be prepared.

NEPA staff also supported preparation of 24 U.S. Air Force (USAF) Environmental Checklists (AF-813 forms) submitted for land-use permits and SNL/NM projects on KAFB property.

2.1.12 Endangered Species Act (ESA)

ESA applies to both the activities of private individuals and federal agencies (Section 7 of the ESA specifically applies to federal agencies). At SNL/NM, ESA compliance is coordinated with NEPA compliance reviews. The law ensures that any action authorized, funded, or carried out by a federal agency will not jeopardize the continued existence of a "threatened or endangered species," or result in adverse modifications to its habitat.

Wildlife

There are several state- and federally-listed threatened and endangered species that could potentially occur in Bernalillo County as shown in Table 2-4. Two state-listed, threatened species have the potential to occur on KAFB. These include the spotted bat (*Euderma maculatum*) and the gray vireo (*Vireo vicinior*). The gray vireo has been sighted in the Cibola National Forest land withdrawn area. Two state-listed species that could be transients through KAFB include the bell's vireo (*Vireo bellii*) and baird's sparrow (*Ammondramus bairdii*). There are no plant species known to occur on KAFB that are currently listed as endangered by the New Mexico Forestry and Resource Conservation Division of the New Mexico Energy, Minerals and Natural Resources Department.

TABLE 2-3. Summary Data for SNL/NM NEPA Reviews Performed in Calendar Year 2001

NEPA Reviews		Types	Quantity
DOE NEPA		DOE Checklist Submittals	62
SNL/NM NEPA	**NEPA Module Reviews**	SNL/NM SWEIS Citations	124
		SNL/NM 'Other' Citations[1]	41
		SNL/NM citing Categorical Exclusions	6
		Additional Reviews[2]	28
	ER Project NEPA[3]	ER Project Reviews (Total)	11
	EDP[4]	SNL/NM SWEIS Citations	18
		EA-1195 Citations	11
		Under review	1
		SNL/NM Reviews (Total)	302
Air Force (AF) NEPA[5]		Land Use Permit Renewals	12
		Land Use Permit Terminations	1
		Other Projects	11
		AF-813 Submittals (Total)	24
GRAND TOTAL	**(SNL/NM Reviews plus AF-813 Submittals)**		326

NOTE: [1]Includes citations to several existing environmental assessments (EAs) and several comprehensive National Environmental Policy Act (NEPA) checklists.
[2]Includes other U.S. Department of Energy (DOE) determinations such as new Site-Wide Environmental Impact Statement (SWEIS) supplement analyses, and other DOE determinations, including categorical exclusions.
[3]All Environmental Restoration (ER) reviews cite the ER Project EA. Projects that did not fit within the scope of the EA required preparation of a NEPA checklist. ER activity checklists were captured in the "DOE Checklist Submittals" count and in the Air Force "Other Projects" count.
[4]Experiment Development Plan (EDP): An electronic system used by the Full-Scale Experimental Complex to record Project information, including NEPA reviews. All EDP reviews are subsequently reviewed by the NEPA Team.
[5]All Air Force NEPA documents are prepared by the NEPA Team in cooperation with the project originator.
SNL/NM = Sandia National Laboratories, New Mexico

TABLE 2-4. Threatened and Endangered Species Potentially Occurring in Bernalillo County, New Mexico

Species		Federal Status	State Status
MAMMALS			
Spotted bat	*Euderma maculatum*	--	Threatened
New Mexican jumping mouse	*Zapus hudsonius luteus*	--	Threatened
FISH			
Rio Grande silvery minnow	*Hybognathus amarus*	Endangered	Endangered
PLANTS			
None listed			
BIRDS			
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
Common black-hawk	*Buteogallus anthracinus anthracinus*	--	Threatened
American peregrine falcon	*Falco peregrinus anatum*	--	Threatened
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	--
White-eared hummingbird	*Hylocharis leucotis borealis*	--	Threatened
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered
Whooping crane	*Grus americana*	Endangered	Endangered
Bell's vireo	*Vireo bellii*	--	Threatened
Gray vireo	*Vireo vicinior*	--	Threatened
Baird's sparrow	*Ammodramus bairdii*	--	Threatened
Neotropic cormorant	*Phalacrocorax brasilianus*	--	Threatened

NOTE: There are no listed endangered or threatened plant, reptile, or amphibian species in Bernalillo County.

The SNL/NM Environmental Information Document (EID) (SNL 1999b), a resource document for the SWEIS (DOE 1999), includes a section on biological resources. The management of sensitive species and habitat is also discussed in the SNL/NM ES&H Manual, Section 10B, "NEPA, Sensitive Species, and Historic Properties" (SNL 2002k).

2.1.13 Migratory Bird Treaty Act (MBTA)

The MBTA of 1918, as amended, was established by Canada, Japan, Russia, Mexico, and the United States. The MBTA prevents the taking, possession, killing, transportation, and importation of migratory birds, their eggs, parts, and nests. Federal institutions are not exempt from the MBTA. Guidance is being developed by the U.S. Fish and Wildlife Service to assist federal institutions in interpreting the MBTA. At SNL/NM, MBTA is coordinated with NEPA compliance reviews and through Telecon work orders. In 2001, no migratory birds were relocated.

2.1.14 Cultural Resources Acts

The three primary cultural resources acts applicable at SNL/NM are as follows:

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

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

Historical properties, as defined by NHPA and implementing regulations, include archaeological sites, historic buildings, and structures. Historic buildings and structures may include those over 50 years old that are historically significant, or younger structures of exceptional significance.

There are no known archaeological sites located on DOE/NNSA-owned property, although cultural and historic sites do exist in proximity to DOE/NNSA-leased property and ER sites. These areas are located both on USAF property and on portions of the Cibola National Forest land withdrawn area. Sandia Corporation's activities are usually planned to avoid potential impacts to such archaeological sites. It is DOE's responsibility to ensure that cultural resources are not adversely impacted by DOE activities.

The EID provides information on cultural resources at KAFB (SNL 1999b). Cultural resources compliance is discussed in the SNL/NM ES&H Manual, Section 10B, "NEPA, Sensitive Species, and Historic Properties" (SNL 2002k).

Historical Building Assessment

In 2000, information was prepared to assist DOE in determining whether buildings in TA-I are eligible for the National Register of Historic Places as required under NHPA. There are 81 buildings in TA-I of greater than 1,000 ft^2 that were built or acquired before 1990. These buildings have been documented on State of New Mexico Historic Building Inventory forms. DOE will determine the eligibility of TA- I buildings to be included in the National Register in consultation with the New Mexico State Historic Preservation Officer (SHPO). To date, this consultation has not yet been completed.

2.1.15 Environmental Compliance Executive Orders (EOs)

There are four EOs related to environmental compliance:

- Floodplain Management (EO 11988), as amended – This EO has minimal impact for SNL/NM, since all active SNL/NM facilities are located outside the 500-year floodplain as described by the U.S. Army Corps of Engineers (ACE) (USACE 1979). This applies to both major on-site drainages: Tijeras Arroyo and Arroyo del Coyote.

- Protection of Wetlands (EO 11990), as amended – Wetlands are areas inundated by surface or groundwater with a frequency sufficient to support a prevalence of aquatic plant and/or animal life. Wetlands generally include swamps, bogs, potholes, ponds, mudflats, and areas around natural springs. There are several natural springs on KAFB with a limited wetland setting. These springs, located on USAF property and the land withdrawn area, are managed by the USAF and the U.S. Forest Service (USFS). The springs provide an important source of drinking water for wildlife and create a unique biological niche in an otherwise arid habitat.

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

- Greening the Government Through Leadership in Environmental Management (EO 13148) – EO 13148 requires federal agencies to ensure that "all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning processes, across all agency missions, activities, and functions." Among the primary agency goals is support to the development and implementation of environmental management systems, and the establishment of environmental compliance audit programs and policies "that emphasize pollution prevention as a means to both achieve and maintain environmental compliance." Sandia Corporation is working under guidance from DOE/NNSA/OKSO towards compliance with this law.

2.1.16 DOE Orders

There are six primary DOE Orders that pertain to environmental protection and management:

- DOE Order 5400.1, General Environmental Protection Program (DOE 1990);
- DOE Order 5400.5, Radiation Protection of the Public and the Environment (DOE 1993);
- DOE Order 231.1, Environment, Safety, and Health Reporting, Attachment 1, "Contractor Requirements Document" (DOE 1996);
- DOE M 231.1-1, Environment, Safety, and Health Reporting Manual, as amended by DOE Order 470.2A (DOE 2000a);
- DOE Order 435.1, Radioactive Waste Management (DOE 2001b); and
- DOE/AL Order 5400.2A, Environmental Compliance Issue Coordination (DOE 1993a).

In 2001, Sandia Corporation met all requirements stated in these DOE Orders.

2.1.17 Summary of Radiological Releases

A summary of radiological releases and public dose resulting from Sandia Corporation operations is provided in Table 2-5. More detailed information is found in Chapters 5 and 6 of this report.

2.2 CURRENT COMPLIANCE ISSUES AND ACTIONS

Environmental issues and actions current in 2001 relating to noncompliance or corrective actions at SNL/NM are discussed below.

- MW Management – Although Sandia Corporation is in compliance with the FFCO, MW is stored at SNL/NM for more than one year in violation of the hazardous waste land disposal restrictions specified in state and federal regulations. The FFCO acknowledges the lack of permitted treatment and disposal capacity for MW and allows such wastes to be stored for more than one year. During 2001, Sandia Corporation continued to process MW in compliance with the schedule and plan developed under the FFCO. However, it will be several years before Sandia Corporation is able to process all of the wastes stored on-site. Table B-3 in Appendix B details the history of Sandia Corporation's MW compliance.

- Ozone (Smog) Issue – On October 1999, a 1-hour ozone standard was proposed to ensure that the public receives continued health protection from ground-level ozone. On July 5, 2000, the EPA officially reinstated its 1-hour ozone standard in nearly 3,000 counties across the U.S. Ambient ozone at SNL/NM has been continuously monitored since 1995.

- Particulate Matter (PM) (Soot) Issue – A new standard was developed for PM in 1998 to include particulates with a diameter less than or equal to 2.5 µm ($PM_{2.5}$). A proposed annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ and a 24-hour standard of 65 $\mu g/m^3$ were established. SNL/NM plans to monitor for $PM_{2.5}$ during 2002.

TABLE 2-5. SNL/NM Radiological Dose Reporting for Calendar Year 2001

Pathway	Dose to MEI		% of DOE 100 mrem/yr Limit	Estimated Population Dose (80 km radius)		Population within 80 km radius of site	Estimated Background Radiation Population Dose	
	mrem	mSv		Person-rem	Person-Sv		Person-rem	Person-Sv
Air	3E-3	3E-5	0.03%	3.7E-1	3.7E-3	698,691	-	-
Water	0	0	0	0	0	0	-	-
Other Pathways	0	0	0	0	0	0	-	-
All Pathways	3E-3	3E-5	0.03%	3.7E-1	3.7E-3	698,691	2.5E5	2.5E3

Radiological Atmospheric Releases for 2001 (in Curies)

Tritium	Kr^{85}	Noble Gases ($t_{1/2}$ <40 days)	Fission and Activation Products ($t_{1/2}$ <3 hr)	Fission & Activation Products ($t_{1/2}$ >3 hr)	Total Radio-iodine	Total Radio-strontium	Total U	Pu	Other Actinides	Other
4.5	0	16.2	7.6E-4	3.9E-7	0	3.8E-7	1.1E-6	1E-13	9.7E-6	1.1E-4

Liquid Effluent Releases of Radioactive Material for 2001

Tritium	Fission and Activation Products ($t_{1/2}$ <3 hr)	Fission & Activation Products ($t_{1/2}$ >3 hr)	Total Radio-iodine	Total Radio-strontium	Total U	Pu
0	0	0	0	0	0	0

NOTE: mrem = millirem
mSv = millisievert
DOE = U.S. Department of Energy
MEI = maximally exposed individual

- U.S. Supreme Court Rules in Ozone and PM Case – The U.S. Supreme Court on February 27, 2001, unanimously upheld the constitutionality of the CAA as EPA had interpreted it in setting health-protective air quality standards for ground-level ozone and particles. The EPA set those standards in 1997 to better protect the public from the wide variety of health problems that air pollution can cause. The Supreme Court also reaffirmed EPA's long-standing interpretation that it must set these standards based solely on public health considerations without consideration of costs.

2.3 2001 AUDITS AND APPRAISALS

Operations at SNL/NM are routinely subjected to audits by external regulatory agencies including the DOE. Sandia Corporation also conducts its own self-assessments and appraisals. Audits identify issues that may be positive or negative in nature. Addressing negative issues resulting from audits and appraisals is the responsibility of each program area. The ES&H Manual provides requirements for addressing and tracking corrective actions (SNL 2002). Audits and appraisals conducted by external agencies in 2001 are listed in Table 2-6.

2.4 2001 RELEASES AND ENVIRONMENTAL OCCURRENCES

An occurrence is defined as a problem, concern, failure, malfunction, or a deficiency in equipment, process, procedure, or program. It is also any condition or event that adversely affects, or may adversely affect, DOE or contractor personnel, the public, property, the environment, or the DOE's mission, security, or operations. Environmental occurrences that occurred in 2001 are described in Section 2.4.2.

2.4.1 Occurrence Tracking

Occurrence reporting is tracked by the ES&H Safety and Security Reporting, Feedback, and Information Management Department. All occurrences at SNL/NM are entered into the ORPS database, which tracks corrective actions and closeouts. Final responsibility for completing corrective actions rests with each affected organization. Table 2-7 presents a five-year history of occurrence reporting status for SNL/NM.

TABLE 2-6. Environmental Program Audits and Appraisals Conducted in 2001

Appraising Agency	Title	Date	Summary
External Audits, Appraisals, and Assessments			
EPA/NMED	Multi-Media audit	June - August 2001	Multi-media environmental assessment focused on waste, air, water, and PCBs
DOE/NNSA/ OKSO	Contractor Performance Assessment Program	September 2001	Appraisals of ISMS, worker safety, cross-cutting functions, environmental/public protection, nuclear explosives safety. There were 8 Findings, 10 Noteworthy Practices, and 11 Observations.
Lockheed Martin Corporation (LMC)	SNL/NM Nuclear Safety Programs	September 2001	LMC personnel reviewed programs associated with nuclear safety including QA, Nuclear Operations, Radiation Protection, Internal Audits, PAAA, and RMWMF
URS Corporation	Meteorological Towers	November 2001	An independent assessment of the meteorological towers operated by the Environmental Management Department in support of the air quality and emergency management programs.
Inspections and Observations			
City of Albuquerque	Follow-up to First Annual Air Quality Inspection and EPA Method 9 Visual Determination of Opacity	February 2001	Inspected Standby Power Plant Building 862 and its four standby diesel generators.
Sampling and Inspections			
City of Albuquerque	Wastewater sampling	March 2000	Collected routine samples at five permitted wastewater discharge points
City of Albuquerque	Routine Wastewater Inspection	April 2001	Routine inspection of wastewater discharge subject to permit 2069 G
City of Albuquerque	Routine Wastewater Inspection	May 2001	Routine inspection of wastewater discharge subject to permit 2069 K
City of Albuquerque/ NMED	Routine Wastewater Inspection	June 2001	Routine inspection of wastewater discharge subject to permit 2069 A, 2069 F, 2069 G, 2069 I, 2069 K. NMED also obtained samples for radiological analysis at 2069 K.

NOTE: DOE = U.S. Department of Energy
OKSO = Office of Kirtland Site Operations
ISMS = Integrated Safety Management System
PAAA = Price-Anderson Amendments Act
RMWMF = Radioactive and Mixed Waste Management Facility
NNSA = National Nuclear Security Administration
EPA = U.S. Environmental Protection Agency
NMED = New Mexico Environment Department
PCB = polychlorinated biphenyl
QA = quality assurance

TABLE 2-7. Summary of Environmental Occurrences at SNL/NM in the Past Five Years

Year	Waste Management	Surface Discharge or Water Quality	Air Quality	Other	Total Reportable Releases to the Environment
2001	**1**	**4**	**0**	**1**	**6**
2000	0	10 (9)	0	1	11 (10)
1999	2	4	1	1	8
1998	4	0	0	0	4
1997	7 (6)	5 (3)	1	0	13 (10)

NOTE: The numbers in parentheses for 1997 and 2000 represent the incidences for which an occurrence report was prepared.

Information on the ORPS can also be found at the following website:

http://tis.eh.doe.gov/oeaf/orps.html

DOE Order 232.1A, Occurrence Reporting and Processing of Operations Information (DOE 1997), establishes a DOE system for identification, categorization, notification, analysis, reporting, follow-up, and closeout of occurrences. The DOE notifies appropriate agencies based on the nature of each occurrence.

Occurrence Categories

There are three types of environmental occurrences that are determined by the severity of the event as described on page 2-17. All significant releases in the first two categories are reportable to outside state and federal agencies and the DOE immediately upon occurrence categorization. An occurrence can also be incurred as the result of an audit finding or other break in permit compliance and/or official agreement.

ES&H Occurrence Reporting Guidance

An internal guidance agreement from DOE/NNSA/OKSO for categorizing occurrence reporting (in addition to environmental categories) was recently updated to include: (1) electrical shocks, (2) suspicious packages, (3) near-miss occurrences, (4) unauthorized firearm discharge, and (5) sealed source accountability limits. The ES&H Manual, Chapter 18, "Reporting, Investigating and Correcting ES&H Events," was updated in May 2000 to improve guidance for determining what constitutes an occurrence and the proper reporting procedures (SNL 2000a).

Emergency Preparedness at SNL/NM

Sandia Corporation's notification and communication procedures are given in the SNL/NM Emergency Plan (SNL 2002j). The plan also describes SNL/NM's major facilities, hazards, and potential chemical releases. In addition to Sandia Corporation and the DOE, the plan is distributed to the City of Albuquerque emergency response officials, the State of New Mexico Department of Public Safety, the KAFB Fire Department, and other KAFB officials. DOE Order 151.1A, Comprehensive Emergency Management System (DOE 2000), provides the requirements for the SNL/NM Emergency Plan (SNL 2002j).

2.4.2 2001 Occurrences

There were six reportable environmental occurrences at SNL/NM in 2001:

(1) Cooling tower sludge discharged to storm drain - On March 3, 2001, SNL/NM maintenance personnel were cleaning a cooling tower sump, and were pumping sludge and water from the sump into a truck mounted holding tank. The holding tank overflowed, discharging sludge and water to the concrete drive in the area of the loading dock. Most of the discharged material pooled on the concrete drive, but a small quantity (approximately ten gallons) entered a storm drain inlet located at the edge of the concrete drive. On March 5, SNL/NM personnel cleaned up the dried material on the drive, and DOE verbally reported the release to NMED. DOE also provided 7-day and 15-day reports to NMED as required in 20 NMAC 6.2.

Emergency Preparedness at SNL/NM

Emergency planning notification, as required by EPCRA, facilitates emergency response and preparedness capabilities through better coordination and planning with state and local authorities.

Sandia Corporation conducts routine emergency drills and an annual full-scale exercise to simulate events such as a release or event with off-site impacts. These events are conducted through the Emergency Operations Center (EOC) and may involve full participation from the KAFB Fire Department, hazardous materials teams, and local hospitals.

Emergency exercises test Sandia Corporation's ability to quickly coordinate a response and function efficiently with other emergency response agencies. Of key importance is the ability to quickly characterize the level of emergency and to make proper notifications to DOE, city, state, and Indian Pueblo authorities in a timely manner. The ability to disseminate accurate and timely news reports to local media are handled by the Joint Information Center.

Environmental Occurrence Categories	*Category Description*
Emergency Occurrence	An "Emergency Occurrence" describes any actual or potential release of material that would put communities or the environment in great harm. There are three levels of emergency occurrences—Alert, Site Area, and General Emergency. A General Emergency is a release that goes beyond DOE/NNSA/OKSO-owned property or is a very significant on-site event. All state and federal agencies would be immediately contacted after the occurrence was categorized. There has never been an "Emergency Occurrence" of any level at SNL/NM.
Unusual Occurrence	An "Unusual Occurrence" includes CERCLA RQ releases and other more significant events based on quantities released or damage incurred. All releases in this category are reported to outside state or federal agencies and DOE. DOE must be notified as soon as practical, but within two hours of occurrence categorization.
Off-Normal Occurrence	An "Off-Normal Occurrence" is an unplanned release that adversely affects the environment. An occurrence in this category does not exceed federal limits, involve personal injury, or result from the violation of safety and operational rules. Almost all historical occurrences at SNL/NM fall into this category.

NOTE: RQ = reportable quantity
DOE = U.S. Department of Energy
NNSA = National Nuclear Security Administration
OKSO = Office of Kirtland Site Operations
SNL/NM = Sandia National Laboratories, New Mexico
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

(2) VOCs poured down drain - On March 21, 2001, personnel at the SNL/NM Environmental Restoration Chemical Laboratory (ERCL) discovered that two people had been disposing of excess solutions containing VOCs by pouring them down the drain. Such disposal is prohibited by SNL/NM internal policy and by the conditions of SNL/NM wastewater discharge permit 2069K-3. DOE notified the City of Albuquerque on March 23, 2001. ERCL personnel have reviewed the appropriate chemical waste disposal requirements and use of waste receptacles per SNL/NM requirements.

(3) 12" Water Line Break at Wyoming and H Avenue - On May 17, 2001, a large volume of water was observed flowing south on Wyoming Boulevard. An estimated 13,000 gallons per minute flowed for about 30 minutes for a total discharge of approximately 400,000 gallons. Reporting was delayed due to uncertainty concerning ownership of the utilities in the area. The discharge was reported to NMED.

(4) Road Grading of Closed Road - On September 6, 2001, a portion of the road at the end of No Sweat Boulevard that had been closed for restoration was graded by SNL/NM Facilities Management & Operations Center (FMOC) Structural and Grounds Services Department at the request of the Coyote Test Field (CTF) Management to allow personnel expedited access to the Cable Site Anchor location. The following interim corrective actions have been put in place until the root cause analysis and formal corrective actions are complete: The FMOC has highlighted a map of roads that are graded on a routine maintenance schedule. This map has been provided to DOE/NNSA/OKSO for concurrence. The FMOC will not grade any roads unless they are identified on that map. Any request for grading on other roads will be reviewed through the standard FMOC process.

(5) Transfer Case Hose - On September 20, 2001, SNL/NM personnel were working on the transfer case on a tractor when a mouse hopped out of the engine housing and surprised them. They stopped work, notified the pest control team, and awaited arrival of pest control. When the team did not arrive by the end of the workday, the mechanics left work without checking to see if hoses were secure. After hours, a hose fitting came loose, a hose dropped to the pavement, and diesel fuel leaked out due to gravity siphon. Three to five gallons of diesel fuel oil dripped slowly out onto the pavement. The fuel was contained that night. A small amount possibly entered the storm drain inlet.

(6) Loss of Hazardous Waste Container – On November 21, 2001, SNL/NM manifested a shipment of hazardous waste to ENSCO, a hazardous waste treatment facility located in El Dorado, Arkansas. Rinchem Company Inc., the transporter of the waste, took this shipment to its Albuquerque facility for temporary storage. The shipment consisted of 33 containers of hazardous waste exhibiting the characteristics of ignitability, reactivity and/or corrosivity. On November 27, 2001, when the SNL/NM shipment was being loaded for transport, Rinchem Company Inc. discovered that one container was missing. The container in question was determined to be a five gallon plastic pail that contained an absorbent and a piece of coal weighing less than 0.1 lbs potentially contaminated with copper, aluminum, carbon, and plastic.

2.5 SUMMARY OF REPORTING REQUIREMENTS

External reporting requirements (other than to the DOE) are necessary for both non-routine and routine releases of pollutants or hazardous substances. Release information may be used to evaluate facility operation compliance, waste handling activities, and emergency response programs. Table 2-8 summarizes the three primary reporting requirements for releases applicable to SNL/NM.

2.6 SUMMARY OF ENVIRONMENTAL PERMITS

Table B-1 in Appendix B lists all environmental permits and registrations that were in effect in 2001. This includes permit applications that are pending and are under review by various agencies. There were no permit standard exceedences or violations in 2001.

2.7 ENVIRONMENTAL PERFORMANCE MEASURES

Environmental progress at SNL/NM is tracked through performance measures and indicators, including annual summaries, such as this report.

Environmental performance is also tracked through the National Nuclear Security Administration FY01 Multi-Program Laboratory Appraisal of Sandia National Laboratories (NNSA 2001) and FY01 DOE/SNL Annual Appraisal Agreement (DOE/SNL 2001). Through this process, performance measures are developed and tracked on a quarterly and annual basis. As part of laboratory operations support, performance measures were included for the following areas of ES&H and ER/WM:

- Integrated Safety Management System (ISMS)
- Comparison of Injury and Illness Rates and Lost Workday Case Rates
- Radiation Exposures and Radiological Operations
- Environmental Compliance
- Price Anderson Amendments Act
- Occurrence Reporting
- ER Site Closure
- Treatment and Disposal of Legacy Waste
- Treatment and Disposal of Newly Generated W aste
- Preventing Pollution and Conserving Resources

The FY 2001 DOE/NNSA Multi-Program Laboratory Appraisal report indicated that, "Overall performance in operations and administration support was outstanding" (NNSA 2001).

In addition, Sandia Corporation continued exploring the enhancement of the ISMS to incorporate Environmental Management Systems (EMSs) in FY 2001.

TABLE 2-8. Summary of Sandia Corporation's Reporting Requirements to Outside Agencies (Other than the DOE) for Releases of Pollutants or Hazardous Substances

Report Title	Description	Agency
Annual NESHAP Dose Assessment Report	A dose assessment of the calculated effective dose equivalent (EDE) to the maximally exposed individual (MEI) is based on the assumption that an exposed individual resides 24 hours per day at an area of highest incident radiation. Dose assessment is discussed in Section 5.4 of this report.	EPA 40 CFR 61, Subpart H
Reportable Quantity (RQ) Accidental Release Reporting	RQ release reporting is required by CERCLA and SARA Title III, or EPCRA NRC. CERCLA and EPCRA are discussed in Section 2.1.1 and 2.1.2 of this report. There were no RQ releases at SNL/NM in 2000.	NRC 40 CFR 302
Toxic Release Inventory (TRI) Report	EPCRA, Section 313, requires a TRI report to be filed by facilities conducting specifically listed industrial activities and using listed toxic chemicals. As discussed in Section 2.1.2, Sandia Corporation is not currently required to submit a TRI report because its chemical use is below the reporting threshold.	EPA 40 CFR 372, Subpart B
Notification of Discharge	NMED requires reporting of oil or other water contaminate, in such quantity as may with reasonable probability injure or be detrimental to human health, animal or plant life, or property, or unreasonably interfere with the public welfare or use of the property shall make oral notification as soon as possible after learning of such a discharge, but in no event more than 24 hours thereafter to the Chief of the Ground Water Protection and Remediation Bureau. Within one week, the owner and/or operator shall send written notification to the Chief of the Bureau verifying the prior oral notification. Within 15 days, the owner and/or operator shall send written notification to the Chief of the Bureau describing any corrective actions taken and/or to be taken relative to the discharge.	NMED 20 NMAC 6.2.1203
Accidental Slug Discharge Notification	The City of Albuquerque requires immediate notification to the Wastewater Utility Division of any accidental/slug discharge that may cause potential problems for the POTW. Within five days following such occurrence, the user is required to provide the Industrial Waste Engineer with a detailed written report describing the cause of the dangerous discharge and measures to be taken to prevent similar future occurrences.	City of Albuquerque Ordinance § 6-3-5

NOTE: NESHAP = National Emission Standards for Hazardous Air Pollutants
NRC = U.S. National Response Center
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
SARA = Superfund Amendments and Reauthorization Act
EPCRA = Emergency Planning and Community Right-to-Know Act
EPA = U.S. Environmental Protection Agency
CFR = Code of Federal Regulations
POTW = Publicly-Owned Treatment Works

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Chapter 3

Environmental Programs Information

In this Chapter ...

Chapter Summary

Sandia National Laboratories, New Mexico (SNL/NM) began environmental monitoring in 1959. Since then, SNL/NM established programs in Environmental Restoration (ER), Waste Management, Biological Control, Pollution Prevention (P2), Oil Storage and Spill Control, the National Environmental Policy Act (NEPA), and Environmental Education Outreach. There are also a variety of surveillance and effluent monitoring programs that are discussed in subsequent chapters of this report.

Sandia Corporation continued forward with many environmental initiatives and accomplishments. The ER Program, with recycling initiatives in place, actively remediated eight sites in 2001. In anticipation of the closure of the ER Program in 2009, Sandia Corporation and the U.S. Department of Energy (DOE) completed a Long-Term Environmental Stewardship (LTES) Plan to address future environmental responsibilities.

The NEPA Program streamlined the review process with the introduction of the Integrated Safety Managment System (ISMS) Software.

Environmental Snapshot

- *The Environmental Education Outreach Program participated in 11 events in 2001.*
- *Fleet Services eliminated the use of hazardous solvents by utilizing citrus cleaners.*
- *SNL/NM was a primary partner in KOB-TV's "Waste to Warmth" Project.*

Waste Management handled 11,219 individual items, many of which were recycled, at the Hazardous Waste Management Facility (HWMF). Sandia Corporation has been recognized for various P2 awards including the EPA "2001 Waste-Wise Federal Partner Award."

SNL/NM personnel participate in Environmental Education Outreach Program activities.

Environmental programs at SNL/NM are in place to protect the environment, safety, and health (ES&H) of its employees and the community. Sandia Corporation has established and implemented environmental management programs to meet or exceed the requirements of federal, state, and local environmental regulations. DOE Orders and executive orders (EOs) also serve to guide program criteria.

Environmental program areas covered in this chapter include:

- ER Project
- Hazardous and Chemical Waste Management
- Radioactive and Mixed Low-level Waste (MLLW) Management
- Solid Waste Management
- Biological Control Activity
- P2 Program
- Oil Storage and Spill Control
- NEPA Program
- Environmental Education Outreach

Effluent and surveillance monitoring activities are discussed in Chapters 4, 5, 6, and 7.

Commitment to Health and the Environment
It is the DOE, National Nuclear Security Administration (NNSA), Office of Kirtland Site Operations (OKSO) and Sandia Corporation's policy to minimize risks to the public and the environment to "as low as reasonably achievable" (ALARA) levels. For example, Sandia Corporation often exceeds regulatory requirements through Best Management Practices (BMPs) and P2 measures implemented on a corporate-wide basis.

Environmental Monitoring History at SNL/NM
Environmental monitoring began at SNL/NM in 1959, at which time the principal objective was to monitor radioactive effluents and determine any associated environmental impacts. Since then, environmental programs, along with other ES&H activities, have greatly expanded at SNL/NM.

3.1 ER PROJECT

Sandia Corporation's ER Project was created under the DOE/NNSA Office of Environmental Restoration and Waste Management (ER/WM) to identify, assess, and remediate sites potentially contaminated by past spill, release, and disposal activities.

The DOE/NNSA/OKSO has oversight of Sandia Corporation's ER Project, which is administered under four departments within the Geoscience and Environment Center:

- ER Project Office,
- ER for Tech Areas and Miscellaneous Sites,
- ER for Landfills and Test Areas, and
- Site Closures.

3.1.1 Regulations

The remediation and cleanup of areas of past contamination at SNL/NM are regulated by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984. HSWA requirements apply to ER sites, or Solid Waste Management Units (SWMUs) at SNL/NM. A SWMU is any unit "from which hazardous constituents might migrate, irrespective of whether the units were intended for the management of solid and or hazardous waste" (EPA 1985). Specific requirements for SWMUs are described in Module 4 of Sandia Corporation's RCRA Part B Operating Permit. SWMUs that must be addressed are listed in the RCRA Part B Operating Permit.

There are some additional sites at SNL/NM not regulated as SWMUs (primarily closed-out septic systems) that are also under ER investigation. These sites were not identified at the time of issuance of Module 4 of the RCRA Part B Operating Permit; they are being investigated and addressed in the same manner as if they were listed on the permit.

ER Project Awards and Commendations

All performance measures were completed on or ahead of schedule and received the highest rating of "Outstanding" by the DOE and Sandia Corporation appraisal system (DOE/SNL 2001). This was the seventh year in a row (ending FY 2001) that the ER Project has received this rating; a very noteworthy achievement for Sandia Corporation. In addition, the ER Project received the "Green Zia Environmental Excellence Award" from the NMED.

SNL/NM personnel sorting debris in a tent building at the Chemical Waste Landfill.

The ongoing voluntary corrective measure (VCM) (excavation) at the Chemical Waste Landfill (CWL) is being conducted as part of the ER program. As discussed in Section 2.1.3, the CWL was operated under interim status for hazardous waste disposal and is undergoing closure.

3.1.2 Cleanup and Site Closures

Waste generated from SNL/NM ER sites include radioactive low-level waste (LLW), MLLW, and RCRA-hazardous waste, Toxic Substances Control Act (TSCA) waste (primarily polychlorinated biphenyls [PCBs] and some asbestos), and industrial solid waste. Radioactive and MLLW generated by the ER Project is handled by the Radioactive and Mixed Waste Management Facility (RMWMF). RCRA-regulated hazardous waste and TSCA-regulated waste is handled by the HWMF. Other solid waste is disposed of directly to local landfills, such as the KAFB Landfill and the Torrance County Landfill, just east of Albuquerque. The waste management section in this chapter shows the waste volumes generated by the ER Project.

No Further Action (NFA) Status

Many ER sites were proposed for NFA based on insignificant contamination present or after remediation had already been completed. At SNL/NM, remediation is accomplished through VCMs or Voluntary Corrective Actions (VCAs). Once the New Mexico Environment Department (NMED) grants NFA status, the site is removed from the RCRA permit, although responsibility for any future actions, should they become necessary, remain with the site owner. The appropriate land-use category (i.e., industrial use) is used as part of the input for calculating the remaining risks to human health and the ecosystem. This method is used to ensure these calculated risks are small enough to warrant NFA status, if any residual contamination remains.

Table 3-1 shows the ER Project status since 1992. Sandia Corporation continues to actively pursue the closure of proposed NFA sites by working with the NMED to provide adequate and/or further verification, as requested, for a successful determination.

3.1.3 2001 Status and Activities

At the close of 2001, there were 158 regulated ER sites remaining on Sandia Corporation's RCRA Part B Operating Permit and eight sites were being actively remediated at SNL/NM. During 2001, a Class III Permit modification and request proposed removal of 30 sites from the permit. Approval was granted by NMED on November 2001. In 2002, the ER Project expects to remove approximately 10 sites from the permit, as well as to propose three more sites for NFA status. All NFA proposals (Class III Permit modifications) are available for review at the University of New Mexico (UNM) Zimmerman Library.

ER Project History

The initial identification of ER sites at SNL/NM was completed in 1987. At that time, 117 sites under Sandia Corporation's jurisdiction were identified in the initial *Comprehensive Environmental Assessment and Response Program (CEARP) Phase I: Installation Assessment* (DOE 1987). By 1992, the year Sandia Corporation's ER Project was initiated, a total of 172 sites were identified. By the end of FY 1992, the number of identified sites reached 219. These included SNL/NM-operated sites in other locations such as California, Nevada, and Hawaii.

Between 1992 and 1998, a total of 500 individual sites, potential sites, or individual historical activities had been identified for investigation. Many of these sites were confirmed to contain little or no contamination of regulatory concern.

In 1992, the ER Project at SNL/NM was officially initiated to implement assessment and remediation activities for sites that had been contaminated or potentially contaminated because of Sandia Corporation's past operations. In addition to the SNL/NM site, other sites included in the original scope of Sandia Corporation's ER Project were Sandia National Laboratories, Livermore, California (SNL/CA), the Kauai Test Facility (KTF), and the Tonopah Test Range (TTR). There

Project Highlights

Of the eight sites undergoing remediation in 2001, the following two sites are highlighted:

- ***Classified Waste Landfill (ER Site 2)*** *– The Classified Waste Landfill contained waste that is classified based on its shape or components. Contaminants of concern at this landfill included radionuclides, metals, and volatile organic compounds (VOCs). Cleanup at the landfill began in March 1998; two years later, in February 2000, excavation was completed (four and a half months ahead of schedule). Approximately 50,000 yd^3 of soil were excavated, more than 600 tons of scrap objects were removed, and more than 175 tons of materials have been recycled. Final work to complete this project includes waste sorting/segregation, demilitarization, recycling, waste management, confirmatory soil sampling, and revegetation. Final closure is expected in FY 2003.*

- ***CWL (ER Site 74)*** *– The CWL is the most significant cleanup project remaining to be completed by the ER Project. Excavation at the CWL began in September 1998 and was completed to 12 feet in June 2001. Some areas will be excavated deeper depending on the presence of debris and/or contaminated soil.*

  In 2001, approximately 45,000 yd^3 of soil were excavated. Additionally, over 2,000 intact chemical containers and over 350 unbreached compressed gas cylinders were exhumed and managed. Final work to complete this project includes waste management, defining the nature and extent of residual contamination, closure of the site operational boundary, backfilling, and revegetation.

  In August 1998, the Vapor Extraction Project (VEP) at the CWL was completed. This system was emplaced in three existing monitoring wells and several boreholes to remove VOCs from the vadose zone. Approximately 5,000 lbs of VOCs were removed from the soil over the course of the project. Prior to vapor extraction, groundwater results showed trichloroethene (TCE) in groundwater samples at about four times the regulatory standard of 5 µg/L in some wells. Based on nine quarterly sampling events after vapor extraction, no VOCs have been detected in the groundwater above the drinking water standards in any CWL monitoring well, demonstrating the success of the program. FY 2001 groundwater results for the CWL are presented in Section 7.2.2 of this report.

TABLE 3-1. Summary of ER Project Status

	A	B	C	D	E	F **
Year	Total ER Sites at Start of FY	ER Sites Proposed for NFA in FY	Sites Approved for NFA in FY	Corrective Actions Completed by End of FY	New ER Sites Identified During FY	Total ER Sites at End of FY
2001	**87**	**7**	**0**	**4**	**71**	**158**
2000	146	10	64	10	5	87
1999	146	4	0	20	0	146
1998	146	16	0	0	0	146
1997	153	30	7	4	0	146
1996	155	35	2	29	0	153
1995	191	61	36	34	0	155
1994	219	48	28	3	0	191
1993	219	0	0	0	0	219
1992	172	0	0	0	47	219

NOTE: FY = Fiscal Year
ER = environmental restoration
NFA = No Further Action
*The "new" sites are the result of reconciliation of Sandia Corporation and U.S. Department of Energy (DOE) records with the New Mexico Environment Department (NMED) tabulations, as well as inclusion of areas of concern, which the NMED consider to be qualified to be on the permit (i.e., equivalent to ER sites). No truly "new" sites were identified during FY 2001.
** Column totals: F = A - C + E
Some of the original 219 sites included Tonopah Test Range (TTR), Kauai Test Facility (KTF), and other off-site areas in New Mexico and internationally.

were also a number of miscellaneous sites located in other areas, both nationwide and internationally. Currently, the only ER sites remaining to be addressed are located at SNL/NM. All other sites have been closed out or transferred to other agencies. All ER sites at SNL/NM are scheduled for completion in 2009 with LTES to follow. This date, however, may be subject to change based on available funding.

Corrective Action Management Unit (CAMU)
The CAMU is permitted under RCRA as a storage, treatment, and containment facility for the management of remediation waste generated by ER Project activities.

The CAMU contains a number of areas and facilities for the management of hazardous waste materials that include a bulk waste staging area (BWSA), four temporary tent-like buildings called Sprung™ structures, a containerized waste staging area, a waste treatment area, a treated waste staging area, and a containment cell designed to hold approximately one million cubic feet (37,000 yd^3) of waste material.

Drainage within the CAMU boundaries is routed to a series of storm water retention ponds to prevent uncontrolled runoff. The storm water retention ponds are designed to accommodate a 25-year, 24-hour storm event. During Calendar Year (CY) 2001, approximately 560,000 gallons of storm water was sampled, analyzed, and discharged from the CAMU in compliance with NMED regulations and permit requirements.

In 2001, inflatable covers were installed in each of the six bays of the BWSA. These covers have improved the operational efficiency and safety of BWSA activities and provide increased environmental protection for the soil staged at the CAMU.

Originally, the CAMU was designed to accept only hazardous waste, which includes soil VOCs, semi-volatile organic compounds (SVOCs), and heavy metals. The waste acceptance criteria for the CAMU was revised to accept low-concentration tritium-contaminated soils beginning in November 1999 and PCB-contaminated soils beginning in May 2000.

It is anticipated that all of the remediation waste to be accepted into the CAMU will come from the excavation of the CWL. In FY 2001, approximately 530,000 ft^3 of soil was sent to the

View of the CAMU Bulk Waste Storage Area

CAMU and a cumulative total of approximately 800,000 ft^3 of soil is currently being managed. In addition, approximately 1600 ft^3 of contaminated debris is temporarily staged in roll-off bins in the waste staging area.

Current plans are for soil contaminated with VOCs and SVOCs to be treated at the CAMU by low temperature thermal desorption (LTTD). Soil contaminated with heavy metals will be stabilized in a pug mill using a cement-based mixture. Both LTTD-treated and stabilized soil that meet permit-specific treatment criteria will be placed in the containment cell, which contains leak detection monitors and a leachate collection and removal system. Any treated waste that does not meet permit criteria will be disposed of at off-site permitted facilities. Once closed, the containment cell will be capped and subject to long-term monitoring for approximately 30 years.

LTES Plan
In 2001, Sandia Corporation and DOE completed a LTES Plan to address residual contamination that will remain at some ER sites after remediation, and submitted the plan to DOE, Headquarters (HQ). Initial cost estimates have been determined through 2070, as addressed by the budgeting software. Actual stewardship responsibilities by the DOE are not limited by that date (DOE/SNL 2001a).

In 2001, other activities conducted by the ER Project included media and public events for discussion of issues related to the Mixed Waste Landfill (MWL) and other sites that will be incorporated into the LTES Plan.

3.2 WASTE MANAGEMENT

With hundreds of individual research laboratories, SNL/NM generates over 15,000 different waste streams. Waste at SNL/NM is processed at three facilities: the HWMF, the RMWMF, and the Solid Waste Transfer Facility (SWTF). The primary waste types handled by these waste management facilities are shown below.

3.2.1 HWMF Characterization

The HWMF packages, segregates, stores, and ships hazardous and chemical wastes. A lined catchment pond within the HWMF perimeter is used to contain all storm water runoff.

HWMF	RMWMF	SWTF
Hazardous & Chemical Waste	**Radioactive & Mixed Waste**	**Non-hazardous Solid Waste**
Hazardous	LLW	Sanitary
Biohazardous	MW	Recycled Paper
Chemical	Transuranic Waste (TRU)	Other Recyclables
Asbestos	TRU/MW	
PCB	Special Case Waste	
Recyclables		

Hazardous waste is tracked from the point of generation to final disposal through meticulous documentation at each waste-handling step. Each generator at SNL/NM initiates the "cradle to grave" tracking process by preparing a waste description Disposal Request (DR) describing the quantity and type of waste requested for pickup. Generators characterize their own waste by either process knowledge or, if necessary, sampling and analysis. Each waste item received at the HWMF is labeled with a unique bar code, linking the item to the original DR. The item is also labeled with the Department of Transportation (DOT) hazard class and RCRA waste code, if applicable. RCRA hazardous waste is waste that has the characteristics of ignitability, corrosivity, reactivity, or toxicity—or is otherwise listed as hazardous. An individually coded waste item typically is a bottle, plastic bag, or other small item that contains chemical materials.

A front view of the HWMF

All waste is reviewed at the HWMF before being placed in isolated bays according to DOT waste categories. These categories ensure that incompatible wastes are segregated. The bays are designed with a secondary containment to hold any spills and are equipped with earthquake shelving to withstand minor tremors. After sufficient quantities of items have accumulated in the bays, the items are packed into larger containers, which are also bar coded. These packages are moved to an adjacent building to await shipment to a permitted treatment, storage, and disposal (TSD) facility or recycling center. Waste is usually processed and shipped off-site within 60 days of receipt.

All applicable regulations for hazardous and chemical waste handled by the HWMF are listed in Appendix B.

2001 Activities at the HWMF

In 2001, a total of 11,219 individual items were handled by the HWMF. The HWMF shipped a total of 97,755 lbs (44,341 kg) of RCRA-regulated hazardous waste (including recyclable waste). Figure 3-1 summarizes waste handling operations at the HWMF over the last five years. Specific waste categories managed in 2001 are shown in Table 3-2.

Recycling

Sandia Corporation recycles all categories of hazardous and chemical waste, where feasible. RCRA recycled waste includes various batteries, silver compounds, mercury compounds, lamps, capacitors, and toxic metals. A total of 19,592 lbs (8,887 kg) of RCRA hazardous waste and 30,821 lbs (13,980 kg) of used oil was recycled. "Other recyclable waste" includes miscellaneous recycled categories not regulated under RCRA or TSCA. This category includes various batteries, fluorescent lamps, various oils, and non-PCB ballasts, lead, and capacitors. A total of 94,891 lbs (43,042 kg) of material was recycled in this category.

Asbestos Waste Handling

Asbestos waste is tracked through Sandia Corporation's Asbestos Program working in tandem with the Facilities Asbestos Program. Facilities is responsible for removal of asbestos from building demolitions or renovations and the proper packaging of all waste generated asbestos. Facilities-generated asbestos waste is stored in a building adjacent to the main HWMF compound.

At SNL/NM, the abatement of asbestos-containing equipment and building materials is ongoing. Asbestos material removal is only done if the material presents an inhalation hazard, or if the building is to be torn down or renovated. Typical asbestos-containing building materials consist of floors, ceilings, and roofing tile, certain types of insulation, and other fire retardant construction materials.

Similarly, in instances where laboratory equipment has asbestos-containing material in a non-friable form (which poses no inhalation risk), the item is allowed to remain in service or is redistributed through the property reapplication program. Typical asbestos waste generated from equipment abatement consists of fume hoods, ovens, and cable insulation. Asbestos waste from SNL/NM is disposed at a New Mexico landfill permitted to accept friable asbestos waste. In 2001, a total of 131,895 lbs (59,827 kg) of asbestos waste was generated and disposed.

PCB Handling
PCBs are a class of organic chemicals that were widely used in industrial applications due to their practical physical and chemical properties. Use of PCBs included dielectric fluids (used in transformers, capacitors, etc.), hydraulic fluids, and other applications requiring stable, fire-retardant materials. Due to findings that PCBs may cause adverse health effects and because of their persistence and accumulation in the environment, the TSCA banned the manufacture of PCBs after 1978. PCB regulations, as promulgated in 40 CFR 761, include requirements specifying use, storage, marking, disposal, cleanup, decontamination, and record keeping.

Sandia Corporation has identified and replaced most PCBs and PCB-containing equipment. The largest source of regulated PCBs that remain in use at SNL/NM are capacitors contained inside fluorescent light ballasts manufactured before July 2, 1979. Other than ballasts, ten PCB regulated items remain in use or storage for reuse at SNL/NM. Eight areas of existing PCB spill contamination at SNL/NM are being actively managed through a regulatory use authorization. Significant quantities of PCB-contaminated soils were generated in 2001 as a result of an ER project at the CWL.

PCB waste is managed by HWMF personnel and stored at an adjoining storage facility. Most of the PCB-contaminated soil is generated and managed by ER and stored in two locations: the CWL and the CAMU.

In 2001, a total of 28,737 lbs (13,035 kg) of PCB waste was shipped off-site, 21,290 lbs (9,657 kg) of PCB waste for disposal, and 7,447 lbs (3,378 kg) of PCB waste for recycling. No ER-generated PCB-contaminated soil was shipped in 2001.

Explosive Waste
Explosive waste generated at SNL/NM is usually managed at the point of generation until it can be shipped for treatment. SNL/NM has a permitted facility for the treatment of certain explosive waste streams; however, this facility was not used in 2001. In 2001, 862 lbs (391 kg) were sent to the Explosive Ordnance Disposal (EOD); four large rocket motors totalling 29,844 lbs (13,537 kg) were sent to Hill Air Force Base for treatment.

3.2.2 RMWMF Characterization

The RMWMF, located in the southeast corner of Technical Area III (TA-III), manages LLW, MLLW, transuranic (TRU), and TRU/MLLW. No high-level radioactive waste (HLW) is generated at SNL/NM. Although Sandia Corporation operates several nuclear reactors, no spent fuel has ever been produced since the original fuel rods are still viable. Furthermore, because SNL/NM is not a power-producing utility, any spent fuel that would eventually be removed from the research reactors would not be classified as HLW.

Most radioactive and MLLW generated on-site is processed through the RMWMF. However, some waste, which is already sealed and characterized, is put directly into temporary storage areas on-site. The waste processing functions at the RMWMF include waste characterization, segregation, treatment, packaging, storage, and shipment to permitted off-site facilities.

The primary waste handling facility at the RMWMF is equipped with a main control room for monitoring activities and controlling airflow throughout the facility. Handling bays, sorting rooms, and various waste storage areas operate under negative airflow to ensure that all emissions are channeled through the facility's stack.

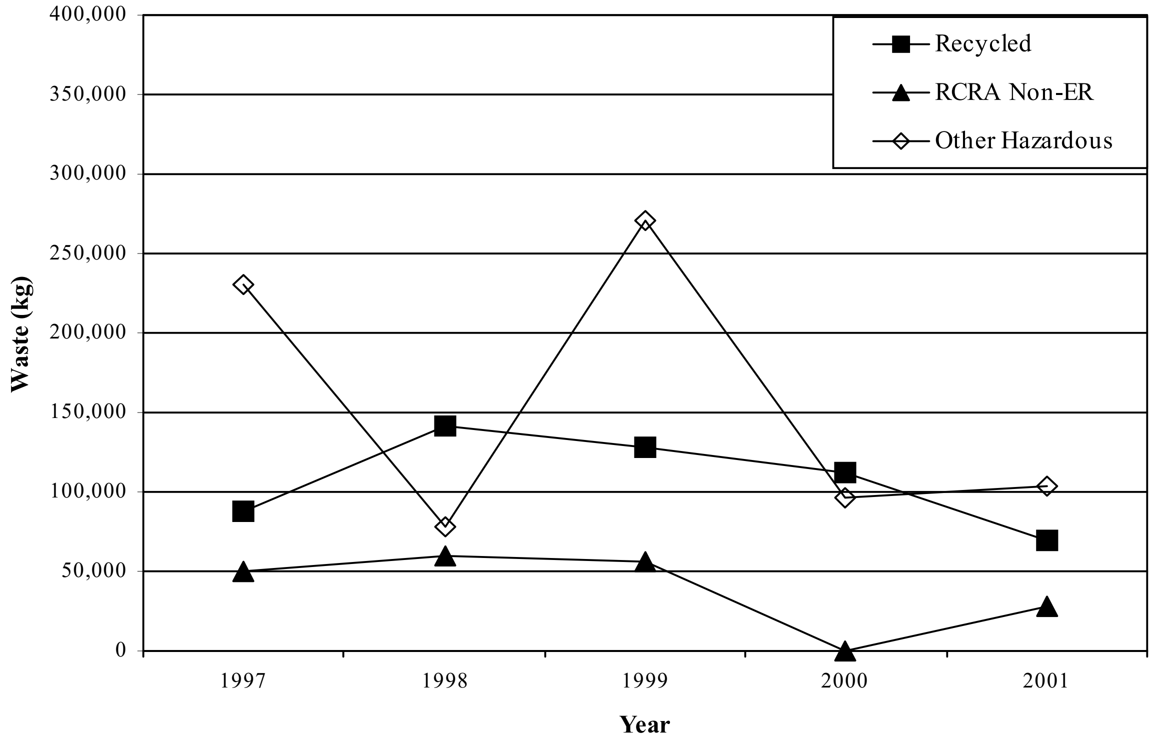


FIGURE 3-1. Five-Year Summary of Waste Shipped at the HWMF

TABLE 3-2. Waste Shipped by the HWMF in 2001

Waste Categories Handled at the HWMF	2001 Waste Shipped	
RCRA Waste	**(kg)**	**(lbs)**
Hazardous Waste	28,083	61,912
Hazardous Waste (Generated by ER Project)	7,371	16,250
Hazardous Waste (recycled)	8,887	19,592
Total	**44,341**	**97,755**
TSCA		
Asbestos	59,827	131,896
Polychlorinated Biphenyl (PCB)	9,657	21,290
PCB (recycled)	3,111	6,859
Total	**72,595**	**160,045**
BIOHAZARDOUS		
Infectious Waste	**338**	**745**
OTHER		
Chemical Waste	32,958	72,660
Non-hazardous Solid Waste (RCRA Subtitle D)	627	1,382
Non-RCRA (Generated by ER Project)	1,201,641	2,649,164
Used Oil (recycled)	13,980	30,821
Lead (recycled)	11,882	26,195
Other (recycled) – various batteries, fluorescent lamps, and non-PCB (ballasts, capacitors, and oils)	31,160	68,696
Total	**1,292,248**	**2,848,919**
Total Waste and Recyclables Shipped	**1,409,522**	**3,107,464**

NOTE: RCRA = Resource Conservation and Recovery Act
TSCA = Toxic Substances Control Act (primarily regulates asbestos and PCBs)

Sandia Corporation has developed a comprehensive plan for all radioactive waste disposal. All radioactive and mixed waste (MW) generators must contact the Radioactive Waste Program before generating waste and obtain prior approval. This will ensure that a proper waste pathway is in place before any waste is generated. Radioactive waste is shipped off-site within a one-year time frame in accordance with DOE Orders. This is similar to the RCRA mandates for hazardous waste and MW.

Applicable DOE Orders and regulations for radioactive waste and MLLW management are listed in Appendix B.

Radioactive Waste Storage
Presently, radioactive waste generated from SNL/NM is temporarily stored at the RMWMF, the Manzano Storage Bunkers, and the High Bay Waste Storage Facility (HBWSF) in TA-V. TRU and TRU/MW will be routed through Los Alamos National Laboratory (LANL) or directly to the Waste Isolation Pilot Plant (WIPP) for final disposal.

Sorting at the RMWMF
RMWMF personnel sort all radioactive and MLLW that has not been fully characterized. There are four sorting levels based on the known hazards present or the level or prior characterization:

- **Level 1** - Radioactive waste that is well characterized, in a sealed container, and contains very low radiation levels. Personnel may open the container to verify the contents, but are not required to contact the waste. At this level, only coveralls, glasses, and work gloves are required for handling.

- **Level 2** - Radioactive waste that has been previously characterized and has very low radiation levels and minor chemical hazards associated with it. Extra precautions are taken as the waste may require handling to take samples or to be repackaged. Waste may be physically segregated to remove known hazardous chemical components, which would otherwise classify the waste as MLLW.

- **Level 3** - Radioactive waste that has not been fully characterized and therefore has a higher associated risk. RMWMF personnel handling this waste category wear fully-contained personal protective equipment (PPE), including respirators.

- **Level 4** - Radioactive waste with a high hazard level. The waste is either poorly characterized (e.g., some legacy waste), or is known to contain high radiation levels. All waste is contacted through a glove box; workers wear full-containment PPE.

2001 Activities at the RMWMF
In 2001, the RMWMF managed all four waste types (LLW, MLLW, TRU, and TRU/MW). LLW and MW was shipped to permitted off-site facilities for treatment and disposal.

In 2001, the RMWMF shipped 683,761 lbs (310,149 kg) of LLW, 117,082 lbs (53,108 kg) of MW, and 0 lbs (0 kg) of TRU waste at SNL/NM. A five-year summary of radioactive waste shipped at SNL/NM during 2001 is shown in Figure 3-2. ER waste makes up the bulk of radioactive waste managed by the RMWMF.

SNL/NM's Radioactive Waste

LLW *- LLW is primarily contaminated with isotopes of strontium, plutonium, cobalt, americium, thorium, cesium, tritium, and uranium. (Plutonium and americium in LLW are below the activity level designated for TRU waste.) Sandia Corporation's LLW inventory is radioactively-contaminated soils excavated from ER sites, decontamination and demolition (D&D) debris, PPE, and laboratory waste.*

MLLW *- Generally consists of the same materials as LLW, with the addition of RCRA-hazardous components such as metals and solvents. The radioactive component in MW results primarily from tritium, cesium, strontium, plutonium, americium, and uranium.*

TRU *- May derive from sealed instrument sources, D&D waste, PPE, and laboratory waste. The radioactive component in TRU is generally americium, plutonium, neptunium, and curium.*

TRU/MLLW *- A combination of radioactive and hazardous waste as described above.*

Waste Generated by the ER Project in FY01

LLW (Managed) = 7,609 ft^3
MLLW (Managed) = 246 ft^3
TRU (None generated in 2001)

3.2.3 Mixed Waste (MW) Management Regulatory Status

As discussed in Section 2.1.4, Sandia manages mixed wastes in compliance with the Federal Facility Compliance Order (FFCO) (SNL 2001f). The requirements include:

- Deadlines for processing and/or disposing of various types of waste, and
- Providing an annual update of activities and the current inventory of stored waste still on-site.

During CY 2001, Sandia Corporation proposed Revision 6 to the FFCO, submitted the proposal to the NMED, and is currently awaiting approval.

Sandia Corporation operates the RMWMF, the HBWSF, and the Manzano Storage Bunkers (MSB) under interim status as noted in Section 2.1.3. SNL/NM's compliance history regarding MW management is shown in Table B-3 of Appendix B.

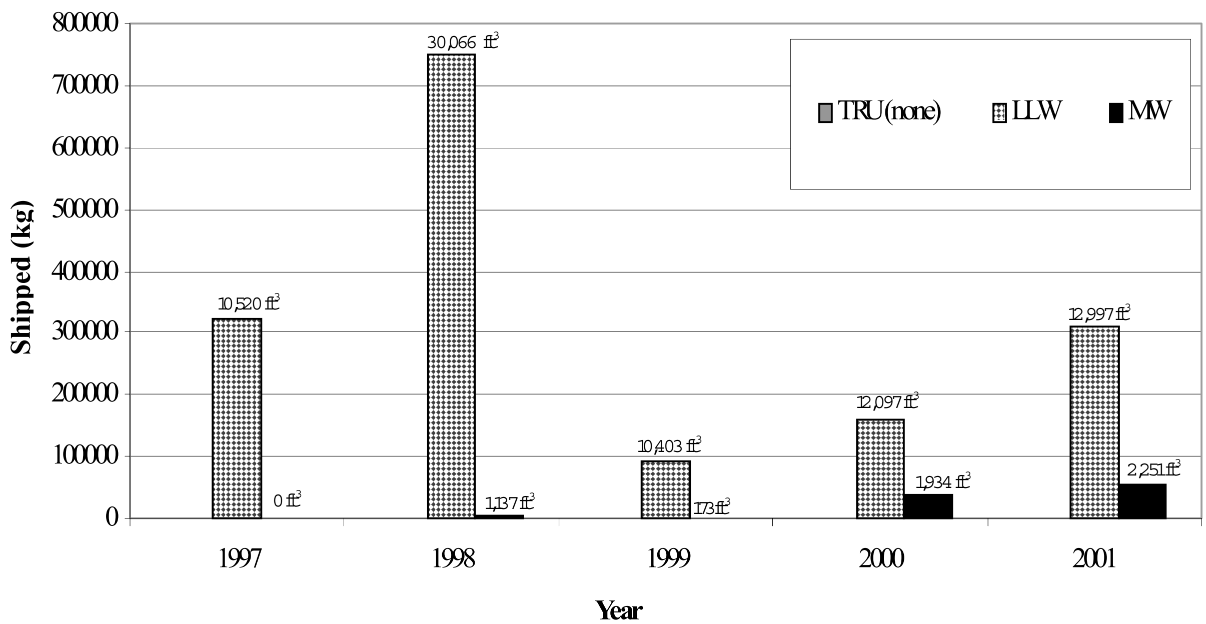
MW Treatment
Table 3-3 lists the current MW categories (TG-1 to TG-20 including TRU/MW), with the preferred treatment options and the status for each category.

Five of the treatment technologies listed in the table are performed on-site at the RMWMF: mechanical processing (including shredding) chemical deactivation (including pH neutralization), thermal deactivation, stabilization, and macroencapsulation. These are described in the current RCRA Part B Operating Permit application (submitted to NMED in 1996). They are also included in the updated and revised application submitted to NMED in February 2002.

Status of MW Management in 2001
The majority of MW now being stored on-site consists of very low-level radioactive sludges from ER Project septic tank system closeouts, oils and absorbed oils, and radioactive metallic objects with RCRA metals. No off-site MW was received from other DOE sites in 2001.

3.2.4 SWTF Characterization

The SWTF is designed to process sanitary waste consisting primarily of office trash, recyclable paper, and cardboard. The primary purpose of the facility is to screen all solid waste generated at SNL/NM to ensure compliance with solid waste regulations. A secondary feature of the SWTF is to act as the recycling center for SNL/NM.



NOTE: Both mass and volume are shown since mass alone can be misleading due to the weight of the containers (e.g., a 2,000 lb container may hold less than 100 lb of waste)

FIGURE 3-2. Five-Year Summary of Total Radioactive Waste Shipped at SNL/NM

TABLE 3-3. Mixed Waste Treatment and Disposal Status

Waste Category	Volume (m^3)	Preferred Treatment Technology	Description	Status and Plans
TG-1	0.01	Deactivation	Inorganic Debris with Explosive Component	Investigating treatment and disposal options.
TG-2	0	Deactivation	Inorganic Debris with Water Reactive Component	No waste currently in inventory
TG-3	0	Deactivation	Reactive Metals	No waste currently in inventory
TG-4	0.3	Macro-encapsulation	Elemental Lead	Performing on-site treatment in compliance with interim status requirements for MW management, or shipping to one or more permitted off-site facilities for treatment.[a]
TG-5	0	Neutralization/ Stabilization	Aqueous Liquids (Corrosive)	No waste currently in inventory
TG-6	0	Amalgamation	Elemental Mercury	No waste currently in inventory
TG-7	0	Incineration	Organic Liquids I	No waste currently in inventory
TG-8	4.8	Thermal Desorption	Organic Debris with Organic Contaminants	Off-site treatment.[a]
TG-9	25.8	Macro-encapsulation	Inorganic Debris with TCLP Metals	Performing on-site treatment in compliance with interim status requirements for MW management, or shipping to one or more permitted off-site facilities for treatment.[a]
TG-10	2.2	Sorting/ Reclassification	Heterogeneous Debris	Sort waste as needed to determine more suitable treatability groups
TG-11	0.11	Hydrothermal Processing	Organic Liquids II	Shipment to one or more permitted off-site facilities for treatment.[a]
TG-12	5.6	Macro-encapsulation	Organic Debris with TCLP Metals	Performing on-site treatment in compliance with interim status requirements for MW management, or shipping to one or more permitted off-site facilities for treatment.[a]
TG-13	0	Deactivation/ Stabilization	Oxidizers	No waste currently in inventory
TG-14	0	Evaporative Oxidation	Aqueous Liquids with Organic Contaminants	No waste currently in inventory
TG-15	0.02	Stabilization	Soils <50% Debris and Particulates (w/TCLP Metals)	Performing on-site treatment in compliance with interim status requirements for MW management, or shipping to one or more permitted off-site facilities for treatment.[a]
TG-16	0	Oxidation	Cyanide Waste	No waste currently in inventory
TG-17	9.1	Incineration followed by Stabilization	Liquid/Solid with Organic and/or Metal Contaminants	Shipment to one or more permitted off-site facilities for treatment.[a]
TG-18	1.15	Incineration	Particulates with Organic Contaminants	Shipment to one or more permitted off-site facilities for treatment.[a]
TG-19	0.01	Stabilization	Liquids with Metals	Performing on-site treatment in compliance with interim status requirements for MW management, or shipping to one or more permitted off-site facilities for treatment.[a]
TG-20	0.3	Deactivation/ Stabilization	Propellant with TCLP Metals	Investigating on-site treatment in compliance with interim status requirements for MW management. Investigating treatment at permitted off-site facilities.
TRU/MW	0.8	To be Determined	TRU with Hazardous Components	Investigating treatment at permitted off-site facilities.

NOTE: [a]Disposal at one or more permitted off-site facilities.
Treatments are detailed in the *Site Treatment Plan for Mixed Waste, Sandia National Laboratories, New Mexico* (SNL 2001f) and the *Site Treatment Plan for MW, FY01 Update* (SNL 2002b).
TCLP = toxicity characteristic leaching procedure
m^3 = cubic meters
TRU/MW = transuranic/mixed waste

SNL/NM met all four 2001 milestone deadlines set forth in the FFCO and STP regarding the treatment and shipment of specific MW stored at SNL/NM (SNL 2001f). Sandia Corporation submitted an annual update for the STP covering FY 2000 activities by the March 2001 deadline.

Materials routinely recycled through the SWTF include paper, cardboard, mixed paper (junk mail), plastic, aluminum cans, toner cartidges, and computers.

SNL/NM's sanitary waste is brought into the facility and dumped on the tipping floor. The waste is then inspected (screened) for hazardous or prohibited materials. After screening, the material is delivered to a baler via a conveyor belt where the waste is compacted and baled. Each bale of waste is about the size of an office desk and weighs approximately one ton. The bales are then staged for transportation and disposal at an off-site permitted disposal facility. Applicable DOE Orders and regulations are listed in Appendix B.

SWTF Operations
All solid waste accepted at the SWTF must be sanitary non-hazardous waste. Any waste with hazardous characteristics are placed on a DR and managed through the HWMF. The SWTF does not accept food service waste, construction debris, radioactive, explosive, or other hazardous waste streams. Construction debris and food service waste is collected and transported directly to local landfills. All non-recyclable solid waste handled by the SWTF is disposed of at the Torrance County Landfill, approximately 30 miles east of Albuquerque.

Recyclables
The SWTF is the central processing point for recyclable paper, cardboard, and other materials generated from SNL/NM and several outside cooperating agencies including LANL, KAFB, DOE field offices, and the Lovelace Respiratory Research Institute (LRRI).

Profits from the sale of recyclable materials are split among the cooperating agencies and are used to increase recycling programs.

Figure 3-3 illustrates the type and volume of recyclable material processed by the SWTF during CY 2001.

2001 Activities at the SWTF

In 2001, two major activities were accomplished at the SWTF:

- *SNL/NM was a primary partner in KOB-TV's "Waste to Warmth" project. This project allowed SNL/NM to collect, process, bale, and ship approximately 200,000 lbs of recycled newsprint from the greater Albuquerque area. The newsprint was processed into cellulose insulation and used to insulate low-income homes in Albuquerque.*

- *SNL/NM also started a pilot program with KAFB to investigate the potential of combining SNL/NM and KAFB waste streams. If this pilot program is successful, it would greatly assist KAFB with solid waste management requirements and demonstrate potential cost savings.*

  Additionally, a new shredder was added to the SWTF in 2001. The shredder is used to shred unusable computers, thus producing valuable recyclable material.

3.3 WASTE MINIMIZATION AND P2 PROGRAMS

3.3.1 Program Scope

The focus of the P2 Program is to reduce resource use, generated waste, and enhance the overall efficiency of processes and organizations within Sandia Corporation. The program focuses on reducing all waste streams—air emissions, water discharges, and hazardous, radioactive, and solid wastes. Additional efforts focus on energy and water conservation as well as reduction of overall impacts to the environment. P2 also assists SNL/NM's line organizations to meet regulatory goals associated with recycling, waste generation, purchase of material containing recycled content, and reduction of energy use.

The P2 Program forms partnerships with numerous organizations at SNL/NM, including line organizations and ES&H personnel. P2 also provides background research on waste reduction technologies and products, performs cost-benefit analyses, and locates funding for new waste reduction processes. Waste minimization is

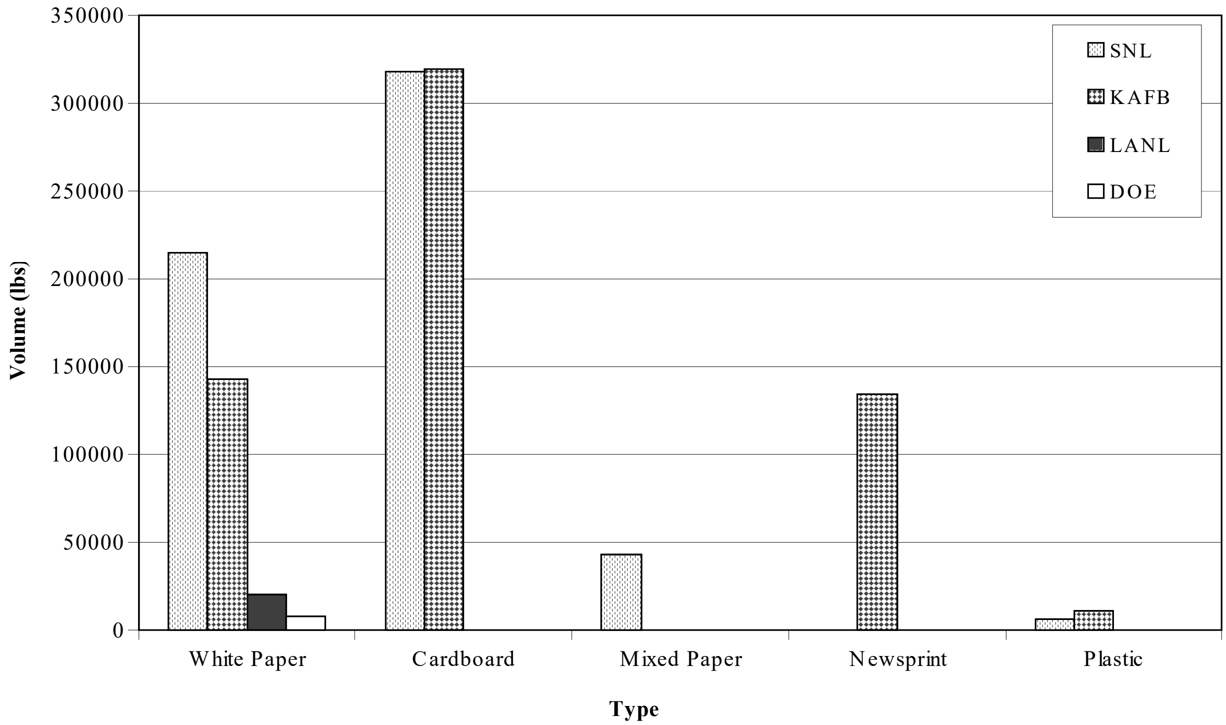


FIGURE 3-3. Recyclable Material Processed by the SWTF During Calendar Year 2001

promulgated by federal EOs as listed in Appendix B.

P2 Awards
Sandia Corporation received recognition by the NMED for participating in NMED's prestigious Environmental Excellence Program. This is the third year SNL/NM has received this recognition. The three level of awards given to companies that have shown significant efforts are Commitment, Achievement, and Environmental excellence. In October 2001, Governor Gary Johnson presented three Sandia Corporation organizations with "Commitment Level" awards:

- **Fleet Services**
  In receiving the Green Zia Commitment level award, Fleet Services has retained its reputation and its long record of excellence. Fleet Services has managed to eliminate the use of hazardous solvents by substituting them with citrus cleaners and power washers. Closed loop contracts for used oil recycling and re-refined oil purchased have been set up. Engine coolants are reclaimed and reused. Between 1994 and 1997 Fleet Services reduced its total waste by 6,151 lbs (2,790 kg) thus reducing its waste disposal costs by $31,200.

- **ER**
  ER has been committed to waste minimization and environmentally sound practices for several years. Since 1997, P2 opportunities identified have reduced 600 m^3 of waste, with a cost savings of over one million dollars:

Site	**Waste Reduction (tons)**
Site 2	253 tons waste reduction
Site 16	1,070 tons waste avoided
Site 228	2,229 tons waste avoided
Site 74	6,400 tons waste avoided

- **Manufacturing Science and Technology**
  In 2000, the Machine Shop (a subunit of 14100) was awarded the "Green Zia Award" based on their energy and hazardous waste reduction and overall commitment efforts to environmental excellence. An estimated 15 to 30 percent reduction in overall energy will be obtained within the next three years.

Other Environmental Awards in 2001

Sandia Corporation has been recognized for various other efforts and has been given the following awards:

- The U.S. Environmental Protection Agency (EPA) selected Sandia Corporation for the "2001 Waste-Wise Federal Partner Award" in recognition of accomplishments in the federal government category. The award recognizes noteworthy practices for waste prevention, recycling, and purchasing of recycled-content products. This award recognized Sandia Corporation's efforts in sustainable design (SD), construction and demolition waste recycling, waste reduction efforts within Custodial Services and the Cafeteria, and results in environmentally preferable procurement. There is only one award given nation-wide in this category.

- The DOE also awarded Sandia Corporation its "Pollution Prevention Accomplishment Award" for efforts in SD and environmentally preferrable or "green" purchasing. This award will also allow Sandia Corporation to be considered for the prestigious "White House Closing the Circle Award" to be presented in CY 2002.

3.3.2 Environmentally Preferable Purchasing (EPP) Program

In 2001, a significant advancement was seen in the area of "green" purchasing. The Just-in-Time (JIT) Procurement team in conjunction with P2 developed a method called "dedicated contracting" to ensure that suppliers provide recycled content products to Sandia Corporation. Through the three dedicated contracts there has been remarkable improvement to Sandia Corporation's EPP Program. In total these contracts (1) have saved Sandia Corporation $72,000; (2) increased the total dollars spent on recycled products from these categories from $223,000 to one million dollars; and (3) increased SNL/NM total compliance from 42 percent in FY 1998 to 85 percent in FY 2001. This system of initiating dedicated contracts is applicable to the entire DOE/NNSA Complex. SNL/NM purchasing has already shared its success with several of its service contractors who have also initiated remanufactured toner cartridge contracts with Document Solutions Inc. and LANL for office products. This approach has streamlined the procurement process for Sandia Corporation personnel, while providing quality environmentally preferable products and has lead to better relations with our suppliers. This program takes an innovative approach to purchasing by working within the constraints of the current procurement system, but goes beyond typical purchasing by looking for environmentally preferable suppliers to achieve a long-term solution.

3.3.3 SD Concept

The SD concept is based on the idea that buildings, processes, and products should be designed and built with the environment in mind. The concept uses a variety of methods to reduce the environmental impact of human activities including preference for renewable and or recycled materials, incorporating systems for water harvesting, using alternative energy such as photovoltaics, and choosing building materials that reduce waste or require great amounts of energy to manufacture, maintain, or dispose.

Sandia Corporation is revising its procurement procedures, standard construction specifications, and the Design Manual to reflect industry best practices for SD in the construction of large facilities. SD is also gradually being included in smaller projects site-wide. The goal is to minimize overall resource consumption by using building products with a high recycled content and selecting materials and designs that will contribute to lower operational costs for the facility. Designs also incorporate "indoor environmental quality" concepts such as maximizing natural light sources and incorporating harmonious meeting places for Sandia Corporation personnel.

Integrating SD into the following two construction projects at SNL/NM involves the collaborative effort of the Energy Manager, the Water Conservation Officer, the P2 Program, and Facilities engineers and architects. Design Team members look at materials, components, and systems from different perspectives and work together for the optimum solution. The solutions are based on the following parameters:

- quality of workplace
- initial cost
- life cycle cost
- overall efficiency
- environmental impact
- productivity
- creativity
- future flexibility

SD was integrated into the following two construction projects at SNL/NM:

- **Model Validation Facility (MVF) -** Renovations to the MVF were designed to incorporate day lighting to both improve indoor environmental quality and reduce energy costs by 30 percent. The design also incorporates water harvesting, use of recovered materials, and a "built-in" recycling center. The use of native plants in landscaping will provide a water-conserving, pleasing, southwestern look to the exterior of the facility. The design also required construction contractors to recycle construction debris. To date, 676 tons of material have been recycled.

- **The Joint Computational Engineering Laboratory (JCEL) and the Microsystems and Engineering Sciences Application (MESA) -** The JCEL and MESA facilities, totaling over 400,000 ft^2, are both in the early design stages. The architects chosen to design these facilities were evaluated partially on their experience with SD. Because of SD practices, a 30 percent reduction in energy costs is expected and both buildings are expected to receive U.S. Green Building's Leadership in Energy and Environmental Design certifications.

3.3.4 Waste Reduction and Recycling

Sandia Corporation continues to reduce volumes of generated waste and to improve recycling programs. Through an analysis known as P2 Opportunity Assessments, processes generating wastes are routinely assessed and waste stream methods are established.

As described under the Waste Management sections of this chapter, Sandia Corporation routinely recycles paper products, oil, metals, and office products. Additionally, other items not handled by the waste management facilities that are recycled include tires and construction materials. Table 3-4 summarizes the quantities of materials that Sandia Corporation recycled in all categories during 2001.

3.4 BIOLOGICAL CONTROL ACTIVITY

The Biological Control Activity provides customer support related to animal control issues and compiles information on pesticide use at SNL/NM. Animal control support includes providing general information and resolving issues related to removing nuisance animals. Requests for assisting in resolving nuisance animal problems are relayed and documented through Sandia Corporation's Facilities Telecon and Industrial Hygiene. This effort may entail interfacing, as necessary, with U.S. Air Force (USAF) and State of New Mexico agencies to resolve animal control issues. The Biological Control Activity also involves providing support in addressing animal-borne disease concerns (e.g., Hanta Virus) through activities such as disinfecting, sanitizing, and cleanup of areas infested with rodents or pigeons.

Pesticide use at SNL/NM includes the use of herbicides for weed control, rodenticides for controlling mice, and insecticides for the control of insects in food service and work areas. Sandia Corporation uses EPA-registered pesticides that are primarily applied by certified pest control agencies. Material Safety Data Sheets (MSDSs) and product labels for pesticides used at SNL/NM are maintained under the program. Pesticide use (product names and amounts applied) is documented in quarterly reports. Documents related to the program are listed in Chapter 9.

3.5 OIL STORAGE AND SPILL CONTROL

SNL/NM has an oil storage capacity of 5.5 million gallons. In 2001, DOE/NNSA-owned 98 regulated containers, including oil-containing equipment, transformers, underground storage tanks (USTs), and aboveground storage tanks (ASTs). All oil containment sites with regulated volumes must be equipped with secondary spill containment, although Sandia Corporation provides spill containment for smaller volumes as well. Secondary containment structures include concrete lined basins, retaining walls, containment reservoirs, earthen berms, sloped pads, and trenches.

The preparation of a Spill Prevention Control and Countermeasures (SPCC) Plan is required by 40 CFR 112, "Oil Pollution Prevention," and 40 CFR 110, "Discharge of Oil," which are promulgated under the Clean Water Act (CWA). The focus of these regulations is to protect specifically defined waterways, or "navigable waters of the United States" from potential oil contamination. "Navigable waters" is a broad term that includes rivers, lakes, oceans, water channels (tributaries) such as streambeds and arroyos that connect to a river. This applies to the Tijeras Arroyo, which discharges to the Rio Grande.

TABLE 3-4. Categories of Waste Recycled at SNL/NM in 2001

Recycled Categories	Weight (metric tons)
Scrap metal (steel, iron, stainless steel)	394.4
Concrete	2,471.42
Copper	21.6
Aluminum metal	24.76
Lead	13.09
Used oils	14.56
Toner cartridges	8.09
Batteries	26.99
Tires	0.82
Construction debris	705.39
Plastic	2.83
Mercury items	1.79
Transformers. Capacitors, and PCB items	11.29
Light bulbs (fluorescent, sodium, incandescent etc.)	8.61
Non-PCB light ballasts	1.68
Office paper (white and mixed)	122
Cardboard	146.17
Electronic Scrap	14.98
Phone books	1.48
Aluminum cans	1.33
Tin	18.35
Soil	0.3
Carpet	117.86
Other chemicals	0.12
Total	**4,129.91**

Sandia Corporation's SPCC Plan describes oil storage facilities and the mitigation controls in place to prevent inadvertent discharges of oil (SNL 1999f). Regulated facilities are those that contain 660 gallons of oil or more in one container or 1,320 gallons of oil in multiple containers at one location. Facilities at SNL/NM subject to the regulations include:

- Oil storage tanks (USTs and ASTs),
- Bulk storage areas (multiple containers),
- Electrical transformers and substations,
- Temporary or portable tanks, and
- Other oil-containing equipment.

USTs

In 1990, the State of New Mexico adopted federal standards contained in RCRA Subpart I for USTs. There are three fiberglass USTs in inventory at SNL/NM: two 20,000 gallon tanks and one 9,750 gallon tank. Program documents are listed in Chapter 9. Applicable regulations are listed in Appendix B.

3.6 NEPA COMPLIANCE ACTIVITIES

The NEPA, signed into law in January 1970, is one of the nation's most comprehensive legislative and public policy statements on the protection of the environment. It requires federal agencies to consider environmental impacts of their proposed activities and to prepare documentation on potential environmental impacts. Where these impacts may be significant, the process of assessing the impacts and determining subsequent agency action must provide for public review of the decision-making process.

NEPA Program

Sandia Corporation's NEPA Compliance Program provides DOE/NNSA/OKSO with technical assistance on NEPA and resource protection laws, such as the Endangered Species Act (ESA) and the National Historic Preservation Act (NHPA). Under a self-managed program, Sandia Corporation personnel review projects for conformance to existing DOE NEPA documents and determinations. For some projects, a NEPA checklist or an AF Form 813 is prepared for DOE determination if the proposed action:

(1) Does not fall within an existing SNL/NM NEPA document, or
(2) Would occur on USAF property.

NEPA program documents are listed in Chapter 9. NEPA regulations are listed in Appendix B.

SNL/NM Site-Wide Environmental Impact Statement (SWEIS)

As a matter of policy, DOE prepares a SWEIS for its large, multiple-facility sites. In November 1999, DOE issued the final SWEIS for the SNL/NM site (DOE 1999), and in December 1999, issued the Record of Decision (ROD) selecting the "Expanded Operations" alternative as the preferred alternative.

The SWEIS allows DOE to "tier" subsequent NEPA documents to the larger analysis and reduce the need to revisit the same impact analysis for each new project proposed. By doing so, DOE can focus on project-specific issues in its NEPA determinations. In accordance with 10 CFR 1021, DOE will examine the SWEIS every five years to decide whether the analysis remains valid, or if a new or supplemental SWEIS should be prepared.

ISMS Software NEPA Module

In 2001, the ISMS and NEPA teams continued the development and deployment of the ISMS Software NEPA Module. The use of the ISMS Software NEPA Module has been proven to facilitate SNL/NM internal project reviews (citing existing NEPA documentation such as the SWEIS), and to streamline preparation of DOE NEPA checklists, when required. The NEPA Module has also supported Quality Assurance (QA) by providing a consistent framework that makes NEPA compliance documentation and information readily available. The NEPA Module also supports DOE in response to information requests, and in supplying information for appraisals and audits.

3.7 ENVIRONMENTAL EDUCATION OUTREACH PROGRAM

Sandia Corporation's Environmental Education Outreach Program reaches out to the community at large. Presentations on both local and national environmental issues and concerns are held at community centers, schools, and environmental conferences. The hands-on approach is used wherever feasible, such as involving the community and students in field trips to perform environmental sampling, conducting in-field measurements, and observing local ecological systems. In 2001, Sandia Corporation participated in the following events:

- The 4th Annual Youth Conference on the Environment
- Explora Science Units
- The New Mexico Environmental Health Conference
- The School To World Conference
- Earth Day at the New Mexico State Fair
- School presentations throughout Albuquerque

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Chapter 4

Terrestrial and Ecological Surveillance

In this Chapter ...

Chapter Summary

Terrestrial and ecological surveillance are conducted at Sandia National Laboratories, New Mexico (SNL/NM) to detect the possible migration of contaminants to off-site locations and to determine the impact, if any, of SNL/NM's operations on human health or the environment.

The Terrestrial Surveillence Program samples surface soils, arroyo and river sediments, and vegetation from various on-site, perimeter, and off-site locations to detect if radiological and non-radiological constituents are present.

There are 39 on-site, 17 perimeter, and 16 off-site fixed locations that SNL/NM typically samples each year, which effectively makes statistical comparisons with results from previous years.

Environmental Snapshot

- *In 2001, there were no terrestrial sample results that indicated a significant level of concern that would trigger actions at locations that are not already being addressed by the Environmental Restoration (ER) Project.*

Radiological Parameters include gamma-emitting radionuclides, tritium (H^3) radioisotope, and uranium. Non-radiological parameters include metals such as aluminum, iron, silver, and zinc.

Echinocerus fendleri at SNL/NM

4.1 Terrestrial Surveillance Program

Terrestrial surveillance began at SNL/NM in 1959 with the collection of environmental samples for radiological analysis. Since 1959, the number of sampling locations has increased to account for the growth of the laboratory. Several other significant programmatic changes have occurred over the years, including:

- 1983 – Added gamma radiation level measurements, utilizing thermoluminescent dosimeters (TLD's);
- 1993 – Added collection of samples from arroyo and river sediments;
- 1993 – Began non-radiological (metals) analysis of soil and sediment samples;
- 1996 – Began non-radiological (metals) analysis of vegetation samples;
- 1996 – Began the Ecological Surveillance Program; and
- 2000 – Discontinued sampling of off-site surface water (Rio Grande River and Las Huertas Creek).

4.1.1 Program Objectives

The Terrestrial Surveillance Program is designed to meet the objectives of the U.S. Department of Energy (DOE) Order 5400.1, *General Environmental Protection Program* (DOE 1990):

- Collect and analyze samples in order to characterize environmental conditions and identify trends;
- Establish baseline (or background) levels of radiological and non-radiological constituents;
- Assess the effectiveness of pollution abatement programs;
- Identify new or existing environmental quality problems, and their potential impacts on human health or the environment; and
- Verify compliance with applicable laws and regulations, as well as commitments made in official documents (such as Environmental Impact Statements [EISs], in accordance with the National Environmental Policy Act [NEPA]).

Standards for Comparison
No regulatory limits are available to directly compare concentrations of radiological or non-radiological constituents in surface soils, vegetation, or sediments; however, SNL/NM conducts statistical analyses to compare the results from on-site and perimeter samples to off-site results, and to establish trends in order to identify possible pollutants and their potential impact on human health or the environment.

In addition, sample results for metals in surface soils are compared to U.S. surface soil average concentrations, published in *Trace Elements in Soils and Plants* (Kabata-Pendias and Pendias, 1992), or local/regional surface soil average concentrations, published in *Elements in North American Soils* (Dragun and Chiasson, 1991).

The DOE, National Nuclear Security Administration (NNSA) Oversight Bureau of the New Mexico Environment Department (NMED) splits samples with SNL/NM, at several locations, for an added measure of verification. The results are available upon request from the NMED, which can be found at the following website:

http://www.nmenv.state.nm.us/

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

The results of the statistical analyses allow SNL/NM to prioritize sample locations for possible follow-up action. The prioritization process is a decision-making tool to assist in determining the appropriate level of concern for each sample result. The Statistical Analysis

Prioritization Methodology (Shyr, Herrera, and Haaker, 1998) is based on two "yes or no" questions resulting in a matrix of four priority levels. The matrix is shown in Table 4-1.

Prior to 2001, there have been no terrestrial sample results that have indicated a significant level of concern (Priority-1) that would trigger actions at locations that are not already being addressed by the ER Project.

In past years, the period of time covered by the statistical analysis was from 1991 to present (for soils), and from 1993 to present (for sediments and vegetation). In Calendar Year (CY) 2001, the analysis was limited to a five-year period (beginning in 1997). The reason for the change was that SNL/NM changed analytical laboratories in CY 2000, with lower detection capabilities for many of the metals. As a result, a large number of false decreasing trends were noted for non-radiological parameters when the whole data set was analyzed. By limiting the analysis to a five-year period, the number of apparent decreasing trends was reduced, and should be eliminated over the next couple of years.

4.1.2 Sample Media

Samples of surface soils, arroyo and river sediments, and vegetation are collected as part of the Terrestrial Surveillance Program, and analyzed for radiological and non-radiological constituents.

Soil

Soil samples are collected to ascertain the presence, or buildup, of pollutants that may have been transported by air or water, and deposited on the ground surface. Approximately 1,500 grams of sample is collected from the top two inches of soil in accordance with local procedures. In 2001, soil samples were collected from a total of 43 locations (24 on-site, 13 perimeter, and six off-site locations). Soil samples were not collected at seven on-site locations (2NE, 2NW, 2SE, 2SW, 32E, 32S, and 53) due to human error.

Sediment

Sediment samples are collected from arroyo beds and from the banks of rivers and creeks to ascertain the presence, or buildup, of pollutants deposited from surface waters. Approximately 1,500 grams of sample is collected from the top two inches of sediment in accordance with local procedures. In 2001, sediment samples were collected from a total of nine locations (three on-site, three perimeter, and three off-site locations). One on-site sediment sample was not collected (79 – Arroyo del Coyote Upstream) due to human error.

Vegetation

Vegetation is sampled to monitor for potential uptake of pollutants, which could provide an exposure pathway to forage animals, as well as to humans through the food chain. In actuality, human exposure to contaminants through the food chain is highly unlikely on Kirtland Air Force Base (KAFB), since there is no hunting, livestock or commercial farming within the boundaries of the base. Approximately 500 grams of sample is collected, preferably from perennial grasses, by cutting back several inches of growth from the plant. If grass is not available, samples from small leafy plants may be collected. In 2001, vegetation was collected at a total of 15 locations (nine on-site, three perimeter, and three off-site locations). Due to a lack of vegetation at 11 locations, samples were not collected in 2001.

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

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

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

Samples were also not taken at two locations (2NE and 2NW) due to human error.

Gamma Radiation Levels

Gamma Radiation Levels are measured using TLD's to determine the impact, if any, of SNL/NM's operations on ambient radiation levels. The TLD's are changed out on a quarterly basis and processed at an on-site laboratory.

4.1.3 Sampling Locations

On-site

On-site locations are selected within or near areas of past or present SNL/NM operations. These areas include the five technical areas, as well as active and inactive facilities and test areas outside the technical area boundaries. Sample locations are chosen near sites with known contamination from past operations, and near facilities that have the potential to discharge radiological or non-radiological pollutants to the environment. Other considerations in the selection of sampling locations include local topography and meteorology. The 39 routine on-site sampling locations are listed in Table 4-2 and shown in Figure 4-1. Locations where sampling did not occur for 2001 are indicated in Table 4-2 (identified with a dash).

Perimeter

Perimeter locations are selected to determine if contaminants are migrating from SNL/NM sites toward the off-site community. Perimeter locations are typically off of SNL/NM property, but (with few exceptions) within the boundary of KAFB. The 17 routine perimeter sampling locations are listed in Table 4-3 and shown in Figure 4-1. Locations where sampling did not occur for 2001 are indicated in Table 4-3 (identified with a dash).

Off-site

Off-site locations are selected to establish concentrations of radiological and non-radiological constituents for comparison with on-site and perimeter results. Sample locations have been selected within a 25-mi radius of SNL/NM in areas where the accumulation of pollutants is expected to be minimal. The 16 routine off-site sampling locations are listed in Table 4-4 and shown in Figure 4-2. Locations where sampling did not occur in 2001 are indicated in Table 4-4 (identified with a dash).

Occasionally, sampling locations are added or dropped for different reasons, including startup or closure of an existing facility or operation; additional characterization of areas with elevated concentrations or increasing trends; or other technical or budgetary reasons. No changes were made to the sampling locations in 2001; however, soil samples were inadvertently missed at several locations and insufficient vegetation was present for sampling at several locations.

4.1.4 Radiological Parameters and Results

Radiological analyses are performed on all soil, sediment, and vegetation samples. The CY 2001 analytical results are found in Appendix E of this report. The detailed statistical analyses are documented in *2001 Data Analysis in Support of the Annual Site Environmental Report* (SNL 2002c). Radiological parameters include:

- ***Gamma-emitting radionuclides*** – Gamma spectroscopy is used to detect the emission of gamma radiation from radioactive materials. Radionuclide identification is possible by measuring the spectrum of gamma energies associated with a sample, since each radionuclide has a unique and consistent series of gamma emissions. Cesium-137 (Cs-137) is an example of a long-lived gamma emitter that is prevalent in the environment (as fallout from historical nuclear weapons testing) and is used as a possible indicator of environmental contamination from reactor facilities.

- ***Tritium (H^3) radioisotope*** **-** H^3 is a radioactive isotope of hydrogen with a half-life of 12.5 years. Unlike the most common element of hydrogen (${}_1H^1$), which has a single proton in its nucleus, H^3 contains one proton and two neutrons. Tritium occurs naturally at low levels in the environment and is also a common material in nuclear weapons research and development.

- ***Uranium*** – Uranium occurs naturally in soils and may also be present as a pollutant in the environment due to past testing conducted at SNL/NM. Total uranium (U_{tot}) analysis is used to measure all uranium isotopes present in a sample. A high U_{tot} measurement may trigger an isotope-specific analysis to determine the possible source of uranium (natural or man-made, enriched or depleted).

- ***External gamma radiation exposure rates -*** TLDs are used to measure ambient gamma exposure rates. Several natural gamma radiation sources exist, including cosmic radiation and radioactive materials that exist in geologic materials at SNL/NM. Many

TABLE 4-2. On-site Terrestrial Surveillance Locations and Sample Types
There are 39 on-site sampling locations.

Location Number	Sampling Location	Soil	Sediment	Vegetation	TLD
1	Pennsylvania Ave.	X			X
2NW	Mixed Waste Landfill (MWL) (northwest)	—		—	X
2NE *	MWL (northeast)	—		—	
2SE	MWL (southeast)	—			
2SW	MWL (southwest)	—			
3	Coyote Canyon Control	X			X
6	TA-III (east of water tower)	X		X	X
7 *	Unnamed Arroyo (north of TA-V)	X			X
20 *	TA-IV (southwest) (KAFB Skeet Range)	X		—	X
31	TA-II Guard Gate				X
32S	TA-II, Bldg. 935 (south bay door)	—			
32E	TA-II, Bldg. 935 (east personnel door)	—			
33	Coyote Springs	X		X	
34	Lurance Canyon Burn Site	X		X	
35	Chemical Waste Landfill (CWL)	X		X	
41	TA-V (northeast fence)	X			X
42	TA-V (east fence)	X		—	X
43	TA-V (southeast fence)	X		—	X
45	Radioactive and Mixed Waste Management Facility (RMWMF), TA-III (northwest corner)	X		X	X
45E	RMWMF, TA-III (east fence)				X
46	TA-II (south corner)	X		X	X
47	Tijeras Arroyo (east of TA-IV)				X
48	Tijeras Arroyo (east of TA-II)				X
49	Near the Explosive Components Facility (ECF)	X		—	
51	TA-V (north of culvert)	X		X	
52	TA-III, northeast of Bldgs. 6716 and 6717	X		X	
53 *	TA-III south of long sled track	—			
54	TA-III, Bldg. 6630	X			
55	Large Melt Facility (LMF), Bldg. 9939	X		X	
56	TA-V, Bldg. 6588 (west corner)	X			
57	TA-IV, Bldg. 970 (northeast corner)	X			
66	KAFB Facility	X		—	
72	Arroyo del Coyote (midstream)		X		
74N	TA-IV, Tijeras Arroyo (midstream)		X		
75	Arroyo del Coyote (down-gradient)		X		
76	Thunder Range (north)	X			
77	Thunder Range (south)	X			
78	School House Mesa	X			
79	Arroyo del Coyote (up-gradient)		—		

NOTE: *Replicate sampling locations: In addition to single samples taken for each medium, two replicate samples are collected for internal checks on comparability of sampling and analysis.
TLD = thermoluminescent dosimeters
"— " = Indicates location not sampled during CY 2001 either due to error or no vegetation present
TA = Technical Area
KAFB = Kirtland Air Force Base

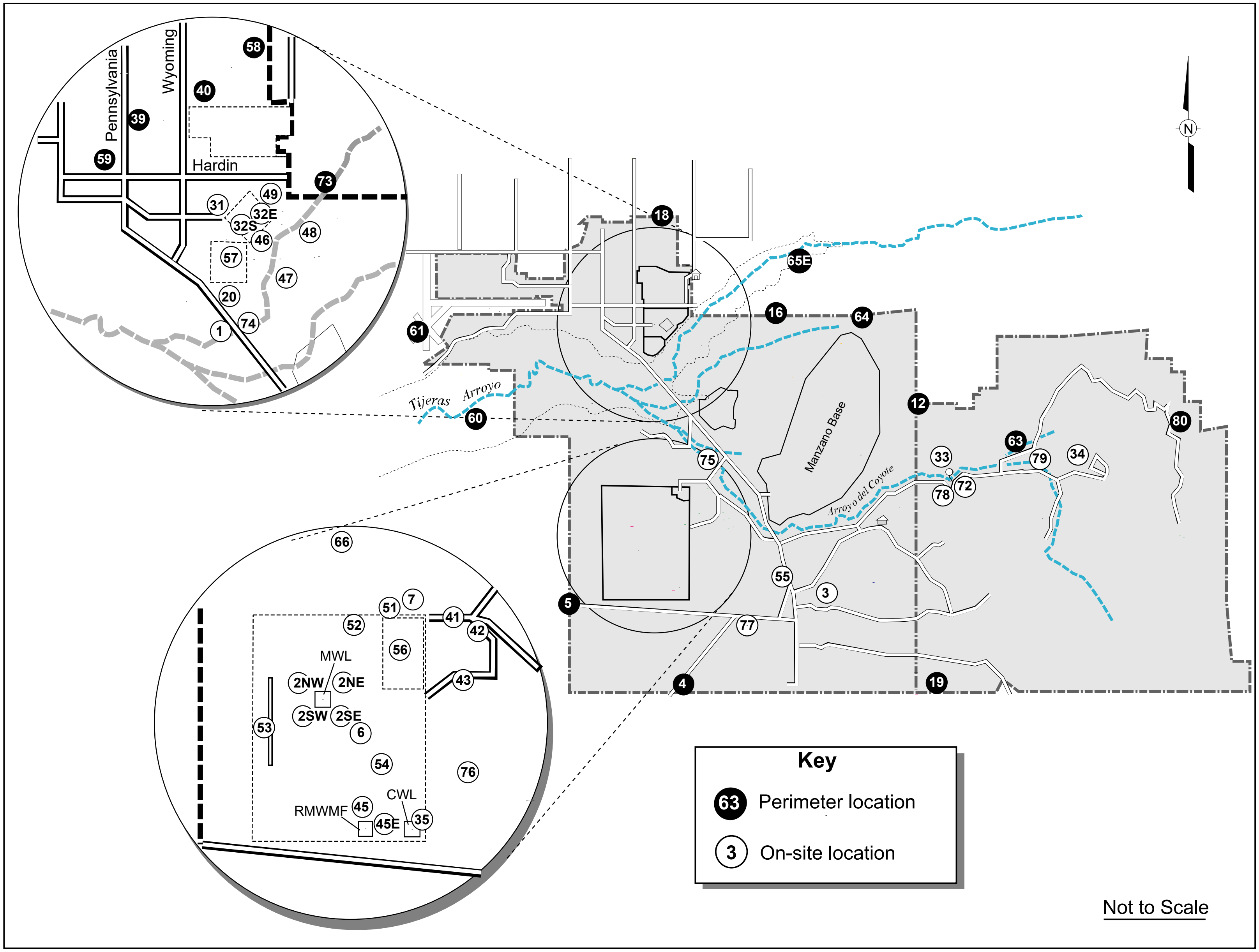

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FIGURE 4-1. Terrestrial Surveillance Program On-site and Perimeter Sampling Locations
On-site locations are within areas of SNL/NM operations. Perimeter locations are located both on and off KAFB property

TABLE 4-3. Perimeter Terrestrial Surveillance Locations and Sample Types
There are 17 perimeter sampling locations.

Location Number	Sampling Location	Soil	Sediment	Vegetation	TLD
4	Isleta Reservation Gate	X		X	X
5	McCormick Gate	X		—	X
12	Northeast Perimeter	X		X	
16	Four Hills	X			X
18	North Perimeter Road				X
19	USGS Seismic Center Gate	X			X
39	Northwest DOE Complex				X
40	TA-I, northeast (by Bldg. 852)				X
58	North KAFB Housing	X		—	
59	Zia Park (southeast)	X			
60	Tijeras Arroyo (down-gradient)	X	X	X	
61	Albuquerque International Sunport (west)	X			
63	No Sweat Boulevard	X			
64 *	North Manzano Base	X		—	
65E	Tijeras Arroyo, east (up-gradient)	X	X		
73 *	Tijeras Arroyo (up-gradient)		X		
80	Madera Canyon	X			

NOTE: *Replicate sampling locations: In addition to single samples taken for each medium, two replicate samples are collected for internal checks on comparability of sampling analysis.
TLD = thermoluminescent dosimeter
"—" = Indicates location not sampled during CY 2001
USGS = U.S. Geological Survey

TABLE 4-4. Off-site Terrestrial Surveillance Locations and Sample Types
There are 16 off-site sampling locations within a 25-mile radius of SNL/NM.

Location Number	Sampling Location	Soil	Sediments	Vegetation	TLD
8	Rio Grande, Corrales Bridge (up-gradient)	X	X	X	
9	Sedillo Hill, I-40 (east of Albuquerque)	X		X	
10	Oak Flats	X		—	X
11 *	Rio Grande, Isleta Pueblo (down-gradient)	X	X	X	X
21	Bernalillo Fire Station 10, Tijeras				X
22	Los Lunas Fire Station				X
23	Rio Rancho Fire Station, 19th Ave.				X
24	Corrales Fire Station				X
25	Placitas Fire Station	X		—	X
26	Albuquerque Fire Station 9, Menaul NE				X
27	Albuquerque Fire Station 11, Southern SE				X
28	Albuquerque Fire Station 2, High SE				X
29	Albuquerque Fire Station 7, 47th NW				X
30	Albuquerque Fire Station 6, Griegos NW				X
62	East resident	X		—	
68	Las Huertas Creek		X		

NOTE: *Replicate sampling locations: In addition to single samples taken for each medium, two replicated samples are collected for internal checks on comparability of sampling and analysis.
TLD = thermoluminescent dosimeter
"—" = Indicates location not sampled during CY 2001

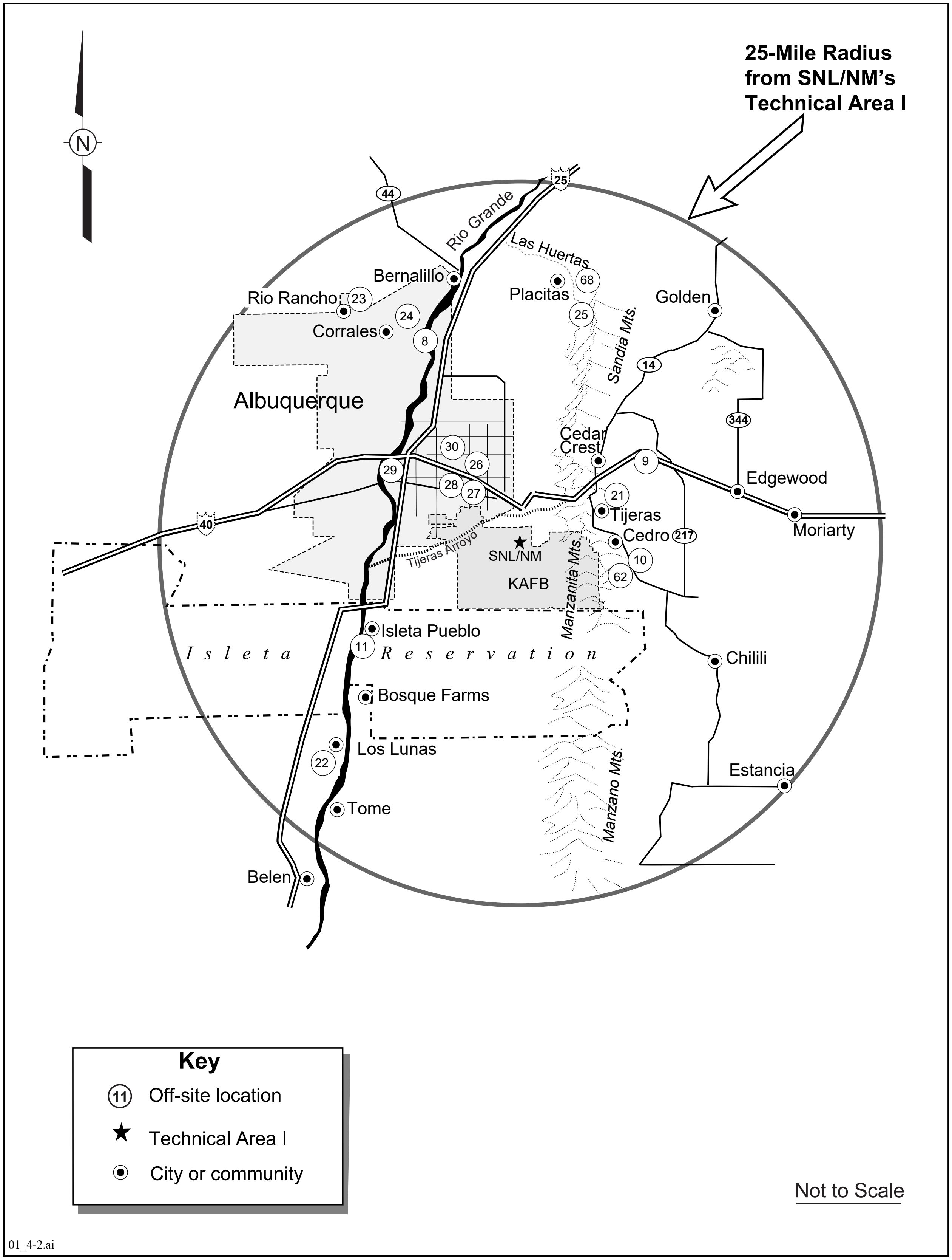

FIGURE 4-2. Terrestrial Surveillance Program Off-site Sampling Locations

sources of man-made gamma radiation also exist at SNL/NM, such as reactor and accelerator facilities. The TLD network was established to determine the regional gamma exposure rate due to natural sources and to determine the impact, if any, of SNL/NM's operations on these levels. The dosimeters are placed on aluminum poles at a height of approximately one meter, and are exchanged and measured quarterly (January, April, July, and October) at 34 on-site, perimeter, and off-site locations.

Radiological Results

The results of the statistical analysis showed no on-site or perimeter soil, sediment, or vegetation locations that were both higher than off-site and with an increasing trend (Priority-1). Several locations were identified as either Priority-2 or Priority-3 (higher than off-site or increasing trend). The Priority-2 and Priority-3 locations and parameters are listed in Tables 4-5 through 4-7.

Cs-137

Three perimeter locations (12, 64, and 80) continue to be identified as Priority-2 (higher than off-site) for Cs-137 in surface soils. Locations 12 and 80 are located on the U.S. Forest Service (USFS) land withdrawn area. Location 64 is located north of Manzano Base, near the KAFB boundary. Cs-137 is prevalent in surface soils worldwide. Higher Cs-137 at these sample locations is a result of their being at a higher elevation and not due to SNL/NM operations. It should also be noted that one off-site location (9) showed an increasing trend for Cs-137 in soil. Location 9 is at Sedillo Hill, east of Albuquerque. The reported results at this location ranged from 0.08 to 0.683 pCi/g.

One on-site location (75) was identified as Priority-3 (increasing trend) for Cs-137 for sediments. This is the first time this location has been observed. Location 75 is located in the Arroyo de Coyote (down-gradient). The recorded values for Cs-137 ranged from 0 to 0.143 pCi/g; there was no statistical difference when compared to the off-site values.

All other locations were identified as Priority-4 (consistent with off-site results and no increasing trends) for Cs-137 for vegetation.

Tritium

No locations were identified as Priority-1 in CY 2001. Although not sampled in CY 2001, two on-site locations (2NE and 32E) are still identified as Priority-2 (higher than off-site) for tritium in soils. These locations have been identified in past years, and are associated with ER sites. Location 2NE (ER Site 76) is located just outside the Mixed Waste Landfill (MWL) in Technical Area III (TA-III) and location 32E (ER Site 159) is located outside Building 935 in Technical Area II (TA-II). Although elevated, the concentration of H^3 at these locations does not present a hazard to workers in these areas. It should be noted that both locations 2NE and 32E show a decreasing trend for H^3. Both locations have shown a significant decrease in the amount of H^3 present from 1997 through 2000. Location 2NE had a maximum concentration of 43.0 pCi/mL in 1997 with a minimum concentration of 1.48 pCi/mL in 2000 while location 32E had a maximum concentration of 98.0 pCi/mL in 1997 with a minimum concentration of 0.181 pCi/mL in 2000.

Location 2NE was also noted to be Priority-2 for H^3 in vegetation. (Again, this location was not sampled during CY 2001.) Although elevated, the concentration of H^3 at these locations does not present a hazard to workers in these areas.

All locations were identified as Priority-4 for H^3 in sediment.

TABLE 4-5. Summary Statistics for Soil Locations (1997-2001) Noted as PRIORITY-2 During Calendar Year 2001

Analyte	Units	Location	Sample Size	Average	Median	Std Dev	Min	Max
Cesium-137	pCi/g	12	5	1.108	1.20	0.416	0.430	1.54
		64	5	0.890	0.84	0.408	0.435	1.40
		80	5	0.819	0.78	0.632	0.050	1.50
Tritium	pCi/mL	2NE	4	14.02	5.80	19.66	1.48	43.0
		32E	4	24.81	0.54	48.79	0.181	98.0

NOTE: Std Dev = Standard deviation
pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter

Total Uranium

TLD

TLD exposure by quarter and location class for 2001 is shown in Appendix E, Table E-20.

Data for 1997 through 2001 was analyzed to determine if any statistical differences were observed for either location class (on-site, perimeter, or community) or year. The statistical analysis did show that TLD exposure for 1999 was higher than any other year while the total exposure for 2000 and 2001 were significantly less than any other year. TLD exposure for community locations were significantly less than on-site or perimeter locations. (Note: There was no statistical difference between on-site or perimeter locations.) Table 4-8 shows the overall summary statistics for TLD Exposure for 1997 - 2001. Figure 4-3 shows the TLD exposure by year and location class.

Data for locations 20 and 39 are incomplete for CY 2001, so the data for these locations are not included in the annual summary statistics.

4.1.5 Non-Radiological Parameters and Results

All soil, sediment, and vegetation samples are analyzed for the following 21 metals:

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

TABLE 4-6. Summary Statistics for Vegetation Locations (1997-2001) Noted as PRIORITY-2 During Calendar Year 2001

Analyte	Units	Location	Sample Size	Average	Median	Std Dev	Min	Max
Tritium	pCi/mL	2NE	4	6.66	5.47	6.76	0.68	15.0

NOTE: Std Dev = Standard deviation
pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter

TABLE 4-7. Summary Statistics for Sediment Locations (1997-2001) Noted as PRIORITY-3 During Calendar Year 2001

Analyte	Units	Location	Sample Size	Average	Median	Std Dev	Min	Max
Cesium-137	pCi/g	75	4	0.073	0.074	0.060	0	0.143

NOTE: Std Dev = Standard deviation
pCi/mL = picocurie per milliliter

TABLE 4-8. Summary Statistics for TLD Exposure, 1997 - 2001

Location Class	No. of Obs	Average	Median	Std Dev	Minimum	Maximum
Community	59	92.04	90.4	11.18	73.2	116.9
Perimeter	32	96.87	95.9	10.62	78.9	127.2
On-Site	66	98.37	97.3	9.40	82.7	119.7

NOTE: If a location had missing data for one quarter, it was excluded from the analysis for the year.
TLD = thermoluminescent dosimeter
Std Dev = standard deviation
Obs = observations

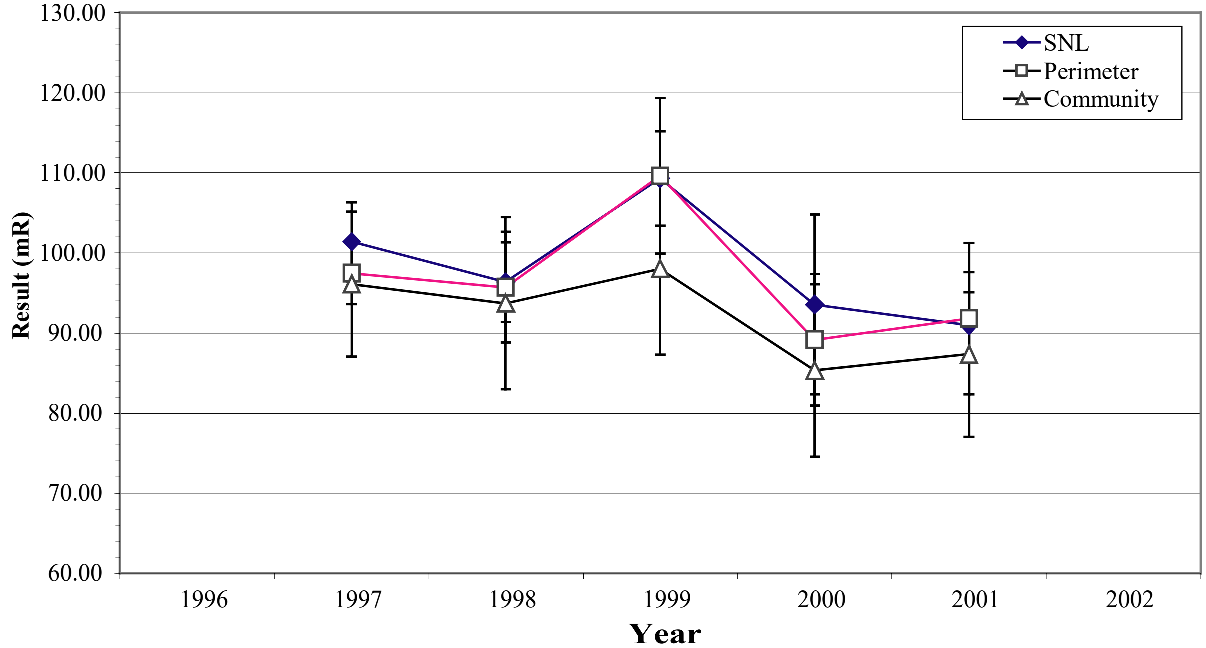

FIGURE 4-3. TLD Results By Year and Location Class

All metals, except for mercury, are determined using the Inductively Coupled Plasma-Atomic Emission Spectrum (ICP-AES) method. Mercury is determined by the Cold Vapor Atomic Absorption (CVAA) method.

The CY 2001 analytical results are found in Appendix E of this report. The detailed statistical analyses are documented in *2001 Data Analysis in Support of the Annual Site Environmental Report* (SNL 2002c).

Non-Radiological Results

The results of the statistical analysis showed one perimeter soil sampling location (64) with manganese results that were both higher than off-site and with an increasing trend (Priority-1). No other on-site or perimeter locations were identified as Priority-1 (soil, sediment, or vegetation). Several locations were identified as either Priority-2 or Priority-3 (higher than off-site or increasing trend). The Priority-2 and Priority-3 locations and parameters are listed in Tables 4-9 and 4-10.

Several metals were listed as Priority-4 for all soil, sediment, and vegetation samples: antimony, arsenic, beryllium, chromium, copper, mercury, nickel, selenium, silver, and thallium.

Aluminum

One on-site location (52) and one perimeter location (65E) were identified as Priority-2 (higher than off-site) for aluminum in surface soils. The concentration at both locations is well within the range of background identified for New Mexico surface soils and is expected to be naturally occurring.

All sediment and vegetation samples, and the remaining soil sample locations were identified as Priority-4 for aluminum.

Barium

One on-site location (3) was identified as Priority-2 (higher than off-site) and one perimeter location (80) was identified as Priority-3 (increasing trend) for barium in surface soils. The concentration of barium at both locations is well within the range of background identified for New Mexico surface soils and is expected to be naturally occurring.

All sediment and vegetation samples, and the remaining soil sample locations were identified as Priority-4 for barium.

TABLE 4-9. Summary Statistics for All Locations (1997-2001) Identified as PRIORITY-2 for Metals During Calendar Year 2001 (all units in mg/kg)

Matrix	Analyte	Location Type	Location	Sample Size	Average	Std Dev	Min	Max
Soil	Aluminum	On-site	52	5	15160	2479	11700	18000
		Perimeter	65E	5	15540	5626	8300	24000
	Barium	On-site	3	5	266	121	99	400
	Cadmium	On-site	20	5	1.81	0.85	0.5	2.8
	Cobalt	Perimeter	64	5	8.10	0.88	7	9.07
		Perimeter	65E	5	9.26	2.73	5.2	12
	Iron	Perimeter	64	5	18960	1877	17000	21700
		Perimeter	65E	5	21740	6187	12000	28000
	Lead	On-site	20	5	1435	2203	62.6	5300
	Magnesium	On-site	3	5	5142	1565	2900	6600
		Perimeter	64	5	6442	957	5600	7770
		Perimeter	65E	5	7986	2748	3900	11000
	Manganese	Perimeter	65E	5	559	207	220	750
	Potassium	Perimeter	60	5	3752	239	3380	4000
		Perimeter	65E	5	4786	1673	2200	6800
	Vanadium	Perimeter	65E	5	38.4	10.2	23	50
	Zinc	Perimeter	64	5	73.2	7.0	65	78.9
		Perimeter	65E	5	79.2	26.4	41	110
Sediment	Iron	On-site	74N	5	14520	5626	8500	23000
	Vanadium	On-site	74N	5	28.1	10.9	16	45
Vegetation	Magnesium	Perimeter	60	4	4625	1387	3000	6300

NOTE: Std Dev = Standard deviation
mg/kg = milligram per kilogram

TABLE 4-10. Summary Statistics for Soil Locations (1997-2001) Identified as PRIORITY-3 for Metals During Calendar Year 2001 (all units in mg/kg)

Matrix	Analyte	Location Type	Location	Sample Size	Average	Std Dev	Min	Max
Soil	Barium	Perimeter	80	5	140	20	120	171
	Cobalt	Perimeter	80	5	4.82	0.70	4	5.78
	Lead	On-site	33	5	14.6	1.1	13	15.6
	Manganese	On-site	33	5	318	33	280	368
		Perimeter	80	5	281	28	240	319
	Potassium	Perimeter	80	5	2462	441	2000	3060
	Zinc	Perimeter	33	5	59.9	15.7	43	82.3
Sediment	Magnesium	Perimeter	65E	5	2262	265	1800	2460

NOTE: Std Dev = Standard deviation
mg/kg = milligram per kilogram

Cadmium
One on-site location (20) continues to be identified as Priority-2 for cadmium in surface soils. This location is associated with the old KAFB skeet range and the elevated cadmium is associated with the operation of the skeet range. Although the cadmium is recognized as a contaminant (in addition to natural background concentration) at this site, the concentration is within the range of background for New Mexico surface soils, and well below the NMED's soil screening levels (SSLs) (NMED 2000).

All sediment and vegetation samples, and the remaining soil sample locations were identified as Priority-4 for cadmium.

Cobalt
Two perimeter locations (64 and 65E) continue to be identified as Priority-2 (higher than off-site) and one perimeter location (80) was identified as Priority-3 (increasing trend) for cobalt in surface soils. The concentration at all three locations is well within the range of background for cobalt in New Mexico surface soils and is expected to be naturally occurring.

All sediment and vegetation samples, and the remaining soil sample locations were identified as Priority-4 for cobalt.

Iron
Two perimeter locations (64 and 65E) continue to be identified as Priority-2 (higher than off-site) for iron in surface soils and one on-site location (74N) was identified as Priority-2 for iron in sediments. The concentration at all three locations is well within the range of background for iron in Western U.S. surface soils and is expected to be naturally occurring.

All vegetation samples, and the remaining soil and sediment sample locations were identified as Priority-4 for iron.

Lead
One on-site location (20) continues to be identified as Priority-2 (higher than off-site) and one on-site location (33) was identified as Priority-3 (increasing trend) for lead in surface soils. Location 20 is associated with the old KAFB skeet range and the elevated lead is associated with the operation of the skeet range. Although lead is recognized as a contaminant (in addition to the natural background concentration) at this site, the concentration is well below the NMED's SSLs (NMED 2000).

The lead concentration at location (33) is within range of background for lead in New Mexico surface soils and is expected to be naturally occurring.

All sediment and vegetation samples and the remaining soil sample locations were identified as Priority-4 for lead.

Magnesium
One on-site location (3) and two perimeter locations (64 and 65E) were identified as Priority-2 (higher than off-site) for magnesium in surface soils. One perimeter sediment location (65E) was identified as Priority-3 (increasing trend) and one perimeter vegetation location (60) was identified as Priority-2 (higher than off-site). The concentration at all soil and sediment locations is within the range of background for magnesium in New Mexico surface soils.

All remaining soil, sediment, and vegetation samples were identified as Priority-4 for magnesium.

Manganese
One perimeter location (64) was identified as Priority-1 (higher than off-site and increasing trend) for manganese in surface soils. In addition, one perimeter location (65E) was identified as Priority-2 (higher than off-site) and one on-site (33) and one perimeter (80) location were identified as Priority-3 (increasing trend) for manganese in surface soils.

Possible causes for the Priority-1 designation at location 64 are being investigated. This location has routinely been identified as higher than off-site, but this is the first year that an increasing trend has been identified. It is suspected that the change in analytical laboratories that occurred in CY 2000 is the cause of the increasing trend. The increasing trend can be seen in Figure 4-4. The concentration at location 64, as with the other locations, is within the range of background for manganese in New Mexico surface soils, and the concentration does

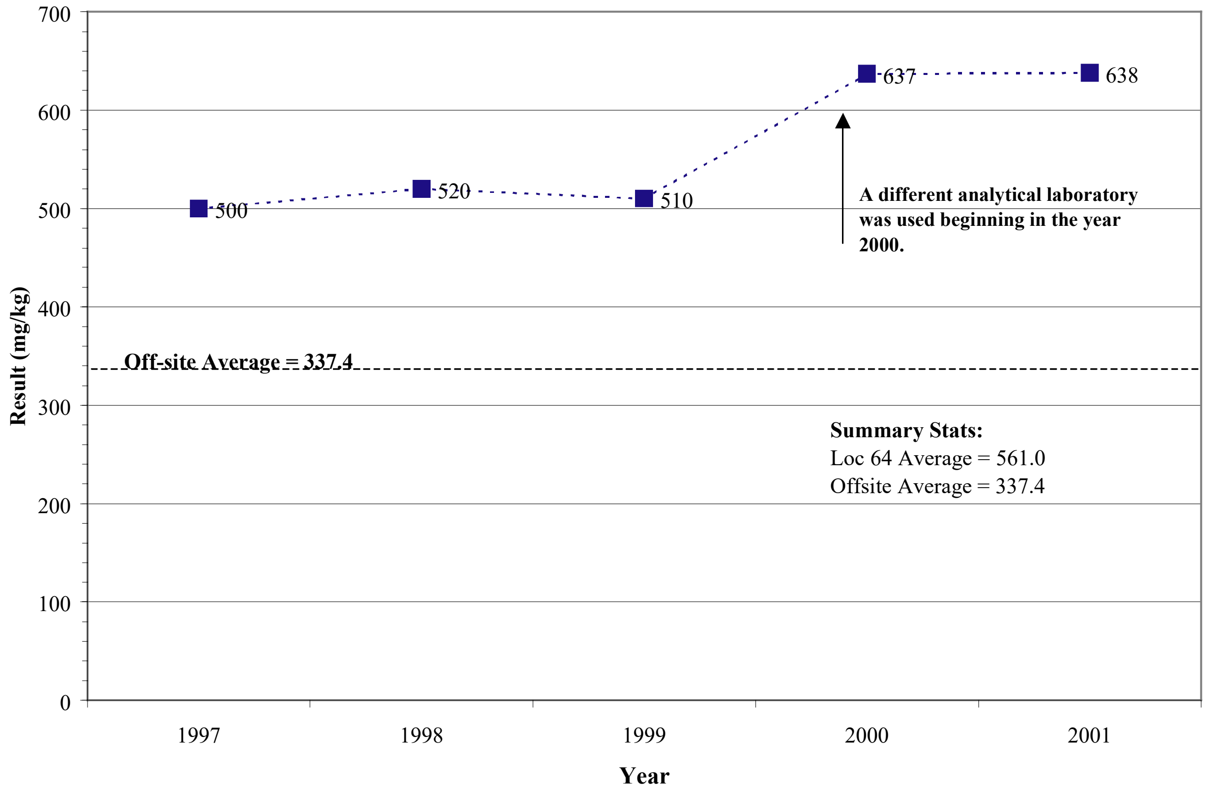

FIGURE 4-4. Observed Concentration of Manganese Within Western U.S. Surface Soil Limits (30-500 mg/kg)

not indicate a risk (it is well below the New Mexico SSLs). Figure 4-4 shows the concentrations of manganese at location 64 over the past five years.

All sediment and vegetation samples, and the remaining soil sample locations were identified as Priority-4 for manganese.

Potassium
Two perimeter locations (60 and 65E) were identified as Priority-2 (higher than off-site) for potassium in surface soils. One perimeter location (80) was identified as Priority-3 (increasing trend). All soil concentrations are within soil concentrations identified in the Western U.S. soils concentrations.

All sediment and vegetation samples, and the remaining soil sample locations were identified as Priority-4 for potassium.

Vanadium
One perimeter location (65E) was again identified as Priority-2 (higher than off-site) for vanadium in surface soils. One on-site location (74N) was identified as Priority-2 for vanadium in sediments. The concentration at both locations is within the range of background for vanadium in New Mexico surface soils.

All vegetation locations and the remaining soil and sediment locations were identified as Priority-4 for vanadium.

Zinc
Two perimeter locations (64 and 65E) were again identified as Priority-2 (higher than off-site) for zinc in surface soils. One on-site location (33) was identified as Priority-3 (increasing trend) for zinc in surface soils. The concentration at locations 64 and 33 were within the range background for zinc in New Mexico surface soils. Location 65E had two values that were outside the range for New Mexico surface soil concentrations, but both of these values were observed prior to the change in analytical laboratories in 2000.

All sediment and vegetation locations, and the remaining soil locations were identified as Priority-4 for zinc.

4.2 Ecological Surveillance

Biota monitoring began in 1996 as an additional element of environmental monitoring within the Terrestrial Surveillance Program. The biota data collected are a part of the suggested requirements under DOE Order 5400.1 (DOE 1990). Data are collected on small mammal, reptile, amphibian, bird, and plant species currently inhabiting SNL/NM. Data are also collected in support of Facilities and the National Environmental Policy Act (NEPA) Program. Data collected includes information on population abundance, species diversity, and land use patterns.

TA-II Monitoring Study

Site-specific monitoring was conducted from June through September 2001. The study site is located at the perimeter of TA-II and the control site in the southeastern end of the perimeter fence separating KAFB and Isleta Pueblo (SNL 2000j). Baseline data sets are compiled through visual population counts of plants and mark-and-release trapping of animals. Information collected includes species information, sex, various body dimensions, and number of recaptures. During the study, a total of 20 animal species and 42 plant species were recorded (Table 4-11).

Contamination data sets are compiled through tissue samples collected at the study sites. Whole body tissue analysis helps to determine if contaminant loads are present within the biota.

Tissue samples are analyzed for H^3, U_{tot}, gamma spectroscopy, ICP-20 metals, and strontium-90. The two sample t-test was used in the analysis of analytes exceeding the minimum detectable activity (MDA). These analytes were then compared between the study site and control site in order to determine if a statistically significant variation in analyte concentrations occurred. No analytes exhibited a concentration difference between the two sites.

TABLE 4-11. Species Identified in TA-II Monitoring Study During Calendar Year 2001

BIRDS			
Mourning dove	*Zenaida macroura*	Northern mockingbird	*Mimus polyglottos*
Western meadowlark	*Sturnella neglecta*	Loggerhead shrike	*Lanius ludovicianus*
American robin	*Turdus migratorius*	European starling	*Sturnus vulgaris*
Western kingbird	*Tyrannus verticalis*	Black-chinned hummingbird	*Archilochus alexandris*
House finch	*Carpodacus mexicanus*	Barn swallow	*Hirundo rustica*
Say's phoebe	*Sayornis saya*	Canyon Towhee	*Pipilo fuscus*
Broad-tailed hummingbird	*Selasphorus platycercus*		
MAMMALS			
Deer mouse	*Peromyscus maniculatus*	White-footed mouse	*Peromyscus leucopus*
Silky pocket mouse	*Perognathus flavus*	Desert shrew	*Notiosorex crawfordi*
REPTILES			
New Mexico whiptail	*Cnemidophorus neomexicanus*	Great Plains skink	*Eumeces obsoletus*
Side-blotched lizard	*Uta stansburiana*		
PLANTS			
Purple three-awn	*Aristida purpurea*	Nightshade	*Solanum eleagnifolium*
Cresent milkvetch	*Astragalus amphioxys*	Scaly globe mallow	*Sphaeralcea leptophylla*
Hoary Aster	*Machaeranthera canescens*	Spike dropseed	*Sporobolus contractus*
Six-weeks grama	*Bouteloua barbata*	Ring muhly	*Muhlenbergia torreyi*
Black grama	*Bouteloua eriopoda*	Four-wing saltbush	*Atriplex canescens*
Hoffmannseggia	*Caesalpinia drepanocarpa*	Summer cypress	*Kochia scoparia*
Rush pea	*Caesalpinia jamesii*	Annual Goldenweed	*Machaeranthera gracilis*
Alkali weed	*Cressa truxillensis*	Globe mallow	*Sphaeralcea angustifolia*
Mesa dropseed	*Sporobolus flexuosus*	Perennial golden- weed	*Machaeranthera pinnatifida*
Snakeweed	*Gutierrezia sarothrae*	Nuttall locoweed	*Astragalus nuttallianus*
Winterfat	*Kraschenninikovia lanata*	Soapweed Yucca	*Yucca glauca*
Bladderpod	*Lesquerella fendleri*	Buffalo grass	*Buchloe dactyloides*
Globe mallow	*Sphaeralcea incana*	Rush pea	*Caesalpinia jamesii*
New Mexico porcupine grass	*Stipa neomexicana*	Fluff grass	*Dasyochloa pulchella*
Club cholla	*Opuntia clavata*	Hairy evolvulus	*Evolvulus nuttallianus*
Galleta	*Pleuraphis jamesii*	Plains prickly pear	*Opuntia polyacantha*
Purple sage	*Psorothamnus scoparius*	Gramma grass cactus	*Sclerocactus papyracantha*
Tumbleweed	*Salsola kali*	Bush muhly	*Muhlenbergia porteri*
Burro grass	*Scleropogon brevifolius*	Tree cholla	*Opuntia imbricata*

NOTE: TA = Technical Area

Chapter 5

Air Quality Compliance and Meteorological Monitoring

In this Chapter ...

Chapter Summary

Sandia National Laboratories, New Mexico (SNL/NM) conducts air quality monitoring and surveillance under three programs: (1) the Clean Air Network (CAN) Program, (2) the National Emission Standards for Hazardous Air Pollutants (NESHAP) Program, and (3) the Air Quality Compliance (AQC) Program.

Meteorological monitoring and ambient air surveillance are conducted by the CAN Program within the Environmental Management (EM) Department. In 2001, data was collected from eight meteorological towers located throughout KAFB. The data collected from the meteorological towers provide air dispersion and transport modeling information. The ambient air surveillance data is utilized to establish background concentration levels for pollutants of concern and evaluate potential effects of Sandia Corporation's operations on air quality.

The NESHAP Program monitors radionuclide air emissions at 18 facilities (16 point and two diffuse emission sources). As required by the U.S. Environmental Protection Agency (EPA), the NESHAP Program must assess the dose to the maximally exposed individual (MEI) for radionuclide air emissions. In 2001, the MEI dose was 0.0030 mrem/yr, lower than the EPA limit of 10 mrem/yr.

The AQC Program maintains compliance with Title V regulations. In 1996, a Title V Operating Permit Application was submitted to the City of Albuquerque. Issuance of a final permit was anticipated in 2001. To date, the City of Albuquerque has yet to issue the final permit.

Environmental Snapshot

- *In 2001, SNL/NM earned the "Large Business Air Quality Pollution Prevention (P2) Award for 2001" given by the New Mexico Facility Managers Network.*

SNL/NM personnel surveying a meteorological tower location.

The following three programs at SNL/NM conduct air quality monitoring and surveillance:

- CAN Program - conducts meteorological monitoring and ambient air surveillance.
- NESHAP Program - coordinates with facility owners to meet radiological air emission regulations.
- AQC Program - ensures that all nonradiological air emission sources at SNL/NM, such as generators, boilers, chemical users, and vehicles meet applicable air quality standards.

5.1 METEOROLOGICAL MONITORING PROGRAM

The Meteorological Monitoring Program at SNL/NM commenced operations in 1994. The main objective of the Meteorological Monitoring Program is to provide site-specific representative data for SNL/NM. Data from the Meteorological Monitoring Program supports various operations and programs across SNL/NM. The data is used for air dispersion and transport modeling, to support emergency response activities, and to support regulatory permitting and reporting processes. Additional uses of meteorological data include the support of various environmental activities and programs, and providing data to SNL/NM's research and development (R&D) projects.

U.S. Department of Energy (DOE) Orders and regulations applicable to the Meteorological Monitoring Program are listed in Appendix B.

Tower Instrumentation
SNL/NM conducts meteorological monitoring through a network of eight meteorological towers located throughout Kirtland Air Force Base (KAFB) on or near SNL/NM property. The network includes:

- Six 10-meter towers,
- One 50-meter tower, and
- One 60-meter tower.

Routine instrument calibrations and weekly tower site visits are performed as part of the Quality Assurance (QA) Program for the monitoring network. Both meteorological and ambient air monitoring (Section 5.2) are conducted under the CAN Program within the EM Department. The CAN network of meteorological towers and ambient air monitoring locations are shown in Figure 5-1.

5.1.1 Meteorological Monitoring Results

The A36 60-meter tower is used to describe general meteorology at SNL/NM due to its central geographic position and availability of data at all instrument levels. Data taken at the A15 50-meter tower, while close to the densely populated area of SNL/NM, shows micro-scale urbanization effects and is not used to describe general meteorology. The 2001 annual climatic summary for tower A36 is shown in Table 5-1.

In general, the annual statistics for each of the towers are similar; however, daily meteorology varies considerably across the CAN network. This real-time variability of meteorological conditions has implications on transport and dispersion of pollutants, which are important in atmospheric emergency release scenarios and air dispersion modeling. Figure 5-2 shows some of the extremes and variations found in meteorological measurements across SNL/NM.

Meteorological Monitoring Towers

All meteorological towers are instrumented to measure temperature and wind velocity at 3- and 10-meter levels, with the exception of tower A15, which only has a 10-meter level. Temperature and wind velocity are also measured at the top of the two tallest towers (50- and 60-meters).*

Additionally, relative humidity is measured at the 3-meter level. Rainfall is measured at the 1-meter level at towers A36, A21, and SC1. Barometric pressure is measured at the 2-meter level at towers A36 and A21.

**Including the standard deviation of horizontal wind direction (sigma theta).*

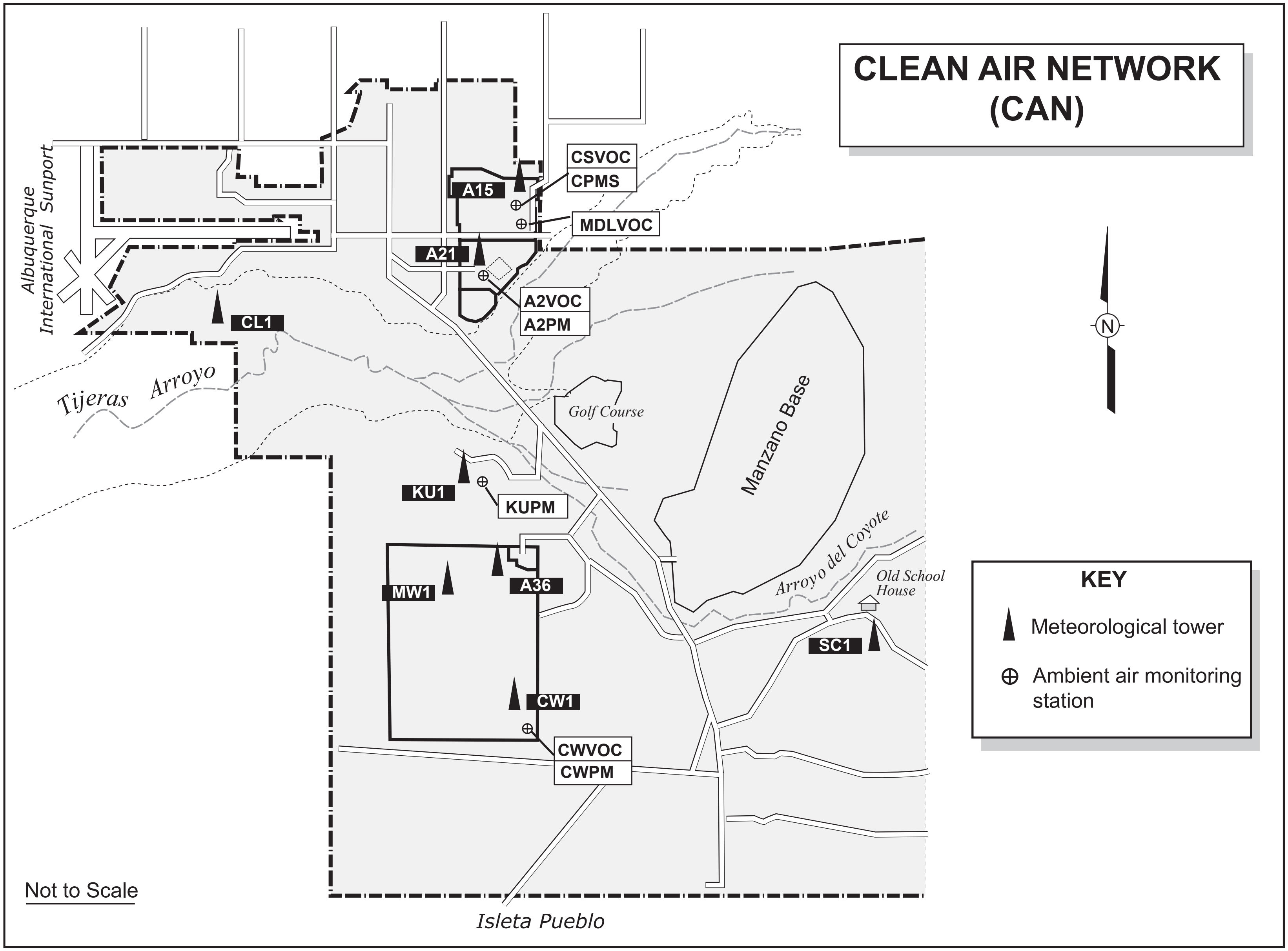

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FIGURE 5-1. The Clean Air Network (CAN) of Meteorological Towers and Ambient Air Monitoring Stations

TABLE 5-1. 2001 Annual Climatic Summary from Tower A36

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Totals
Temperature (°C)													
Daily Max	6.67	10.41	15.90	19.00	25.35	27.60	26.42	27.41	24.30	20.31	15.59	9.76	**19.1**
Daily Min	-4.36	-2.32	3.18	6.47	9.36	15.56	21.06	19.82	16.55	10.81	-3.59	-3.59	**7.4**
Average	0.91	6.04	8.59	13.70	19.90	24.24	24.66	22.90	21.55	15.78	8.59	2.51	**14.1**
Temperature Extremes (°C)													
High	12.35	18.52	23.45	27.01	32.46	35.39	34.97	33.30	31.98	26.84	21.55	15.45	**35.4**
Low	-11.51	-8.49	-3.29	0.04	2.31	6.90	15.62	12.73	6.09	2.83	-6.90	-9.17	**-11.5**
Relative Humidity (%)													
	42.13	39.52	41.85	28.55	17.82	33.71	37.51	39.89	29.90	61.17	56.22	52.17	**40.0**
Precipitation (cm)													
Monthly	0.81	0.66	0.89	1.17	0.89	3.25	2.46	2.49	0.64	0.03	1.96	1.07	**16.3**
24 Hour Max	0.33	0.28	0.51	0.51	0.43	2.29	1.27	0.48	0.36	0.03	0.94	0.46	**2.3**
Wind (m/s)													
Monthly	3.56	3.73	3.91	4.51	4.49	4.23	3.52	3.47	3.55	3.57	3.43	2.97	**3.7**
24 Hour Max	11.04	7.56	9.57	9.10	8.16	7.30	7.01	5.35	5.73	6.50	7.37	6.11	**11.0**
Max Gust	25.25	21.25	21.25	26.05	22.05	23.65	23.65	25.25	23.65	18.85	22.05	22.05	**26.1**
Barometric Pressure (mb)													
	835.84	833.82	832.39	833.04	833.64	834.77	836.99	838.38	836.76	836.10	836.14	834.67	**835.2**

NOTE: Conversions to English Units: Temperature …. °F = (1.8)(°C) + 32
Wind Speed ….. mph = (2.2369)(m/s)
Rainfall ……… in. = (2.54)(cm)

°C = degree centigrade
cm = centimeter
m/s = meters per second
mb = millibars

5.1.2 Wind Analysis

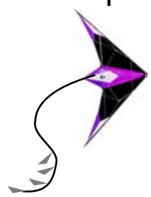
Annual wind roses for three locations across SNL/NM are illustrated in Figure 5-3. A wind rose is a graphical presentation of wind speed and direction frequency distribution. Wind direction is the true bearing when facing the wind (the direction from which the wind is blowing). As shown in Figure 5-3, wind directions and speeds can vary significantly across SNL/NM. Although not shown, the annual wind frequency distribution for Technical Area I (TA-I) shows yet another pattern with the greatest direction frequency from the east and east-northeast, as winds blow from Tijeras Canyon. The predominant wind direction at most locations is produced by topographic influences that also create nocturnal drainage flows.

A comparison of the A15 tower wind speed data with the rest of the CAN network reveals building effects on wind speed. The larger percentage of calms and low wind speeds produces the lowest average annual wind speed, as shown in Figure 5-2. In addition to the lower wind speeds, stability class frequency (not shown in the table) is also affected by the variations in wind direction by flow around and over buildings. The diurnal pattern of wind flow common through many areas KAFB is not apparent in the annual frequency distribution. Figure 5-4 shows the day and night wind frequency distributions for tower A36, respectively. In general, the closer to the mountains or canyons, the greater the frequency of winds coming from the easterly directions at night. Daytime wind patterns are not quite as pronounced, but winds generally flow towards the mountains or channel into the canyons.

5.2 AMBIENT AIR SURVEILLANCE PROGRAM

Ambient air surveillance is conducted under the CAN Program through a network of air monitoring stations located throughout KAFB on or near SNL/NM property. The primary objective of the Ambient Air Surveillance Program is to show compliance with the National Ambient Air Quality Standards (NAAQS) (40 CFR 50) and New Mexico Ambient Air Quality Standards (NMAAQS). Ambient air surveillance is also

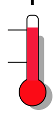
Wind Speed



	Minimum (m/sec)	Maximum (m/sec)	Spread (m/sec)
Average Annual Wind Speed	2.88 tower A15	3.97 tower CW1	1.07
Greatest Difference in Wind Speed over 24 hours	5.81 tower A15	9.36 tower KU1	3.55
Greatest Difference in Daily Maximum Wind Speed	26.05 tower A21	14.85 tower CW1	11.2*
Average Difference in Daily Wind Speed	1.36 (all towers)		

*Last of several occurrences at various locations.

Temperature



	Minimum (°C)	Maximum (°C)	Spread (°C)
Average Annual Temperature	13.79 tower SC1	14.42 tower KU1	0.63
Network Annual Temperature Extremes	-11.7 tower MW1	36.2 tower A15	47.9
Greatest Difference in Daily Minimum Temperature	12.3 tower A36	21.1 tower KU1	8.8
Greatest Difference in Average Daily Temperature	-1 tower SC1	1.3 tower A21	2.3
Greatest Difference in Daily Maximum Temperature	3.8 tower CL1	8.49 tower SC1	4.66

Precipitation

	Minimum (cm)	Maximum (cm)	Spread (cm)
Annual Precipitation (Extremes)*	16.36 tower A36	22.40 tower SC1	6.04
Daily Rainfall Variation	0	2.74 tower SC1	2.74
Greatest Monthly Precipitation Difference	2.51 tower A36	4.95 tower SC1	2.44
Greatest in Monthly Rainfall		4.95 tower SC1	

NOTE: Winter precipitation that falls as snow is underestimated (mostly at the SC1 tower)

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FIGURE 5-2. Variations and Extremes in Meteorological Measurements Across
the Meteorological Tower Network During Calendar Year 2001

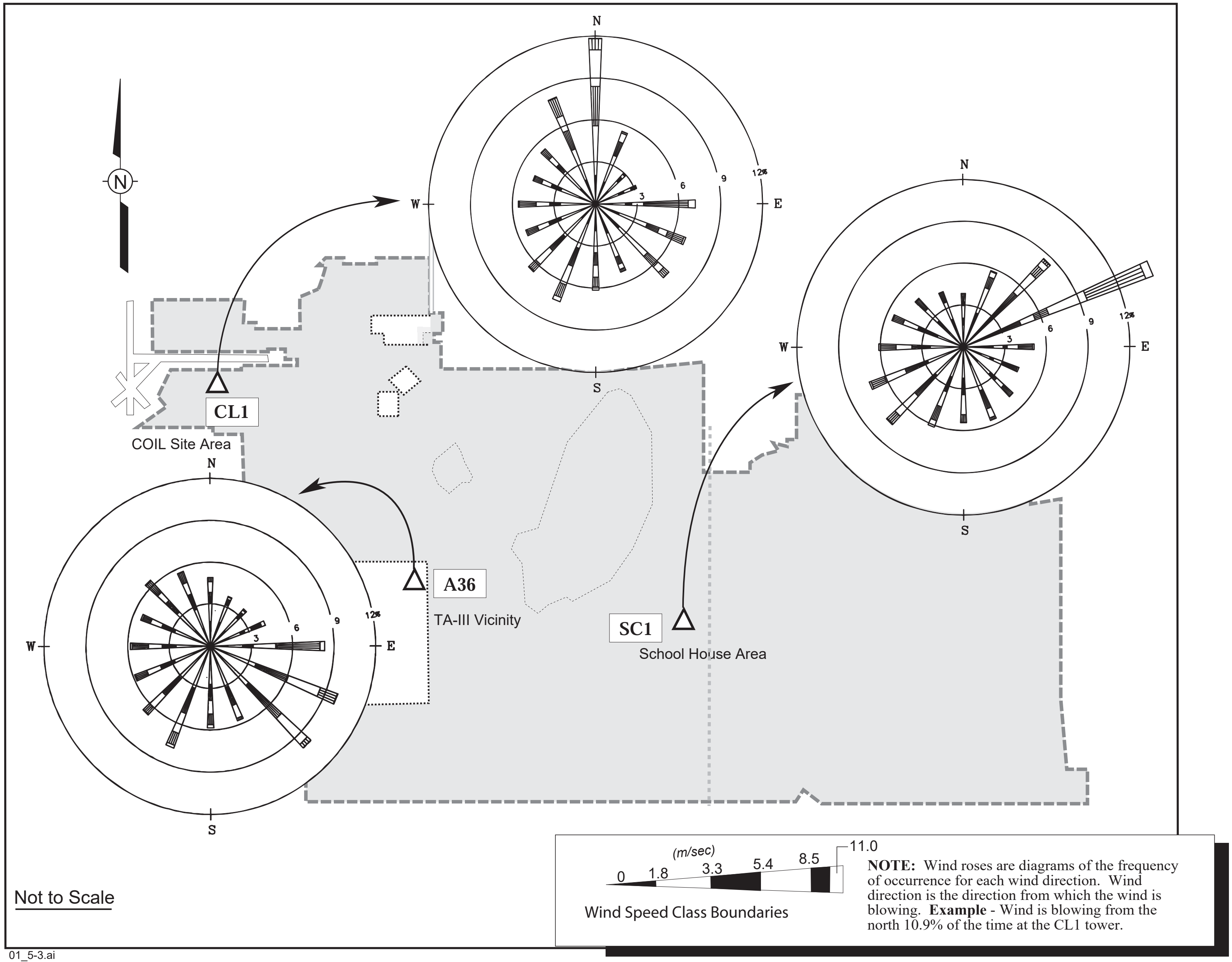

FIGURE 5-3. 2001 Annual Wind Roses for Towers CL1, A36, and SC1

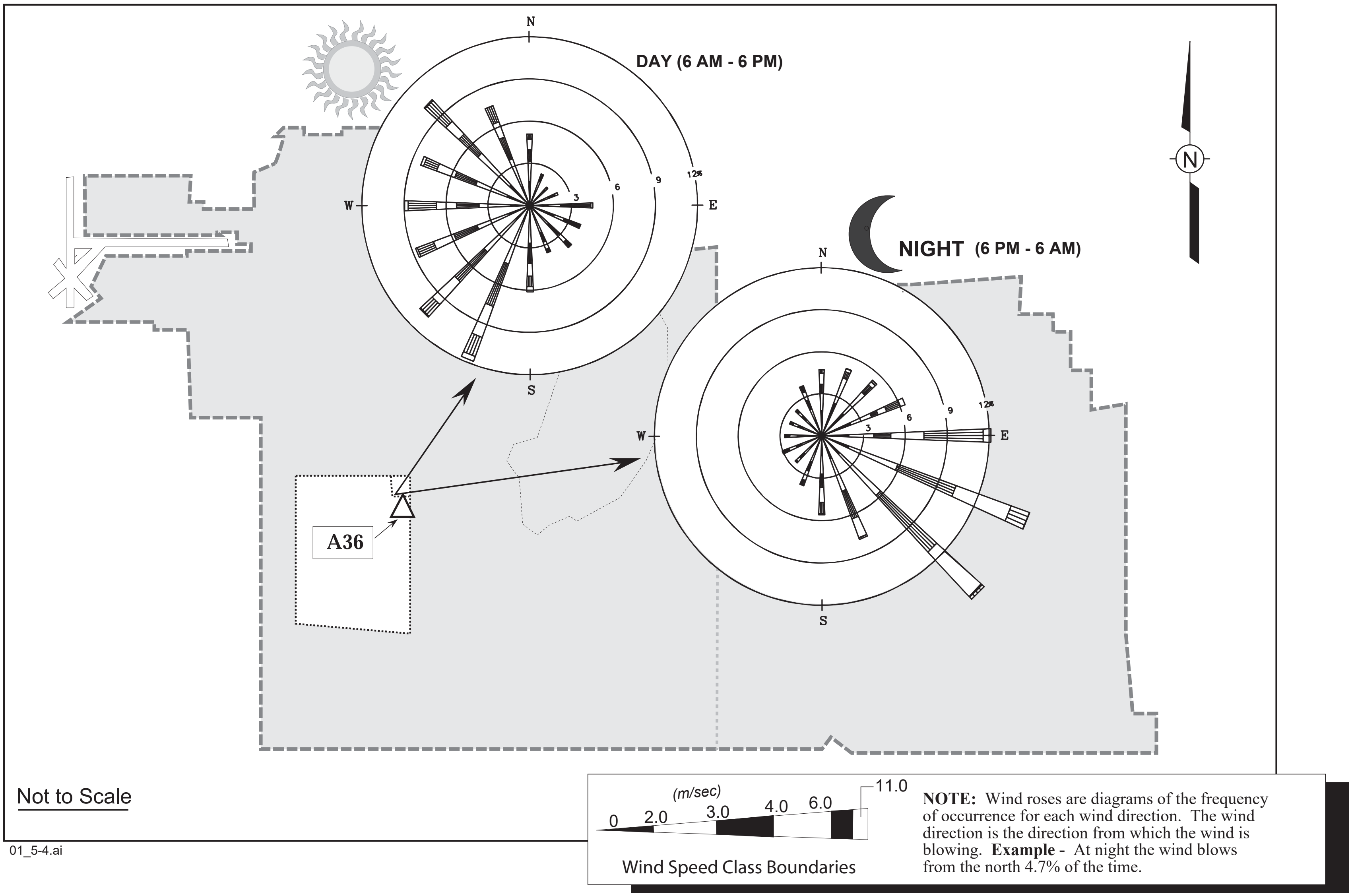

FIGURE 5-4. 2001 Annual Wind Roses for Daytime and Nighttime Wind Frequency at the A36 Tower

The SC1 meteorological tower is located near the foothills of the Manzanita Mountains on the east side of KAFB.

effects, if any, from SNL/NM operations on the public and the environment due to operations at SNL/NM. DOE Orders and applicable regulations are listed in Chapter 9 and Appendix B, respectively.

Ambient air surveillance is performed at five locations and is discussed below and illustrated in Figure 5-1.

- ***Criteria Pollutant Monitoring Station (CPMS)*** – There is one CPMS in the CAN network, which is located in the most populated area of SNL/NM on the northeast corner of TA-I. The CPMS is used to perform continuous monitoring for sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxides (NO_x), and ozone (O_3). Data are then compiled into hourly averages. A particulate matter (PM) is a part of the CPMS. Lead, a criteria pollutant, is one of 23 metals analyzed from PM samples at this station.

- ***PM Stations*** – There are four PM monitoring locations (CPMS, A2PM, KUPM, and CWPM) distributed throughout SNL/NM. Samples are collected over a 24-hour period starting and ending at midnight, every sixth day. This schedule is consistent with the National Air Sampling Program. Samples are analyzed for 23 metals, gross alpha, gross beta, beryllium-7, potassium-40, and total uranium.

- ***Volatile Organic Compound (VOC) Stations*** There are four VOC monitoring stations (CSVOC, MDLVOC, CWVOC, and A2VOC). VOC samples are collected once a month over a 24-hour period.

important to establish background concentration levels for pollutants of concern and evaluate the New air quality standards for $PM_{2.5}$ (with a diameter equal to or less than 2.5 microns) were finalized in 2001. The annual $PM_{2.5}$ standard is 15 µg/m^3 and the 24-hour standard is 65 µg/m^3. SNL/NM plans to monitor for $PM_{2.5}$ during 2002.

5.2.1 Ambient Air Monitoring Results

Criteria Pollutants

In 2001, the automated data recovery for criteria pollutants was 94.1 percent for SO_2, 59.5 percent for NO_x, 95.1 percent for CO, and 92.8 percent for O_3. Table 5-2 lists the results from the CPMS and compares them to NAAQS and NMAAQS for criteria pollutants.

Although violations of annual federal standards for criteria pollutants are not allowed, exceedences for short-term standards are allowable once a year. State standards also allow short-term exceedences due to meteorological conditions such as in the case of an atmospheric inversion where air mixing may be extremely restricted.

PM

Data recovery for PM_{10} (with a diameter equal to or less than 10 microns) was 56 percent complete based on an every-sixth-day sampling schedule. The highest daily particulate loading (103 µg/m^3) occurred at the KUPM site (Table 5-2). This station also had the highest annual loading for 2001. Due to the variable number of samples per season and site that existed as a result of the poor data recovery, no additional meaningful comparisons between stations can be made. During 2001, there were no violations or exceedences of federal or state standards for PM_{10}.

All filters collected from the PM_{10} stations that have complete field data are analyzed for 23 metals plus five radionuclides (gross alpha, gross beta, beryllium-7, potassium-40, and uranium). Filters are collected every sixth day and are consolidated into monthly composites for analyses. In 2001, monthly composites varied from one to five filters per month, depending on the sampling schedule and missed samples. Analyses are conducted by an EPA-approved off-site laboratory. The laboratory results for the samples are subtracted from the monthly blank analysis and are averaged over the year. Due to the lack of appropriate monthly blanks and data quality problems, results for 2001 cannot be reliably calculated. Problems were corrected in

Criteria Pollutants

The EPA has listed the following as criteria pollutants:

SO_2 *is a primary contributor to acid rain and lower visibility resulting largely from coal and oil combustion, steel mills, refineries, pulp and paper mills, and from nonferrous smelters.*

NO_2 *is a reddish brown, highly reactive gas. NO_X is an important precursor for both O_3 and acid rain. The two major emission sources for NO_X are transportation and stationary fuel combustion, such as electric utility and industrial boilers.*

CO *is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon fuels. Most CO emissions nationwide come from motor vehicles. Other major CO sources include wood-burning stoves, incinerators, and industrial sources.*

O_3 *is a photochemical oxidant and a primary ingredient in smog. Although O_3 is an important component of the upper atmosphere to shield the earth from harmful ultraviolet light, it is an air quality concern at ground level. O_3 is formed with sunlight through a complex chemical reaction involving VOC and NO_X precursors.*

PM *is dust, dirt, soot, smoke, and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activities, fires, and natural windblown dust. PM_{10} (with a diameter equal to or less than 10 microns) is considered a criteria pollutant because it poses an inhalation hazard. $PM_{2.5}$ (with a diameter equal to or less than 2.5 microns) is considered a criteria pollutant because it is respirable into the lungs.*

TABLE 5-2. 2001 Criteria Pollutant Results as Compared to Regulatory Standards

Criteria Pollutant	Averaging Time	Unit	NMAAQS Standard	NAAQS Standard	Yearly Summary of Measured Concentrations
Carbon Monoxide	1 hour	ppm	13.1	35	4.60
	8 hours	ppm	8.7	9	2.21
Nitrogen Dioxide	24 hours	ppm	0.10	-	0.035
	Annual	ppm	0.05	0.053	0.009
Sulfur Dioxide§	3 hours	ppm	-	0.50	0.011
	24 hours	ppm	0.10	0.14	0.006
	Annual	ppm	0.02	0.03	0.001
Ozone	1 hour	ppm	0.12	0.12	0.066
	8 hour	ppm	-	0.080	0.062
PM_{10}	24 hours	$\mu g/m^3$	-	150	103
	Annual	$\mu g/m^3$	-	50	15.9
$PM_{2.5}$	24 hours	$\mu g/m^3$	-	65	-
	Annual	$\mu g/m^3$	-	15	-
Total Suspended Particulates	7 days	$\mu g/m^3$	110	-	-
	30 days	$\mu g/m^3$	90	-	-
Lead	30 days	$\mu g/m^3$	-	-	NA
	Any quarter	$\mu g/m^3$	-	1.5	NA

NOTE: ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter
NMAAQS = New Mexico Ambient Air Quality Standards
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter (diameter equal to or less than 10 microns)
$PM_{2.5}$ = respirable particulate matter (diameter equal to or less than 2.5 microns)
§Standards are defined in $\mu g/m^3$ and have been converted to ppm.
NA = not available

2001 Ambient Air Monitoring Results

Criteria Pollutants *– There were no violations or short-term exceedences in 2001. Measured criteria pollutants were significantly below maximum EPA standards.*

PM *– There were no violations of federal or state standards for PM_{10} during 2001.*

VOC *– All measured VOCs were significantly below TLVs.*

early 2002, and data will be available in subsequent years.

VOCs

VOCs are highly evaporative chemicals that off-gas into the air from various sources such as petrochemical and synthetic materials, including fossil fuels, solvents, glues, plastics, paints, dry cleaning fluids, and cleaning chemicals. In 2001, the data recovery for VOC monitoring was 96 percent. Monthly VOC samples were analyzed for 33 VOC species plus total non-methane hydrocarbon (TNMHC). As shown in Table 5-3, monthly results for compounds detected are reported as averaged concentrations. These are not considered annual averages due to the method of including the sample only if the compound is detected. This method of averaging is done to prevent diluting the reported average.

The VOCs generally observed at SNL/NM are products or by-products of fossil fuels or are found in solvents. An analysis of variance was performed to determine if any statistical differences existed between locations for each VOC. The analysis of variance did not reveal any unexpected results. VOC results were significantly below TLVs, where established.

5.3 RADIOLOGICAL AIR EMISSIONS

The EM Department provides NESHAP compliance support to all SNL/NM facilities and operations. The EPA regulates radionuclide air emissions in accordance with 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities." The EPA has set a MEI radiological dose limit of 10 millirems per year (mrem/yr) resulting from all radiological air emissions produced from a DOE facility.

5.3.1 Compliance Reporting

Sandia Corporation prepares an annual NESHAP report that summarizes radionuclide air emission releases from SNL/NM facilities and presents the results of the annual dose assessment. The EPA requires this report to be submitted by June 30th following the reporting year. The DOE, National Nuclear Security Administration (NNSA), Office of Kirtland Site Operations (OKSO) submits the annual report to EPA, and the City of Albuquerque, Environmental Health Division. The NESHAP report is complimented by a more comprehensive report detailing facility emission factors, demographic data, and dose assessment calculations and is available to the EPA, the DOE, and the New Mexico Environment Department (NMED) upon request. The NESHAP reports prepared in 2001 include the *NESHAP Annual Report for CY01, Sandia National Laboratories, New Mexico* (SNL 2002d) and the *Radiological Dose Calculations and Supplemental Dose Assessment Data for NESHAP Compliance, Sandia National Laboratories, New Mexico 2001* (SNL 2002e).

5.3.2 SNL/NM NESHAP Facilities

SNL/NM currently has 18 NESHAP facilities that may be defined as either point or diffuse emissions sources. Point sources are produced from an exhaust stack or vent, while diffuse sources emanate from broad areas of contamination, such as radionuclide-contaminated soils present at some Environmental Restoration (ER) sites.

Table 5-4 lists the radionuclides and the total reported emissions (in curies) from each SNL/NM NESHAP source in 2001. Of the 18 sources, 16 were point sources and two were diffuse sources (landfills). Three of the 18 facilities reported zero emissions in 2001. Calculations were used to estimate the emissions from the Chemical Waste Landfill (CWL), which is another non-routine source.

The 18 SNL/NM NESHAP facilities located in five TAs (Figure 5-5) are described below. Each facility process that produces radioactive air emissions is also briefly described.

TABLE 5-3. VOC Average Concentrations Compiled from Monthly Results at Four Stations
Average was computed using only detected results.

Compound	VOC Stations				TLV* (ppbv)
	CPMS (ppbv)	CWLVOC (ppbv)	MDLVOC (ppbv)	A2VOC (ppbv)	
1,1,1-Trichloroethane	0.068	5.642	30.112	0.074	350,000
1,1,2-Trichlorotrifluoroethane	0.112	0.094	0.084	0.077	1,000,000
1,2-Dichlorobenzene	0.139	--	--	--	10,000
1-Butene/Isobutene	0.553	0.243	0.636	0.430	N/A
2,2,4-Trimethylpentane	0.224	0.053	0.471	0.099	N/A
2-Butanone	1.058	0.468	1.367	0.734	200,000
2-Methylbutane	3.294	0.379	1.682	1.756	1,770,000
3-Methylpentane	0.390	0.043	0.295	0.136	N/A
4-Methyl-2-pentanone (MIBK)	0.076	--	--	--	50,000
Acetone	6.166	5.455	6.743	6.285	500,000
Benzene	0.540	0.086	0.384	0.206	500
Carbon tetrachloride**	0.084	0.086	0.084	0.077	5,000
Chlorobenzene	0.055	0.070	0.056	--	10,000
Chloromethane	0.594	0.587	0.584	0.557	50,000
Dichlorodifluoromethane	0.628	0.738	0.592	0.584	10,000
Ethylbenzene	0.155	0.063	0.263	0.216	100,000
Isohexane	0.442	0.083	0.256	0.247	500,000
Methylene chloride**	1.002	1.143	1.340	6.507	50,000
n-Butane	1.481	0.390	0.923	0.776	800,000
n-Hexane	0.649	0.325	0.334	0.171	50,000
n-Pentane	1.932	0.273	0.895	0.958	600,000
n-Undecane	0.483	--	0.598	1.180	N/A
o-Xylene	0.163	0.085	0.214	0.167	100,000
m/p-Xylene	0.402	0.155	0.350	0.337	100,000
Tetrachloroethene	0.099	0.344	0.050	0.095	25,000
Toluene	2.029	0.124	1.906	0.684	50,000
Trichloroethene	5.610	--	0.030	0.048	50,000
Trichlorofluoromethane	0.429	0.327	0.522	0.307	1,000,000*
TNMHC (total non-methane hydrocarbons)	33.231	10.075	33.063	15.829	N/A

NOTE: ppbv = parts per billion by volume
ND = not detected
N/A = not applicable or not measured or not available
VOC = volatile organic compounds. VOCs may be shown of as separate species as well as in combination with another analyte.
TLV= threshold limit value. (TLVs are guidelines and not legal standards. TLV guidelines assist in the control of health hazards.) (ACGIH 2002)
*Values listed are time-weighted averages (TWAs) except where marked. TWA is the concentration for a normal 8-hour workday and a 40-hour week, to which nearly all workers may be repeatedly exposed without adverse effect. Short-term exposure limit (STEL) is a 15-minute TWA which should not be exceeded at any time during the workday even if the 8-hour TWA is within the TLV.
** Ozone depleting compounds.

TABLE 5-4. Summary of Radionuclide Releases from the 18 NESHAP Sources in 2001

TA	Facility Name	Monitoring Method *	CAP88 Input?	Radionuclide	Reported Release (Ci/yr)
I	Sandia Tomography and Radionuclide Transport (START) Laboratory	Calculation	no	Sodium-22 Technetium-99 Uranium-232 Americium-241 Plutonium-241	1.0×10^{-13} 1.0×10^{-13} 1.0×10^{-13} 1.0×10^{-13} 1.0×10^{-13}
I	Radiation Laboratory	Calculation	no	Tritium Nitrogen-13 Nitrogen-16 Argon-41	1.0×10^{-5} 2.0×10^{-7} 1.0×10^{-6} 1.0×10^{-9}
I	Calibration Laboratory	Calculation	no	Tritium	2.75×10^{-4}
I	NGF – North Wing Tritium Envelope	Calculation	**yes**	Tritium	4.2
I	TANDEM Accelerator	Calculation	no	Tritium	1.0×10^{-6}
I	Metal Tritide Shelf-Life Laboratory	Calculation	no	Tritium	$< 5.0 \times 10^{-9}$
I	Cleaning and Contamination Control Laboratory (CCCL)	Calculation	no	Carbon-14	3.5×10^{-6}
II	Explosive Components Facility (ECF)	Calculation	no	Tritium	4.65×10^{-4}
III	MWL (Diffuse emissions)	Periodic	**yes**	Tritium	0.294
III	RMWMF	Continuous	**yes**	Tritium Americium-241 Srontium-90 Cesium-137	6.43×10^{-3} 2.52×10^{-7} 3.83×10^{-7} 1.06×10^{-8}
III	Chemical Waste Landfill (CWL) (Diffuse emissions)	Calculation	**yes** (not routine)	Cobalt-60 Tritium Thorium-232 Radium-228 Thorium-228 Actinium-228 Radium-224 Lead-212 Bismuth-212 Thallium-208 Uranium-235 Thorium-231 Uranium-238 Radium-226 Lead-214 Bismuth-214 Cesium-144 Chromium-51 Iron-59 Thorium-234 Americium-241 Cesium-137 Ruthenium-106 Cesium-134 Ruthenium-103 Zirconium-95 Yittrium-88 Potassium-40	1.69×10^{-8} 1.31×10^{-5} 3.99×10^{-6} 3.74×10^{-6} 9.3×10^{-7} 3.8×10^{-6} 1.09×10^{-6} 3.86×10^{-6} 1.16×10^{-6} 9.08×10^{-7} 1.14×10^{-7} - 6.11×10^{-7} 4.12×10^{-6} 3.37×10^{-6} 7.15×10^{-7} 4.41×10^{-8} 5.29×10^{-8} 5.61×10^{-8} 7.03×10^{-7} 5.54 x 10-8 5.13 x 10-8 5.13 x 10-8 1.19 x 10-8 1.06 x 10-8 5.08 x 10-8 3.19 x 10-8 8.89 x 10-5

NOTE: See notes at end of table.

TABLE 5-4. Summary of Radionuclide Releases from the 18 NESHAP Sources in 2001 *(concluded)*

TA	Facility Name	Monitoring Method *	CAP88 Input?	Radionuclide	Release (Ci/yr)
IV	HERMES III	Periodic	no	Nitrogen-13 Oxygen-15	6.87×10^{-4} 6.87×10^{-5}
IV	Saturn Facility	Calculation	**no** (no releases in 2001)	none	0
IV	SPHINX	Periodic	**no** (no releases in 2001)	none	0
IV	Z-Facility (Accelerator)	Calculation	**yes**	Uranium-234 Uranium-235 Uranium-238	2.05×10^{-7} 9.10×10^{-9} 1.99×10^{-7}
V	Hot Cell Facility (HCF)	Periodic	**no** (no releases in 2001)	none	0
V	Annular Core Research Reactor (ACRR)	Periodic	**yes**	Argon-41	16.2
V	Sandia Pulsed Reactor (SPR)	Periodic	**no** (no releases in 2001)	none	0

NOTE: *Monitoring Method: Periodic = Based on periodic measurements
Calculation = Calculated from known parameters
Continuous = Based on continuous air monitoring results
HERMES III = High Energy Radiation Megavolt Electron Source III
CAP88 = Clean Air Act Assessment Package (EPA 2001)S
SPHINX = Short Pulse High Intensity Nanosecond X-Radiator
Ci/yr = curies per year
TA= Technical Area

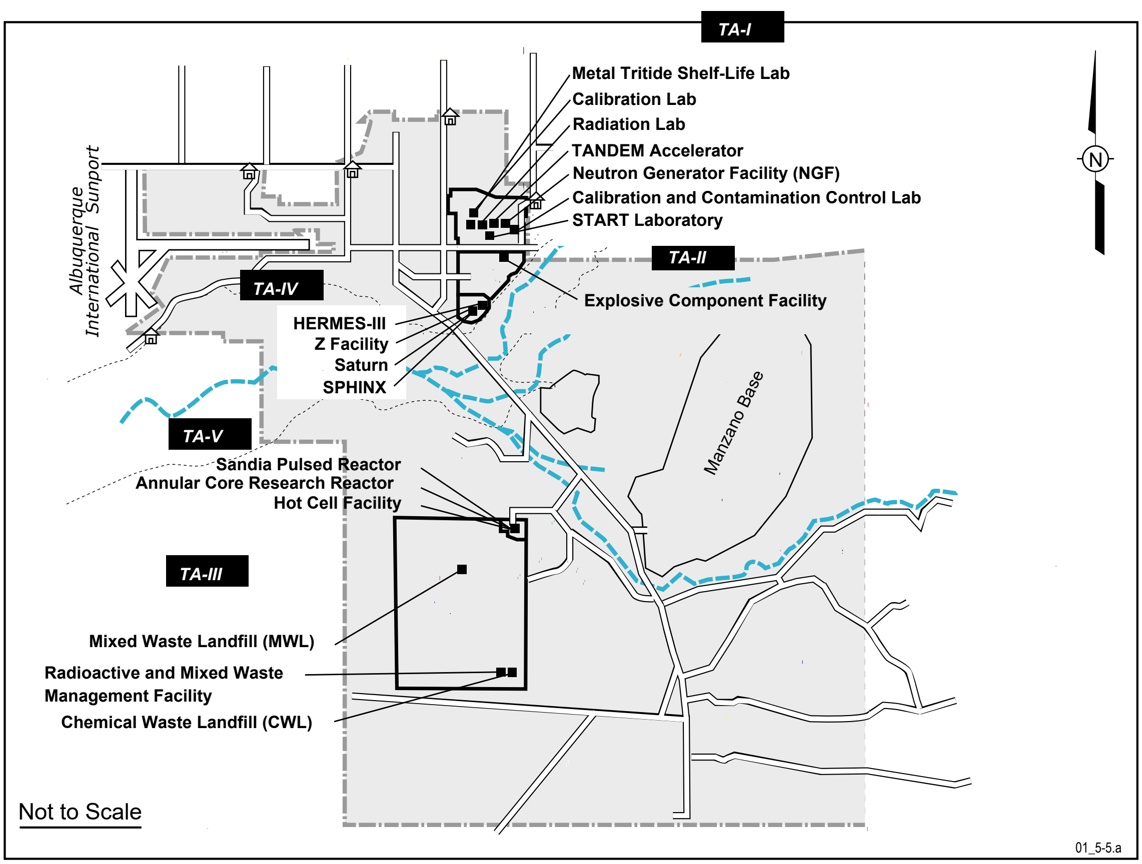

FIGURE 5-5. Locations of the 18 Facilities at SNL/NM that Provided Radionuclide Release Inventories in 2001

TA-I Sources

Calibration Laboratory – Calibration on radiation detection equipment resulted in small releases of tritium.

Cleaning and Contamination Control Laboratory (CCCL) – The CCCL is used for R&D of new and superior materials for government and industrial needs. Carbon-14 was the only radionuclide emission reported in 2001.

Metal Tritide Shelf-Life Laboratory – This laboratory, which conducts research on tritium materials, released negligible levels of tritium (five billionths of a curie).

Neutron Generator Facility (NGF) – The NGF is the nation's principal production facility for neutron generators used in nuclear weapons. This facility currently emits only tritium. The facility has two stacks, but only utilizes the main stack in the Tritium Envelope North Wing. In 2001, 4.2 Curies (Ci) were reported released from the North Wing stack, based on continuous stack monitoring. Although anticipated tritium releases do not exceed the regulatory threshold requiring continuous monitoring, it is performed voluntarily at the NGF as a best management practice (BMP).

Radiation Laboratory – Small-scale radiation experiments resulted in the release of air-activation products and tritium.

Sandia Tomography and Radionuclide Transport (START) Laboratory – This laboratory is used to perform small-scale experiments. In 2001, the facility reported emissions of sodium-22, technetium-99, plutonium-241, americium-241, and uranium-232.

TANDEM Accelerator – This is an ion solid interaction and defect physics accelerator facility. Although the TANDEM did not operate in 2001, the facility reported emissions of tritium that was being housed in the facility.

Weapons Assembly (WA) System Level Testing Facility – This is a research facility that assembles weapons trainers for various tests. Zero emissions have been reported since 1997. Operations within the facility are not expected to change in the future. As a result, the WA System Level Testing Facility has been removed from the NESHAP program.

TA-II Sources

Explosive Components Facility (ECF) – The ECF conducts destructive testing on neutron generators. The only release in 2001 was tritium. Noise caused by explosive testing activities is addressed in the *SNL Final Site-Wide Environmental Impact Statement* (DOE 1999).

TA-III Sources

CWL – The CWL is a non-routine NESHAP source. The primary contaminants identified at this diffuse source are cobalt-60, tritium, potassium-40, and uranium and thorium series radionuclides. Remediation on the CWL began in 1998. Soil and debris samples were collected and analyzed for radioactive content and used to estimate the total radioactivity excavated in 2001. A worst case analysis was perfomed, which assumed that all radioactivity present was re-suspended into the air.

Mixed Waste Landfill (MWL) – The MWL was closed in 1988. Although a diverse inventory of radionuclides is present in the MWL, measurements indicate that tritium is the only radionuclide released into the air. In 1992 and 1993, two special studies were conducted to quantify the tritium emissions (Radian 1994).

Radioactive and Mixed Waste Management Facility (RMWMF) – The RMWMF primarily handles low-level waste (LLW), mixed waste (MW), and some transuranic (TRU) waste. In 2001, the RMWMF reported tritium releases, americium-241, strontium-90, and cesium-137 as determined by continuous stack monitoring. Although anticipated tritium releases do not exceed the regulatory threshold requiring continuous monitoring, it is performed voluntarily at the RMWMF as a BMP.

TA IV Sources

High-Energy Radiation Megavolt Electron Source - III (HERMES - III) – The HERMES-III accelerator is used to test the effects of prompt radiation on electronics and complete military systems. This facility produces air activation products, primarily nitrogen-13 and oxygen-15.

Saturn Accelerator – This is a modular, high powered, variable spectrum, x-ray simulation source that reproduces the radiation effects of nuclear countermeasures on electronic and material components. Zero emissions were reported in 2001.

Short Pulsed High Intensity Nano-second X-Radiator (SPHINX) Facility – The SPHINX is a high voltage, high shot rate bremsstrahlung accelerator used to measure the x-ray induced photo currents from short, fast rise time pulses in integrated circuits. Zero emissions were reported in 2001.

Z Facility – The Z Facility is an accelerator used for research on light ion inertial confinement fusion. Large amounts of electrical energy are stored over several minutes and then released as an intense concentrated burst (shot) at a target. In 2001, uranium targets were utilized. Consequently, the facility reported releases of uranium-234, uranium-235, and uranium-238.

TA V Sources

Annular Core Research Reactor (ACRR) – This reactor is used primarily to support defense program projects. If required in the future, the facility also has the capability to support the Medical Isotope Production Project (MIPP). Argon-41, an air activation product, was the only reported release in 2001.

Hot Cell Facility (HCF) – The HCF provides full capability to remotely handle and analyze radioactive materials such as irradiated targets. The facility is in standby mode to support MIPP should production be required in the future. No emissions were reported in 2001.

Sandia Pulsed Reactor (SPR) – The SPR is used to produce intense neutron bursts for effects testing on materials and electronics. No emissions were reported in 2001. In September 2000, the reactor was placed in temporary storage. Operations are expected to resume in Calendar Year (CY) 2003.

5.4 ASSESSMENT OF POTENTIAL DOSE TO THE PUBLIC

In general, the dose received by a person is dependent on the distance from the source, the available pathways in the environment (food chain, air, and water), radionuclide quantities and properties, and meteorological conditions. Historically, radioactive releases from SNL/NM have resulted in doses to the public that are several orders of magnitude below the EPA's standard of 10 mrem/yr. Radiation protection standards specific to DOE facilities are given in Appendix B**.**

5.4.1 NESHAP Dose Assessment Input

Emission Sources

To assess compliance, all NESHAP facilities at SNL/NM must submit annual facility emission data to the NESHAP Program administrator. The emissions from eight "primary" sources (ACRR, CWL, SPR, HCF, Z Facility, NGF, RMWMF, and MWL) are modeled using version 2 of the EPA's Clean Air Act (CAA) Assessment Package-1988 (CAP88) (EPA 2001a) to estimate the annual dose to each of 29 identified public receptors. Primary sources are those that determine their emissions by direct measurements or by calculations based on measured operational parameters. The HCF and SPR were the only primary sources to report zero emissions in CY 2001.

The NESHAP regulation requires DOE to continuously monitor any radionuclide air emission source that has the potential to produce a dose of 0.1 mrem/yr to the MEI; however, there are no facilities at SNL/NM that exceed this criterion. As a BMP, some SNL/NM facilities do perform continuous stack monitoring. Other facilities base their emission estimates on periodic confirmatory measurements or engineering calculations.

In 2001, the highest emissions were argon-41 and tritium. Historically, these radionuclides have been the most significant contributors to the effective dose equivalent (EDE) of the MEI. Figure 5-6 shows the annual reported release in curies of argon-41 and tritium over the past 12 years.

Demographic Data

Demographic data includes resident population, the number of beef and dairy cattle, and the utilized food crop area fraction for the 50-mi radius study area. The densities for resident population, cattle, and food crops are calculated as the quotient of the most recent county data and the county land area (e.g., cows per acre). In 2001, the NESHAP calculation for resident population was based on the state's 1994 to 1995 estimated urban and county population data and U.S. Census Bureau data (DOC 2002). The beef and dairy cattle numbers and the food crop area fractions were calculated using the 1995 agricultural statistics supplied by the New Mexico Department of

Agriculture (NMDOA 2002). The following values were used in the 2001 CAP88 calculation:

15,790	Dairy cattle
32,696	Beef cattle
87.7	Food crops square miles (sq mi)
695,406	Population (within 50-mi radius)

On-site and Off-site Public Receptors

A total of 29 receptor locations (22 on-site at KAFB and seven off-site) in the vicinity of SNL/NM have been identified as potential locations of maximum exposure to a member of the public. Off-site receptor locations extend to the Isleta Indian Reservation, the Four Hills subdivision north of KAFB, the Manzanita Mountains (east mountain residents), and areas near the Albuquerque International Sunport west of KAFB. On-site receptors include U.S. Air Force (USAF) facilities, offices and housing areas, as well as other non-DOE and non-U.S. Department of Defense (DoD) facilities on KAFB. In October 2000, the United States Geological Survey (USGS) Seismic Center receptor was relocated to the former location of KAFB's Space Vehicle Directorate. USAF occupants at this location were moved to various other areas within KAFB that are already on SNL/NM's list of receptors. The USGS receptor has been removed from the list of SNL/NM receptors for CY 2001.

Meteorology

Data from four meteorological towers (CW1, A36, A21, and MW1) in the proximity of NESHAP emission sources were used in 2001. Data from each tower consisted of approximately 35,000 hourly observations of wind direction, wind speed, and stability class (inferred from wind and solar insolation data). The data are compiled into a normalized distribution from which all wind and stability frequency-of-occurrence data were derived.

5.4.2 Dose Assessment Results

CAP88 utilizes a gaussian plume equation that estimates air dispersion in both the horizontal and vertical directions. Individual EDEs to off-site and on-site receptors are presented in Tables 5-5 and 5-6, respectively. Dose assessment results are summarized in Table 5-7.

The total dose at each receptor location is determined by summing the individual doses resulting from each source. The dose to the MEI member of the public is then compared to the EPA limit of 10 mrem/yr.

In 2001, the MEI was again located on KAFB, at the KAFB Storage Facility, northwest of TA-V. The MEI dose of 0.0030 mrem/yr resulted primarily from releases of argon-41.

Collective Dose

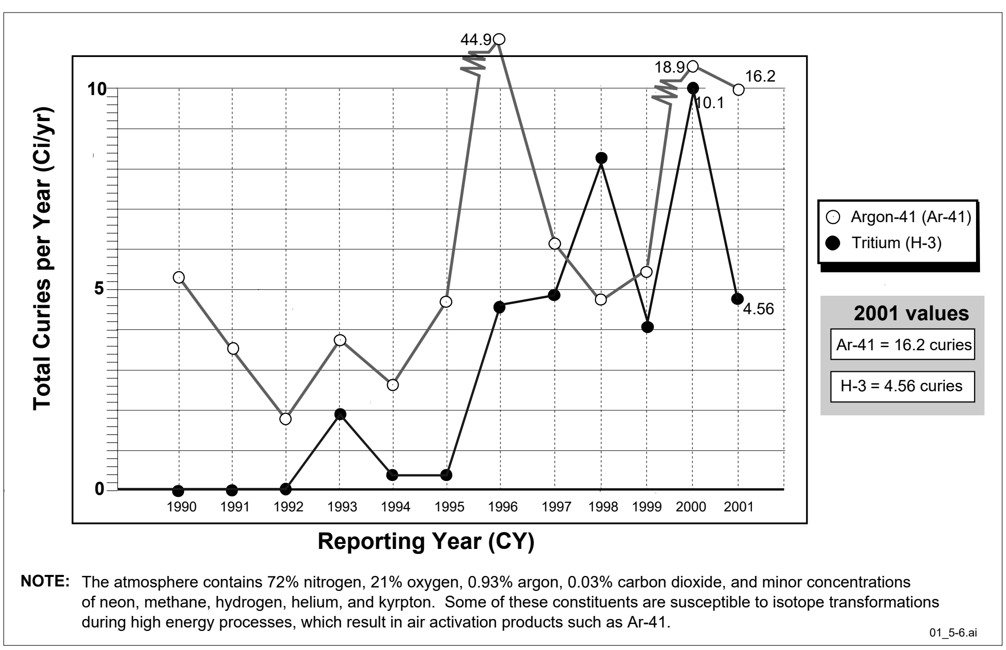

FIGURE 5-6. Summary of Atmospheric Releases in Argon-41 and Tritium from SNL/NM Facilities Since 1990

TABLE 5-5. Annual Source-Specific Effective Dose Equivalent (EDE) to Off-site Receptors in 2001

Receptor	ACRR	SPR	CWL	RWMWF	MWL	NGF	Z Facility	EDE (mrem/yr)
Albuquerque City Offices	3.60E-04	0.00E+00	4.00E-05	3.50E-06	7.80E-06	2.10E-04	9.50E-06	**6.31E-04**
East Resident	2.10E-05	0.00E+00	7.30E-06	9.90E-07	5.50E-06	1.90E-04	6.90E-07	**2.25E-04**
Eubank Gate Area	2.30E-04	0.00E+00	1.90E-05	1.80E-06	6.40E-06	3.50E-04	1.50E-05	**6.22E-04**
Four Hills	2.50E-04	0.00E+00	2.00E-05	1.90E-06	6.30E-06	2.10E-04	6.40E-06	**4.95E-04**
Isleta Bingo	5.30E-05	0.00E+00	2.10E-05	2.00E-06	6.00E-06	2.00E-04	1.90E-06	**2.84E-04**
Northeast Resident	1.10E-04	0.00E+00	1.70E-05	1.70E-06	5.90E-06	2.00E-04	1.80E-06	**3.36E-04**
Tijeras Arroyo (West)	5.10E-04	0.00E+00	5.20E-05	4.40E-06	9.00E-06	2.20E-04	8.60E-06	**8.04E-04**

NOTE: mrem/yr = millirem per year
SPR = Sandia Pulsed Reactor
RMWMF = Radioactive Mixed Waste Management Facility
ACRR = Annular Core Research Reactor
CWL = Chemical Waste Landfill
MWL = Mixed Waste Landfill
NGF = Neutron Generator Facility

TABLE 5-6. Annual Source-Specific Effective Dose Equivalent (EDE) to On-site Receptors in 2001

Receptor	ACRR	SPR	CWL	RWMWF	MWL	NGF	Z Facility	EDE (mrem/yr)
Airport	4.80E-04	0.00E+00	2.20E-05	1.60E-06	1.40E-06	4.80E-05	2.20E-05	**5.75E-04**
Airport East	2.40E-04	0.00E+00	1.90E-05	1.40E-06	1.10E-06	5.40E-05	1.10E-05	**3.27E-04**
U.S. Air Force (USAF) #1	3.40E-04	0.00E+00	1.70E-05	1.20E-06	1.10E-06	8.20E-05	4.70E-05	**4.88E-04**
USAF #2	2.10E-04	0.00E+00	1.40E-05	1.00E-06	8.70E-07	1.10E-04	1.20E-05	**3.48E-04**
Chestnut Test Site	5.00E-04	0.00E+00	4.00E-04	2.80E-05	2.60E-06	7.00E-06	2.20E-06	**9.40E-04**
East Capehart	1.80E-04	0.00E+00	1.30E-05	9.40E-07	7.80E-07	3.30E-05	9.90E-06	**2.38E-04**
Golf Course Clubhouse	1.20E-03	0.00E+00	3.70E-05	2.70E-06	2.40E-06	1.70E-05	1.20E-05	**1.27E-03**
Golf Course Maintenance Area	8.00E-04	0.00E+00	3.00E-05	2.20E-06	1.80E-06	2.40E-05	2.50E-05	**8.83E-04**
Honeywell Instrument Support Site	4.50E-04	0.00E+00	2.00E-05	1.40E-06	1.40E-06	6.30E-05	2.10E-04	**7.46E-04**
ITRI/Lovelace	1.50E-04	0.00E+00	3.40E-05	2.30E-06	6.20E-07	4.00E-06	1.10E-06	**1.92E-04**
KAFB Landfill	4.30E-04	0.00E+00	2.20E-05	1.60E-06	1.20E-06	5.00E-05	4.90E-05	**5.54E-04**
Kirtland Air Force Base (KAFB) Fire Station #4	2.40E-04	0.00E+00	6.90E-05	5.20E-06	1.30E-06	4.80E-06	1.30E-06	**3.22E-04**
KAFB Storage Facility	2.90E-03	0.00E+00	5.60E-05	4.10E-06	5.60E-06	1.90E-05	1.10E-05	**3.00E-03**
Loop Housing	2.00E-04	0.00E+00	1.40E-05	1.00E-06	8.60E-07	1.20E-04	1.90E-05	**3.55E-04**
Manzano Offices (Fire Station)	6.10E-04	0.00E+00	4.30E-05	2.90E-06	1.50E-06	9.70E-06	3.30E-06	**6.70E-04**
Maxwell Housing	2.50E-04	0.00E+00	1.50E-05	1.10E-06	1.40E-06	2.70E-05	5.70E-06	**3.00E-04**
Pershing Park Housing	2.10E-04	0.00E+00	1.20E-05	9.00E-07	7.60E-07	7.00E-05	1.30E-05	**3.07E-04**
Riding Club	1.30E-03	0.00E+00	4.70E-05	3.30E-06	2.30E-06	1.20E-05	6.10E-06	**1.37E-03**
Sandia Federal Credit Union	2.90E-04	0.00E+00	1.50E-05	1.10E-06	9.90E-07	2.20E-04	3.10E-05	**5.58E-04**
Seismic Center (USGS)	1.90E-04	0.00E+00	3.20E-05	2.10E-06	7.70E-07	4.60E-06	1.40E-06	**2.31E-04**
West Capehart	2.30E-04	0.00E+00	2.10E-05	1.00E-06	7.70E-07	1.70E-05	3.90E-06	**2.74E-04**
Zia Park Housing	2.80E-04	0.00E+00	1.60E-05	1.50E-06	1.20E-06	9.10E-05	2.20E-05	**4.12E-04**

NOTE: ACRR = Annular Core Research Reactor
SPR = Sandia Pulsed Reactor
CWL = Chemical Waste Landfill
RMWMF = Radioactive Mixed Waste Management Facility
mrem/yr = millirem per year Storage Complex
MWL = Mixed Waste Landfill
NGF = Neutron Generator Facility
USGS = U.S. Geological Survey
KAFB = Kirtland Air Force Base

TABLE 5-7. Calculated Dose Assessment Results for On-site and Off-site Receptors and for Collective Populations in 2001

Dose to Receptor	Location	2001 Calculated Dose	NESHAP Standard
Individual Dose			
On-site Receptor EDE to the MEI	KAFB Facility	0.0030 mrem/yr *(0.000030 mSv/yr)*	10 mrem/yr *(0.1 mSv/yr)*
Off-site Receptor EDE to the MEI	Tijeras Arroyo (West) West of KAFB	0.0008 mrem/yr *(0.000008 mSv/yr)*	10 mrem/yr *(0.1 mSv/yr)*
Collective Dose			
Collective Regional Population[1]	Residents within an 80-km (50-mi) radius	0.0682 person-rem/yr *(0.000682 person-Sv/yr)*	No standard available
Collective KAFB Population[2]	KAFB housing	0.00144 person-rem/yr *(0.000023 person-Sv/yr)*	No standard available

NOTE: [1]Based on a population of 695,406 people estimated to be living within an 80-km (50-mi) radius.
[2]Based on a population of 3,285 people estimated to be living in permanent on-base housing.
mSv/yr = millisievert per year
person-Sv/yr = person-seviert per year
mrem/yr = millirem per year
EDE = effective dose equivalent
MEI = maximally exposed individual
KAFB = Kirtland Air Force Base
NESHAP = National Emissions Standards for Hazardous Air Pollutants

The collective population dose resulting from all SNL/NM radiological emissions was calculated for both KAFB and the regional area (Table 5-7). Collective dose calculations are not required by NESHAP regulations; however, it provides a useful numerical comparison of the public dose from year to year. Collective dose is calculated by multiplying a representative individual dose, within a population, by the total population. SNL/NM calculates the collective population dose for both the KAFB housing areas and the general Albuquerque area population within an 80-km (50-mi) radius.

- ***Regional*** – The Albuquerque regional collective population dose in 2001 was 0.0682 person-rem/yr. For the purpose of calculating the collective dose, all releases are assumed to occur from a location centered in TA-V . The population dose was calculated by multiplying 695,406 residents by doses per sector.

- ***KAFB*** – A collective population dose for KAFB residents was calculated based on six main housing areas. The total population dose for KAFB was obtained by summing the six areas based on a total residential population of 3,285. This resulted in an estimated population dose of 0.00144 person-rem/yr.

5.5 AIR QUALITY REQUIREMENTS AND COMPLIANCE STRATEGIES

Air quality standards are implemented by regulations promulgated by local and federal governments in accordance with the CAA and the CAA amendments (CAAA) of 1990. The Albuquerque/Bernalillo County Air Quality Control Board (ABC/AQCB), the State of New Mexico, and the EPA determine applicable air quality standards for non-radiological pollutants. Radionuclide air emissions are currently regulated by the EPA under NESHAP, as discussed in Section 5.4, although the radionuclide NESHAP regulations are in the process of being delegated by the EPA to the ABC/AQCB. A complete list of air quality regulations applicable to SNL/NM is given in Appendix B .

5.5.1 SNL/NM Air Emission Sources

As discussed in Section 5.2, criteria pollutants include SO_2, NO_2,, CO, O_3, PM, and lead. For these criteria and other pollutants, the EPA:

- Sets ambient air quality standards, including motor vehicle emissions;
- Requires state plans for protection and improvement of air quality;
- Institutes air quality programs to prevent the nation's air from deteriorating; and
- Establishes hazardous air pollutant (HAP) control programs.

EPA standards for criteria pollutants are given in 40 CFR 50, "National Ambient Air Quality Standards" and implemented in 20 NMAC 11.01 "General Provisions." Compliance with criteria pollutant standards for ambient air is met through ambient air surveillance, periodic direct emission sampling, and fuel throughput tracking and reporting. As discussed in the previous section, ambient air measurements taken in the vicinity of SNL/NM facilities have been well below maximum TLVs and guidelines for criteria pollutants.

The significant sources of criteria pollutants at SNL/NM are listed below.

Steam Plant
The Steam Plant produces steam heat for buildings in TA-I as well as some facilities in KAFB east. The plant has run continuously since 1949. The five boilers (Boilers 1, 2, 3, 5, and 6) run primarily on natural gas, but can also burn diesel. All five boilers were used in 2001. The volume of fuel throughput used in the boilers is reported to the City of Albuquerque. In 2001, fuel throughput reported at the Steam Plant was as follows:
As defined by 20 NMAC 11.67, "Equipment, Emissions, and Limitations," the Steam Plant falls below the applicable minimum emission limits for NO_x. Stack sampling is not required for the Steam Plant since it is a "grandfathered" source and no permit has been previously required. There are no other air quality regulations that apply to the Steam Plant. However, the Steam Plant's air emissions may be subject to the requirements of Title V, since it has the potential to emit greater than 100 tons per year (tpy) of criteria pollutants. As a "grandfathered" existing source, Title V does not require the Steam Plant to change or replace equipment. However, Sandia Corporation initiated the Steam Plant Optimization Project in 1997 to determine ways to improve fuel efficiency and reduce emissions and remain below 100 tpy.

Natural Gas (scf)	***Diesel (gal)***
579,270,350	610,967

NOTE: scf = standard cubic feet
gal = gallon

Vehicles
The majority of government vehicles at SNL/NM are owned and managed by the General Services Administration (GSA). Currently, there are approximately 775 GSA vehicles in SNL/NM's fleet. All GSA vehicles must comply with the same emission standards set for all personal and non-personal vehicles that are issued KAFB vehicle passes. As required by 20 NMAC 11.100, "Motor Vehicle Inspection-Decentralized," Sandia Corporation submits an annual vehicle inventory update and inspection plan to the City of Albuquerque for approximately nine SNL/NM-owned vehicles.

Emergency Generators
Sandia Corporation operates four main standby diesel generators for emergency power supply. These generators are some of SNL/NM's largest generators, each with a 600-kilowatt (kW) capacity. These generators, permitted by the City of Albuquerque (Appendix B, Table B-1) are exercised monthly and their electrical systems are tested quarterly. As required by Title V, all fuel used in the generators is reported to the City of Albuquerque. One additional generator was added at the Processing and Environmental Technology Laboratory (PETL) in 2001.

In 2001, the fuel throughput reported was 6,291 gallons of diesel. In anticipation of a Title V permit being issued by the City of Albuquerque, Sandia Corporation has already instituted a self-imposed fuel cap upon which the Title V air emission fee is based. Sandia Corporation has assumed a maximum use of 500 hours a year for the main standby generators, which is the same usage assumed for all other on-site generators.

Open Burns

New EPA Standard for Ozone

As discussed in Section 2.3, the EPA revoked the NAAQS in 1998 for the 1-hour standard of 0.12 ppm for O_3. However, on May 14, 1999, a federal appeals court blocked the EPA from imposing tougher air quality requirements for ozone and PM. The EPA decided that tougher laws were needed to protect children and adults with respiratory problems. On July 5, 2000, the EPA officially reinstated its 1-hour ozone standard in nearly 3,000 counties across the U.S. On January 19, 2001, the EPA issued a proposed response to a court remand of the 8-hour ozone standard.

As required by 20 NMAC 11.21, "Open Burning," DOE obtains open burn permits for each of Sandia Corporation's applicable scheduled event or test series. The regulation differentiates the permit basis into two categories: multiple-event and single-event. The single-event permit was designed to regulate individual burns having significant were impact. As shown in Appendix B, Table B-1, there were 12 permits issued in 2001. Open burn permits are required for:

- Disposal of Explosives by Burning (avoids the hazards of transport and handling);
- Aboveground Detonation of Explosives (over 20 lb);
- Burning Liquid Fuel 2,000 gallons or more or solid fuel of 5,000 lb in a single-event research and development activity; and
- Igniting Rocket Motors with greater than 4,000 lb of fuel.

5.5.2 New Directions Under Title V

The CAAA of 1990 contained provisions under Title V requiring all existing major air emission sources to obtain an operating permit. A major source is defined as the combined emissions from any facility with the potential to emit:

- 100 tpy or greater of any criteria pollutant,
- 10 tpy of any HAP, or
- 25 tpy of any combination of HAPs.

SNL/NM is considered a major source based on its potential to emit NO_x and CO. Since potential emissions from the Steam Plant are greater than 100 tpy of criteria pollutants, this facility is considered a major source in itself. The intent of Title V is not to add new requirements, but rather to pull together existing requirements under one umbrella regulation, thereby eliminating the need to permit individual sources. SNL/NM sources listed on the permit application include the Steam Plant, the emergency generators, and smaller combustion sources. (Burn permits may continue to be permitted on an individual basis.)

Steam Plant Optimization Project

The Steam Plant is SNL/NM's largest air emission source. In 1997, Sandia Corporation initiated the Steam Plant Optimization Project to determine ways to improve fuel efficiency and reduce emissions for the facility's five boilers. In 1998, design work to retrofit Boilers 5 and 6 for flue gas recirculation (FGR) was completed, and actual retrofitting was accomplished in 1999. Plans were also drawn up to retrofit the remaining boilers (1, 2, and 3). Boiler 3 was retrofitted with FGR in 2000, while Boilers 1 and 2 were retrofitted in 2001. Retrofitting the two large boilers resulted in a reduction of the emission factor from 280 to 100 lb per million standard cubic feet of natural gas burned. NO_x emissions from the Steam Plant boilers with FGR have since been reduced by 68 percent.

The success of the Steam Plant Optimization Project earned SNL/NM the "Large Business Air Quality Pollution Prevention (P2) Award for 2001" given by the New Mexico Facility Managers Network in conjunction with the City of Albuquerque.

Background

The City of Albuquerque implements Title V regulations for Albuquerque and the rest of Bernalillo County under its Operating Permit Program as described in 20 NMAC 11.42, "Operating Permits." The Permit Program received interim approval by the EPA on March 13, 1995. Title V required all existing major sources to apply for a Title V Operating Permit by March 13, 1996. The DOE/NNSA/OKSO submitted Sandia Corporation's Title V Operating Permit application (No. 515, Volume 1) on March 1, 1996; the application, was deemed complete on

May 1, 1996. Although the regulatory due date was March 13, 1998, and the permit was anticipated to be issued in 2001, the City of Albuquerque has yet to issue the final permit.

Small Business Assistance
In 2001, the New Mexico Small Business Assistance (NMSBA) Program, which is managed by SNL/NM, began assisting a Las Cruces, New Mexico cotton gin cooperative in reaching compliance with 20 NMAC 2.72 Construction Permit No. 961.

Title V Fee Structure
The City of Albuquerque's Title V requires major source owners to pay air emission fees, which are implemented under 20 NMAC 11.02, "Permit Fees." Since 1997, source owners were be able to submit an inventory of their actual emissions or fuel throughput for the year and pay an annual fee based on this amount. This fee reduction provision was eliminated in a modification to 20 NMAC 11.02 that became effective on July 1, 2001. Annual fees are now based on an assessed value of a source's maximum allowable to emit regardless of actual emissions, thereby increasing SNL/NM's fees from $2,290 for 2000 to potentially $78,430 for 2001. (For example, the Steam Plant would be assessed on the assumption that it operated at full capacity year-round). Sandia Corporation now intends to meet compliance with Title V by applying for a synthetic minor permit to take federally-enforceable limits on its emission sources to remain below the 100 tpy Title V threshold.

Risk Management Plan (RMP)
A self-assessment audit in 2000 found the hydrochloric acid (HCl) storage tank at the Microelectronics Development Laboratory (MDL), to be below the 37 percent threshold quantity (TQ) requirement for an RMP (40 CFR 68).

5.5.3 Ozone Depleting Substance (ODS) Reductions

Sandia Corporation made progess in Fiscal Year (FY) 2001 towards the secretarial goal of replacing Class I refrigerant chillers greater than 150 tons capacity, manufactured prior to 1984. This replacement was part of a larger upgrade to improve the reliability and the overall efficiency of the associated chilled water system.

In FY 2001, SNL/NM overhauled a CFC chiller, which was necessary to keep it operational. As part of the overhaul, the chiller service contractor installed a new higher-effeciency purge unit and replaced all gaskets, significantly reducing the chance of a CFC leak. The chiller contains a rupture disk and vent guard from a previous retrofit. Expectation is that the chiller is operational for the remainder of the life of the building in which it was installed.

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Chapter 6

Wastewater, Surface Discharge, and Storm Water Monitoring Programs

In this Chapter ...

Chapter Summary

Sandia National Laboratories, New Mexico (SNL/NM) conducts effluent monitoring through wastewater, surface water, and storm water monitoring and surveillance programs.

The Wastewater Discharge Program currently monitors both sanitary discharges and industrial discharges at five on-site outfalls permitted by the City of Albuquerque. In 2001, no discharges to the sanitary sewer exceeded standards for radionuclides.

Surface discharges are monitored through an approval and permitting process by the Surafce Discharge Program. Current water quality regulations protect groundwater and surface water for the potential use as a domestic potable water source. The Surface Discharge Program also tracks and reports any accidental surface releases or spills. In 2001, all surface discharge requests met state standards and were approved.

Environmental Snapshot

- *Sandia Corporation received three "Gold Pre-treatment Awards" from the City of Albuquerque for 100 percent compliance to discharge limits set in permits.*
- *SNL/NM discharges approximately 800,000 gallons of wastewater per day to the public sewer.*

The Storm Water Program monitors storm water runoff at eight stations throughout SNL/NM. The program strives to maintain compliance with the National Pollutant Discharge Elimination System (NPDES) and protects "Waters of the U.S." At SNL/NM, Tijeras Arroyo is defined as a "Water of the U.S." In 2001, no analytical monitoring was required under NPDES.

SNL/NM personnel collecting wastewater monitoring data.

Effluent monitoring is the collection of samples or direct measurements taken from liquid or gaseous waste stream processes for the purpose of quantifying contaminants and determining regulatory compliance. In this chapter, effluent monitoring is confined to water monitoring activities that include wastewater discharges, which are made up of sanitary and industrial effluents, surface discharges, and storm water runoff. Water quality monitoring at SNL/NM is conducted by Sandia Corporation's Environmental Management (EM) Department.

Sandia Corporation complies with water quality regulations established by local, state, and federal agencies. U.S. Environmental Protection Agency (EPA) standards are implemented at the state and local level by the New Mexico Environment Department (NMED) and the City of Albuquerque. Currently, EPA Region VI implements storm water regulations under the NPDES; SNL/NM's five on-site outfalls are permitted by the City of Albuquerque. Storm water is the only discharge at SNL/NM regulated by NPDES. Sandia Corporation also adheres to the water quality guidelines contained in U.S. Department of Energy (DOE) Orders 5400.1, *General Environmental Protection Program* (DOE 1990) and 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993).

6.1 WASTEWATER DISCHARGE PROGRAM

Wastewater that is discharged to the public sewer system from SNL/NM facilities is divided into two categories: sanitary discharges and industrial discharges. Sanitary waste streams include wastewater from restrooms and showers, food service establishments, and other domestic-type activities. Industrial discharges are produced from general laboratory research operations, including electroplating, metal finishing, microelectronic development, and photographic processes.

Sandia Corporation closely monitors its liquid effluent discharges to meet regulatory compliance. Sandia Corporation further reduces its toxic discharges by implementing Toxic Organic Management Plans (TOMPs) and general good housekeeping and engineering practices. Pollution prevention (P2) measures to reduce, substitute, or eliminate toxic chemicals are implemented, where feasible, as discussed in Section 3.3.

6.1.1 SNL/NM and the City of Albuquerque Sewer System

City of Albuquerque Publicly-Owned Treatment Works (POTW)

SNL/NM's sewer system connects to the City of Albuquerque's sanitary sewer line at four permitted outfalls. SNL/NM also has one additional industrial permitted wastewater outfall at the Microelectronics Development Laboratory (MDL), which is upstream of the final discharge points. Wastewater effluent discharged from any of the five outfalls must meet the City of Albuquerque's Sewer Use and Wastewater Control Ordinance (SUWCO) requirements. SUWCO information can be found at the American Legal Publishing Corporation's website, which publishes the City of Albuquerque's Code of Ordinance:

www.amlegal.com/albuquerque_nm/

All SNL/NM effluent discharge standards were within the City of Albuquerque's SUWCO established limits.

Wastewater Compliance Awards

The City of Albuquerque's reporting requirements are defined under its SUWCO. The SUWCO specifies the discharge quality and requirements that the City of Albuquerque will accept at its POTW. Sandia Corporation received three "Gold Pre-treatment Awards" and two "Silver Pre-treatment Awards" from the City of Albuquerque for the 2000 to 2001 reporting year. A "Gold Pre-treatment Award" is given based on a facility's 100 percent compliance to discharge limits set in permits or exceptional source reduction and P2.

6.1.2 Permitting and Reporting

The City of Albuquerque Public Works Department, Liquid Waste Division, implements the EPA's water quality standards under the authority of the SUWCO. Sandia Corporation submits semi-annual wastewater reports to the City of Albuquerque. Results from the January 1 to June 30, 2001 period were submitted by July 31, 2001; results from the July 1 to December 31, 2001 period were submitted by January 31, 2002. The primary regulatory drivers for the Wastewater Program are listed in Appendix B. Important program documents and reports are listed in Chapter 9.

Discharge Control Program
The Water Quality Group (WQG) at Sandia Corporation maintains a Discharge Control Program to track wastewater discharges resulting from ongoing chemical, manufacturing, and industrial processes conducted at SNL/NM facilities. Facility processes are reviewed for contaminants, concentrations, and discharge frequencies to determine if the effluent will meet regulatory criteria. Once approved, a facility is issued an internal SNL/NM permit, which is reviewed annually. If there are any process or discharge changes to the facility prior to the annual review, the facility owner must notify the WQG. Generally, processes are well characterized and any constituents that are detected over the limits at a wastewater monitoring station can usually be tracked back to the source facility. Corrective actions to mitigate further releases are implemented, as necessary.

One-time releases are approved on a case-by-case basis. Buildings that only produce domestic sewage, such as from lavatories, sinks, and fountains, are not required to obtain an internal permit.

6.1.3 Wastewater Monitoring Stations

SNL/NM has five on-site outfalls permitted by the City of Albuquerque (Figure 6-1). Wastewater permits are listed in Appendix B, Table B-1. Four of these stations discharge directly to the public sewer, which flows into the Tijeras Arroyo Intercept and one station is for an upstream categorical pre-treatment process. SNL/NM discharges approximately 800,000 gallons of wastewater per day to the public sewer.

The EPA has established categorical pre-treatment standards for specified classes of industrial discharges. Station WW007 monitors the wastewater discharged from the Acid Waste Neutralization (AWN) System at the MDL in Technical Area I (TA-I).

The MDL uses acids for etching electronic boards and other components.

Wastewater Monitoring
All outfall stations are equipped with flow meters and pH sensors to continuously monitor wastewater 24 hours-a-day, 365 days-a-year. In the event that an exceedence is detected, an auto-dialer will contact personnel at SNL/NM and the DOE/NNSA/OKSO will notify the City of Albuquerque within 24 hours. Station equipment parameters are listed in Table 6-1.

Sandia Corporation splits quarterly wastewater samples taken from SNL/NM outfalls with the City of Albuquerque to determine compliance with permit requirements. NMED is notified when sampling is scheduled to occur and is offered the opportunity to obtain samples for analysis. All samples are obtained as 24-hour flow proportional or time-weighted composites. Sandia Corporation sends SNL/NM split samples to an EPA-approved laboratory for analysis. Sandia Corporation sampling results are compared with results obtained by the City of Albuquerque. Currently, the procedure is to sample randomly from a list of potential pollutants. The City of Albuquerque determines which parameters it plans to analyze. Analytes are chosen from the parameters shown in the shaded box (shown on page 6-5).

Septic Systems
Sandia Corporation maintains three active septic tank systems in remote areas on Kirtland Air Force Base (KAFB), which are used only for domestic sanitary sewage collection. Since these tanks receive only domestic sewage and no industrial discharges, they do not require sampling prior to pumping and discharge to the public sewer. However, as a Best Management Practice (BMP), Sandia Corporation periodically obtains samples from these active tanks prior to pumping and discharge.

6.1.4 TA-V Radiological Screening

Several research reactors in TA-V have the potential to produce radiologically-contaminated process wastewater. To ensure that all wastewater from these facilities meets regulatory standards, liquid effluent is separated into two streams: reactor and non-reactor wastewater. Reactor process wastewater is defined as any effluent to a drain that is generated from a building or facility in TA-V that uses, processes, or stores radioactive materials. Reactor process wastewater is channeled to holding tanks where it can be screened using the Liquid Effluent Control System (LECS) and can be sampled for radiological

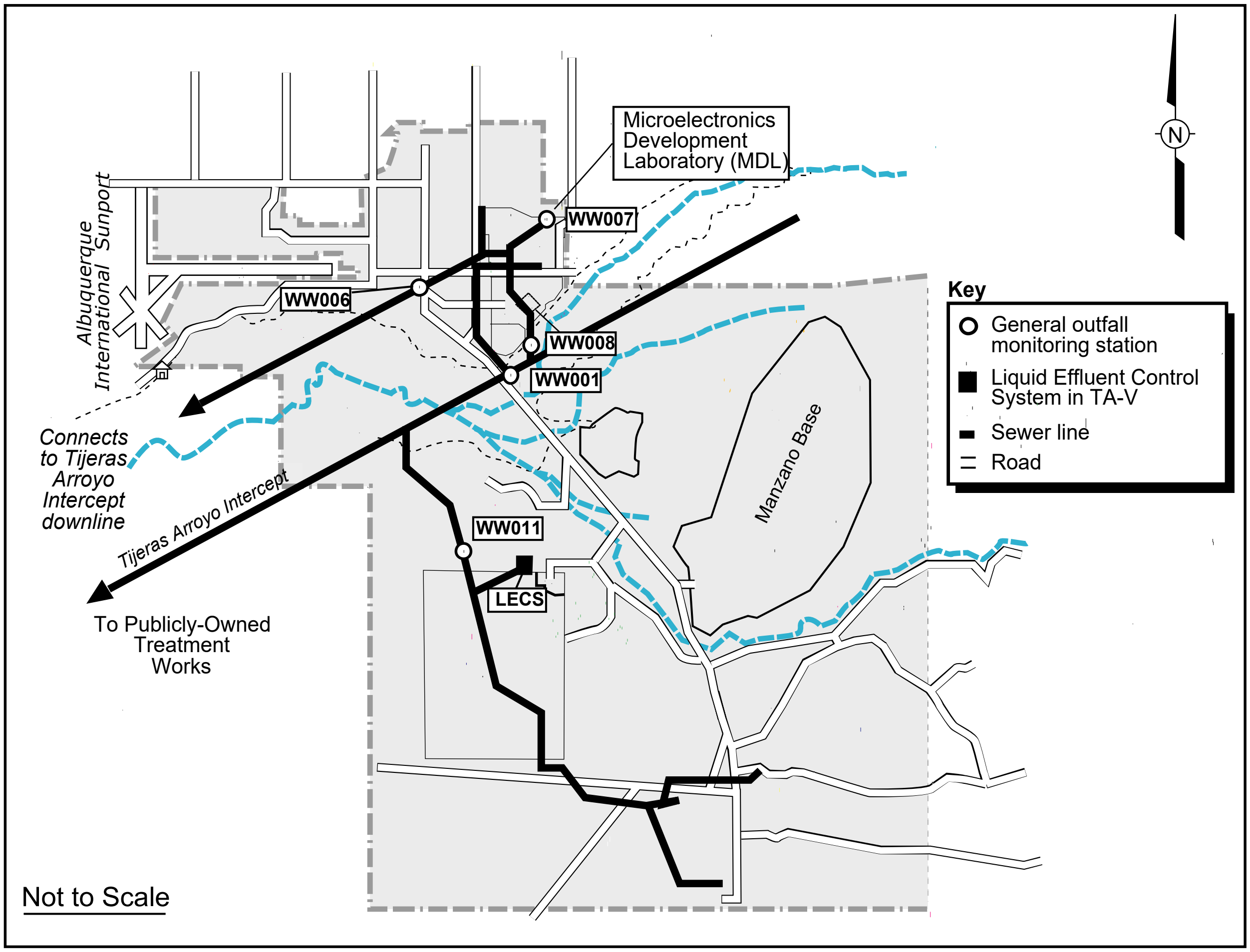

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FIGURE 6-1. Wastewater Monitoring Station Locations

TABLE 6-1. SNL/NM Wastewater Discharge Permits and Station Characteristics

Permit	Waste Stream Process	Flume Size
General Outfall		
WW001	All waste streams	3 in. Parshall*
WW006	All waste streams	6 in. Parshall
WW008	All waste streams	6 in. Parshall
WW011	All waste streams	6 in. Parshall
Categorical		
WW007	MDL	45° v-notch Weir
Not Permitted		
LECS	Radiological screening of TA-V process water	N/A

NOTE: "All waste streams" include both domestic and industrial discharges.
*A Parshall Flume is a primary flow-measuring device characterized by a constricted throat that produces a head that is related to discharge flow rate. This type of flume is used in sanitary sewer systems because it is self-cleaning.
LECS = Liquid Effluent Control System
MDL = Microelectronics Development Laboratory
N/A = not applicable

Wastewater Analyte Parameters

Metals
- Aluminum
- Arensic
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Silver
- Selenium
- Zinc

Radiological
- Tritium
- Gross beta
- Gross alpha
- Gamma spectroscopy

General Chemistry
- Cyanide
- Soluble fluoride
- Formaldehyde
- Phenolic compounds
- Oil and grease
- Volatile organic compounds (VOCs)
- Semi-Volatile organic compounds

contaminants before the contents are released to the public sewer system. Discharges to the sanitary sewer have not exceeded standards for radionuclides at any of SNL/NM's wastewater stations, including the LECS.

The LECS consists of three 5,000-gallon tanks and one ion exchange and filter system. The LECS is monitored 24 hours-a-day and is equipped with alarms to alert SNL/NM personnel to the presence of radioactive materials or high water levels. Water samples are analyzed for tritium, gross alpha, gross beta, and gamma spectroscopy to ensure radiological levels meet regulatory standards before the water is released to the public sewer system. If radioactivity levels are detected above permit limits, the water will not be released and an alternative disposal path will be found or the radionuclides will be allowed to decay in place over a matter of days or weeks if the contamination is due to short-lived radioisotopes. Once the activity is at or below regulatory levels, the water can be safely discharged to the public sewer system.

6.1.5 Summary of Monitoring Results

During 2001, Sandia Corporation split quarterly SNL/NM wastewater samples with both the City of Albuquerque and the NMED. The City of Albuquerque staff also inspected SNL/NM facilities to ensure that Sandia Corporation was in compliance with the City of Albuquerque's discharge requirements. In 2001, laboratory analysis results for wastewater samples taken at SNL/NM's monitoring stations confirmed that Sandia Corporation was in compliance with all state and local regulations. All water discharged from the LECS in 2001 also met federal regulatory standards and DOE Orders for radiological levels in wastewater.

Reportable releases that occurred in 2001 are discussed under occurrence reporting in Section 2.4.2. All permit conditions were met in 2001.

6.2 SURFACE DISCHARGE PROGRAM

All water and water based compounds that discharge to the ground surface are evaluated for compliance with New Mexico Water Quality Control Commission (NMWQCC) regulations as implemented by the NMED's Groundwater Bureau. These regulations are designed to protect the groundwater and surface water of the state for potential use as a domestic potable water source. The primary regulations are listed in Appendix B. Important program documents are listed in Chapter 9.

6.2.1 Surface Discharge Approval and Permitting

Surface discharges are releases of water and water based compounds made to roads, open areas, or impoundments. Surface discharges are only made with the approval of the Surface Discharge Program within the EM Department. The Surface Discharge Program assists SNL/NM facility owners in meeting requirements set forth by the state and documents all requests and discharges. Proposed discharges are evaluated for potential contaminants and concentration levels to determine if the discharge complies with strict water quality guidelines for surface releases. Uncontaminated water discharges must also be approved, since large volumes of water discharged in areas of prior contamination (such as Environmental Restoration [ER] sites) could increase infiltration rates and move contaminants deeper into the soil column. If any discharges do not meet surface water quality standards, alternative methods of disposal are found.

2001 Surface Discharge Activities
Surface discharge requests are generally made when access to a sanitary sewer line is not available, such as in remote locations on KAFB where no sewer lines exist. Typical surface

discharge requests include discharges made by the Groundwater Protection Program (GWPP) to dispose of well purge water from groundwater monitoring wells. Wells are purged before a representative groundwater sample can be taken. Other surface discharges are requested as a result of fire training activities, the need to flush eyewash stations, and the cleaning of building exteriors. In 2001, 28 individual surface discharge requests were made; all met state standards and were approved.

6.2.2 Surface Discharge Releases in 2001

The Surface Discharge Program must be contacted in the event of an accidental release or spill to the ground surface. In 2001, four reportable releases occurred. These occurrences are discussed in Section 2.4.2.

6.2.3 Pulsed Power Evaporation Lagoons

The Surface Discharge Program at SNL/NM reports water quality results from routine samples taken from two surface discharge lagoons in TA-IV. Both lagoons are permitted through NMED due to the ongoing nature of the discharges and the large volumes of water involved. A *Discharge Plan Renewal Application, DP-530* (SNL 2001h) was submitted to NMED in 1999 and was approved in 2001.

The two surface discharge lagoons, are primarily used to contain and evaporate water that collects in the secondary containments around seven outdoor oil storage tanks used to store dielectric oil. The largest tank is 250,000 gallons in capacity. The secondary containments are designed to hold the entire contents of a tank in the event of a spill. Significant volumes of precipitation can collect in the containments during the monsoon season. The water is visually inspected for oil contamination and any oil present is skimmed off prior to discharge. Lagoon I is a 137,500-gallon capacity rectangular pond, approximately 50 by 70 ft and 11 ft deep. Lagoon II is a 127,000-gallon capacity trapezoidal-shaped pond, approximately 40 by 70 ft and 8 ft deep.

Water Level Measurements
Water levels in the lagoons are measured annually and water quality samples are taken biennially during even numbered years, as required by DP-530 (SNL 2001h). Water level measurements were obtained from Lagoons I and II on November 8, 2001. The water level in Lagoon I was recorded at 13 percent of capacity and the water level in Lagoon II was at 0 percent of capacity. Biennial samples will be obtained from both lagoons during 2002. Lagoons I and II were cleaned and inspected during 2001 and the liners were determined to be sound and intact. All permit requirements for both lagoons were met in 2001.

6.3 STORM WATER PROGRAM

6.3.1 Storm Drain System

Storm water runoff flowing over the ground surface has the potential to pick up and transport contaminants. This is especially true in industrial areas where runoff can be significant after heavy showers since pavement and buildings prevent precipitation from infiltrating into the ground. The Storm Water Program works in coordination with the P2 Group, the Surface Discharge Program, and the ER Project to implement measures and BMPs to prevent or reduce potential contaminants from being transported in storm water runoff. Potential contaminants may derive from:

- Oils and solvents from machine shops and manufacturing areas;
- Vehicle residues from streets and parking lots;
- Hazardous chemicals and metals from waste handling facilities;
- Residual radioactive and hazardous constituents from Solid Waste Management Units (SWMUs);
- Building material contaminants from construction activities; and
- Pesticides and fertilizers from landscaped areas.

Sandia Corporation controls the potential contaminants that may be picked up by storm water runoff by limiting storm water contact with chemical storage containers and carefully controlling runoff in areas where wastes, chemicals, and oils are stored or handled. Secondary containments for all outdoor oil storage tanks and chemical containers prevent potential pollutants from being transported in storm water runoff. Some facilities, such as the Hazardous Waste Management Facility (HWMF) and the Radioactive and Mixed Waste Management Facility (RMWMF) are designed to divert all runoff from the facility to a lined catchment basin. Water that accumulates in the basin evaporates. If evaporation is not adequate due to meteorological conditions, the accumulated water is evaluated and pumped to either the storm drain system or to the sanitary sewer for disposal. Approval must be granted by the City of Albuquerque through the DOE.

NPDES Regulations
The NPDES regulates storm water runoff from industrial facilities in order to protect "Waters of the U.S." as defined by the Clean Water Act (CWA). As it applies to SNL/NM, the Tijeras Arroyo, which discharges to the Rio Grande, is a "Water of the U.S." The arroyo is generally dry, but during heavy downpours it has significant water-carrying capacity. Any runoff that flows into the arroyo through a channel, arroyo conduit, or overland surface flow is considered a discharge point.

As shown in Figure 6-2, Tijeras Arroyo enters KAFB from the northeast, flows just south of TA-I, TA-II, and TA-IV, exits at KAFB's west boundary, and continues about eight miles to its discharge point at the Rio Grande River. The arroyo has created a significant topographic feature across KAFB where erosion of unconsolidated basin sediments has resulted in a channel over one half mile wide in some areas.

Affected Areas at SNL/NM
NPDES permits are required if storm water runoff discharges to "Waters of the U.S." Sandia Corporation facilities in TA-I, TA-II, and TA-IV have storm drains, culverts, and channels that divert storm water runoff to discharge points on the north side of Tijeras Arroyo which is classified as "Waters of the U.S." Sandia Corporation also conducts various activities in remote mountain and canyon areas in the Arroyo del Coyote watershed which empties into Tijeras Arroyo northwest of the KAFB Golf Course. Activities in all of these areas are evaluated for possible NPDES permitting.

Drainages south of the Arroyo del Coyote watershed are generally short and undeveloped. Runoff in this area infiltrates quickly into highly permeable soils. Discharges from these areas do not reach any designated "Waters of the U.S."; therefore, NPDES permits are not required for facilities in this area. TA-III, TA-IV, and several remote sites are located in this area.

After reissuance of a new NPDES permit in January 2001, several stations were added to monitor runoff in the Arroyo del Coyote watershed. The expansion of the Storm Water Program is discussed in Section 6.3.2.

NPDES Permit
The EPA provides regulatory oversight for SNL/NM's Storm Water Program. SNL/NM facilities are covered under the NPDES "Multi-Sector General Storm Water Permit" issued by the EPA in January 2001 (EPA 2001). Currently, there are eight SNL/NM monitoring stations on the permit. The permit was reissued in 2001 for five years and covers four primary industrial activities at SNL/NM as defined in 40 CFR 122. Key facilities affected by NPDES regulations are listed in Table 6-2. Appendix B and Chapter 9 of this report lists all applicable regulations and program documents, respectively.

Construction activities that disturb over five acres also require permitting under NPDES. Individual construction projects are not listed on the "Multi-Sector General Storm Water Permit" (EPA 2001). A construction permit requires the ground to be stabilized upon completion of the project. In 2001, one storm water construction permit was in effect: the ER Storm Drain, Sanitary Sewer, Domestic Water System Modernization (SSWM) Project. Storm water permits are listed in Appendix B, Table B-1.

6.3.2 Storm Water Monitoring Stations

Sandia Corporation currently collects storm water samples from eight monitoring points (Figure 6-2). Monitoring Points 2 through 5 monitor runoff from the majority of industrial activities in TA-I, TA-II, and TA-IV. Monitoring Points 6, 7, 9, and 10 monitor discharges in Arroyo del Coyote.

EPA Appraisal
On June 4, 2001, an EPA enforcement officer conducted an assessment of the Storm Water Program at SNL/NM. As a result of this inspection and at the request of EPA, the Storm Water Pollution Prevention Plan (SWP3) for SNL/NM was revised (SNL 2001d). Specific improvements to the SWP3 included clarifications of non-storm water discharges, records of preventive maintenance, and the relationship between SWP3 "industrial" and "construction" permits. The SNL/NM site maps have been revised to include information regarding storage areas.

References to detailed site maps and files maintained by the Project Leader have also been added as well as explanations of the relationship of SNL/NM's Environment, Safety, and Health (ES&H) Manual to storm water training and BMPs.

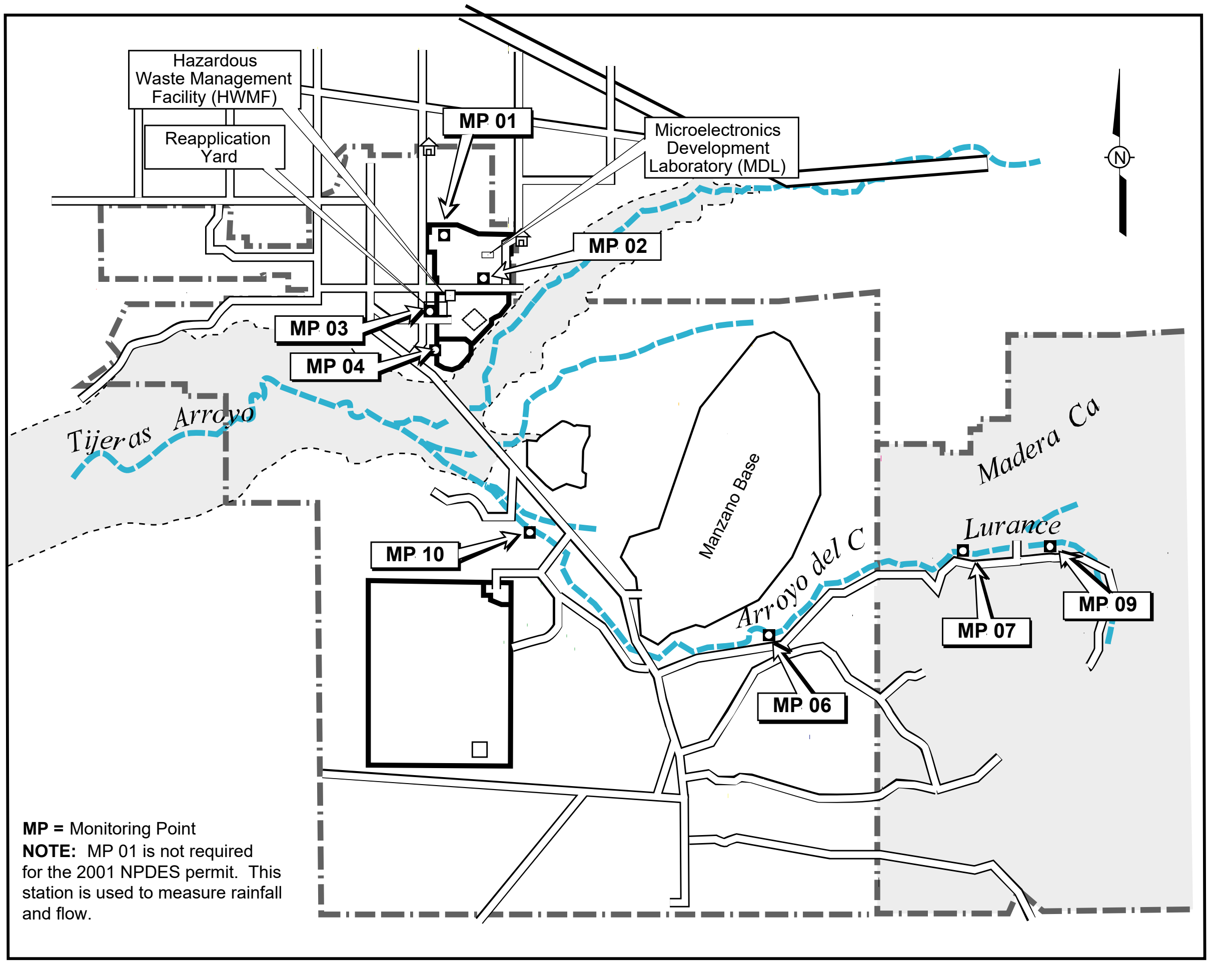

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FIGURE 6-2. Storm Water Monitoring Point Locations at Eight Sites

TABLE 6-2. SNL/NM Facilities Subject to Storm Water Permitting

These facilities are in areas where storm water can potentially drain to Tijeras Arroyo.

Description of SIC Code*	Potential Pollutants and Impacts	Applicable SNL/NM Facilities **
NPDES Multi-Sector Storm Water Permit		
Scrap and Waste Recycling	- Various solid objects with potential residual surface contamination	- Reapplication and Storage Yard
Hazardous Waste Treatment, Storage, or Disposal Facilities	- Regulated hazardous chemical and radioactive waste	- HWMF - Manzano Storage Complex - SWMUs (including those in Lurance and Madera Canyons)
Electronic and Electrical Equipment Manufacturing	- Raw chemical storage such as acid and sodium hydroxide - Electroplating processes	- MDL - AMPL - CSRL
Short-Term Construction Permits		
Construction Activities in 2001	- Building material pollutants - Disturbed soil	- PETL - Storm Drain Modernization Project

NOTE: *The EPA requires a National Pollution Discharge Elimination System (NPDES) Storm Water Permit for all industrial facilities that have processes defined in the Standard Industrial Classification (SIC) codes listed in Appendix A of 40 CFR 122.
**Applicable facilities are monitored under the expanded Storm Water Program, which was in effect in October 2001. The expanded program is documented in the revised Storm Water Pollution Prevention Plan (SWP3) (SNL 2001d).

AMPL = Advanced Manufacturing Process Laboratory
CSRL = Compound Semi-Conductor Research Laboratory
HWMF = Hazardous Waste Management Facility
SWMU = Solid Waste Management Unit
MDL = Microelectronics Development Laboratory
PETL = Processing and Environmental Technology Laboratory

TABLE 6-3. 1999 and 1998 Storm Water Sampling Results
(Results in bold are above benchmark values given in the EPA permit.)

		1999 *					1998 **	
Analytes	**Units**	**MP 03 1st Qtr**	**MP 03 2nd Qtr**	**MP 04 1st Qtr**	**MP 04 3rd Qtr**	**MP 04 4th Qtr**	**MP 04**	**Benchmark Values**
TSS	mg/L	**150**	27	**113**	**131**	**233**	--	100
pH	--	8.1	8.4	8.5	8.3	8.1	--	N/A
Oil & Grease	mg/L	(ND)	6	(ND)	6	11	--	15
COD	mg/L	48	22	72	**413**	61	--	120
Nitrate + Nitrite	mg/L	**1.60**	**2.05**	0.58	0.45	0.65	**0.75**	0.68
Total Kjeldahl N	mg/L	1.4	(ND)	1.3	8.8	1.1	(ND)	--
Cyanide	--	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	0.0636
Ammonia	mg/L	(ND)	(ND)	(ND)	1.2	(ND)	(ND)	19
Aluminum	mg/L	**13.2**	**1.37**	**7.47**	**1.19**	**18.2**	**9**	0.75
Arsenic	mg/L	0.006	0.00201	0.0049	(ND)	0.00613	0.005	0.16854
Cadmium	mg/L	0.00796	(ND)	(ND)	(ND)	(ND)	0.007	0.05
Copper	mg/L	0.057	(ND)	0.0152	(ND)	0.0152	0.0108	0.0636
Iron	mg/L	**10.8**	**1.07**	**5.45**	**18.5**	**13.4**	**6.05**	1.0
Lead	mg/L	0.0534	(ND)	0.0239	(ND)	0.0352	0.009J	0.0816
Magnesium	mg/L	**5.01**	**1.65**	**3.73**	**2.16**	**8.82**	**5.27**	0.0636
Mercury	µg/L	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	0.0024
Selenium	mg/L	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	0.2385
Silver	mg/L	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	0.0318
Zinc	mg/L	**0.210**	0.0191	**0.0861**	0.033	**0.114**	0.053	0.065

NOTE: Source: SNL 2000g
Analytical samples were not collected in 2001 since sampling is only required in the 2nd and 4th year of the permit.
*In 1999, rainfall throughout the year was sufficient to produce five good samples: two from Monitoring Point (MP) 03 and three from MP 04.
**Only one sampling event was collected in 1998 from MP 04, which was not adequate to produce meaningful results.
TSS = total suspended solids (The benchmark value is 100 mg/L.)
J = Detected below the reporting limit or is an estimated concentration
Qtr = quarter mg/L = milligram per liter
ND = not detected N/A = not available
COD = chemical oxygen demand
µg/L = microgram per liter

6.3.3 Routine Inspections

All routine inspection results are attached to the SWP3. The following routine inspections are conducted:

- **Monitoring station inspections** are conducted monthly to ensure that samplers and other equipment are functioning properly.
- **Material storage area inspections** are conducted quarterly. All waste handling areas, vehicle and equipment cleaning areas, and loading and unloading areas are inspected for uncovered and unprotected potential contaminant sources and spills. These inspections increase personnel awareness and responsibility for storm water P2.
- **Wet weather inspections** are conducted quarterly during a storm event, if possible, but generally during the rainy season from April through September. Samples are collected and visually inspected for foaminess, clarity, and the presence of oil. These inspections also provide an opportunity to check for broken levees and floating debris.
- **Dry weather inspections** are conducted quarterly when storm drains and ditches are dry primarily to detect illicit discharges. In general, only storm water is allowed in the storm drain system; however, with approval from the Surface Discharge Program, water that meets NPDES permit conditions can be discharged to storm drains. An example of NPDES permit-approved discharges would be water used during fire training exercises or

Construction Site Monitoring

Sandia Corporation mitigates potential storm water pollution from all construction sites (or disturbed areas) by adhering to strict guidelines to prevent contaminant migration from various construction materials and processes. If the construction site is greater than five acres, the activity must be permitted under NPDES regulations. All permitted construction activities must develop a site-specific storm water P2 plan.

Once a construction project is completed, disturbed areas must be stabilized before the permit is terminated. Stabilization techniques include:

(1) Constructing drainages/diversions;
(2) Reseeding open areas;
(3) Xeriscaping (landscaping method that employs using drought-resistant plants in order to conserve resources, especially water) and other landscaping; and
(4) Asphalting to prevent the transport of residual pollutants and erosion.

Storm Water Station 5 (the roofline shown just to the right of this channel) samples storm water at a discharge point to Tijeras Arroyo.

fire hydrant testing. Dry weather inspections also provide an opportunity to inspect ditches for excess vegetation, accumulated sediment, and debris. Storm channels are cleaned out annually, or as necessary.

- **Annual Inspections** of all permitted facilities and the entire storm water system are conducted. After the inspections have been completed, a report is generated indicating the extent of the inspections and certifying that SNL/NM is in compliance with NPDES permit. Any inconsistency between the SWP3 and conditions at the facilities is noted in the report. If changes to the SWP3 are required as a result of these inspections, revisions to the SWP3 are initiated. If potential pollution problems are uncovered at the facilities, this is also noted in the report along with a schedule for addressing the problem areas.

Sampling Protocols

The NPDES permit requires quarterly analytical sampling to be conducted in the second and fourth year of the five-year permit, weather permitting. Due to Albuquerque's semi-arid climate and high infiltration rates, precipitation rarely produces adequate runoff for monitoring in the months of October through March. In general, the most consistent storm water sampling occurs during the rainy season from April through September. After a rainfall of sufficient intensity and duration (as defined in the regulation), storm water runoff flowing through monitoring each station is collected as a grab sample by the automatic sampler. The discharge is collected within the first 30 minutes of the runoff event to allow for the sampling of any residues picked up in the soil upstream of the station. All samples are sent to off-site laboratories and analyzed according to protocols established by the EPA.

6.3.4 2001 Activities

2001 Sampling Results

No analytical monitoring was required under NPDES in fiscal year (FY) 2001. The next required analytical sampling began in October 2001 (FY 2002). However, quarterly visual samples were collected at five monitoring points (MPs) and inspected as described under "wet weather inspections." No unusual characteristics were noted.

Past Sampling Results

Past sampling results from 1998 and 1999 analysis have shown a presence of metals such as zinc, magnesium, and iron elevated above benchmark values (Table 6-3). However, since the collection of storm water samples at SNL/NM did not begin until 1997, there is not yet enough data to draw meaningful conclusions. The presence of these metals may be due to natural conditions associated with rocks and soils derived from the igneous/ metamorphic complex of the Manzanita Mountains.

SSWM Project

In 1999, construction began on the SSWM Project. Phases 1, 2, and 3, completed in 2000, consisted of the realignment of 20th Street near KAFB's Eubank Gate and replacement of existing earth ditches in TA-I with concrete channels up to MP 04. Phase 4 received funding in FY 2001 and included the replacement of underground storm sewer pipes in the northwest section of TA-I. Completion of this project is scheduled to be completed in FY 2002.

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Chapter 7

Groundwater Programs

In this chapter ...

Chapter Summary

Sandia Corporation collects groundwater data for the Groundwater Protection Program (GWPP) and the Environmental Restoration (ER) Project. Both programs work together to monitor wells throughout Sandia National Laboratories, New Mexico (SNL/NM), as well as maintain data sets from the surrounding communities.

The GWPP establishes baseline water quality and groundwater flow information, determines if any impact from operations is affecting the quality of groundwater, and maintains compliance with local, state, and federal regulations. Groundwater sampling is conducted at various locations and is analyzed for a variety of contituents, including Volatile Organic Compounds (VOCs), metals, and radionuclides. Results are described in subsequent sections of this chapter.

The ER Project conducts groundwater monitoring in five project areas. These areas include the Chemical Waste Landfill (CWL), the Mixed Waste Landfill (MWL), Tech Area V, Tijeras Arroyo Groundwater (TAG) Investigation, and the Canyons Area. The New Mexico Environment Department (NMED) provides oversight for these monitoring activities.

The ER Project utilized the Vapor Extraction Project (VEP) to remove VOCs from the groundwater and vadose zone at the CWL. This method was effective in the extraction of trichloroethene (TCE) in groundwater systems.

Environmental Snapshot

- *In 2000, KAFB pumped 1.38 billion gallons of water. The amount of water pumped in 2001 decreased to 1.24 billion gallons of water.*

SNL/NM personnel taking water level measurements.

Groundwater monitoring wells are located at and around SNL/NM operational areas and environmental remediation sites to determine potential impacts to groundwater, monitor the effectiveness of groundwater protection strategies, characterize potential contamination at ER sites, and demonstrate compliance with federal, state, and local groundwater requirements. Groundwater monitoring is conducted on an annual, biannual, or quarterly basis, depending on individual project areas. Water level measurements are conducted quarterly and monthly.

Two programs within Sandia Corporation collect groundwater data: The GWPP and the ER Project. The GWPP is responsible for groundwater surveillance to determine the impacts on groundwater from current operations at SNL/NM. The ER Project is responsible for identifying, investigating, and remediating groundwater contamination from historic activities at the facility. Program goals and objectives are coordinated under the Groundwater Protection Management Program Plan (GPMPP) at SNL/NM. The type of groundwater data collected includes water quality information as well as information on the physical aspects of the groundwater system. Specific task areas performed in Fiscal Year (FY) 2001 under both programs are shown in Figure 7-1. As shown in Figure 7-1, coordination with outside groundwater monitoring agencies is a key component of the GWPP.

The ER Project at SNL/NM is funded directly by the U.S. Department of Energy (DOE), with local oversight provided by the Office of Kirtland Site Operations (OKSO). The GWPP works hand in hand with ER Project sites requiring groundwater monitoring to provide well registry and oversight for ER wells and other SNL/NM-owned wells.

The GWPP Groundwater Surveillance Task collects groundwater samples from a network of wells at SNL/NM and Kirtland Air Force Base (KAFB) that are not associated with ER Project sites. Data results generated from both the ER Project and the GWPP at SNL/NM are summarized in the *FY 2001 Annual Groundwater Monitoring Report* (SNL 2002f).

Figure 7-2 shows groundwater wells located on and around KAFB. Wells shown in Figure 7-2 include ER monitoring wells, GWPP surveillance wells, City of Albuquerque production wells, KAFB production wells, U.S. Geological Survey (USGS) monitoring wells, and KAFB Installation Restoration Program (IRP) wells. In FY 2001, 67 wells were sampled by the GWPP or the ER Project and are shown in bold in Figure 7-2.

7.1 OVERVIEW OF GROUNDWATER PROGRAMS AT SNL/NM

GWPP and ER Project sites and activities are described in this section.

7.1.1 GWPP Activities

The GWPP is mandated by DOE Order 5400.1, *General Environmental Protection Program*, which sets forth guidelines for groundwater protection management programs that must be implemented at DOE/National Nuclear Security Administration (NNSA) facilities (DOE 1990). The program is funded indirectly by DOE/NNSA as part of the overhead cost of the facility, which is operated by Lockheed Martin Corporation. Applicable regulations are listed in Appendix B. Groundwater quality results are compared to federal, state, and DOE guidelines, where established. The GWPP has structured its surveillance activities to conform to Resource Conservation and Recovery Act (RCRA) groundwater monitoring guidelines.

The primary function of the GWPP is to conduct groundwater surveillance monitoring to detect groundwater contamination from current operations or undiscovered legacy contamination. The following outlines the specific purpose of surveillance monitoring:

- Establish baseline water quality and groundwater flow information for the groundwater system at SNL/NM;
- Determine the impact, if any, of Sandia Corporation's operations on the quality and quantity of groundwater; and
- Demonstrate compliance with all federal, state, and local groundwater requirements.

Generally, the GWPP samples the same wells each year. Occasionally, wells may be added or removed from the network based on operational changes, such as facility closures or new facility startups.

The GWPP is responsible for tracking information on all wells owned by Sandia Corporation, including ER Project wells and characterization boreholes. The primary purpose of the GWPP Well Registry and Oversight task is to ensure that all wells owned

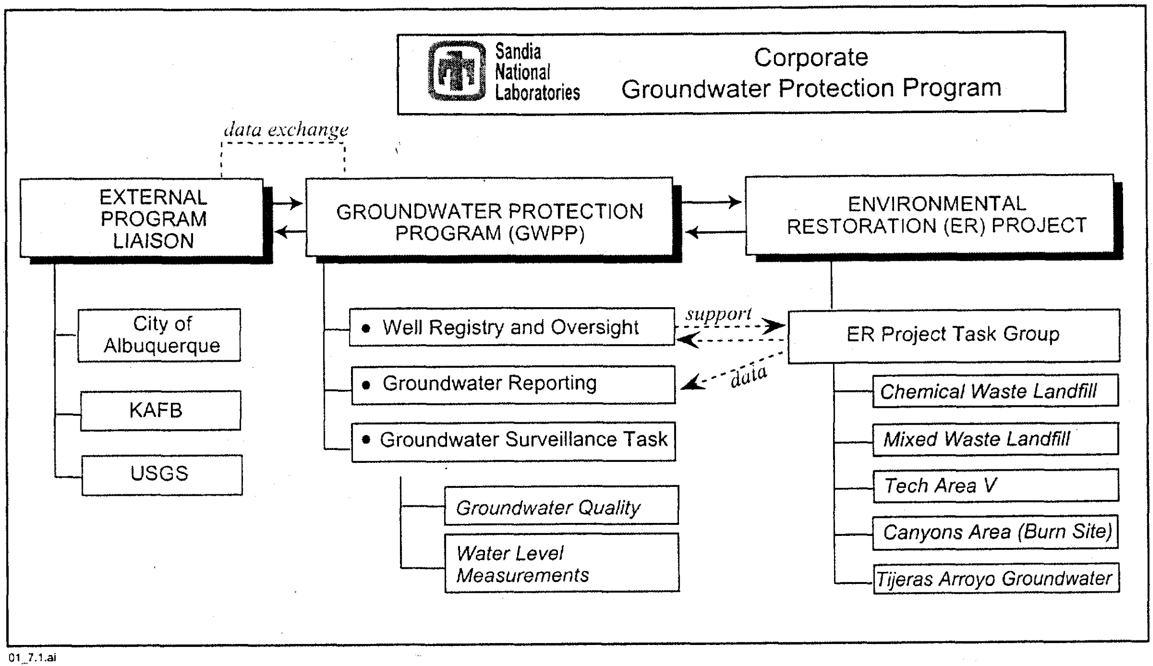


FIGURE 7-1. SNL/NM's Groundwater Programs and Interfaces

to review new well design proposals, record construction information, track well ownership and maintenance records, perform annual well inspections, and consult with owners, if and when plugging and abandonment of a well or borehole is required.

Trend Data

The GWPP performs statistical trending on groundwater surveillance results by comparing past years' data with current year results. Trend data for groundwater contaminants that exceed regulatory limits is presented in Appendix D, which provides statistical descriptors and graphical representation. Data are analyzed to determine if the results are within a normal range of expected values or if a significant difference is present. By doing so, early detection and possible source identification can be made when contaminants are at levels far below regulatory concern. Conversely, unchanging baseline levels demonstrate Sandia Corporation's successful groundwater best management practices (BMPs) and protection strategies.

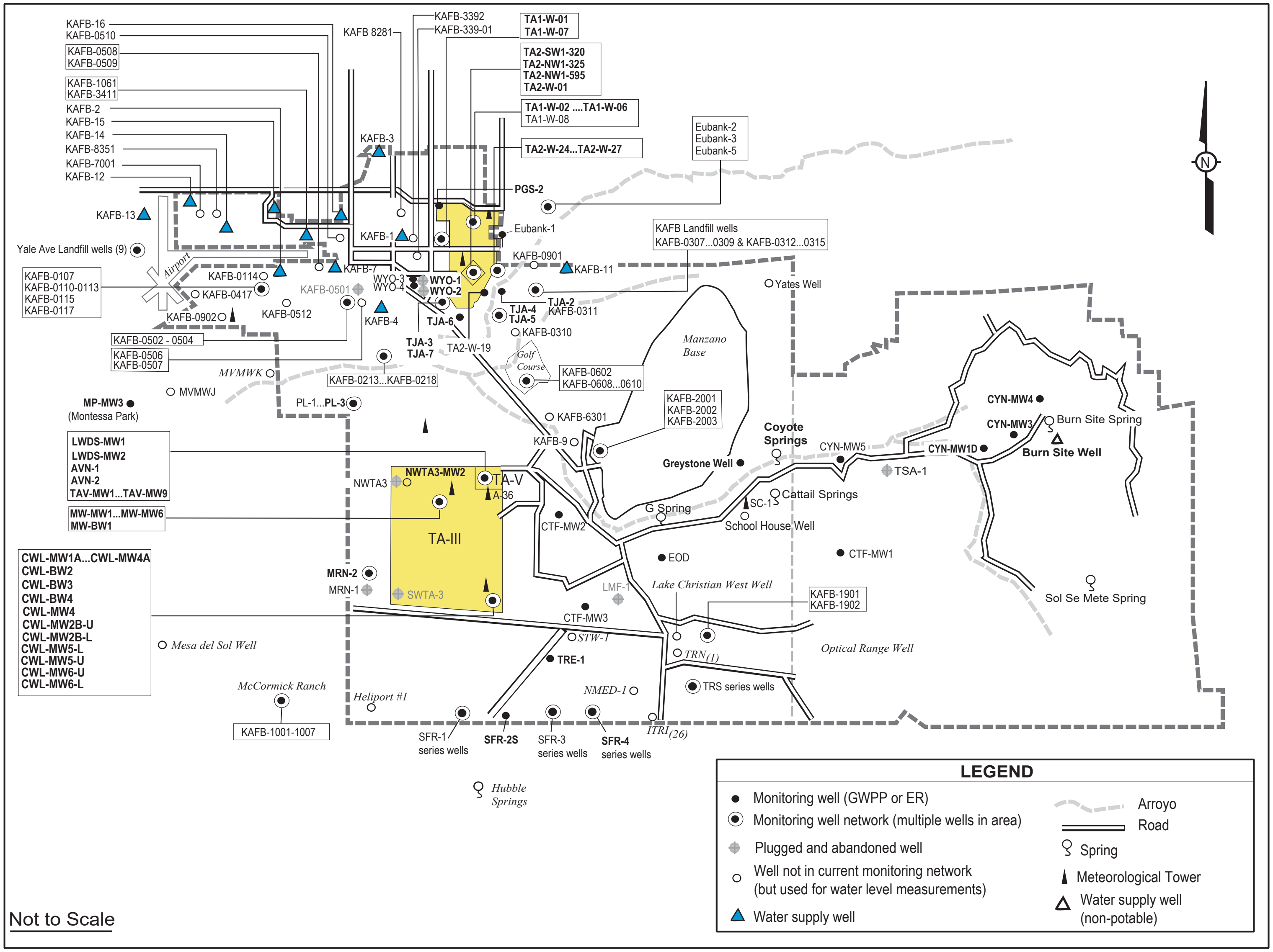
7.1.2 ER Project Groundwater Activities

ER Project activities are directed by RCRA regulations that mandate the cleanup and management of active and inactive treatment, storage, and disposal (TSD) facilities. Applicable regulations are listed in Appendix B. Most ER sites are permitted on Sandia Corporation's RCRA Part B Hazardous and Solid Waste Amendments (HSWA) Operating Permit.

A few sites, such as the CWL and some septic systems, have interim operating permits that were identified after the permit was issued and are not listed on the HSWA permit.

In RCRA, ER sites are known as Solid Waste Management Units (SWMUs). Many SWMUs are listed for investigation based on past activities conducted at the site that had the potential to contaminate the surface or subsurface. Following a site investigation, the site will be placed in one of three categories:

- No contamination exists,
- Contamination is at levels below regulatory concern, or
- The site requires remediation.


KAFB-16
KAFB-0510
KAFB-0508
KAFB-0509
KAFB-1061
KAFB-3411
KAFB-2
KAFB-15
KAFB-14
KAFB-8351
KAFB-7001
KAFB-12
KAFB 8281
KAFB-3392
KAFB-339-01
TA1-W-01
TA1-W-07
TA2-SW1-320
TA2-NW1-325
TA2-NW1-595
TA2-W-01
TA1-W-02 ....TA1-W-06
TA1-W-08
TA2-W-24...TA2-W-27
KAFB-3
Eubank-2
Eubank-3
Eubank-5
PGS-2
KAFB-13
Yale Ave Landfill wells (9)
KAFB-1
Eubank-1
KAFB Landfill wells
KAFB-0307...0309 & KAFB-0312...0315
Airport
KAFB-7
KAFB-0901
KAFB-11
KAFB-0107
KAFB-0110-0113
KAFB-0115
KAFB-0117
KAFB-0114
KAFB-0501
WYO-3
WYO-4
WYO-1
WYO-2
Yates Well
KAFB-0417
KAFB-0902
KAFB-0512
KAFB-4
TJA-2
KAFB-0311
TJA-4
TJA-5
TJA-6
KAFB-0310
KAFB-0502 - 0504
KAFB-0506
KAFB-0507
TJA-3
TJA-7
TA2-W-19
Golf Course
Manzano Base
MVMWK
KAFB-0213...KAFB-0218
KAFB-0602
KAFB-0608...0610
MVMWJ
MP-MW3
(Montessa Park)
PL-1...PL-3
KAFB-2001
KAFB-2002
KAFB-2003
KAFB-6301
CYN-MW4
CYN-MW3
Burn Site Spring
Coyote Springs
CYN-MW5
CYN-MW1D
Burn Site Well
KAFB-9
LWDS-MW1
LWDS-MW2
AVN-1
AVN-2
TAV-MW1...TAV-MW9
Greystone Well
TSA-1
NWTA3
NWTA3-MW2
TA-V
A-36
Cattail Springs
G Spring
SC-1
MW-MW1...MW-MW6
MW-BW1
CTF-MW2
School House Well
TA-III
CWL-MW1A...CWL-MW4A
CWL-BW2
CWL-BW3
CWL-BW4
CWL-MW4
CWL-MW2B-U
CWL-MW2B-L
CWL-MW5-L
CWL-MW5-U
CWL-MW6-U
CWL-MW6-L
EOD
CTF-MW1
MRN-2
MRN-1
SWTA-3
LMF-1
Lake Christian West Well
Sol Se Mete Spring
KAFB-1901
KAFB-1902
CTF-MW3
Mesa del Sol Well
STW-1
Optical Range Well
TRN(1)
TRE-1
McCormick Ranch
NMED-1
TRS series wells
Heliport #1
KAFB-1001-1007
ITRI(26)
SFR-1
series wells
SFR-2S
SFR-3
series wells
SFR-4
series wells
Hubble Springs
N
LEGEND
Monitoring well (GWPP or ER)
Monitoring well network (multiple wells in area)
Plugged and abandoned well
Well not in current monitoring network
(but used for water level measurements)
Water supply well
Arroyo
Road
Spring
Meteorological Tower
Water supply well
(non-potable)
Not to Scale

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by SNL/NM are properly constructed and maintained to protect groundwater resources. The GWPP works together with SNL/NM well owners ER sites with the potential to contaminate groundwater are conducting groundwater investigations, including contaminant monitoring. The NMED's Hazardous Waste Bureau provides regulatory oversight for remediation activities, including groundwater monitoring performed at ER sites.

There are currently five ER Project areas with ongoing groundwater investigations:

- CWL
- MWL
- Tech Area V
- Tijeras Arroyo Groundwater (TAG)
- Canyons Area

CWL – From 1962 to 1989, the CWL, covering just over two acres in the southeast corner of Technical Area III (TA-III), was used to dispose of liquid chemical wastes by discharging them into pits. Some of the pits were lined, while others were not. The area was also used for aboveground storage of containerized waste. In 1985, the first monitoring wells were installed at the request of NMED. Currently, there are 13 active wells in the network, including three background (upgradient) wells and three multiple screen wells.

The CWL is a RCRA Interim Status site (Interim Status applies to all active TSD sites or TSD sites that were still active in 1982). A separate cleanup and closure plan, *Chemical Waste Landfill Final Closure Plan and Postclosure Permit Application* (SNL 1993), has been developed. The ER Project began excavation and remediation at the CWL in 1998. A Corrective Action Management Unit (CAMU) was established adjacent to the CWL to facilitate site cleanup and the CAMU allows for temporary storage and on-site treatment of hazardous waste excavated from the CWL. The CAMU has extensive containment and detection systems to prevent groundwater contamination at the facility.

MWL – The MWL is a 2.6-acre site located in TA-III that was operational from 1959 to 1989 and was used to dispose of radioactive and mixed waste (MW). The site has two distinct disposal areas–one for classified waste and one for unclassified waste. A total of 100,000 ft^3 of low-level radioactive waste (LLW) and MW were buried in unlined trenches and pits. The total activity of waste at the time of disposal was 6,300 Curies (Ci). No bulk liquid waste was disposed of at the MWL except in 1967 when 271,000 gallons of reactor coolant water with a total activity of 1 Ci were discharged into an unlined trench (Peace 1996). Cesium-137 and tritium are present in surface soil samples (see Chapter 4). Tritium has been detected in the unsaturated zone up to 120 ft below the surface, approximately 350 ft above the present water table at concentrations slightly above the detection limits of the analysis. Tritium has not been detected above its minimum detectable activity (MDA) (~300 pCi/L) in any groundwater samples to date. The U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) for tritium in drinking water is 20,000 pCi/L.

Tech Area V – The Gamma Irradiation Facility (GIF), the Hot Cell Facility (HCF), and two reactor facilities are located in TA-V. From 1967 to 1971, the Liquid Waste Disposal System (LWDS) located in TA-V was used to dispose of reactor coolant water. Groundwater contaminants of concern at the LWDS are nitrates and VOCs such as TCE, which was first detected in the groundwater in 1993. Elevated nitrate levels have been detected in two wells. There are currently nine active monitoring wells at this site.

TAG – The TAG Investigation includes groundwater beneath TA-I, TA-II, and the Tijeras Arroyo. There are currently 25 monitoring wells in the TAG study area. Of these, 12 are regional aquifer wells and 13 are shallow groundwater

VEP at the CWL

The VEP was a very successful cleanup initiative for removing VOCs from the groundwater and vadose zone at the CWL. From 1997 to 1999, the project removed approximately 5,000 lbs of VOCs from the soil.

Three CWL monitor wells were converted for extraction of VOCs from the vadose zone as part of a Voluntary Corrective Measure (VCM). The principal groundwater contaminant of concern at the CWL is TCE. As a volatile molecule, TCE is mobile within the vadose zone and migrated to the groundwater. Prior to the VEP, TCE levels in groundwater were measured above regulatory levels in four wells at this site. In 1999, TCE was detected in only one well above the limits, and in 2000, TCE was not detected above the limits in any well.

system wells. The shallow groundwater system consists of water-bearing strata elevated above the regional groundwater system (water table), that have not been developed for domestic use. TCE, PCE, thallium, and nitrates are the contaminants of concern for TAG. The discovery of TCE in several TA-I and TA-II wells led to the TAG Investigation in an effort to identify the source of the contamination and characterize the shallow groundwater system (to date, no definitive source has been identified).

Canyons Area – The Canyons Area is located around the active Lurance Canyon Burn Site (LCBS) facility. Groundwater investigations were initiated in 1997 at the request of NMED after elevated nitrate levels were discovered in the LCBS water well. In 1997, one groundwater monitoring well was installed, and in 1999, two additional wells were installed, including two piezometers to detect any groundwater flow at the interface of the arroyo sediments and bedrock. To date, both piezometers have remained dry. The LCBS facility is the only ER site within the U.S. Forest Service (USFS) land withdrawn area where groundwater contamination has been detected.

7.1.3 Summary of SNL/NM Groundwater Monitoring Activities

Table 7-1 provides an overview of the level of activity associated with groundwater monitoring at SNL/NM. The table details the number of wells sampled, the number of samples collected, and the number of analyses performed. The percentage of the analyses that are non-detects are reported. The table also provides a list and range of values for groundwater sample analytes. Information for monitoring that is associated with groundwater remediation as conducted by the ER Project and groundwater surveillance as conducted by the Environmental Management Department's GWPP are shown separately in Table 7-1.

7.2 GROUNDWATER QUALITY ANALYSIS RESULTS

Analytical results for groundwater quality monitoring conducted by the GWPP and the ER Project are compared to state, federal and DOE guidelines as shown in Table 7-2. The frequency of groundwater monitoring performed at SNL/NM is shown in Table 7-3. All groundwater samples are analyzed in accordance with EPA protocols.

Water quality results for both the GWPP and the ER Project are published in the *FY 2001 Annual Groundwater Monitoring Report for SNL/NM* (SNL 2002f).

7.2.1 GWPP Surveillance Results

During May and June 2001, annual sampling of groundwater was conducted by the GWPP Groundwater Surveillance Task. Samples were collected from 13 wells and one spring. Groundwater surveillance samples for the GWPP were analyzed for the following parameters:

- VOCs
- Metals
- Major ions including nitrate
- Alkalinity/total phenols perchlorate
- Total halogenated organics (TOX)
- Gamma spectroscopy
- Selected radionuclides
- Gross alpha & beta activity

Metals, excluding mercury, were analyzed from filtered groundwater samples to conform to New Mexico Water Quality Control Commission (NMWQCC) Standards for dissolved concentration limits. An unfiltered groundwater sample was analyzed for total mercury.

In addition, field measurements taken at each well included alkalinity, turbidity, dissolved oxygen, potential of hydrogen (pH), specific conductivity, oxidation reduction potential (or redox [Eh]), and temperature.

VOCs
No groundwater samples exceeded MCLs for VOCs. Trace concentrations of methylene chloride, acetone, and chloroform were detected. Methylene chloride and acetone are attributed to laboratory contamination of samples because the same constituents were found in quality control (QC) sample blanks. Chloroform was detected in well TRE-1 at a concentration of 1.32 µg/L.

There is no established EPA MCL for chloroform; however, the maximum allowable concentration (MAC) established by the NMWQCC is 100 µg/L. No source for the chloroform has been identified; were analyzed for the total concentration. The there is

TABLE 7-1. Summary of SNL/NM Groundwater Monitoring Activities During Fiscal Year 2001

	Remediation	Environmental Surveillance
Number of Active Wells Monitored	56	13
Number of Samples Taken	174	14
Number of Analyses Performed	15,031	1,135
% of Analyses that are Non-Detect	84.30%	72.16%
Range of Results for Positive Detections		
Tritium (pCi/L)	79.1 – 132	N/A
TCE (µg/L)	0.13 – 23	N/A
Chloroform (µg/L)		1.3
Other VOCs (µg/L)		
Acetone	1.17 – 2650	1.07 – 5.74
Methylene chloride	0.666 – 118	0.708 – 0.833
Trace Metals (mg/L)		
Aluminum	0.0087 – 5.8	0.00368 – 0.186
Antimony	0.00011 – 0.00161	0.00013 – 0.00018
Arsenic	0.00036 – 0.011	0.02
Barium	0.014 – 0.43	0.0127 – 0.133
Beryllium	0.00005 – 0.00045	0.0002 – 0.00744
Cadmium	0.00007 – 0.00073	0.00008 – 0.00032
Calcium	41 – 320	34.8 – 466
Chromium	0.00085 – 0.0942	0.00086 – 0.00226
Cobalt	0.00023 – 0.012	0.00073 – 0.00892
Copper	0.0007 – 0.011	0.00325
Iron	0.0506 – 5.2	0.0475 – 23.9
Magnesium	7.6 – 45	3.59 – 103
Manganese	0.0034 – 7.5	0.00495 – 1.44
Nickel	0.00081 – 2	0.00077 – 0.0264
Potassium	1.6 – 12.1	1.85 – 43.5
Selenium	0.00201 – 0.047	0.00166 – 0.015
Silver	0.00013 – 0.0063	0.00024 – 0.00044
Sodium	16 – 110	15.7 – 1080
Thallium	0.00016 – 0.00745	0.00004 – 0.00099
Zinc	0.00114 – 0.452	0.00493 – 0.2
Other Contaminants		
Nitrate as N (mg/L)	0.4 – 40	2
Nitrate plus Nitrite	0.05 – 20.7	0.02 – 7.95

NOTES: Remediation wells are those wells associated with Environmental Restoration (ER).
Environmental Surveillance wells are those wells associated with the Groundwater Protection Program (GWPP).
pCi/L = picocurie per liter
µg/L = micorgram per liter
mg/L = milligram per liter
N/A = not applicable

TABLE 7-2. Guidelines Used for Groundwater Quality Sample Comparisons

Agency	Regulation/Requirements	Limits
EPA	National Primary Drinking Water Regulations (40 CFR 141)	MCL
State of New Mexico	NMWQCC, Standards for Groundwater	MAC
DOE	DOE Drinking Water Guidelines for Radionuclides	DCG

NOTE: DCG = derived concentration guide
MAC = maximum allowable concentration
MCL = maximum contaminant level

TABLE 7-3. Sampling Frequency for Groundwater Quality Monitoring at SNL/NM During FY 2001

		ER Project Sites				
Sampling Period	***GWPP***	***CWL***	***MWL***	***Tech Area V***	***TAG***	***Canyons Area***
Oct 00			✓			
Nov 00				✓		✓
Dec 00						
Jan 01			✓		✓	
Feb 01				✓		✓
Mar 01					✓	
Apr 01			✓ (annual)			
May 01	✓			✓		✓
Jun 01					✓	
Jul 01		✓ (bi-annual)	✓			
Aug 01				✓		✓
Sep 01					✓	

NOTE: ER = Environmental Restoration
GWPP = Groundwater Protection Program
CWL = Chemical Waste Landfill
MWL = Mixed Waste Landfill
TAG = Tijeras Arroyo Groundwater
FY = Fiscal Year

no drinking water well near the TRE-1 monitor well location.

Non-metal Inorganic Compounds and Phenolics

No groundwater samples exceeded MCLs for any non-metallic inorganic constituent:

- Nitrate plus nitrite (NPN) (as nitrogen)
- Phenolics
- TOX
- Total cyanide
- Alkalinity (calcium carbonate)
- Ions (bromide, chloride, fluoride, and sulfate)

Chloride exceeded the NMWQCC MAC in water samples collected from Coyote Springs. The elevated concentrations are from natural sources and are consistent with background concentrations determined for this location.

Metals

The analyses were conducted for dissolved metals using filtered samples, except for mercury, which groundwater standards of the NMWQCC are based on dissolved concentration. The following metals analyses were conducted:

- Aluminum
- Arsenic
- Antimony
- Beryllium
- Barium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Nickel
- Potassium
- Selenium
- Silver
- Uranium
- Thallium
- Sodium
- Zinc

The metals list was compiled from the EPA's primary drinking water standards and NMWQCC standards.

The water sample collected from Coyote Springs exceeded the MCL for beryllium. The spring is located on KAFB property and is not located near any known source of contamination.

BERYLLIUM *MCL = 0.0004 mg/L*		
Well	**Concentration**	**Period**
Coyote Springs	0.0074	May 2001

NOTE: mg/L = milligram per liter

All other metals analyses were below drinking water standards, where established.

Iron concentrations in samples collected from the EOD well and the Schoolhouse well exceeded the NMWQCC Groundwater standard for domestic water supply. The MAC of 1 mg/L established by the NMWQCC is based on aesthetics and not health based considerations. The iron concentrations were 23.9 mg/L and 7.4 mg/L for the EOD and Schoolhouse wells, respectively.

Radionuclide Activity
Radioisotopic analyses were conducted on all samples. Specific analyses included:

- Gamma spectroscopy
- Gross alpha & beta
- Radium-226 and -228
- Uranium-233/234
- Uranium-235 and -238

Gamma spectroscopy analyses indicated the presence of potassium-40 in the EOD Hill and SFR-25 samples at an activity of 61.5 pCi/L and 55.6 pCi/L, respectively, as compared to the DOE drinking water guideline of 280 pCi/L. Cesium-137 was detected in monitor well NWTA3-MW-2 at 6.39 pCi/L. The DOE guideline for drinking water is 120 pCi/L. This is the initial sampling of this well, so no history exists for the Cesium-137 activity.

Uncorrected gross alpha results for samples from SFR-2S, TRE-1, and EOD Hill exceed the MCL of 15 pCi/L. When the results are corrected by subtracting the uranium activity, the results for SFR-2 and TRE-1 are below the MCL. The corrected gross alpha result for the EOD Hill sample exceeds the MCL.

GROSS ALPHA *MCL = 15 pCi/L*			
Well	**Activity**	**Corrected Activity***	**Period**
EOD Hill	87.3 pCi/L	27.6 pCi/L	May 2001
SFR-2S	30.1 pCi/L	6.2 pCi/L	May 2001
TRE-1	27.7 pCi/L	0.9 pCi/L	May 2001

NOTE: *Corrected Activity is minus the activity of uranium isotopes (uranium-234, -235, and –238). pCi/L= picocurie per liter

URANIUM - 234 *DOE Drinking Water Guideline = 20.0 pCi/L*		
Well	**Concentration**	**Period**
EOD Hill	53.1 pCi/L	May 2001
TRE-1	21.1 pCi/L	May 2001

NOTE: pCi/L = picocurie per liter

All groundwater samples were analyzed for uranium-234, -235/236, and -238. The activities for uranium-234 in samples from EOD Hill and TRE-1 exceeded the DOE drinking water guideline of 20 pCi/L. Wells with elevated uranium are located east of the Tijeras fault complex (Figure 7-3) In this region, groundwater contacts bedrock material that contains minerals that are naturally high in uranium. The activity for uranium-234 detected in EOD Hill and TRE-1 is consistent with elevated uranium activities for this well in prior years' groundwater analyses. Although the analysis for isotopic uranium-234 exceeds the DOE drinking water guideline, the total uranium concentration, as noted above, is below the newly promulgated EPA MCL for total uranium of 30 µg/L (40 CFR 141).

7.2.2 ER Project Water Quality Results

CWL
Semi-annual groundwater monitoring for VOCs and total metals (40 CFR 264, Appendix IX) was performed in January and February 2001 and July and August 2001. Samples were collected from 10 monitor wells located at the CWL.

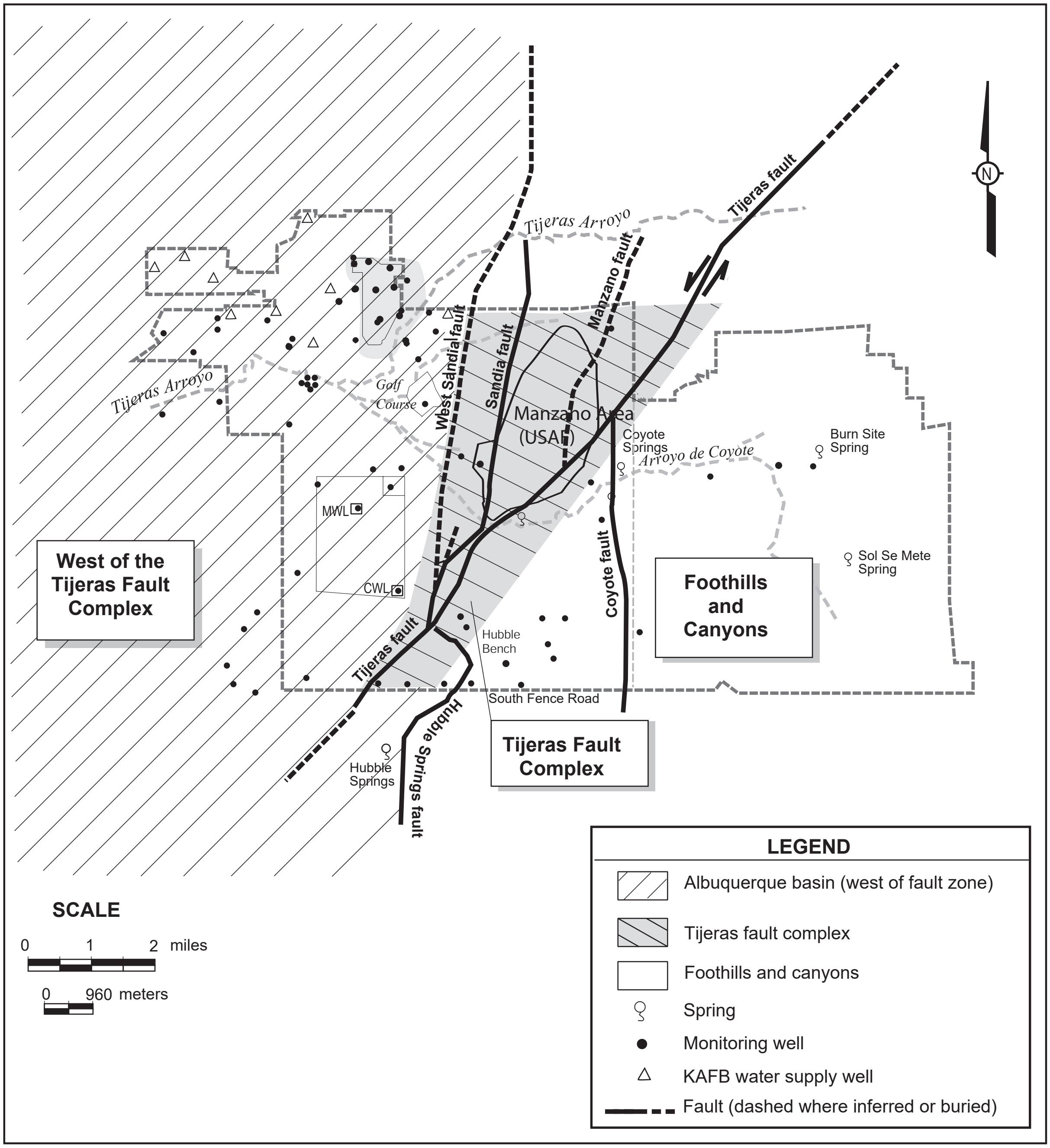
VOCS
VOCs were not detected at concentrations above MCLs or above the laboratory practical quantitation limit (PQL). Three VOCs that were detected above the method detection limit (MDL), but below the laboratory PQLs were TCE and acetone.

Metals
Analyses for the following total metals (unfiltered) were conducted:

- Arsenic
- Beryllium
- Cadmium
- Cobalt
- Iron
- Mercury
- Selenium
- Tin
- Vanadium
- Antimony
- Barium
- Chromium
- Copper
- Lead
- Nickel
- Silver
- Thallium
- Zinc

NOTE: The metals list was compiled from 40 CFR 264 Appendix IX metals, plus iron.

No Appendix IX metals were detected in the samples above established MCLs.



Tijeras fault
Tijeras Arroyo
Manzano fault
West Sandia fault
Sandia fault
Golf Course
Tijeras Arroyo
Manzano Area (USAF)
Coyote Springs
Arroyo de Coyote
Burn Site Spring
MWL
CWL
Sol Se Mete Spring
Coyote fault
West of the Tijeras Fault Complex
Foothills and Canyons
Hubble Bench
Tijeras fault
South Fence Road
Hubble Springs fault
Hubble Springs
Tijeras Fault Complex
N
SCALE
0 1 2 miles
0 960 meters
LEGEND
Albuquerque basin (west of fault zone)
Tijeras fault complex
Foothills and canyons
Spring
Monitoring well
KAFB water supply well
Fault (dashed where inferred or buried)

01_7-3.ai

Perchlorate

During FY 2001, groundwater samples from CWL-MW2A and CWL-MW4 were analyzed for perchlorate. Detected perchlorate levels were below the laboratory PQL. No MCL for perchlorate has been established.

MWL

Annual groundwater samples from the MWL wells were collected in April 2001 and were analyzed for VOCs, NPN (as nitrogen), RCRA metals plus nickel, and radionuclides. Five monitoring wells at the MWL were sampled. Quarterly samples were collected from MWL-MW5 and MWL-MW6 in January, April, and July. Additional sampling was conducted at MWL-BW1 and MWL-MW4 in October and MWL-MW4 was resampled in February.

VOCs

No VOCs were detected above established MCLs. Trace concentrations of toluene were detected in MWL-MW5 in January, in MWL-MW4 in February, in MWL-MW1, MWL-MW2, MWL-MW4, and MWL-BW1 in April. Acetone was detected in MWL-MW2 in April. Trace concentrations of TCE and cis-1,2-dichloroethene were detected in MWL-BW1 in April. Cis-1,2-dichloroethene is a degradation product of TCE. Bis (2-ethylhexyl) phthalate, a plastic additive and common laboratory contaminant, was detected in MWL-MW5 and MWL-MW6 in July. Multiple other polyaromatic compounds were also detected at low concentrations in the July sample from MWL-MW6.

NPN (as nitrogen) and Perchlorate

NPN (as nitrogen) was not detected in concentrations above the MCL of 10 mg/L. No perchlorate was detected in any MWL wells.

Metals

Samples for total metal concentrations were analyzed for the following nine metals:

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Mercury
- Nickel
- Selenium
- Silver

NOTE: The metals list was compiled from the EPA's primary drinking water standards, plus silver.

The sample from MWL-MW1 was analyzed for the full Appendix IX metals list. Total nickel and/ or chromium in the samples from four of the older wells exceeded the background concentration for these metals as determined by the NMED for this site. None of the metal concentrations exceeded EPA drinking water MCLs. The elevated nickel and chromium concentrations are attributed to corrosion of the stainless steel screens installed in the four wells.

Radionuclide Activity

The radiochemical analyses of MWL groundwater samples included:

- Gross alpha & beta
- Gamma spectroscopy
- Tritium
- Strontium-90
- Uranium isotopes

No radionuclides were detected above EPA drinking water standards or DOE guidelines for drinking water. Gamma spectroscopy analyses did not detect any isotopes above associated MDAs, except for short-lived, naturally-occurring radon daughter products. Tritium was not detected above the associated MDAs in any MWL groundwater samples. Strontium-90 was detected at low concentrations in two of the well samples in January and in one sample in April. These detections are characterized as false positives. Ratios of uranium-238 to uranium-235 are consistent with natural equilibrium (balance) and indicate that the uranium is at background concentrations.

Tech Area V

Quarterly groundwater samples were collected from nine wells at TA-V in November 2000 and February, May, and August 2001. The samples collected in November 2000 and February and August 2001 were analyzed for VOCs and NPN (as nitrogen). In May 2001, samples were analyzed for VOCs, metals, alkalinity (as $CaCO_3$), and radionuclides. As requested by NMED, the samples collected during FY 2001 were also analyzed for perchlorate.

VOCs

VOC concentrations exceeding MCLs were not detected in samples from any TA-V wells with the exception of TCE at LWDS-MW1.

LWDS – MW1 TRICHLOROETHENE (TCE) *MCL = 5 µg/L*	
Period	**Concentration**
Nov 2000	23 µg/L
Feb 2001	19 µg/L
May 2001	16 µg/L
Aug 2001	18.4 µg/L

NOTE: µg/L = microgram per liter

Historically, the concentration of TCE has been increasing in this well and recent data suggests that concentrations have leveled off and are no longer increasing.

Non-Metallic Inorganic Chemical Analyses
Inorganic chemical analyses include alkalinity (calcium carbonate), NPN (as nitrogen), ions (bromide, chloride, fluoride, and sulfate), phenolics, and perchlorate.

NPN (as nitrogen) concentrations exceeded the MCL of 10 mg/L in samples from several wells. The groundwater sample from LWDS-MW1 consistently exceeded the MCL. NPN(as nitrogen) concentrations in the well ranged from 11 to 19 mg/L. NPN(as nitrogen) values for wells AVN-1 and AVN-2 exceeded the MCL in three of the four quarters of sampling. The AVN-1 values ranged from 2.8 to 13 mg/L and the ANV-2 values ranged from 4.1 mg/L to 12 mg/L. Perchlorate was detected slightly above the MDL in several wells during each sampling period in FY 2001. Perchlorate results are unreliable at low concentrations with currently available analytical technology. There is no established MCL for perchlorate.

NITRATE (AS NITROGEN) *MCL = 10 mg/L*		
Well	**Concentration**	**Period**
AVN-2	12 mg/L	Nov 2000
LWDS-MW1	19 mg/L	Nov 2000
AVN-1	11 mg/L	Feb 2001
AVN-2	12 mg/L	Feb 2001
LWDS-MW1	19 mg/L	Feb 2001
AVN-1	13 mg/L	May 2001
AVN-2	11mg/L	May 2001
LWDS-MW1	14 mg/L	May 2001
LWDS-MW1	11.2 mg/L	Aug 2001

NOTE: mg/L=millogram per liter

Metals
In May 2001, dissolved metal analyses were conducted on groundwater samples collected from all nine wells in the TA-V monitoring network. The metals analyte list was compiled from the EPA's Appendix IX parameters and from the EPA's primary drinking water standards. None of the 23 metals in the analyte list exceeded established MCLs.

Radionuclide Activity
Gamma spectroscopy and radioisotopic analyses were conducted on all nine wells in May 2001. All radionuclide activities reported by both methods were below MCLs and DOE drinking water guidelines. Radioisotope analyses included radium-226 and -228 and uranium-233/234, -235/236, and -238.

TAG
The TAG Investigation performed quarterly groundwater sampling during January 2001, March 2001, June/July 2001, and September/October 2001. In June 2001, the GWPP sampled three TAG monitor wells in lieu of TAG quarterly sampling.

TAG wells are either screened in the regional aquifer or within a shallow groundwater system zone above the regional aquifer.

As shown in Figure 7-2, samples were collected from 25 wells. Thirteen were shallow groundwater system wells and 12 were regional wells.

Samples were analyzed for VOCs, metals, non-metallic inorganics (alkalinity and anions including nitrate), gross alpha, gross beta, radioisotopic analysis, and gamma spectroscopy.

VOCs
TCE was detected in groundwater samples of one regional well (WY0-1) and two shallow groundwater system wells above the MCL of 5 µg/L.

TRICHLOROETHENE (TCE) *MCL = 5 µg/L*		
Well	**Concentration**	**Period**
SHALLOW GROUNDWATER SYSTEM WELLS		
TA2-W-26	8.5 µg/L	Jan 2001
TA2-W-26 (dup)	8.7 µg/L	Jan 2001
TA2-W-26 (split)	6.57 µg/L	Jan 2001
TA2-W-26	7.0 µg/L	Mar 2001
TA2-W-26	7.3 µg/L	Jun/Jul 2001
TA2-W-26	6.2 µg/L	Sep/Oct 2001
WYO-2	5.9 µg/L	Jan 2001
WYO-2 (dup)	5.5 µg/L	Jan 2001
WYO-2 (split)	5.5 µg/L	Jan 2001
WYO-2	5.3 µg/L	Mar 2001
WYO-2	5.3 µg/L	Jun/Jul 2001
REGIONAL AQUIFER WELLS		
WYO-1	6.0 µg/L	Jan 2001

NOTE: µg/L = microgram per liter

As discussed in Appendix D, TCE concentrations over time vary from slightly increasing to slightly decreasing trends. Occurrence of TCE in Regional Well is discussed in Appendix D.

PCE concentrations above the MCL of 5.0 µg/L were detected in groundwater samples from TA2-W-26 with a maximum PCE concentration of 6.1 µg/L (September/October 2001).

TETRACHLOROETHENE (PCE) *MCL = 5 µg/L*		
Well	**Concentration**	**Period**
SHALLOW GROUNDWATER SYSTEM WELLS		
TA2-W-26	5.2 µg/L	Jun/Jul 2001
TA2-W-26	6.1 µg/L	Sep/Oct 2001

NOTE: µg/L=microgram per liter

Non-metallic Inorganic Chemical Analyses
Inorganic chemical analyses of quarterly groundwater samples consisted of alkalinity and major anions such as bromide, chloride, fluoride, nitrate, and sulfate.

Historically, nitrate has been consistently detected above the MCL of 10 mg/L in wells TA2-SW1-320 and TJA-4. During FY 2001 quarterly sampling events, nitrate exceeded the MCL in five other wells: TA1-W-03, TA2-W-19, TJA-2, TJA-5, and TJA-7. Of these five wells, only TJA-7 has nitrate concentrations that approach or exceed the concentrations seen in TA2-SW1-320 and TJA-4.

NITRATE (AS NITROGEN) *MCL = 10 mg/L*		
Well	**Concentration**	**Period**
SHALLOW GROUNDWATER SYSTEM WELLS		
TA1-W-03	11 mg/L	Jan 2001
TA2-SW1-320	36 mg/L	Jan 2001
TA2-SW1-320	36 mg/L	Mar 2001
TA2-SW1-320	34 mg/L	Jun/Jul 2001
TA2-SW1-320	29 mg/L	Sep/Oct 2001
TA2-W-19	13 mg/L	Jan 2001
TA2-W-19	24 mg/L	Mar 2001
TJA-2	11 mg/L	Jan 2001
TJA-5	12 mg/L	Jan 2001
TJA-5	14 mg/L	Mar 2001
TJA-5 (dup)	12 mg/L	Mar 2001
TJA-7	39 mg/L	Apr 2001
TJA-7	40 mg/L	Jun/Jul 2001
TJA-7 (dup)	40 mg/L	Jun/Jul 2001
TJA-7 (split)	30.5 mg/L	Jun/Jul 2001
TJA-7	41 mg/L	Sep/Oct 2001
REGIONAL AQUIFER WELLS		
TJA-4	33 mg/L	Jan 2001
TJA-4	31 mg/L	Mar 2001
TJA-4	30 mg/L	Jun/Jul 2001
TJA-4	34 mg/L	Sep/Oct 2001

NOTE: mg/L=milligram per liter

All other inorganic analytes were below MCLs, where established.

Metals
Analyses for the following total metals (unfiltered) were conducted:

- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Potassium
- Nickel
- Silver
- Selenium
- Thallium
- Sodium
- Zinc
- Vanadium

NOTE: The metal list was compiled from Appendix IX parameters and metals from the EPA's primary drinking water standards.

Thallium was the only metal detected at well TA2-W-26 in January 2001 above MCL concentrations. The value at this well location has a J qualifier, indicating that it was detected below the PQL. For unknown reasons, this analysis had an abnormally high PQL of 10 µg/L (well above the 2 µg/L MCL). The PQL for all other thallium analyses during this sampling event was 1.7 µg/L.

THALLIUM *MCL = 2 µg/L*		
Well	**Concentration**	**Period**
Shallow Groundwater System Wells		
TA2-W-26	4.22 J µg/L	Jan 2001

NOTE: µg/L=microgram per liter

Radionuclide Activity
No radionuclides were above established NMED-approved background levels, MCLs, or DOE drinking water guidelines. Samples were analyzed for:

- Gross alpha & beta
- Tritium
- Uranium-234, -235, and –238
- Gamma spectroscopy

<u>**Canyons Area**</u>
The LCBS is the only ER site in the Canyons area with groundwater issues. Quarterly sampling at three Canyon monitoring wells were conducted in November 2000 and February, May, and August 2001. The LCBS production well was also sampled

in June 2001. Groundwater samples were analyzed for VOCs, non-metallic inorganics, phenolics, metals, and radionuclides.

Organic Analysis
The contaminants of concern at the LCBS are petroleum products associated with fuels used in burn tests. Sampled parameters included:

- VOCs
- Semi-volatile organic compounds (SVOCs)
- Total extractable petroleum hydrocarbons (TPH) (diesel)
- TPH (gasoline)
- High explosives (HE)
- Total organic carbon (TOC)

Trace levels of VOCs were present in samples collected from CYN-MW1D in three of the four sampling periods. The species of VOCs (ethyl benzene, toluene, and xylene) detected most likely originated from the jet fuel used by the LCBS facility. All components were significantly less than established MCLs. Common laboratory contaminants (acetone and methylene chloride) were also detected. The only VOCs detected in the downgradient well (CYN-MW3) were acetone and methylene chloride. No SVOCs were detected in any of the wells sampled.

Other organics found in groundwater samples at the LCBS included low levels of diesel range organics. No detects for gasoline range organics were reported in any of the monitor wells sampled.

Analysis of water samples from the LCBS production well resulted in low levels of gasoline and diesel range organics. MCLs have not been established for these analytes. The results reported by the laboratory also included the detection of methylene chloride in the LCBS well sample. Since methylene chloride was also present in the trip blank and the laboratory method blank, it is very likely the results are due to laboratory contamination.

Non-metallic Inorganics Chemical Analyses
Groundwater samples were analyzed for major anions, ammonia, total kjeldahl nitrogen, and perchlorate. Nitrate plus nitrite (as nitrogen) exceeded the MCL in samples from CYN-MW1D and CYN-MW3 during all sampling quarters. Only low levels of nitrate were detected in CYN-MW4, which is upgradient of the LCBS facility. Samples collected from the LCBS water well had nitrate values approaching the MCL. Groundwater samples from CYN-MW1D, CYN-MW3, and CYN-MW4 were analyzed for perchlorate. No perchlorate was detected in CYN-MW4. Only one reported value of perchlorate concentration exceeded the reporting limit of 4 µg/L. That was an 8.96 µg/L value reported for CYN-MW1 in November 2000. Currently available perchlorate analyses are unreliable at these very low concentrations.

NITRATE (AS NITROGEN) *MCL = 10 mg/L*		
Well	**Concentration**	**Period**
CYN-MW1D	13.2 mg/L	Nov/Dec 2000
CYN-MW1D	16 mg/L	Feb/Mar 2001
CYN-MW1D	18.2 mg/L	May/Jun 2001
CYN-MW1D	20.7 mg/L	Aug 2001
CYN-MW3	11.9 mg/L	Nov/Dec 2000
CYN-MW3	11.8 mg/L	Feb/Mar 2001
CYN-MW3	14.4 mg/L	May/Jun 2001
CYN-MW3	14.2 mg/L	Aug 2001

NOTE: mg/L=milligram per liter

Metals
Groundwater samples from all wells were analyzed for 23 common metal analytes. The samples were unfiltered and the results are for total metals. No metals were detected above established MCLs.

Radionuclide Activity
Analyses for radionuclides were performed on groundwater samples collected from the monitor wells in November 2000 and February 2001, and on the LCBS supply well sample collected in June 2001. Samples were analyzed for gross alpha, gross beta, gamma-emitting radionuclides and tritium. The LCBS supply well sample yielded a gross alpha value of 18.2 pCi/L, which exceeds the MCL value of 15 pCi/L. This value has not been corrected by subtracting out the uranium activity value, which was not established. From prior groundwater analyses at this location, the natural uranium activity is significant. When the gross alpha value was adjusted by subtracting the natural uranium activity, the resulting gross alpha value would be well below the MCL.

7.3 WATER LEVELS

Water levels are a means to assess the physical changes of the groundwater system over time. This includes changes in the local water table, the quantity of water available, as well as the direction and speed of groundwater movement. The GWPP gathers groundwater level measurements from a large network of wells on and around KAFB. In addition to wells owned by SNL/NM, data is solicited for the U.S. Air Force (USAF) IRP, the

City of Albuquerque, and the USGS wells. In FY 2001, data from 145 wells were incorporated into the monitor well water level database. Water levels were measured monthly or quarterly by each agency in the following number of wells:

Well Owner	# Sampled
ER Project (SNL/NM)	56
GWPP (SNL/NM)	18
KAFB IRP	57
City of Albuquerque	12
USGS	2

7.3.1 Regional Hydrology

Groundwater Conceptual Model

A brief overview of the regional hydrology is given in Chapter 1, section 1.5 of this report. Although water levels may fluctuate over the course of the year in response to seasonal recharge and groundwater withdrawal, the overall level of the regional aquifer within the basin continues to decline at about 1 to 2 ft/yr. Most of the City of Albuquerque and KAFB water supply wells are completed in the coarser-grained layers of the upper and middle units of the Santa Fe Group. The regional aquifer is located within these units of the Santa Fe Group.

Water level information, with respect to the regional water table in the KAFB area, can be categorized into three general areas. These areas are delineated by bounding faults, as shown in Figure 7-3. Groundwater levels east of the Tijeras fault complex are approximately 100 to 150 ft below the surface. The water table west of the Tijeras fault complex and the Sandia fault are approximately 500 ft or more below the surface. The aquifer system on the eastside of the Tijeras fault complex is not well understood due to the complex geology and the limited number of wells available to characterize the system.

Regional Water Table

The Regional Water Elevation Contour map for SNL/KAFB, FY 2001 is presented in Figure 7-4. The extent of the contoured map area was constructed using August and September 2001 static water level data from 56 wells. Generally, these wells are screened across the regional water table in the upper unit of the Santa Fe Group. They penetrate different depths into the aquifer, and have various lengths of screened intervals. Although most of the water level data represent an unconfined water table, some water levels may represent semi-confined aquifer conditions.

The contour lines shown on Figure 7-4 represent lines of equal elevation of the groundwater table. Groundwater flow is perpendicular to these lines in the direction of decreasing elevation. The apparent direction of groundwater flow within the region (west of the Tijeras fault complex) is west and northwest. This contrasts with the southwesterly direction reported in 1961 (Bjorklund and Maxwell 1961). This change in flow direction results from groundwater pumping by KAFB production wells at the northern part of the KAFB and nearby City of Albuquerque production wells. The groundwater withdrawal has created a depression in the water table. This semi-ellipsoidal depression with the major axis running north-to-south, extends south to the Isleta Pueblo, and is a result of preferential flow through highly conductive ancestral Rio Grande fluvial deposits, which are the primary aquifer material in this area.

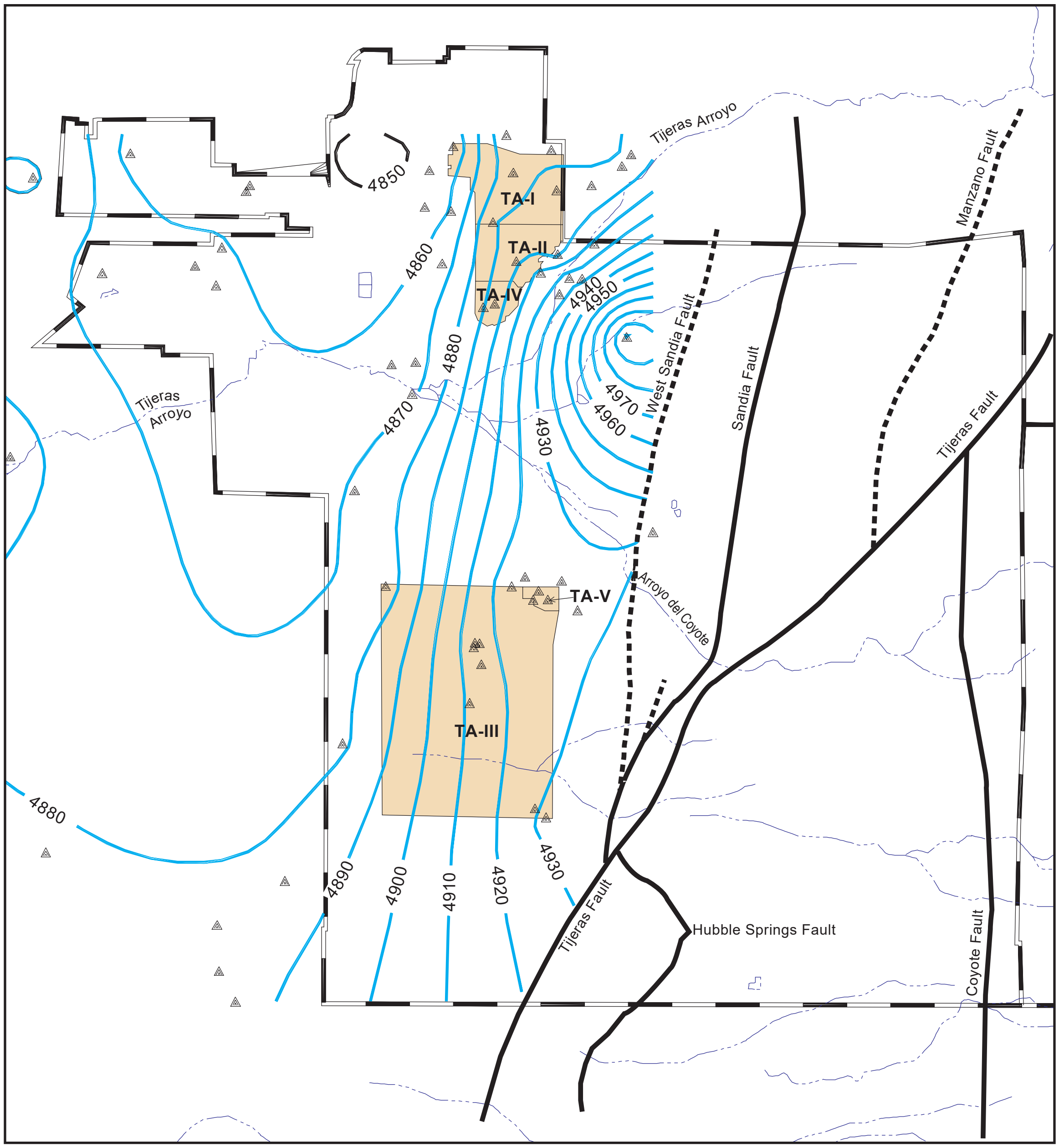
Groundwater Recharge and Loss

The dynamics of water table fluctuations, as reflected by water levels in individual wells, are a balance between groundwater inflow to the basin, recharge, water withdrawal, and basin outflow. Recharge to the groundwater in the Middle Rio Grande basin occurs primarily through mountain front recharge and infiltration from active arroyos, washes, and rivers within the basin.

Recharge potential to the groundwater system is directly related to the amount of precipitation. The regional climate for the Albuquerque basin area is semi-arid. Average precipitation ranges from 8 in./yr near the Rio Grande up to 35 in./yr at the crest of the Sandia Mountains. The majority of rainfall in the Albuquerque area falls during the summer monsoon period from July through September.

Precipitation is measured at two SNL/NM locations: the A36 tower in TA-III and the SCI tower near the Schoolhouse well in the foothills of the Manzanita Mountains. Total precipitation at tower A36 was measured at 6.75 in. for FY 2000 and 4.35 in. for FY 2001. Total precipitation at SC1 was measured at 7.05 in. during FY 2000 and 8.24 in. during FY 2001. Much of the precipitation measured at the SC1 tower fell in the form of snow.

NOTE: Snow is underestimated due to monitor used (it is difficult to determine by how much). In order to estimate precipitation due to snow, the towers would need to be equipped with heated monitors. Annual snowfall in Albuquerque is minimal overall.



Legend

- Well used to construct potentiometric contours
- Kirtland boundary
- 5000 Contoured potentiometric surface, ft amsl
- Drainage
- Fault (dashed where inferred or buried)
- SNL/NM Tech Area

NOTE: amsl = above mean sea level

Regional Water Elevation Map for SNL/KAFB, FY 2001

0 4000 8000
Scale in Feet

0 960 1920
Scale in Meters

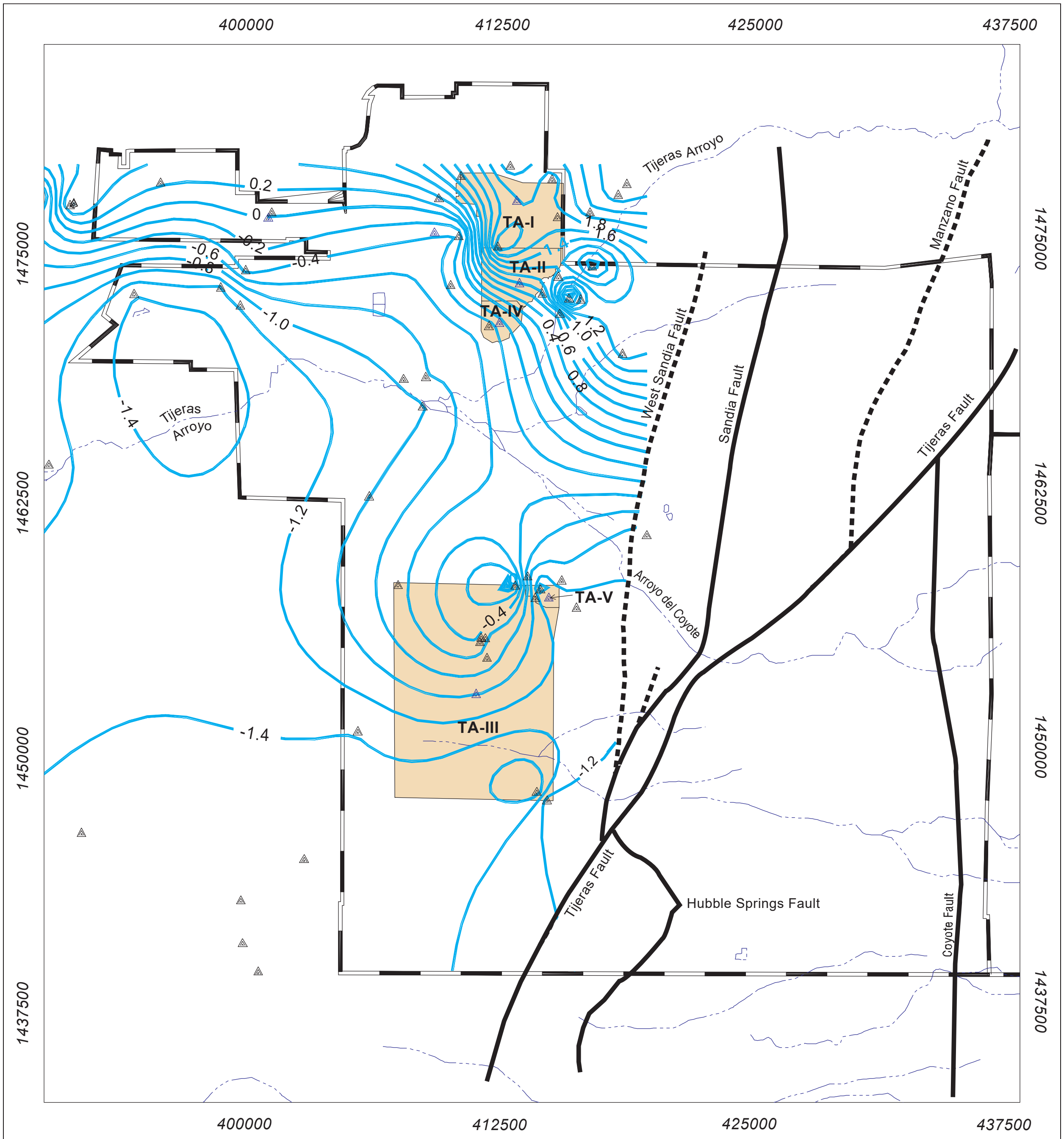
Sandia National Laboratories, New Mexico
Environmental Geographic Information System

The primary water source for SNL/NM and KAFB is pumped from KAFB water supply wells. KAFB production wells extract groundwater from a depth of up to 2,000 ft in the upper and middle unit of the Santa Fe Group, which constitutes the primary aquifer for the Albuquerque Metropolitan Area. In FY 2001, KAFB pumped approximately 1.24 billion gallons (3,808 acre-ft) of groundwater from seven water supply wells. In comparison, 1.38 billion gallons (4,235 acre-ft) of water were pumped for the same period of time in FY 2000. The decrease of water usage is a reflection of increased precipitation in FY 2001.

7.3.2 Groundwater Level Trends

In 1993, the USGS conducted a study on the Santa Fe Group and the Albuquerque area and found that the quantity of water in the aquifer was significantly less than previously estimated (Thorn et al. 1993). The imbalance between recharge and groundwater withdrawal (Figure 7-5) has resulted in a general decline in water levels. Figure 7-5 shows the contour map of the annual water table elevation changes recorded for the western area of KAFB. Annual water level differences in 56 wells were used to construct the map.

As illustrated in Figure 7-5, water levels continue to decline. The most dramatic declines are occurring in the vicinity of McCormick Ranch, where the annual decline is about 1.5 ft/yr. In the eastern portion of the mapped area, including TA-III, water levels show moderate declines. In contrast to the trend of water level declines throughout most of the region, the water levels in the northeast portion of the mapped area are actually rising. In some cases, the increase in water levels is as much as 1.8 ft/yr. This area coincides with a potential recharge area associated with Tijeras Arroyo.



Legend

- Well used to construct water level change contours
- Kirtland boundary
- –1.2– Contoured water table change ft/yr
- Drainage
- Fault (dashed where inferred or buried)
- SNL/NM Tech Area

Annual Water Table Changes - FY 2000 to FY 2001

0 4000 8000
Scale in Feet

0 960 1920
Scale in Meters

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Chapter 8

Quality Assurance

In this Chapter ...

Chapter Summary

Quality Assurance (QA) principals, elements, and tools are an integral part of Sandia National Laboratories, New Mexico (SNL/NM) activities to assure management, customers, regulators, and the community that SNL/NM is conducting business in a compliant manner, with respect for our employees, the community, and the environment. One of the QA principles used by SNL/NM is the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) Integrated Safety Management System (ISMS) to ensure that work is planned, hazards are analyzed and controlled, work is performed according to approved plans, and continuous improvement is performed and communicated. An Environmental Management System (EMS) is in the design process and provides an additional environmental aspect to the ISMS.

Environmental programs utilize QA principles to maintain the integrity of program plans, sampling, and analysis. The Sample Management Office (SMO) helps provide environmental programs with guidance and sample management support. The SMO works to ensure that contractor laboratories provide the quality data and labaroratory analysis through validation of laboratory data packets and by conducting audits of contractor laboratories. QA plans ensure that data validation and records management are a key asset to providing quality environmental data.

Environmental Snapshot

- *The SMO processed 10,991 samples in 2001. Of those, 1,814 samples were for environmental monitoring and surveillance projects.*
- *Quality Control (QC) samples totalled 1,507 in 2001. Of those, 316 were for environmental monitoring and surveillance projects.*

SNL/NM personnel striving to maintain quality assurance throughout the project.

8.1 CORPORATE LEVEL QA

The Integrated Laboratory Management System (ILMS) (SNL 2000) is the overarching management system for performing all work at Sandia Corporation. ILMS provides a uniform, corporate-wide baseline that identifies the principles, strategies, objectives, values, policies, requirements, and processes by which all work is conducted. Specifically, ILMS provides a set of fundamental management principles and elements that represent essential corporate objectives and requirements.

The Sandia Corporate QA Program (QAP) (SNL 2000f), is the mechanism by which Sandia Corporation evaluates quality implementation for compliance with the DOE QA requirements.

Sandia Corporation Quality Policy
Quality is one of Sandia Corporation's five coporate values. Sandia Corporation's strategy is to apply quality principles to work performed at SNL/NM as follows:

- Provide the greatest value to our customers by understanding and meeting their expectations with respect to cost, schedule, and performance,
- Focus on prevention rather than correction,
- Measure our progress using data, and
- Continually strive to improve our skills, processes, products, and services.

QA Criteria
DOE Order 414.1A, *Quality Assurance* (DOE 2001a) lists 10 Quality Criteria that, when effectively implemented, make up a quality program.

Management criteria:
- Program
- Personnel Training and Qualification
- Quality Improvement
- Documents and Records

Performance criteria:
- Work processes
- Design
- Procurement
- Inspection and Acceptance Testing

Assessment criteria:
- Management assessment
- Independent assessment

DOE ISMS
ISMS was developed by the DOE to systematically integrate safety into management and work practices at all levels to ensure that DOE/NNSA-related missions are accomplished while protecting the public, the worker, and the environment. Additional information on the DOE ISMS can be found at the following website:

http://tis.eh.doe.gov/ism/

Before work at SNL/NM can begin, the associated hazards within each program area must be evaluated. Safety standards and requirements are established to the level of hazard protection required (graded approach) to provide adequate assurance that the public, the workers, and the environment will be protected from potentially adverse consequences. A Primary Hazard Screen (PHS) and a Hazard Analyses (HA) are used to document all potential hazards at a facility or for an activity where workers or the environment may be affected.

Sandia Corporation EMS
The EMS is being designed as an enhancement to the environmental aspect of ISMS to ensure quality environmental programs are in place. As stated in Chapter 1 of this report, much work has been completed on identifying gaps with several sets of environmental standards. A fully developed EMS is expected by Calendar Year (CY) 2002 with full implementation by the end of CY 2003.

8.2 ENVIRONMENTAL PROGRAM QA

Environmental Sampling
Environmental samples are collected through various programs and analyzed for radiological and non-radiological contaminants. Some sampling is specifically mandated by regulations to meet compliance while other sampling activities, which are not regulatory driven, are carried out in accordance with DOE Orders. The following sampling activities directly support regulatory compliance:

- ***Wastewater sampling*** is conducted at various permitted outfalls to meet the City of Albuquerque discharge requirements.

- ***Storm water runoff sampling*** is conducted at eight stations to satisfy U.S. Environmental Protection Agency (EPA) requirements.

- ***Environmental Restoration (ER) Project groundwater sampling*** is required by the EPA Resource Conservation and Recovery Act (RCRA) permit requirements.

- ***Waste sampling*** is performed, as necessary, to characterize radioactive and hazardous waste. This satisfies several regulatory requirements including the necessity to meet U.S. Department of Transportation (DOT) regulations before waste can be shipped off-site for disposal.

The following sampling activities are not directly required by law, but are conducted by Sandia Corporation to meet DOE objectives. Data obtained may be used to support related compliance activities:

- ***Terrestrial surveillance*** samples include surface water, sediment, soil, and vegetation.

- ***Groundwater surveillance*** samples are collected on a site-wide basis to assess general groundwater quality at Kirtland Air Force Base (KAFB) in the vicinity of Sandia Corporation activities.

- ***Ambient air surveillance*** sampling is conducted to satisfy DOE Order 5400.1 requirements. Results are compared against Clean Air Act (CAA) standards for criteria pollutants.

- ***Air emission*** sampling from non-radioactive emission sources may be performed periodically on a case-by-case basis to supply data for various modeling exercises.

All samples are tracked, handled, and shipped to off-site laboratories by the SMO as discussed in Section 8.3.

Environmental Program QA Documents
Environmental programs at SNL/NM have developed Program Documents (PGs) and Quality Assurance Project Plans (QAPjPs) that cover the following program areas:

- Program goals
- Program objectives
- Project descriptions
- Roles and responsibilities
- Interfaces

These documents are supplemented with specific procedures and other supporting documents, as necessary. All Sandia Corporation employees and contractors are individually responsible for ensuring that environmentally-related activities performed are carried out in accordance with applicable policies and procedures set forth in the PGs. Specifically, program participants must adhere to the QA protocol within each program area by ensuring the following criteria are met before activities commence: (1) project requirements are defined in program plans and procedures and are adhered to by personnel performing the work, (2) the proper level of training has been completed and project personnel fully understand and are familiar with the work processes, and (3) the qualification of personnel has been verified by project leaders and/or management.

8.3 ENVIRONMENTAL SAMPLING AND ANALYSIS

Environmental Sampling
Environmental sampling is conducted in accordance with program-specific sampling and analysis plans (SAPs) or work plans, each of which contains applicable QA elements. These documents are prepared and implemented in accordance with the *Sample Management Office (SMO) Quality Assurance Plan (QAP)* (SNL 1996a), and meet appropriate federal, state, and local regulatory guidelines for conducting sampling and analysis activities.

SMO Roles and Responsibilities
The SMO provides guidance and sample management support for field activities. However, each distinct program is responsible for its overall adherence and compliance regarding any sampling and analysis activity performed.

Prior to commencement of any field work, project leaders and SMO coordinators confer to ensure that the requirements of the SAPs are established and coordinated with the analytical laboratory. This step ensures that the data quality objectives (DQOs) (i.e., minimum detection limits [MDL]) stated in the SAPs will be achievable by the laboratory before the project begins. An Analysis Request and Chain-of-Custody (ARCOC) form is filled out for each set of samples once the project begins. The SMO assigns a unique control number to each ARCOC and sample. Samples are labeled and documented on the ARCOC and the sample collection log or logbook. The SMO is responsible for QA and QC once the samples are relinquished to the SMO by field team members.

Program-Specific SAPs
Each program involved in environmental monitoring and sampling develops and follows a relevant SAP. Most project SAPs include the following specific elements: (1) descriptions of sampling procedures (mechanics of the process) applicable to each activity–such as sample handling descriptions, preservation, labeling, and event documentation, (2) a list of EPA-approved sample collection equipment, appropriate sample containers, and equipment decontamination procedures, and (3) a field QC sample collection schedule, at defined frequencies, to estimate sample representativeness and potential contamination acquired during the sampling and handling process.

Selection of a Contract Laboratory
All off-site contract laboratories are selected based on an appraisal (pre-award audit) as described in the SMO QAP (SNL 1996a). All laboratories must employ EPA test procedures wherever possible; if not available, other suitable and validated test procedures are used. Laboratory instruments must be calibrated in accordance with established procedures, methods, and statements of work (SOW). All calibrations must be verified before instruments can be used for analysis. Once a laboratory has passed the initial appraisal and has been awarded a contract, an audit is performed annually thereafter by the SMO.

Contract laboratories are required to participate in applicable DOE and EPA programs for blind-audit check sampling to monitor the overall accuracy of analyses routinely performed on SNL/NM samples.

SMO Sample Processing

The SMO processed the following types of samples in 2001 in support of SNL/NM projects:

- *Radioactive waste*
- *Mixed waste*
- *Hazardous waste*
- *Decontamination and Demolition (D&D)*
- *D&D swipes*
- *D&D materials*
- *Underground Storage Tank (UST)*
- *Sludges and liquids*
- *Soil*
- *Groundwater*
- *Decon water*
- *Solid waste*
- *Air*
- *Wastewater effluent*
- *Surface water*
- *Storm water*
- *Soil gas*
- *Air filters*

Project QC
The Project QC process monitors the quality of data generated by each contract laboratory. Various field QC sample methods are used during the sample collection process to assess the quality of the data. Errors that can be introduced into the sampling process include potential sample contamination in the field or the laboratory, some of which are unavoidable. Additionally, the variability present at each sample location can also affect sample results.

QC samples are submitted to contract laboratories in accordance with project-specific DQOs and SAPs. Depending on the type of investigation, one or more of the following QC sampling measures may be performed:

- ***Duplicate samples*** – Two environmental samples are collected from the same area and submitted to the laboratory to assess the overall variability of data associated with a particular sampling location.

- ***Split samples*** – A known homogeneous sample is divided and analyzed to compare accuracy among multiple laboratories.

- ***Field blank samples*** – An unused (blank) sample is taken to measure conditions known to be present and associated with the field location—such as contributions that may be present in the ambient air during soil sampling. Blank samples are used to assess the quality and unavoidable contamination present in the sampling and analyses process.

- ***Equipment blank samples*** – Rinse water is collected off sampling equipment to determine the effectiveness of the decontamination process of field equipment.

- ***Trip blank samples*** – A sample is prepared in the laboratory and carried through the entire sampling process (e.g., a deionized water sample) to identify baseline volatile organic compound (VOC) contaminants that may be present from routine laboratory chemicals or other potential sources of contamination.

- ***Double blind samples*** – A sample with known concentrations of analytes is prepared and submitted to the laboratory to assess the accuracy of laboratory analyses.

Laboratory QC
With each SNL/NM sample batch, laboratory QC samples are concurrently prepared at defined frequencies and analyzed in accordance with established methods. Analytical accuracy, precision, contamination, and matrix effects associated with each analytical measurement are determined.

QC sample results are compared to statistically established control criteria for acceptance. Analytical results generated concurrently with QC sample results within established limits are considered acceptable. If QC analytical results exceed control limits, the results are qualified and corrective action is initiated if warranted. Reanalysis is then performed for samples in the analytical batch as specified in the SOW and laboratory procedures.

QC sample data results are included in analytical reports prepared by contract laboratories for SNL/NM.

8.4 2001 SMO ACTIVITIES

In 2001, the SMO processed a total of 10,991 samples in support of Sandia Corporation projects, including environmental monitoring (air and water), waste characterization, D&D, and ER. Of these, 1,814 were for environmental monitoring and surveillance projects. A total of 1,507 samples were submitted as field and analytical QC samples to assist with data validation and decision-making. Approximately 316 QC samples were for environmental monitoring and surveillance projects.

SMO contract laboratories perform work based on both the Sandia Corporation SOW (Puissant 2001) and the *DOE/AL Model Statement of Work* (DOE 2001d).

Inter-Laboratory Comparisons
SMO contract laboratories are required to participate in the EPA's Environmental Monitoring Systems Laboratory (EMSL) inter-laboratory comparison programs. In 2001, all result expectations were met.

The DOE Assessment Programs include the Mixed Analyte Performance Evaluation Program (MAPEP), the inter-laboratory QAP, and an EPA-approved vendor program with a similar scope as the privatized EPA Water Pollution and Water Supply studies. SMO contract laboratories have a history of achieving a 90 percent or greater success rate during these comparisons. Acceptable results are based on either established control limits as stated in the applicable methods or statistically applied acceptance windows as determined by the MAPEP. Windows are typically two or three standard deviations around the true value.

Laboratory QA
In 2001, the SMO continued on-site data package assessments and validation at the EPA-approved laboratories used by Sandia Corporation. Data packages (including a wide array of analysis methods) are requested at the time of the on-site visit; the laboratories are not notified in advance and do not know which data packages will be assessed. The handling history of the data package is carefully reviewed from sample receipt to data completion by retracing each step through documentation files. Specific checks for documentation completeness, proper equipment calibration, and batch QC data are made. These

assessments focus on data defensibility and regulatory compliance.

During 2001, Sandia Corporation employed the following contract laboratories to perform analysis of SNL/NM samples:

- ***General Engineering Laboratories (GEL)*** - Charleston, South Carolina;
- ***Severn Trent*** - St. Louis, Missouri; Santa Ana, California; and Richland, Washington; and
- ***Southwest Laboratories*** - Broken Arrow, Okahoma.

QA Audits

The SMO conducted audits in 2001 at all three of its contract laboratories using the centralized QA program criteria established by the DOE/NNSA, Albuquerque Operations Office (AL) Analytical Management Program (AMP). The SMO together with the AMP work closely with the contract laboratories to expeditiously resolve audit findings. Decisions regarding sample distribution to the contract laboratories are based on audit findings and unresolved corrective actions. There were no audit findings during 2001.

Data Validation and Records Management

Sample collection, ARCOC documentation, and measurement data were reviewed and validated for each sample collected. Analytical data reported by the laboratories were reviewed to assess laboratory and field precision, accuracy, completeness, representativeness, and comparability with respect to method compliance and the DQOs of the particular program. Data were reviewed and validated at a minimum of three levels:

- By the analytical laboratory, where the data were validated according to the laboratory's QA plan, standard operating procedures, and client specific requirements;
- By a qualified member of Sandia Corporation's SMO staff, who reviewed the analytical reports and corresponding sample collection and ARCOC documentation for completeness and laboratory contract compliance; and
- By the Sandia Corporation Project Leader responsible for program objectives, regulatory compliance, and project-specific data quality requirements. The Project Leader determines the decision of data usability.

In addition, a pre-determined percentage of data are validated to the methods in accordance with the *SNL/ER Data Validation Procedure for Chemical and Radiochemical Data* (SNL 2000b).

Chapter 9

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- Clean Air Act (CAA) and CAA Amendments (CAAA) of 1990 (42 U.S.C. §7401)
- Clean Water Act (CWA) of 1977 (the Federal Water Pollution Control Act) (33 U.S.C. §1251)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. §9601) Amended by the Superfund Amendments and Reauthorization Act (SARA)
- Emergency Planning and Community Right to Know Act (EPCRA) of 1986 (42 U.S.C. §11001 et seq.) (Also known as SARA Title III.)
- Endangered Species Act (ESA) (16 U.S.C.§1531 et seq.)
- Federal Facility Compliance Act (FFCA) of 1992 (42 U.S.C. §6961)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. §136)
- Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. §703 et seq.)
- National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61)
- National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. §4321)
- National Historic Preservation Act of 1966 (16 U.S.C. §470)
- Pollution Prevention Act of 1990 (42 U.S.C. §13101 et seq.)
- Quiet Communities Act of 1978 (42 U.S.C. §4901 et seq.)
- Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C. §6901 et seq.)
- Safe Drinking Water Act (SDWA) (42 U.S.C §300f)
- Superfund Amendments and Reauthorization Act (SARA) of 1986 (see CERCLA)
- Toxic Substances Control Act (TSCA) of 1976 (15 U.S.C. §2601 et seq.)

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NOTE: U.S.C = United States Code

IMPORTANT ENVIRONMENTAL PROGRAM DOCUMENTS

Air Quality

Meteorological Monitoring Program

- *Quality Assurance Project Plan (QAPjP) Meteorological and Ambient Air Monitoring Program* (SNL 1997i)

Ambient Air Surveillance Program

- *Quality Assurance Project Plan (QAPjP) Meteorological and Ambient Air Monitoring Program* (SNL 1997i)

NESHAP Program

- (1) *NESHAP Annual Report for CY01, SNL/NM* (SNL 2002d)
- (2) *Radiological Dose Calculations and Supplemental Dose Assessment Data for NESHAP Compliance, SNL/NM, 2001* (SNL 2002e)
- *Radiological NESHAP Quality Assurance Project Plan (QAPjP*) (SNL 1997f)

Air Quality Compliance Program

- Title V Operating Permit Application # 515 (1998 update; Volume 1for Sandia National Laboratories) (DOE 1998)
- *Air Quality* (SNL 1999g)
- *Chemical Purchase Inventory Report, Calendar Year 2001* (SNL/URS Corporation 2002)
- *Corporate Ozone-Depleting Substances Management Program* (SNL 1997g)
- Section 17B, “Air Permits in Bernalillo County,” *ES&H Manual* (SNL 1997l)
- Section 17C, “Air Emissions Control Measures,” *ES&H Manual* (SNL 1997e)
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Water Quality

All Water Quality Programs

- *Water Quality* (SNL 1997j)
- Section 10E, "Chemical Spills," *ES&H Manual* (SNL 1997a)
- *Sandia National Laboratories, New Mexico Emergency Plan, ES&H Manual Supplement* (SNL 2002j)

Wastewater Program

- Section 10H, "Discharges to the Sanitary Sewer System," *ES&H Manual* (SNL 1997)
- *SNL/NM Wastewater Sampling and Analysis Plan (*SNL 1996)

Surface Discharge Program

- *Discharge Plan Renewal Application, DP-530, SNL/NM* (SNL 2001h)
- Section 10T, "Surface and Storm Water Discharges," *ES&H Manual* (SNL 1997h)
- Section 10F, "Oils, Greases, and Fuels," *ES&H Manual* (SNL 1997c)

Storm Water Program

- *Storm Water Pollution Prevention Plan (SWP3)* (SNL 2001d)
- Section 10T, "Surface and Storm Water Discharges," *ES&H Manual* (SNL 1997h)
- *Storm Water and Non-Storm Water Discharge Sampling and Analysis Project Plan for SNL/NM* (SNL 1996c)

Groundwater Protection Program (GWPP)

- *Annual Groundwater Monitoring Report (Fiscal Year 2001) for Sandia National Laboratories/ New Mexico* (SNL 2002f)

NEPA Program

- *The National Environmental Policy Act (NEPA), Cultural Resources and Sensitive Species Programs (PG 470110, Issue D)* (SNL 2002i)
- *Sandia National Laboratories Final Site-Wide Environmental Impact Statement (SWEIS)* (DOE 1999)
- *Environmental Assessment(EA) Rapid Reactivation Project* (DOE 1999b)
- *Sandia National Laboratories/New Mexico Facilities and Safety Information Document (FSID)* (SNL 1999a)
- *Sandia National Laboratories/New Mexico Environmental Information Document (EID*) (SNL 1999b)
- Section 10B, "NEPA, Sensitive Species, and Historic Properties," *ES&H Manual* (SNL 2002k)
- *Quality Assurance Project Plan (QAPjP) for the Preparation of Environmental Assessments at Sandia National Laboratories, New Mexico* (SNL 2002m)
- *SWEIS Annual Review- FY 2000* (SNL 2001i)
- *Fiscal Year 2000 Update: Facilities and Safety Information Document and Environmental Information Document* (SNL 2000h)

Various Other Environmental Programs

Biological Control Activity

- Section 6K, "Hazardous Waste Operations and Emergency Response (HAZWOPER)," *ES&H Manual* (SNL 1998b)
- Section 6D, "Hazard Communication Standard," *ES&H Manual* (SNL 2002l)

Oil Storage and Spill Containment

Oil Storage Programs

- *Sandia National Laboratories Spill Prevention Control and Countermeasures (SPCC) Plan* (SNL 1999f)
- Section 10K, "Underground Storage Tanks," *ES&H Manual* (SNL 1997d)
- Section 10F, "Oils, Greases, and Fuels," *ES&H Manual* (SNL 1997c)

Terrestrial Surveillance

- *The Role of Data Analysis in Sampling Design of Environmental Monitoring* (Shyr, Herrera, Haaker 1998)
- *Environmental Monitoring and Surveillance Program* (SNL 2000i)
- *Environmental ALARA Program* (SNL 1996b)
- *Quality Assurance Project Plan (QAPjP) for Terrestrial Surveillance at SNL/NM* (SNL 1998a)
- *2001 Data Analysis in Support of the Annual Site Environmental Report* (SNL 2002c)
- *Environmental Monitoring Plan* (SNL 2000e)
- *Ecological Monitoring for 2000: Small Mammals, Birds, and Vegetation* (SNL 2000j)

Quality Assurance

Sample Management Office (SMO)
- *DOE/AL Model Statement of Work* (DOE 2001d)
- *Sample Management Office (SMO) Quality Assurance Plan (QAP)* (SNL 1996a)

Waste Management

All Waste Management Programs
- *Storm Water Pollution Prevention Plan (SWP3)* (SNL 2001d)
- *Programmatic Waste Acceptance Criteria (*SNL 2001a)
- *Waste Management* (SNL 1999d)
- *Waste Characterization Project Overview (*SNL 2002g)

ER Project
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Hazardous Waste Management Program
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Solid Waste Program
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Radioactive Waste Management Program
- *Site Treatment Plan for Mixed Waste, Sandia National Laboratories/New Mexico,* Revision 5 (SNL 2001f)
- Section 19B, "Radioactive Waste Management," *ES&H Manual* (SNL 2001e)
- *Radioactive Waste/Nuclear Materials Disposition Department (RWNMDD) Waste Management Program* (SNL 2001c)
- *Site Treatment Plan for Mixed Waste, Sandia National Laboratories, New Mexico,* Revision 5 (SNL 2001f)
- *Manzano Nuclear Facilities Maintenance Support Program* (SNL 2001)
- Section 19D, "Radioactive Material Management Areas (RMMAs)," *ES&H Manual* (SNL 1998)
- Section 19C, "Mixed Waste Management," *ES&H Manual* (SNL 2001g)
- Section 19E, "Treatability Studies for Hazardous and Mixed Waste," *ES&H Manual* (SNL 1997b)

TSCA Waste
- Section 6S, "Toxic Substances Control Act (TSCA)," *ES&H Manual* (SNL 1997k)

APPENDIX A

2001 Annual Site Environmental Report
for the
Kauai Test Facility (KTF)

Operated by
Sandia Corporation

ACKNOWLEDGEMENTS

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Kauai Test Facility

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Acronyms and Abbreviations

AIRFA	American Indian Religious Freedom Act
AL	Albuquerque Operations Office
ARPA	Archeological Resources Protection Act
ASER	Annual Site Environmental Report
BMDO	Ballistic Missile Defense Organization
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
EA	Environmental Assessment
EHS	Extremely Hazardous Substance
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ER	Environmental Restoration
ESA	Endangered Species Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FFCA	Federal Facility Compliance Act
FONSI	finding of no significant impact
FTU	Flight Test Unit
HAR	Hawaii Administrative Rules
KTF	Kauai Test Facility
MBTA	Migratory Bird Treaty Act
MSDS	Material Safety Data Sheet
MW	mixed waste
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFA	No Further Action
NHPA	National Historic Preservation Act
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
N/R	Not required
NSPS	New Source Performance Standards
NSP	Non-covered Source Permit
OKSO	Office of Kirtland Site Operations
PCB	polychlorinated biphenyl
PMRF	Pacific Missile Range Facility
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RQ	Reportable Quantity
SARA	Superfund Amendments and Reauthorization Act
SDI	Strategic Defense Initiative
SDWA	Safe Drinking Water Act
SNL/KTF	Sandia National Laboratories, Kauai Test Facility (under Sandia Corporation's control)
SNL/NM	Sandia National Laboratories, New Mexico
SPCC	Spill Prevention Control and Countermeasures (Plan)
STARS	Strategic Targeting System
TRI	Toxic Release Inventory
TSCA	Toxic Substances Control Act
UST	underground storage tank

Night Launch of a STARS Rocket

The Kauai Test Facility (KTF) is operated by Sandia Corporation as a rocket preparation, launching, and tracking facility for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA), as well as in support of other U.S. military agencies. Sandia National Laboratories, Kauai Test Facility (SNL/KTF) refers to the facilities at KTF under Sandia Corporation's Management. The DOE/NNSA oversees operation of SNL/KTF through the Office of Kirtland Site Operations (OKSO), which reports to the Albuquerque Operations Office (AL). SNL/KTF exists as a facility within the boundaries of the U.S. Department of Defense (DoD) Pacific Missile Range Facility (PMRF). SNL/KTF is located on the island of Kauai at the north end of the PMRF, near Nohili Point (Figure A-1). This Annual Site Environmental Report (ASER) summarizes data and the compliance status of the environmental protection and monitoring programs at SNL/KTF through December 31, 2001. This report was prepared in accordance with DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990) and DOE Order 231.1, *Environment, Safety, and Health Reporting* (DOE 1996).

A.1 FACILITIES AND OPERATIONS

SNL/KTF has been an active rocket-launching facility since 1962. The KTF and Range Interfaces Department under Sandia National Laboratories/New Mexico (SNL/NM) manages and conducts the rocket-launching activities at SNL/KTF. The site is primarily used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering re-entry vehicles, scientific studies of atmospheric and exoatmospheric phenomena, and Ballistic Missile Defense Organization (BMDO) programs. Nuclear devices have never been launched from SNL/KTF, nor have radiological materials been used at SNL/KTF.

The first facilities at KTF were constructed in the early 1960s to support the National Readiness Program. The most recent construction, completed in 1994, added four buildings to support DOE and Strategic Defense Initiative (SDI) launches. From 1992 to 2001, there have been 14 launches.

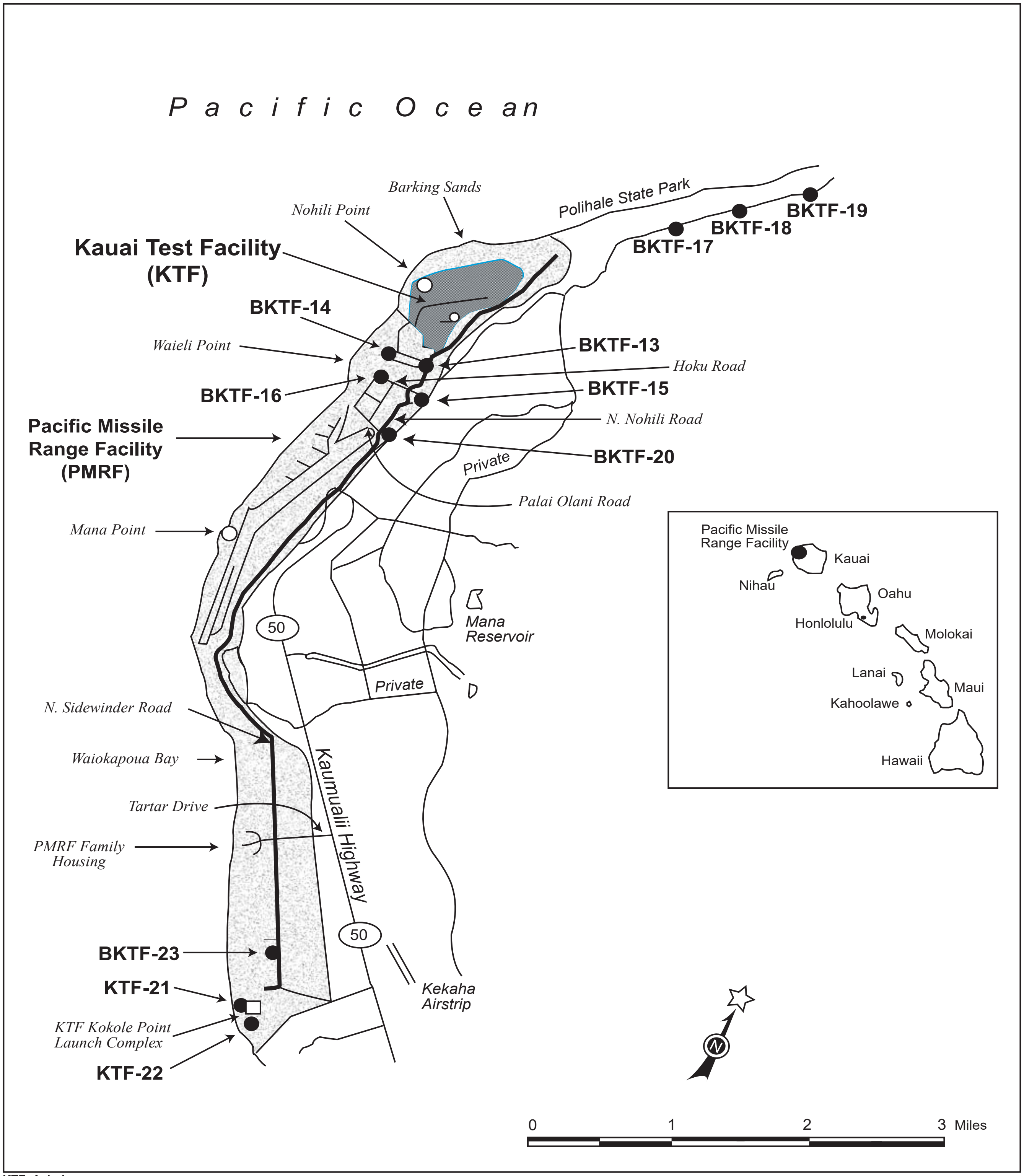
The KTF launcher field was originally designed to accommodate 40 launch pads, but only 15 pads were constructed. Of these, 11 have had their launchers removed. Beyond the implementation of portions of the original plan, two additional launch pads were constructed: Pad 41 at Kokole Point, and Pad 42,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

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

A.2 2001 ROCKET LAUNCHES

There was one rocket launched from SNL/KTF in 2001. This launch was covered by the KTF Environmental Assessment (EA), published in July 1992 (DOE 1992).

- **Navy Theatre Wide FTR-1A Target Test Vehicle TTV-2)-** The TTV-2 launch occurred on January 25, 2001.



KTF_A-1.ai

FIGURE A-1. Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area
The Kauai Test Facility (KTF) is to the north, near Nohi li Point

This system uses a single stage M56 (Second stage of the Minute Man I System) rocket motor. The rocket was employed as a surrogate target in support of the Navy's Theater Ballistic Missile Defense Program.

A.3 DEMOGRAPHICS

There are 13 permanent on-site personnel at SNL/KTF. During operational periods when rocket launches occur, an additional 15 to 130 persons from the U.S. mainland are brought to SNL/KTF (DOE 1992). The closest population center to SNL/KTF is the town of Kekaha (population 3,300), which is eight miles from the site.

A.4 COMPLIANCE SUMMARY

The list of statutes on page A-4 provides an overview of compliance status for Sandia Corporation's operations at SNL/KTF in 2001. Table A-1 lists the applicable permits in place at SNL/KTF.

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

Background – In 1995, a site inspection was performed at SNL/KTF to determine compliance with CERCLA requirements. Three ER sites were identified at that time. Based on the site inspection report (SNL 1995), the U.S. Environmental Protection Agency (EPA) informed the DOE/NNSA/AL on September 30, 1996 that a No Further Action (NFA) determination had been made. This confirmed that SNL/KTF met all CERCLA requirements and no additional sampling or remediation would be necessary at the three areas.

EPA designated ongoing oversight of SNL/KTF to the Hawaii Department of Health Hazard Evaluation and Emergency Response Office. The EPA recommended continued reevaluation for environmental contamination due to the launching facility present. Rocket exhaust continues to be the main source of metals and other hazardous air emission releases.

Superfund Amendments and Reauthorization Act (SARA)
SARA Title III requires chemical inventory information and threshold quantity reporting as directed by the Emergency Planning and Community Right-to-Know Act (EPCRA), Sections 311 and 312. All required information has been submitted to the State of Hawaii. Table A-2 lists SARA Title III reporting requirements.

TABLE A-1. Permits in Place at SNL/KTF

Type	Permit Number	Date Issued	Expiration Date	Regulatory Agency
Non-covered Source Permit (NSP) (two stand-by diesel generators)	0429-01-N	Sep 15, 1998	Sep 1, 2003	State of Hawaii
Resource Conservation and Recovery Act (RCRA)	HI-0000-363309	Sep 23, 1994	Not specified	EPA Region IX and Hawaii Dept. of Health
RCRA	HIP-0000-45104	Oct 20, 1998	One time only - Oct 28, 1998	EPA Region IX and Hawaii Dept. of Health
Diesel Generators (air emission)	NSP-0429-01-N	Oct 25, 1993 Re-issued Sep 15, 1998	Sep 2003	State of Hawaii

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

Major Environmental Regulations & Statutes Applicable to SNL/KTF

Clean Air Act (CAA) and CAA Amendments (CAAA)
Provides standards to protect the nation's air quality

Clean Water Act (CWA)
Provides general water quality standards to protect the nation's water sources and byways

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances.

Cultural resources acts
Includes various acts that protect archeological, historical, and religious sites and resources

Endangered Species Act (ESA)
Provides special protection status for federally-listed endangered and threatened species

Executive Orders (EOs)
Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and greening the government through leadership in environmental management

Federal Facility Compliance Act (FFCA)
Directs federal agencies in the management of mixed waste

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
Controls the distribution and use of various pesticides

Migratory Bird Treaty Act (MBTA) of 1918
Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests

National Emission Standards for Hazardous Air Pollutants (NESHAP)
Specifies standards for radionuclide air emissions and other hazardous air releases

National Environmental Policy Act (NEPA)
Ensures that federal agencies review all proposed activities and include environmental consideration in agency decision-making

Resource, Conservation, and Recovery Act (RCRA)
Mandates the management of listed hazardous waste and hazardous materials

Safe Drinking Water Act (SDWA)
Provides specific standards for sources used for drinking water

Superfund Amendments and Reauthorization Act (SARA)
SARA,Title III, known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community

Toxic Substance Control Act (TSCA)
Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs)

TABLE A-2. 2001 SARA Title III (or EPCRA) Reporting Requirements Applicable to SNL/KTF

Section	SARA Title III Section Title	Requires Reporting?		Description
		Yes	No	
302 - 303	Notification/ Plans	✓		Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/OKSO, which distributes it to the required entities.
304	Emergency Notification		✓	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2001.
311-312	MSDSs/ Chemical Purchase Inventory Report	✓		There are two "Community Right-to-Know" reporting requirements: (a) SNL/KTF completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) SNL/KTF provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA's alternative MSDS reporting, which is detailed in 40 CFR Part 370.21.
313	Toxic Chemical Release Forms		✓	Sandia Corporation is below the reporting threshold in 2001 for producing a TRI Report for SNL/KTF operations.

NOTE: MSDS = Material Safety Data Sheets (gives relevant chemical information)
N/R = not required
EHS = extremely hazardous substance
RQ = reportable quantity
SNL/KTF = Sandia National Laboratories, Kauai Test Facility
DOE/NNSA/OKSO = U.S. Department of Energy, National Nuclear Security Administration, Office of Kirtland Site Operations
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
MSDS = Material Safety Data Sheet

Resource Conservation and Recovery Act (RCRA)
In 1994, SNL/KTF reached "small quantity hazardous waste generator" status as defined by RCRA, and therefore, obtained an EPA Identification Number. However, the volume of waste generated in 2001 qualified SNL/KTF to maintain "conditionally exempt small quantity generator" status.

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

National Environmental Policy Act (NEPA)
NEPA requires federal agencies and private entities that perform federally-sponsored projects, including DOE, to analyze potential impacts to the environment during the early planning of proposed actions. If the proposed action is determined to be environmentally "significant," the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before an irretrievable commitment of resources or funding occurs. Although a major objective of

NEPA is to preserve the environment for future generations, the law does require an agency to select the proposed action alternative with the least environmental impacts. One of the major intents of the law is to ensure that federal agencies are aware of the potential environmental impacts associated with their operations and are able to make informed decisions based on this information. NEPA also mandates that the decision process be open for public review.

Acts and Executive Orders (EOs) related to NEPA compliance include the cultural resources acts, which are discussed in the following paragraphs. The Endangered Species Act (ESA) is a stand-alone regulation, which Sandia Corporation includes within NEPA compliance.

The DOE/NNSA/OKSO coordinates NEPA compliance at SNL/KTF with SNL/NM.

In accordance with NEPA, a comprehensive Site-wide Environmental Assessment (EA) was completed for SNL/KTF in 1992 (DOE 1992), which resulted in a Finding of No Significant Impact (FONSI), issued on July 17, 1992. This EA is the current NEPA document covering all rocket-launching activities at SNL/KTF. Additionally, an Environmental Impact Statement (EIS) specific to the STARS Program is in place for rocket launches of this type (DoD 1998).

Prior to Sandia Corporation beginning any proposed action that may potentially affect sensitive species or habitats, a NEPA Checklist is submitted to DOE/NNSA/OKSO for a determination. As it is applicable, DOE/NNSA/OKSO must consult with the following agencies:

- U.S. Fish and Wildlife Service
- State of Hawaii Department of Land and Natural Resources

In 2001, SNL/NM NEPA staff completed three NEPA compliance reviews for proposed actions at SNL/KTF. One review referenced existing NEPA documentation for KTF and two were sent to DOE/NNSA/OKSO for review and determination.

Endangered Species Act (ESA)

ESA applies to both private individuals and federal agencies (Section 7 of ESA specifically applies to federal agencies). At SNL/KTF, ESA compliance is coordinated with NEPA compliance. The law ensures that any action authorized, funded, or carried out by a federal agency will not jeopardize the continued existence of a “threatened or endangered species,” or result in adverse modifications to its habitat. Table A-3 lists all threatened and endangered state and federal listed species occurring on the island of Kauai.

Surveys Completed in Support of the KTF Environmental Assessment (EA)

- ***Green Sea Turtle Survey Report*** – This survey found at least 32 green sea turtles (*Chelonia mydas agassizi*) in five locations at KTF. The study concluded that constructing an additional launch pad and conducting further launches, similar to those conducted at SNL/KTF since 1962, most likely will not have any quantifiable negative effects on green sea turtles inhabiting waters near SNL/KTF (IT 1990a).

- ***Botanical Survey Report*** – This survey identified four major vegetation types at SNL/KTF and recommended that vehicles be kept off the beaches and dunes. The report recommended moving the entire *Ophioglossum concinnum* colony (a Category 1 proposed endangered fern) to a compatible area within PMRF because of the colony's proximity to a beach access road and its location in a frequently-mowed kiawe/koahaole vegetation zone (IT 1990b). *Note*: Category 1 is a species for which biologic vulnerability exists to the point of support of proposal to list as endangered or threatened.

- ***Ornithological and Mammal Survey Report*** – This survey determined relative population densities of bird species and identified mammalian species at SNL/KTF. Based on mitigations implemented and other commitments made in the KTF EA, no adverse impacts are expected for birds or mammals as a result of Sandia Corporation's operations (IT 1990c).

- ***Soil Sampling Report*** – Sampling was undertaken to delineate the extent and concentration of lead, aluminum, and beryllium in the soil at SNL/KTF and to determine whether the concentrations pose a risk to human health or the environment. The soil sampling results were used to estimate the potential for future soil contamination or human exposure from use of SNL/KTF as a launch facility (IT 1990d).

- ***Archaeological Survey and Sampling*** – No significant cultural resources were found at the surface level on SNL/KTF, during this study. However, subsurface testing at one area indicated a potential for buried cultural resource materials (ASI 1990).

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

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

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

Migratory Bird Treaty Act (MBTA)
In addition to the special consideration afforded to species listed as threatened and endangered, most birds are protected under the MBTA of 1918, as amended. At SNL/KTF, construction sites are surveyed prior to digging or earth movement to avoid possible impacts to nesting birds.

Environmental Compliance Executive Orders (EOs)
The four primary EOs related to environmental compliance at SNL/KTF are as follows:

- EO 11990, *Protection of Wetlands,* as amended

- EO 11988, *Floodplain Management*, as amended

- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* as amended

- EO 13148, *Greening the Government Through Leadership in Environmental Management*

Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990
Ambient air quality is regulated by Hawaii Administrative Rules (HAR), Title 11, Chapter 59 under the jurisdiction of the Hawaii Department of Health, Clean Air Branch. Currently, there are no facilities at SNL/KTF that require air permits or compliance with the New Source Performance Standards (NSPS), "Prevention of Significant Deterioration (PSD)," or 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants" (NESHAP). Within the boundaries of PMRF, no federal air emission permits are held either by DOE for SNL/KTF, or by DoD for PMRF. However, the two electrical generators at SNL/KTF are permitted for operation by the State of Hawaii under a "Non-covered Source Permit" (NSP) (Hawaii Department of Health 1998).

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

Species		Federal Status	State of Hawaii Status
PLANTS			
Liliwai	*Acaena exigua*	Endangered	Endangered
No common name	*Achyranthes mutica*	Endangered	Endangered
Pendant kihi fern	*Adenophorus periens*	Endangered	Endangered
Mahoe	*Alectryon macrococcus var. macrococcus*	Endangered	Endangered
Kuawawaenohu	*Alsinidendron lychnoides*	Endangered	Endangered
No common name	*Alsinidendron viscosum*	Endangered	Endangered
No common name	*Bonamia menziesii*	Endangered	Endangered
Uhiuhi	*Caesalpinia kavaiensis*	Endangered	Endangered
'Awiwi	*Centaurium sebaeoides*	Endangered	Endangered
'Akoko	*Chamaesyce halemanui*	Endangered	Endangered
Pauoa	*Ctenitis squamigera*	Endangered	Endangered
Haha	*Cyanea asarifolia*	Endangered	Endangered
Haha	*Cyanea recta*	Threatened	Threatened
Haha	*Cyanea remyi*	Endangered	Endangered
Haha	*Cyanea undulata*	Endangered	Endangered
Pu'uka'a	*Cyperus trachysanthos*	Endangered	Endangered
Ha'iwale	*Cyrtandra limahuliensis*	Threatened	Threatened
No common name	*Delissea rhytidosperma*	Endangered	Endangered
'Oha	*Delissea rivularis*	Endangered	Endangered
No common name	*Delissea undulata ssp. kauaiensis*	Endangered	Endangered
Asplenium leaved diella	*Diellia erecta*	Endangered	Endangered
No common name	*Diellia pallida (proposed as D. laciniata)*	Endangered	Endangered
No common name	*Diplazium molokaiense*	Endangered	Endangered
Kahalapehu	*Dubautia pauciflorula*	Endangered	Endangered
'Akoko	*Euphorbia haeleeleana*	Endangered	Endangered
Heau	*Exocarpos luteolus*	Endangered	Endangered
Mehamehame	*Flueggea neowawraea*	Endangered	Endangered
No common name	*Gouania meyenii*	Endangered	Endangered
No common name	*Haplostachys haplostachya*	Endangered	Endangered
'Awiwi	*Hedyotis cookiana*	Endangered	Endangered
Na Pali beach hedyotis	*Hedyotis st.-johnii*	Endangered	Endangered
No common name	*Hesperomannia lydgatei*	Endangered	Endangered
Hau kuahiwi	*Hibiscadelphus distans*	Endangered	Endangered
Hau kuahiwi	*Hibiscadelphus woodii*	Endangered	Endangered
Ma'o hau hele	*Hibiscus brackenridgei ssp. mokuleianus*	Endangered	Endangered
Koki'o 'ula'ula; aloalo	*Hibiscus clayi*	Endangered	Endangered
Koki'o ke'oke'o	*Hibiscus waimeae ssp. hannerae*	Endangered	Endangered
Hilo ischaemum	*Ischaemum byrone*	Endangered	Endangered
Aupaka	*Isodendrion laurifolium*	Endangered	Endangered
Aupaka	*Isodendrion longifolium*	Threatened	Threatened

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

Species		Federal Status	State of Hawaii Status
PLANTS *(continued)*			
Koki'o	*Kokia kauaiensis*	Endangered	Endangered
Kamakahala	*Labordia lydgatei*	Endangered	Endangered
Kamakahala	*Labordia tinifolia var. wahiawaensis*	Endangered	Endangered
Nehe	*Lipochaeta fauriei*	Endangered	Endangered
Nehe	*Lipochaeta micrantha var. exigua*	Endangered	Endangered
Nehe	*Lipochaeta micrantha var. micrantha*	Endangered	Endangered
Nehe	*Lipochaeta waimeaensis*	Endangered	Endangered
No common name	*Lobelia niihauensis*	Endangered	Endangered
No common name	*Lysimachia filifolia*	Endangered	Endangered
No common name	*Mariscus pennatiformis ssp. pennatiformis*	Endangered	Endangered
Alani	*Melicope haupuensis*	Endangered	Endangered
Alani	*Melicope knudsenii*	Endangered	Endangered
Alani	*Melicope pallida*	Endangered	Endangered
Alani	*Melicope quadrangularis*	Endangered	Endangered
No common name	*Munroidendron racemosum*	Endangered	Endangered
Kolea	*Myrsine linearifolia*	Threatened	Threatened
'Aiea	*Nothocestrum peltatum*	Endangered	Endangered
Lau 'ehu	*Panicum niihauense*	Endangered	Endangered
Makou	*Peucedanum sandwicense*	Threatened	Threatened
Wawae'iole	*Phlegmariurus mannii (listed as Huperzia mannii)*	Endangered	Endangered
Wawae'iole	*Phlegmariurus nutans (listed as Lycopodium nutans)*	Endangered	Endangered
No common name	*Phyllostegia knudsenii*	Endangered	Endangered
No common name	*Phyllostegia waimeae*	Endangered	Endangered
No common name	*Phyllostegia wawrana*	Endangered	Endangered
Ale	*Plantago princeps var. anomala*	Endangered	Endangered
Ale	*Plantago princeps var. longibracteata*	Endangered	Endangered
No common name	*Platanthera holochila*	Endangered	Endangered
Mann's bluegrass	*Poa mannii*	Endangered	Endangered
Hawaiian bluegrass	*Poa sandvicensis*	Endangered	Endangered
No common name	*Poa siphonoglossa*	Endangered	Endangered
Loulu	*Pritchardia napaliensis*	Endangered	Endangered
Loulu	*Pritchardia viscosa*	Endangered	Endangered
Kaulu	*Pteralyxia kauaiensis*	Endangered	Endangered
No common name	*Remya kauaiensis*	Endangered	Endangered
No common name	*Remya montgomeryi*	Endangered	Endangered
Dwarf naupaka	*Scaevola coriacea*	Endangered	Endangered
Ma'oli'oli	*Schiedea apokremnos*	Endangered	Endangered
No common name	*Schiedea helleri*	Endangered	Endangered
No common name	*Schiedea kauaiensis*	Endangered	Endangered
No common name	*Schiedea membranacea*	Endangered	Endangered

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

Species		Federal Status	State of Hawaii Status
PLANTS *(concluded)*			
No common name	*Schiedea nuttallii*	Endangered	Endangered
No common name	*Schiedea spergulina var. leiopoda*	Endangered	Endangered
No common name	*Schiedea spergulina var. spergulina*	Threatened	Threatened
Laulihilihi	*Schiedea stellarioides*	Endangered	Endangered
'Ohai	*Sesbania tomentosa*	Endangered	Endangered
No common name	*Silene lanceolata*	Endangered	Endangered
Popolo ku mai	*Solanum incompletum*	Endangered	Endangered
Popolo 'aiakeakua	*Solanum sandwicense*	Endangered	Endangered
No common name	*Spermolepis hawaiiensis*	Endangered	Endangered
No common name	*Stenogyne campanulata*	Endangered	Endangered
No common name	*Viola helenae*	Endangered	Endangered
Nani wai'ale'ale	*Viola kauaensis var. wahiawaensis*	Endangered	Endangered
Iliau	*Wilkesia hobdyi*	Endangered	Endangered
No common name	*Xylosma crenatum*	Endangered	Endangered
A'e	*Zanthoxylum hawaiiense*	Endangered	Endangered
MAMMALS			
Hawaiian hoary bat	*Lasiurus cinereus semotus*	Endangered	Endangered
Hawaiian monk seal	*Monachus schauinslandi*	Endangered	Endangered
BIRDS			
Hawaiian Duck	*Anas wyvilliana*	Endangered	Endangered
Hawaiian coot	*Fulica americana alai*	Endangered	Endangered
Hawaiian gallinule	*Gallinula chloropus sandvicensis*	Endangered	Endangered
Kauai Nuku pu'u	*Hemignathus lucidus hanapepe*	Endangered	Endangered
Kauai 'Akia loa	*Hemignathus procerus*	Endangered	Endangered
Black-necked stilt	*Himantopus mexicanus knudseni*	Endangered	Endangered
Kauai 'O'o	*Moho braccatus*	Endangered	Endangered
Large Kauai thrush	*Myadestes myadestinus*	Endangered	Endangered
Small Kauai solitare	*Myadestes palmeri*	Endangered	Endangered
Hawaiian goose	*Nesochen sandvicensis*	Endangered	Endangered
No common name	*Psittirostra psittacea*	Endangered	Endangered
Dark-rumped petrel	*Pterodroma phaeopygia sandwichensis*	Endangered	Endangered
Newell's shearwater	*Puffinus auricularis*	Threatened	Threatened
REPTILES			
Loggerhead sea turtle (incidental in Hawaii)	*Caretta caretta*	Threatened	Threatened
Green sea turtle	*Chelonia mydas*	Threatened	Threatened
Leatherback sea turtle (incidental in Hawaii)	*Dermochelys coriaceae*	Endangered	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Endangered	Endangered
Olive ridley sea turtle (incidental in Hawaii)	*Lepidochelys olivacea*	Threatened	Threatened

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

Species		Federal Status	State of Hawaii Status
SNAILS			
Newcomb's snail	*Erinna newcombi*	Threatened	Threatened
ARACHNIDS			
Kauai cave wolf spider	*Adelocosa anops*	Endangered	Endangered
INSECTS			
Blackburn's sphinx moth	*Manduca blackburni*	Endangered	Endangered
CRUSTACEANS			
Kauai cave amphipod	*Spelaeorchestia koloana*	Endangered	Endangered

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

As required by the EPA, the 2001 Annual Fee and Monitoring Report (air emissions) was submitted to the State of Hawaii at the end of February 2002 (SNL 2002). Sandia Corporation was in compliance with all air quality regulations in 2001.

Clean Water Act (CWA)
There were no compliance issues with respect to any state or federal water pollution regulations in 2001. There are three septic tanks on-site owned by SNL/KTF facilities, which currently do not require permits from the State of Hawaii.

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

Oil Storage – There is one underground storage tank (UST) at SNL/KTF, which is owned by the U.S. Navy. There were no issues or changes in status for this tank during 2001. There is also one 10,000-gallon aboveground fuel tank inside the Main Compound. Sandia Corporation cooperates with the U.S. Navy's spill control guidelines contained in the *Spill Prevention Control and Countermeasures (SPCC) Plan, Pacific Missile Range Facility* (NFEC 1997).

Safe Drinking Water Act (SDWA)
The SDWA does not apply directly to Sandia Corporation activities at SNL/KTF because all drinking water is obtained through PMRF's facilities or is purchased from commercial suppliers.

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

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

Releases and Occurrences
There were no accidental releases or other environmental occurrences at SNL/KTF in 2001.

A.5 ENVIRONMENTAL PROGRAM ACTIVITIES

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

NEPA Program Activities

In completing the KTF EA in 1992 (DOE 1992), several environmental baseline surveys were conducted. These are discussed in Section A.4 under Surveys Completed in Support of the KTF EA.

ER Project Activities

There are no ER sites at SNL/KTF. The three previous sites were taken off the list after the EPA made the determination of No Further Action (NFA) on September 30, 1996. The status was granted after a site inspection and a follow-up report (SNL 1995). No additional assessment or sampling is required at SNL/KTF relative to these ER sites. This, however, does not preclude that other environmental sampling activities will take place at SNL/KTF.

A.6 ENVIRONMENTAL SURVEILLANCE AND MONITORING ACTIVITIES

There were no environmental surveillance and monitoring activities performed at the KTF in 2001.

Wastewater Monitoring

Sandia Corporation's activities at SNL/KTF produce only sanitary sewage, which is directed into five wastewater systems—three septic tanks and two French drains—in accordance with Hawaii Underground Injection Control regulations (HAR Title 11, Chapter 23). The septic systems are periodically pumped by licensed state-certified contractors and inspected by state officials. The limited quantity of sewage released does not impact any protected waters and, as noted earlier, there are no drinking water wells in the area of SNL/KTF. Currently, septic tanks do not require permitting or sampling.

Air Emission Monitoring

Based on effluent air monitoring results of the STARS Flight Test Unit 1 (FTU-1) in February 1993 and the CDX rocket launch in the summer of 1992 (SNL 1992), it was determined that rocket launches at SNL/KTF were not a significant source of air pollutants. Launches are infrequent and emissions recorded did not exceed federal and state standards. Because the STARS type rocket produces the greatest air emissions and remained within acceptable limits, it can be assumed that future launches of this type will also be within acceptable limits. Therefore, no further air emission monitoring is planned at this time. If a new rocket type is launched from SNL/KTF that differs in emission substance from the STARS rocket, or air emission requirements change, funding for future monitoring will be requested.

Meteorological Monitoring

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

Noise Monitoring

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

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IT 1990d IT Corporation, *Soil Sampling Program for Sandia National Laboratories, Kauai Test Facility, Kauai, Hawaii.* IT Corporation, prepared for Sandia National Laboratories, Albuquerque, NM (1990).

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LAWS, REGULATIONS, AND EXECUTIVE ORDERS

Laws

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

Federal and State Regulations

- **Emergency Planning and Notification** (40 CFR 355).
- **EPA Administered Permit Programs: The National Pollutant Discharge Elimination System** (40 CFR 122).
- **Hawaii Administrative Rules (HAR), Title 11, Chapter 23, "Underground Injection Control."**
- **Hawaii Administrative Rules (HAR), Title 11, Chapter 59, "Ambient Air Quality Standards."**
- **Hazardous Chemical Reporting: Community Right-to-Know** (40 CFR 370).
- **National Emission Standards for Hazardous Air Pollutants (NESHAP)** (40 CFR 61).

Executive Orders

- **Executive Order (EO) 11988,** ***Floodplain Management,*** as amended (May 24, 1977).
- **Executive Order (EO) 11990,** ***Protection of Wetlands,*** as amended (May 24, 1977).
- **Executive Order (EO) 12898,** ***Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,*** as amended (Signed February 11, 1994).
- **Executive Order (EO) 13101,** ***Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition*** (Signed September 14, 1998).
- **Executive Order (EO) 13123,** ***Greening the Government Through Efficiency Energy Management*** (Signed June 3, 1999).
- **Executive Order (EO) 13148,** ***Greening the Government Through Leadership in Environmental Management*** (Signed April 21, 2000).
- **Executive Order (EO) 13149,** ***Greening the Government Through Federal Fleet and Transportation Efficiency*** (Signed April 21, 2000).

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APPENDIX B

Permits, Regulations, and Standards for Environmental Programs

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CONTENTS

TABLES

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B.1 ENVIRONMENTAL PERMITS AND REGISTRATIONS

(See Table B-1 on pages B-2 through B-5)

B.2 APPLICABLE REGULATIONS FOR ENVIRONMENTAL PROGRAMS

Water Quality

All Water Quality Programs

Clean Water Act (CWA) (Federal Water Pollution Control Act)
20 NMAC 6.2, "Ground and Surface Water Protection"
Clean Air Act (CAA) and CAA Amendments (CAAA) of 1990

Drinking Water

Safe Drinking Water Act (SDWA)
40 CFR 125, "Criteria and Standards for the National Pollutant Discharge Elimination System" (NPDES)"
40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants"
40 CFR 141, "National Primary Drinking Water Regulations"
20 NMAC 7.10, "Drinking Water"
40 CFR 143, "National Secondary Drinking Water Regulations"

Wastewater Program

City of Albuquerque, "Sewer Use and Wastewater Control Ordinance" (Albuquerque Code of Ordinances Chapter 6, Article 3)
40 CFR 403, "General Pretreatment Regulations for Existing and New Sources of Pollution"
10 CFR 20, "Standards for Protection Against Radiation" (addresses radiological levels in wastewater)
20 NMAC 7.3, "Liquid Waste Disposal" (includes effluents to sewer and septic tanks)

Surface Discharge Program

40 CFR 112, "Oil Pollution Prevention"
20 NMAC 6.4, "Standards for Interstate and Intrastate Streams"

Storm Water Program

40 CFR 122-125, (National Pollutant Discharge Elimination System [NPDES] Regulations)
40 CFR 123, "State Program Requirements"
40 CFR 124, "Procedures for Decision-making"
40 CFR 125, "Criteria and Standards for the National Pollutant Discharge Elimination System"
40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants"

Groundwater Protection Program (GWPP)

40 CFR 141, "National Primary Drinking Water Regulations"
20 NMAC 7.10, "Drinking Water"
20 NMAC 6.2, "Ground and Surface Water Protection"

Groundwater Monitoring at ER Project Sites

40 CFR 265, Subpart F, "Groundwater Monitoring"
40 CFR 264.101, "Corrective Action for Solid Waste Management Units (SWMU)" (applies to all permitted ER sites, except the CWL)

TABLE B-1. Summary of Environmental Permits and Registrations in Effect During 2001

Permit Type and/or Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
SEWER WASTEWATER					
General	WW001 Station Manhole, south of TA-IV at Tijeras Arroyo	2069 A-5	1/3/00	6/30/03	COA
General	WW006 Station Manhole, at Pennsylvania Ave.	2069 F-5	1/3/00	6/30/03	COA
Microelectronics Development Laboratory (MDL)	WW007 Station Manhole, TA-I	2069 G-4	7/1/98	5/31/02	COA
General	WW008 Station Manhole, south of TA-II at Tijeras Arroyo	2069 I-4	1/24/00	1/31/04	COA
General	WW011 Station Manhole, north of TA-III (includes TAs-III and V, and Coyote Test Field sewer lines)	2069 K-3	7/1/98	2/28/02	COA
SURFACE DISCHARGE					
Pulsed Power Development Facilities (Discharge Plan)	TA-IV, Lagoons I and II	DP-530	9/21/01	9/21/06	NMED
UNDERGROUND STORAGE TANKS					
Emergency generator fuel (9,750 gallon)	TA-I	06383	7/1/00[a]	6/30/01	NMED, UST Bur.
Oil storage tank (20,000 gallons)	TA-I	06384	7/1/00[a]	6/30/01	NMED, UST Bur.
Oil storage tank (20,000 gallons)	TA-I	06385	7/1/00[a]	6/30/01	NMED, UST Bur.
STORM WATER					
National Pollution Discharge Elimination System (NPDES) "Multi-sector General" Permit	Storm water discharges from Monitoring Point (MP) 03 and MP 04	NMR05A961	2/01	9/30/05	EPA
Storm Drain, Sanitary Sewer, and Domestic Water System Modernization (SSWM)	9th and 20th Street realignment area	NMR10B507	6/29/99	6/31/03 (estimated date)	EPA
ECOLOGICAL					
Permit to take or band birds Bird banding is conducted under a permit granted to Los Alamos National Laboratory (LANL)	Site-Wide Ecological Monitoring Activity	22783 (LANL permit)	4/30/00	6/30/03	U.S Fish and Wildlife Service
New Mexico Department of Game and Fish for Scientific/Educational Purposes Authorization for Taking of Protected Wildlife	Site-Wide Ecological Monitoring Activity	2931	2/1/01	12/31/01	New Mexico Department of Game and Fish
U.S. Fish and Wildlife Service Special Purpose Salvage Permit	Site-Wide Ecological Monitoring	MB040780-0	5/30/01	12/31/03	U.S. Fish and Wildlife Service
RCRA					
RCRA Part B Operating Permit for the Hazardous Waste Management Facility (HWMF) Module I - General Permit Conditions Module II - General Facility Conditions Module III - Containers	HWMF, TA-II (No treatment performed at the HWMF)	NM5890110518-1	8/6/92	08/06/02	NMED

See notes at end of table.

TABLE B-1. Summary of Environmental Permits and Registrations in Effect During 2001 *(continued)*

Permit Type and/or Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
RCRA *(continued)*					
RCRA Part B Operating Permit Module IV - Hazardous and Solid Waste Amendments (HSWA) Portion for Solid Waste Management Units (SWMUs)	Environmental Restoration (ER) Sites	NM5890110518-2	8/26/93	9/20/02	NMED
Thermal Treatment Facility (TTF) Module I - General Permit Conditions Module II - General Facility Conditions Module III - Containers	TTF, TA-III, Bldg. 6715 (Treatment of explosive waste)	NM5890110518-2	12/4/94	12/4/04	NMED
Class III Permit Modification for the Management of Hazardous Remediation Waste in the Corrective Action Management Unit (CAMU), Tech Area III Modification to Part B Operating Permit	CAMU, TA-III Treatment will start after excavation of CWL	NM5890110518	9/25/97	9/20/02	NMED
Class II Permit Modification for Temporary Treatment Operations at the Corrective Action Management Unit (CAMU)	CAMU, TA-III	NM5890110518	6/19/98	One year after TU is ready for operation	EPA/ NMED
Temporary Authorization for Low Temperature Thermal Disposition Unit at the CAMU	CAMU, TA-III	NM5890110518	8/03/98	6 months after the start of operations	NMED
RCRA Part A and B Permit Applications for Hazardous Waste Management Units for the hazardous component in mixed waste stored and/or treated at three waste management areas.	RMWMF (MW treatment performed at RMWMF) 7 Manzano Bunkers High Bay TA-V, Bldg. 6596	NM5890110518	Interim status first submitted 8/90; Rev. 3, 11/96	Pending Review[b] (No expiration date)	NMED
TSCA					
Risk-Based Approval for Cleanup of the Chemical Waste Landfill (CWL)			Notification 12/98	No expiration date	EPA, Region 6
Storage of Soils Containing Polychlorinated Biphenyls (PCBs) at Regulated Levels			4/28/00 and 5/22/01	Storage period extended pending EPA decision on 40 CFR 761.61(c) request	EPA, Region 6
Risk-Based Approval Request under 40 CFR 761.61(c); Risk-Based Method for Management of PCB Materials; Chemical Waste Landfill and CAMU			Pending		EPA, Region 6

See notes at end of table.

TABLE B-1. Summary of Environmental Permits and Registrations in Effect During 2001 *(continued)*

Permit Type and/or Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
Open Burn Permits*					
Thermal Treatment Facility (permit must be submitted within 30 days of receipt)	TA-III	76-OB-1-2001	1/1/01	12/31/01	COA
Fire Extinguisher Fire Training	Off 9th Street	76-OB-1-2001	1/1/01	12/31/01	COA
Fire Extinguisher Fire Training	Off 9th Street	76-OB-12-2001	11/4/01	11/15/01	COA
Burn Site (Transportation Van)	Open Pool	76-OB-5-2001	2/20/01	2/28/01	COA
Burn Site (Calorimeter Testing)	Open Pool	76-OB-6-2001	2/22/01	9/30/01	COA
185' Drop Tower (Alternative Fuel Tanks)	TA-III	76-OB-7-2001	2/22/01	9/30/01	COA
Burn Site	Igloo 9830	76-OB-2-2001	1/1/01	12/31/01	COA
Burn Site (Large Pool Fire Tests)	Large Pool	76-OB-4-2001	1/1/01	12/31/01	COA
Burn Site/Sled Track (Wood Crib Fire Tests)	Open Ring	76-OB-3-2001	1/1/01	12/31/01	COA
Explosive Testing (9920 & Sled Track)	TA-III	76-OB-10-2001	5/1/01	12/30/01	COA
Explosive Testing (Thermite Applications)	Coyote Canyon	76-OB-8-2001	2/22/01	12/30/01	COA
Burn Site (Decon Foam Tests)	Crib & Pool	76-OB-9-2001	5/1/01	12/31/01	COA
AIR (Permits & Registrations)					
Hammermill Facility	TA-III	144	08/28/85	Biennial update	COA
Fire Laboratory (formally SMERF) used for the Authentication of Modeling and Experiments (FLAME)	Burn Site	196	5/19/88	Registration†	COA
High Energy Radiation Megavolt Electron Source-III (HERMES-III)	TA-III	NESHAP	6/29/88	Approval††	EPA, Region 6
Neutron Generator Facility (NGF)	TA-I	374- MI	7/17/98	Biennial update	COA
Neutron Generator Recertification	TA-I	396	5/7/96	Biennial update	COA
Standby diesel generators (four)	TA-I	402 (old 150)	5/07/96	Biennial update	COA
Radioactive and Mixed Waste Management Facility (RMWMF)	TA-III	415- M1	11/24/99	Biennial update	COA
Isotope Production Facility (HCF)	TA-V	428	7/08/96	Biennial update	COA
Title V Operating Permit	Site-Wide	515 (pending)	Submitted[b] 3/1/96	Pending (5 yr renewal)	COA
Chemical Waste Landfill (CWL) Excavation	TA-III, CWL	540	5/19/99	Registration	COA
Classified Waste Landfill	TA-II, Landfill	560	12/17/96	Biennial update	COA
Classified Waste Landfill	TA-II, Landfill	NESHAP	06/96	Approval††	EPA, Region 6
Advanced Manufacturing Processes Laboratory (AMPL)	TA-I	646	1/23/97	Biennial update	COA

See notes at end of table.

TABLE B-1. Summary of Environmental Permits and Registrations in Effect During 2001 *(concluded)*

Permit Type and/or Facility Name	Location	Permit Number	Issue Date	Expiration Date	Regulatory Agency
AIR (Permits & Registrations) *(concluded)*					
Portable Burn Pools	Burn Site	647	5/5/97	Biennial update	COA
Chemical Waste Landfill (CWL) -Voluntary Corrective Measure (VCM)	TA-III, CWL	648	5/23/97	Registration†	COA
Soil Washing / Soil Stabilization Unit, CAMU	TA-III, CAMU, next to CWL	888	4/20/98	Biennial update	COA
Emergency Generator	TA-I	924	5/5/98	Biennial update	COA
Processing and Environmental Technology Laboratory (PETL)	TA-I	925	5/5/98	Biennial update	COA
Advanced Manufacturing Prototype Facility (AMPF)	TA-I	1406	11/6/00	Registration	COA

NOTES: NMED = New Mexico Environment Department
EPA = U.S. Environmental Protection Agency
UST Bur. = Underground Storage Tank
[a]Applied for permit renewal; not yet received.
[b]Submitted and awaiting agency review.
†Registration = Certificate, no permit required.
††Approval = EPA does not issue a permit.
**Open Burn Permits are issued by the City of Albuquerque for no more than a year at any one time.
NESHAP = National Emission Standards for Hazardous Air Pollutants
TA= technical area
COA= City of Albuquerque

NEPA

NEPA Program

National Environmental Policy Act (NEPA) of 1969
American Indian Religious Freedom Act (AIRFA) of 1978
Archaeological Resources Protection Act (ARPA) of 1979
Endangered Species Act (ESA)
Migratory Bird Treaty Act (MBTA) of 1918, as amended
National Historic Preservation Act of 1966
10 CFR 1021, "National Environmental Policy Act Implementing Procedures" (General Provisions for DOE)
40 CFR 1500-1508, Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act

Air Quality

All Air Quality Programs

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

Meteorological Monitoring Program

40 CFR 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans"

Ambient Air Surveillance Program

40 CFR 50, "National Primary and Secondary Ambient Air Quality Standards" (20 NMAC 11)
40 CFR 58, "Ambient Air Quality Surveillance"
20 NMAC 11, "Albuquerque/Bernalillo County Air Quality Control Board Regulations"

NESHAP Program

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants (NESHAP)"
40 CFR 61, Subpart H, *National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities*

Risk Management Plans

40 CFR 68, "Chemical Accident Prevention Provisions"

Air Quality Compliance

(See Table B-2 on page B-9)

Various Other Environmental Programs

Biological Control Activity

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
New Mexico Pesticide Control Act
21 NMAC 17.50, "Pesticides"

Pollution Prevention (P2) Program

Pollution Prevention Act of 1990
RCRA Section 6002, "Federal Procurement"
EO 13101 Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition

EO 13148 Greening the Government Through Leadership in Environmental Management
EO 12856 Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements (superceded by EO 13148)
EO 13149 Greening the Government Through Federal Fleet and Transportation Efficiency
EO 13123 Greening the Government Through Efficient Energy Management

Chemical Inventory and Emergency Management Programs

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. 9601 et. seq.)
Superfund Amendments and Reauthorization Act (SARA) of 1986
Emergency Planning and Community Right to Know Act (EPCRA) of 1986 (42 U.S.C. 11001 et seq.)
40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP)
40 CFR 302, "Designation, Reportable Quantities, and Notification" (CERCLA Implementing)
40 CFR 355, "Emergency Planning and Notification (EPCRA)"
40 CFR 370, "Hazardous Chemical Reporting: Community Right-to-Know (EPCRA)"
40 CFR 372, "Toxic Chemical Release Reporting: Community Right-to-Know (EPCRA)"

Oil Storage and Spill Containment

Oil Storage Programs

40 CFR 110, "Discharge of Oil"
40 CFR 112, "Oil Pollution Prevention"
40 CFR 122, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)"
40 CFR 123, "State Program Requirements, (NPDES)"
40 CFR 280, "Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks"
40 CFR 281, "Approval of State Underground Storage Tank Programs"
20 NMAC 5, "Underground Storage Tanks (USTs)"

Waste Management

ER Project

40 CFR 261, "Identification and Listing of Hazardous Waste" (20 NMAC 4.1, Subpart II)
40 CFR 262, "Standards Applicable to the Generators of Hazardous Wastes" (20 NMAC 4.1, Subpart III)
40 CFR 264, "Standards for Owners and Operators of Hazardous Waste TSD Facilities" (20 NMAC 4.1, Subpart V)
40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities" (20 NMAC 4.1, Subpart VI)
Subpart F, *Groundwater Monitoring*
Subpart G, *Closure and Post-Closure*
40 CFR 268, "Land Disposal Restrictions" (20 NMAC 4.1, Subpart VIII)
40 CFR 270, "The Hazardous Waste Permit Program" (20 NMAC 4.1, Subpart IX)
40 CFR 761, "PCBs, Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions"

Hazardous Waste Management Program

Resource Conservation and Recovery Act (RCRA) of 1976
RCRA Section 3004j: Land Disposal Restrictions

RCRA Section 6002: Federal Procurement
40 CFR 61, Subpart M, "NESHAP, Asbestos"
40 CFR 68, "Chemical Accident Prevention Provisions"
40 CFR 260, "Hazardous Waste Management System: General"
40 CFR 261, "Identification and Listing of Hazardous Waste"
40 CFR 262, "Standards Applicable to Generators of Hazardous Waste"
40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste"
40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities", including Subpart F, "Releases from Solid Waste Management Units" and Section 264.101, "Corrective Action for Solid Waste Management Units"
40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities"
40 CFR 266, "Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities"
40 CFR 268, "Land Disposal Restrictions"
40 CFR 270, "EPA Administered Permit Programs: The Hazardous Waste Permit Program"
40 CFR 271, "Requirements for Authorization of State Hazardous Waste Programs"
40 CFR 272, "Approved State Hazardous Waste Management Programs"
40 CFR 279, "Standards for the Management of Used Oil"
Hazardous and Solid Waste Amendments Act (HSWA) of 1984 (Module IV to RCRA Section 3004u)
Toxic Substances Control Act (TSCA) of 1976
Pollution Prevention Act of 1990
40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions"
40 CFR 763, "Asbestos"
49 CFR 171–180, (Department of Transportation Regulations for hazardous and radioactive waste shipments)
20 NMAC 4.1, "Hazardous Waste Management" (40 CFR 260-270)
20 NMAC 4.3, "Annual Hazardous Waste Fees"
20 NMAC 9.1, "Solid Waste Management"

Solid Waste Program

20 NMAC 9.1, "Solid Waste Management"

Radioactive Waste Management Program

Atomic Energy Act of 1954
Federal Facility Compliance Act (FFCA) of 1992
10 CFR 835, "Occupational Radiation Protection" (Implements Price Anderson Act)
49 CFR 100-199, (Department of Transportation requirements)
40 CFR 61, "National Emission Standards for Hazardous Air Pollutants (NESHAP)"
Subpart H, *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities*
40 CFR 260-279, RCRA regulations for hazardous waste (as it pertains to mixed waste)

B.3 RADIOLOGICAL DOSE

Radiation Protection

The U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) has established radiation protection standards for the public to control and limit radiation doses resulting from activities at DOE facilities. Sandia National Laboratories, New Mexico (SNL/NM) is the DOE facility specific to this discussion. Public areas are defined as any location that is accessible to non-DOE facility employees (e.g., excluding Sandia Corporation employees and contractors), such as Kirtland Air Force Base (KAFB) personnel and the surrounding community. Radiation protection standards are provided in

TABLE B-2. Federal and State Air Regulations Applicable to SNL/NM

CAA Title	CAA Section	Federal Regulation	Local Regulation	Subject
I	176 (c)	40 CFR 51 W 40 CFR 93 B	20 NMAC 11.04 20 NMAC 11.03	Conformity of Federal Actions (State and Federal Plans) General and Transportation
	110	40 CFR 58	N/A	Ambient Air Quality Surveillance
	109	40 CFR 50	20 NMAC 11.01	National Primary and Secondary Ambient Air Quality Standards (NAAQS)
	165-166	40 CFR 52	20 NMAC 11.02	Permit Fees
		40 CFR 52	20 NMAC 11.05	Visible Air Contaminants
		40 CFR 52	20 NMAC 11.06	Emergency Action Plan
		40 CFR 52	20 NMAC 11.07	Variance Procedure
		40 CFR 52	20 NMAC 11.20	Airborne Particulate Matter (PM)
		40 CFR 52	20 NMAC 11.21	Open Burning
		40 CFR 51–52	20 NMAC 11.40	Source Registration
		40 CFR 51–52	20 NMAC 11.41	Authority-to-Construct
		40 CFR 51.100	20 NMAC 11.43	Stack Height Requirements
		40 CFR 51	20 NMAC 11.44	Emissions Trading
	171-193	40 CFR 51–52	20 NMAC 11.60	Permitting in Nonattainment Areas
	160-169 B	40 CFR 52	20 NMAC 11.61	Prevention of Significant Deterioration
	165-166	40 CFR 60 40 CFR 63	20 NMAC 11.65	Volatile Organic Compounds (VOC)
		40 CFR 60	20 NMAC 11.66	Process Equipment
		40 CFR 60	20 NMAC 11.22	Wood Burning
		40 CFR 60	20 NMAC 11.63	New Source Performance Standards (NSPS)
		40 CFR 60	20 NMAC 11.67	Equipment, Emissions and Limitations (stationary combustion sources)
		40 CFR 60	20 NMAC 11.68	Incinerators
		40 CFR 60	20 NMAC 11.69	Pathological Waste Destructors
II	202-210 213-219 211	40 CFR 85-86	20 NMAC 11.100	Motor Vehicle Inspection
			20 NMAC 11.101	- Decentralized and Centralized (respectively)
		40 CFR 80	20 NMAC 11.102	Oxygenated Fuels
			20 NMAC 11.103	Motor Vehicle Visible Emissions
III	112	40 CFR 61 40 CFR 63	20 NMAC 11.64	National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart H – Radionuclides Subpart M – Asbestos
IV	401-416	40 CFR 72-78	20 NMAC 11.62	Acid Rain
V	501-507	40 CFR 70-71	20 NMAC 11.42	Operating Permits
VI	601-618	40 CFR 82	20 NMAC 11.23	Ozone Protection
VII	113-114	40 CFR 64	20 NMAC 11.90	Administration, Enforcement, Inspection

NOTE: ODS = ozone depleting substances
PM = particulate matter
HAP = Hazardous Air Pollutant
AEHD=Albuquerque Environmental Health Department
SWISH=Small Wind Shielded Facility
SLAMS=Standards for State and Local Air Monitoring Stations
FLAME=Fire Laboratory used for the Authentication of Models and Experiments

TABLE B-3. Summary of Compliance History with Regard to Mixed Waste (MW) at SNL/NM

Date	Milestone	Comment
1984	Amendments to RCRA and HSWA in 1984	MW became an issue after amendments to RCRA and HSWA enforced Land Disposal Restrictions (LDRs).
Aug 1990	RCRA Part A Interim Status Permit Application	Submitted RCRA Part A Interim Status Permit application for MW storage. Later revisions to the permit added proposed MW treatment processes.
Oct 6, 1992	FFCA Passed	The FFCA allows storage of MW over one-year RCRA time limit. Requires U.S. Department of Energy (DOE) to submit a site treatment plan for MW.
Dec 30, 1992	NON Issued	U.S. Environmental Protection Agency (EPA) issued a NON for storage of RCRA-regulated MW over the one-year maximum period.
Oct 1993	Conceptual Site Treatment Plan Submitted	DOE submitted *Conceptual Site Treatment Plan for Mixed Waste* to NMED; other drafts followed.
Mar 31, 1995	Final Site Treatment Plan submitted	DOE submitted final *Site Treatment Plan for Mixed Waste* to NMED
Jun 1995	Historical Disposal Requests Validation (HDRV) Project Initiated	The HDRV Project was initiated to characterize and sort legacy MW. Project continued into 1997 but was replaced with new sorting procedures
Oct 4, 1995	Federal Facility Compliance Order (FFCO) Agreement Signed	The FFCO, an agreement between State, DOE, and Sandia Corporation, details specific actions required with regard to MW management, including the requirement to develop of a Site Treatment Plan (STP), to be updated annually
Oct 6, 1995	Compliance Order Issued	NMED issued a Compliance Order enforcing SNL/NM's STP
Sep 1996	First MW Shipment	First MW shipment made to Perma-Fix/DSSI
Oct 1996	FFCO 1st Amendment	FFCO amended
Nov 1996	Revisions to Proposed Treatment Methods	Re-submitted Part A and B permit application, to reflect revisions to its proposed treatment methods
May 1997	FFCO 2nd Amendment	FFCO amended
Dec 1997	On-site MW Treatment	Onsite treatment of MW began at the RMWMF in Bldg. 6920. Additionally, Bldg. 6921 was converted to a laboratory for the treatment of certain types of MW
Jan 1998	STP Updated	The *Mixed Waste Site Treatment Plan, Compliance Plan Volume Background Volume* was updated to include the current treatment technologies and proposed schedules
Feb 1998	Second MW Shipment	18.5 m^3 of MW shipped to the Idaho National Engineering and Environmental Laboratories (INEEL) for incineration at their Waste Experimental Reduction Facility (WERF)
Sep 1998	Third MW Shipment	1.1 m^3 of MW incineration at Perma-Fix/DSSI
1999	STP Milestones Met	Five milestones listed in the Site Treatment Plan met in 1999 including a waste shipment, onsite waste treatment, waste sorting, and development of a treatment pathway and permit activity for transuranic/mixed waste (TRU/MW)
1999	Proposed Revisions to STP	Submitted revised plan to state
1999	STP FY98 Update	Submitted annual update
2000	Proposal for FFCO Amendment 3	Submitted a proposal to amend FFCO

NOTE: NON = Notification of Non-compliance
RCRA = Resource Conservation and Recovery Act
HSWA = Hazardous and Solid Waste Amendments
FFCA = Federal Facility Compliance Act
NMED = New Mexico Environment Department
DSSI = Diversified Scientific Services, Inc.

DOE Order 5400.5, *General Radiation Protection of the Public and the Environment* (DOE 1993). Environmental monitoring requirements for DOE operations are given in DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990). In addition to these quantitative standards, the overriding DOE policy is that exposures to the public shall be maintained "as low as reasonably achievable" (ALARA).

DOE Order 5400.5 limits the total annual effective dose equivalent (EDE) of all potential exposure pathways to the public (including air, water, and the food chain) to 100 millirem per year (mrem/yr). The Order lists the Derived Concentration Guides (DCGs) for radionuclides in water and air that could be continuously consumed or inhaled (365 days/year). This is a conservative approach that assumes that a member of the public resides at the location continuously. Table B-4 lists the DCGs pertinent to activities at SNL/NM and to this report.

- *Water Pathways* - DOE drinking water guidelines are based on an annual EDE not to exceed 4 mrem/yr. Guideline values for drinking water are calculated at 4 percent of ingested water using DCG values for specific nuclides.
- *Air Pathways* - DOE facilities are required to comply with U.S. Environmental Protection Agency (EPA) standards for radiation protection as given in National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H, specific to radionuclides emitted from DOE facilities (with the exception of radon). This rule mandates that air emissions from DOE facilities shall not cause any individual of the public to receive an EDE of greater than 10 mrem/yr from air pathways. Table B-5 summarizes the public radiation protection standards that are applicable to DOE facilities.

B.4 WATER QUALITY MONITORING PARAMETERS

Resource Conservation and Recovery Act (RCRA)

Table B-5 lists the 40 CFR 265, Subpart F, parameters required for groundwater monitoring analysis, implemented under RCRA. Table B-6 gives the EPA interim primary drinking water standards (40 CFR 265, Appendix III) for the groundwater monitoring parameters. Table B-7 gives EPA secondary drinking water standards. At SNL/NM, this regulation applies to Environmental Restoration (ER) sites.

TABLE B-4. Derived Concentration Guides (DCGs) for Selected Radionuclides*

	Ingested Water		Inhaled Air†	
Radionuclide	DCG (µCi/ml)	f_1 Value**	DCG (µCi/ml)	Solubility Class
Tritium (water)	2×10^{-3}	--	1×10^{-7}	W
Cesium-137	3×10^{-6}	1	4×10^{-10}	D
Uranium, total (U_{tot}) §	6×10^{-6}	--	1×10^{-13}	Y

NOTE: µCi/ml = microcuries per milliliter

*From Figure III-1, DOE Order 5400.5, Change 2, January 7, 1993 (DOE 1993).

†DCG for tritium in air is adjusted for skin absorption.

** F_1 value is the gastrointestinal absorption factor.

§ Listed DCG's for U_{tot} are based on U_{nat} listing in 5400.5. Conversion from microcuries per milliliter (µCi/ml) to micrograms per liter (µg/L) may be made using:

$$\mu g / L = X \mu Ci / ml \frac{\left[1.48 x 10^9 \mu g / L\right]}{\left[1 \mu Ci / ml\right]}$$

TABLE B-5. General Dose Limits to the Public from DOE Facilities

Pathway	Effective Dose Equivalent (EDE) Limit	Comments
All Pathways*	100 mrem/yr 1 mSv/yr	The EDE for any member of the public from all routine DOE operations (normal planned activities including remedial actions). Radiation dose occurring from natural background and medical exposures are not included in the total allowed dose from all pathways.
Air Pathway **	10 mrem/yr 0.10 mSv/yr	Sandia Corporation calculates doses resulting from all potential air depositions and direct inhalation (e.g., emissions, ground shine, food crops)

NOTE: *DOE Order 5400.5, Chapters I and II (DOE 1993)
**40 CFR 61, Subpart H for radionuclides, National Emission Standards for Hazardous Air Pollutants (NESHAP).
mrem/yr = millirem per year mSv/yr = millisievert per year

TABLE B-6. Groundwater Monitoring Parameters Required by 40 CFR 265, Subpart F*

Contamination Indicator	Groundwater Quality	Appendix III† Drinking Water Supply
pH	Chloride	Arsenic
Specific Conductivity	Iron	Barium
Total Organic Halogen (TOX)	Manganese	Cadmium
Total Organic Carbon (TOC)	Phenol	Chromium
	Sodium	Fluoride
	Sulfate	Lead
		Mercury
		Nitrate (as N)
		Selenium
		Silver
		Endrin
		Lindane
		Methoxychlor
		Toxaphene
		2,4-D
		2,4,5-TP Silvex
		Radium
		Gross Alpha
		Gross Beta
		Coliform Bacteria
		Turbidity

NOTE: *Resource Conservation and Recovery Act (RCRA)
†40 CFR 265, Appendix III.

TABLE B-7. EPA Primary Drinking Water Supply Standards/New Mexico Drinking Water Standards

Inorganic Chemicals	MCL	Units
Antimony	0.006	mg/L
Arsenic	0.05	mg/L
Asbestos	7	MFL
Barium	2.0	mg/L
Beryllium	0.004	mg/L
Cadmium	0.005	mg/L
Chromium	0.1	mg/L
Copper	1.3*	mg/L
Cyanide (free cyanide)	0.2	mg/L
Fluoride	4.0	mg/L
Lead	0.015**	mg/L
Mercury (inorganic)	0.002	mg/L
Nickel (New Mexico only) [5]	0.1	mg/L
Nitrate (measured as N)	10	mg/L
Nitrite (measured as N)	1	mg/L
Total Nitrate and Nitrite (measured as N)	10	mg/L
Selenium	0.05	mg/L
Thallium	0.002	mg/L
Organic Chemicals	**MCL**	**Units**
Alachlor	0.002	mg/L
Atrazine	0.003	mg/L
Benzene	0.005	mg/L
Benzo(a)pyrene	0.0002	mg/L
Carbofuran	0.04	mg/L
Carbon tetrachloride	0.005	mg/L
Chlordane	0.002	mg/L
Chlorobenzene	0.1	mg/L
2,4-D	0.07	mg/L
Dalapon	0.2	mg/L
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	mg/L
o-Dichlorobenzene	0.6	mg/L
p-Dichlorobenzene	0.075	mg/L
1,2-Dichloroethane	0.005	mg/L
1,1-Dichloroethylene	0.007	mg/L
cis-1,2-Dichloroethylene	0.07	mg/L
trans-1,2-Dichloroethylene	0.1	mg/L
Dichloromethane	0.005	mg/L
1,2-Dichloropropane	0.005	mg/L
Di(2-ethylhexyl)adipate	0.4	mg/L
Di(2ethylhexyl)phthalate	0.006	mg/L
Dinoseb	0.007	mg/L
Dioxin (2,3,7,8-TCDD)	0.00000003	mg/L
Diquat	0.02	mg/L
Endothall	0.1	mg/L
Endrin	0.002	mg/L

See notes at end of table.

TABLE B-7. EPA Primary Drinking Water Supply Standards/New Mexico Drinking Water Standards *(concluded)*

Organic Parameter *(continued)*	MCL	Units
Ethylbenzene	0.7	mg/L
Ethylene Dibromide	0.00005	mg/L
Glyphosate	0.7	mg/L
Heptachlor	0.0004	mg/L
Heptachlor epoxide	0.0002	mg/L
Hexachlorobenzene	0.001	mg/L
Hexachlorocyclopentadiene	0.05	mg/L
Lindane	0.0002	mg/L
Methoxychlor	0.04	mg/L
Oxamyl (Vydate)	0.2	mg/L
Polychlorinated biphenyls (PCBs)	0.0005	mg/L
Pentachlorophenol	0.001	mg/L
Picloram	0.5	mg/L
Simazine	0.004	mg/L
Styrene	0.1	mg/L
Tetrachloroethylene	0.005	mg/L
Toluene	1	mg/L
Toluene	1	mg/L
Total Trihalomethanes (TTHMs)	0.1	mg/L
Toxaphene	0.003	mg/L
2,4,5-TP (Silvex)	0.05	mg/L
1,2,4-Trichlorobenzene	0.07	mg/L
1,1,1-Trichloroethane	0.2	mg/L
1,1,2-Trichloroethane	0.005	mg/L
Trichloroethylene	0.005	mg/L
Vinyl chloride	0.002	mg/L
Xylenes (total)	10	mg/L
Radionuclides	**MCL**	**Units**
Beta particles and photon emitters	4	mrem/yr
Gross alpha particle activity	15	pCi/L
Radium 226 and Radium 228 (combined)	5	pCi/L
Uranium	0.030	mg/L

NOTE: *action level concentrations which trigger systems into taking treatment steps if 10% of tap water samples exceed the value

**New Mexico Drinking Water Standard only, EPA removed nickel in 1995

MCL = Maximum Contaminant Level

mg/L = milligram per liter; ml = milliliter

MFL= Micro-fibers per liter

mrem/yr = millirem per year

pCi/L = picocurie per liter

TABLE B-8. EPA Secondary Drinking Water Supply Standards

Contaminant	Level
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 color units
Copper	1.0 mg/L
Corrosivity	Non-corrosive
Fluoride	2.0 mg/L
Foaming agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.1 mg/L
Sulfate	250 mg/L
Total dissolved solids (TDS)	500 mg/L
Zinc	5 mg/L

NOTE: EPA = Environmental Protection Agency
mg/L = milligram per liter
pH = potential of hydrogen (acidity)

TABLE B-9. New Mexico Water Quality Control Commission (NMWQCC) Standards for Groundwater of 10,000 mg/L total dissolved solid (TDS) Concentration or Less

A. Human Health Standards		
Arsenic	0.1	mg/L
Barium	1.0	mg/L
Cadmium	0.01	mg/L
Chromium	0.05	mg/L
Cyanide	0.2	mg/L
Fluoride	1.6	mg/L
Lead	0.05	mg/L
Total Mercury	0.002	mg/L
Nitrate (as N)	10.0	mg/L
Selenium	0.05	mg/L
Silver	0.05	mg/L
Uranium	5.0	mg/L
Radioactivity: Radium-226 & Radium 228	30.0	pCi/L
Benzene	0.01	mg/L
Polychlorinated biphenyls (PCB's)	0.001	mg/L
Toluene	0.75	mg/L
Carbon Tetrachloride	0.01	mg/L
1,2-dichloroethane (EDC)	0.01	mg/L
1,1-dichloroethylene (1,1-DCE)	0.005	mg/L
1,1,2,2-tetrachloroethylene (PCE)	0.02	mg/L
1,1,2- trichloroethylene (TCE)	0.1	mg/L
Ethylbenzene	0.72	mg/L
Total Xylene	0.62	mg/L
Methylene Chloride	0.1	mg/L
Chloroform	0.1	mg/L
1,1 –dichloroethane	0.025	mg/L
Ethylene dibromide (EDB)	0.0001	mg/L
1,1,1 –trichloroethane	0.06	mg/L
1,1,2 –trichloroethane	0.01	mg/L
1,2,2,2 –tetrachloroethane	0.01	mg/L
Vinyl Chloride	0.001	mg/L
PAHs: total naphtalene + monomethylnapthalenes	0.03	mg/L
Benzo(a)pyrene	0.0007	mg/L
B. Other Standards for Domestic Water Supply		
Chloride	250.0	mg/L
Copper	1.0	mg/L
Iron	1.0	mg/L
Manganese	0.2	mg/L
Phenols	0.005	mg/L
Sulfate	600.0	mg/L
Total Dissaolved Solids	1000.0	mg/L
Zinc	10.0	mg/L
pH	Between 6 and 9	

NOTE: mg/L = milligram per liter
pH = potential of hydrogen (acidity)
pCi/L = picocurie per liter

MAC = maximum allowable concentration

TABLE B-9. New Mexico Water Quality Control Commission (NMWQCC) Standards for Groundwater of 10,000 mg/L total dissolved solid (TDS) Concentration or Less *(concluded)*

Contaminant	MAC	Units
C. Standards for Irrigation Use – Groundwater shall meet the standards of Subsection A,B, and C unless other wise provided		
Aluminum	5.0	mg/L
Boron	0.75	mg/L
Cobalt	0.05	mg/L
Molybdenum	1.0	mg/L
Nickel	0.2	mg/L

NOTE: mg/L = milligram per liter
MAC = maximum allowable concentration
pCi/L = picocurie per liter

REFERENCES

DOE 1990: U.S. Department of Energy, General Environmental Protection Program, DOE Order 5400.1. DOE, Washington, DC (June 29, 1990).

DOE 1993: U.S. Department of Energy, Chapter I, General Radiological Protection of the Public and the Environment; Chapter II, Requirements for Radiation Protection of the Public and the Environment; and Chapter III, Derived Concentration Guides for Air and Water. DOE Order 5400.5, DOE, Washington, DC (January 7, 1993).

LAWS and REGULATIONS

Resource Conservation and Recovery Act (RCRA) of 1976. (42 U.S.C. § 6901 et seq.)

40 CFR 61, Subpart H for radionuclides. National Emission Standards for Hazardous Air Pollutants (NESHAP).

40 CFR 122, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)"

40 CFR 141, National Primary Drinking Water Regulations, as amended.

40 CFR 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, as amended.

New Mexico Administrative Code (NMAC), Title 20, Chap. 6. Part 2, Ground and Surface Water Protection

New Mexico Administrative Code (NMAC), Title 20, Chap. 7. Part 10, Drinking Water

APPENDIX C

2001 Wastewater Monitoring Results

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CONTENTS

TABLES

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TABLE C-1. Permitted Sanitary Outfalls, March 2001
(All results reported in milligrams per liter [mg/L] unless otherwise noted.)

Permit No:	2069A		2069F		2069G		2069I		2069K		Regulatory Limit COA (mg/L)
Station:	WW001		WW006		WW007		WW008		WW011		
Date Collected:	03/20/01		03/20/01		03/20/01		03/20/01		03/20/01		
Sample ID:	054781		054786		054783		054784		054785		
Analyte											
Aluminum	0.0343	U	1.96		0.0343	U	0.0343	U	0.161		900
Arsenic	0.0155		0.0194		0.00457	U	0.0141		0.014		0.051
Boron	0.149		0.404		0.0119	J	0.0827		0.254		NE
Cadmium	0.000357	J	0.00166	J	0.000251	U	0.000328	J	0.000725	J	0.5
Chromium	0.000781	U	0.0046	J	0.000781	U	0.000781	U	0.00253	J	4.1
Copper	0.0239		0.0886		0.00267	U	0.00882		0.063		5.3
Fluoride	0.759		0.679		12.1		5.55		0.48		36
Lead	0.00344	U	0.00962		0.00344	U	0.00344	U	0.00356	J	1
Molybdenum	0.0305		0.0197		0.000594	U	0.0249		0.892		2
Nickel	0.00115	J	0.0105		0.000773	J	0.00091	J	0.00347	J	2
Selenium	0.00309	U	0.0035	J	0.00309	U	0.00309	U	0.00309	U	0.46
Silver	0.000616	J	0.00142	J	0.000197	U	0.000244	J	0.00234	J	5
Zinc	0.0608		0.143		0.00701		0.0391		0.165		2.2

Permit No:	2069A		2069F		2069G		2069I		2069K		Regulatory Limit COA (mg/L)
Station:	WW001		WW006		WW007		WW008		WW011		
Date Collected:	03/21/01		03/21/01		03/21/01		03/21/01		03/21/01		
Sample ID:	054787		054788		054789		054790		054791		
Analyte											
Aluminum	0.0979		0.244		0.456		0.0909		0.15		900
Arsenic	0.017		0.0152		0.00457	U	0.0178		0.0129		0.051
Boron	0.248		0.246		0.0162	J	0.106		0.192		NE
Cadmium	0.000322	J	0.0004	J	0.000251	U	0.00043	J	0.000433	J	0.5
Chromium	0.000815	J	0.000781	U	0.00215	J	0.000781	U	0.00176	J	4.1
Copper	0.0364		0.0215		0.00653		0.00762		0.0489		5.3
Fluoride	0.647		0.706		12.7		5.23		0.738		36
Lead	0.00344	U	0.00344	U	0.00344	U	0.00344	U	0.00344	U	1
Molybdenum	0.697		0.0692		0.000594	U	0.0254		0.688		2
Nickel	0.00124	J	0.00422	J	0.0011	J	0.000743	U	0.00259	J	2
Selenium	0.00309	U	0.00309	U	0.00309	U	0.00309	U	0.00309	U	0.46
Silver	0.00101	J	0.000857	J	0.000197	U	0.000197	U	0.00142	J	5
Zinc	0.102		0.0498		0.105		0.0822		0.137		2.2

NOTES: COA = City of Albuquerque
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective MDL. For radiochemical analytes the result is less than the decision level.
J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.

TABLE C-1. Permitted Sanitary Outfalls, March 2001 *(concluded)*

(All results reported in milligrams per liter [mg/L] unless otherwise noted.)

Permit No:	2069A		2069F		2069G		2069I		2069K	Regulatory
Station:	WW001		WW006		WW007		WW008		WW011	Limit
Date Collected:	03/21/01		03/25/01		03/22/01		03/22/01			COA
Sample ID:	054793		054794		055045		054795			(mg/L)
Analyte										
Cyanide, Total	0.00678		0.00276	U	0.00276	U	0.00276	U	Not Sampled	0.45
Cyanide, Total	0.0109		0.00582		0.00276	U	0.00276	U	Not Sampled	0.45
Cyanide, Total	0.0136		0.00276	U	0.00276	U	0.00276	U	Not Sampled	0.45
Cyanide, Total	0.00276	U	0.00276	U	0.00276	U	0.00276	U	Not Sampled	0.45

NOTES: COA = City of Albuquerque

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

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

TABLE C-2. Summary of Sanitary Outfalls of Radiological Analyses, March 2001
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	2069A			2069F-4			2069I-3			2069K			
Station	WW001			WW006			WW008			WW011			Regulatory
Date Collected:	03/20/01			03/20/01			03/20/01			03/20/01			Limit
Sample ID:	054781			054786			054784			054784			10 CFR 20
Analyte	Activity		MDA	Activity		MDA	Activity		MDA	Activity		MDA	
Actinium-228	3.92 ± 13.7	U	15.7	5.67 ± 7.58	U	14.1	0 ± 14.2	U	13.1	6.31 ± 16	U	12.9	300,000
Americium-241	3.69 ± 8.6	U	15.5	2.46 ± 9.06	U	16.1	-2.27 ± 14.1	U	21.1	1.14 ± 8.91	U	15.6	200
Cerium-144	3.67 ± 12	U	20.9	3.88 ± 12	U	20.7	6.43 ± 11	U	18.4	-1.98 ± 11	U	18.5	30,000
Cesium-134	-2.36 ± 2.38	U	3.32	-0.0352 ± 2.21	U	3.33	-0.559 ± 1.77	U	2.95	-0.984 ± 1.83	U	2.61	9,000
Cesium-137	1.16 ± 2.18	U	3.91	-1.22 ± 2.05	U	3.38	0.3 ± 1.76	U	3.01	-0.169 ± 1.77	U	2.98	10,000
Chromium-51	0.207 ± 20	U	33.3	-13.7 ± 19.7	U	31.2	-12.1 ± 18.9	U	31.9	-12.6 ± 15.7	U	26.6	5,000,000
Cobalt-60	-0.277 ± 2.2	U	3.92	-0.712 ± 2.32	U	3.98	2.06 ± 1.95	U	3.68	-0.612 ± 1.84	U	3.11	30,000
Iron-59	2.85 ± 4.11	U	7.87	-0.721 ± 4.22	U	6.44	2.46 ± 3.96	U	7.26	-2.3 ± 3.81	U	6.34	100,000
Lead-212	0 ± 4.1	U	7.16	5.3 ± 7.38	U	6.71	0 ± 3.34	U	5.88	1.72 ± 6.09	U	4.99	20,000
Lead-214	4.33 ± 4.63	U	7.96	3.13 ± 4.28	U	7.7	2.39 ± 6.88	U	6.83	6.07 ± 7.31		5.66	1,000,000
Potassium-40	49.4 ± 50.4		31.9	34 ± 63.5	U	34.5	0 ± 26.4	U	50.8	39.4 ± 44.1		30.1	40,000
Radium-226	0.121 ± 8.5	U	8.39	6.61 ± 8.11	U	8.5	6.61 ± 3.84	U	6.84	0.0881 ± 6.92	U	5.83	600
Radium-228	3.92 ± 13.7	U	15.7	5.67 ± 7.58	U	14.1	0 ± 14.2	U	13.1	6.31 ± 16	U	12.9	600
Ruthenium-103	0.18 ± 2.13	U	3.76	-3.2 ± 2.05	U	3.14	-1.58 ± 2.13	U	3.48	-2.06 ± 1.74	U	2.76	300,000
Ruthenium-106	-13.8 ± 17.9	U	29.5	6.45 ± 18.2	U	31.9	-8.28 ± 16	U	26.3	0.442 ± 15.1	U	25.7	30,000
Thorium-231	-3.42 ± 10.9	U	17.9	11 ± 11	U	18.9	9.85 ± 9.28	U	16.5	-2.5 ± 9.67	U	15.7	300
Thorium-232	0 ± 4.07	U	7.1	5.25 ± 7.32	U	6.65	0 ± 3.28	U	5.79	1.7 ± 6.04	U	4.95	500,000
Thorium-234	0 ± 83.9	U	144	120 ± 79.1	U	139	78.9 ± 208	U	153	0 ± 87.2	U	140	50,000
Tritium	-20.5 ± 134	U	85.5	-69 ± 133	U	85.4	-72 ± 131	U	84.6	-60.7 ± 131	U	84.3	10,000,000
Uranium-235	12.6 ± 12.5	U	21.7	3.32 ± 12.5	U	21.5	16 ± 11.9	U	19.6	13.6 ± 21.5	U	19.8	3,000
Uranium-238	0 ± 83.9	U	144	120 ± 79.1	U	139	78.9 ± 208	U	153	0 ± 87.2	U	140	3,000
Yttrium-88	-1.54 ± 2.34	U	3.82	0.183 ± 2.36	U	4.36	0.207 ± 1.98	U	3.66	0.91 ± 2.1	U	3.89	100,000
Zirconium-95	0.692 ± 3.58	U	6.31	0.881 ± 3.55	U	6.2	-0.333 ± 3.17	U	5.32	2.28 ± 3.07	U	5.38	200,000

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

TABLE C-3. Permitted Sanitary Outfalls, June 2001

(All results reported in milligrams per liter [mg/L] unless otherwise noted.)

Permit No:	**2069A**	**2069F**	**2069G**	**2069I**	**2069K**	**Regulatory Limit COA (mg/L)**
Station:	**WW001**	**WW006**	**WW007**	**WW008**	**WW011**	
Date Collected:	**06/12/01**	**06/12/01**	**06/12/01**	**06/12/01**	**06/12/01**	
Sample ID:	**055741**	**055742**	**055743**	**055744**	**055745**	
Analyte						
Aluminum	0.0343 U	0.0505	0.461	0.166	0.0343 U	900
Arsenic	0.0191	0.0127	0.00457 U	0.0173	0.0167	0.051
Boron	0.151	0.163	0.00864 J	0.0962	0.17	NE
Cadmium	0.000441 J	0.000269 J	0.000251 U	0.000413 J	0.000611 J	0.5
Chromium	0.000781 U	0.000781 U	0.000781 U	0.000781 U	0.00496 J	4.1
Copper	0.0236	0.0131	0.00412 J	0.017	1.1	5.3
Fluoride	0.748	0.498	9.11	8.43	0.672	36
Lead	0.00344 U	0.00344 U	0.00344 U	0.0046 J	0.00613	1
Molybdenum	0.0174	0.0698	0.000594 U	0.0139	0.121	2
Nickel	0.000743 U	0.000743 U	0.000743 U	0.000743 U	0.00632	2
Selenium	0.0057	0.00374 J	0.00309 U	0.00309 U	0.00538	0.46
Silver	0.000373 J	0.000228 J	0.000197 U	0.000197 U	0.000709 J	5
Zinc	0.115	0.0252	0.0183	0.322	0.187	2.2

Permit No:	**2069A**	**2069F**	**2069G**	**2069I**	**2069K**	**Regulatory Limit COA (mg/L)**
Station:	**WW001**	**WW006**	**WW007**	**WW008**	**WW011**	
Date Collected:	**06/13/01**	**06/13/01**	**06/13/01**	**06/13/01**	**06/13/01**	
Sample ID:	**055747**	**055748**	**055749**	**055750**	**055751**	
Analyte						
Aluminum	0.0343 U	0.0343 U	0.193	0.09	0.0343 U	900
Arsenic	0.0174	0.0138	0.00457 U	0.0152	0.0188	0.051
Boron	0.152	0.195	0.00804 J	0.085	0.406	NE
Cadmium	0.00034 J	0.00037 J	0.000251 U	0.000251 U	0.000251 U	0.5
Chromium	0.000781 U	0.000781 U	0.000781 U	0.000918 J	0.00112 J	4.1
Copper	0.0257	0.0115	0.00267 U	0.0075	0.0599	5.3
Fluoride	0.697	0.494	8.46	4.61	0.49	36
Lead	0.00344 U	0.00344 U	0.00344 U	0.00344 U	0.00359 J	1
Molybdenum	0.0185	0.0736	0.000828 J	0.0116	0.0304	2
Nickel	0.00285 J	0.00274 J	0.00261 J	0.0028 J	0.00388 J	2
Selenium	0.00309 U	0.00309 U	0.00309 U	0.00309 U	0.00309 U	0.46
Silver	0.000197 U	0.000197 U	0.000197 U	0.000197 U	0.000253 J	5
Zinc	0.108 B	0.0302	0.00281 U	0.0886 B	0.0745 B	2.2

NOTES: COA = City of Albuquerque

B = The analyte was found in the blank above the effective MDL (organics), or the effective PQL (inorganics).

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

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

TABLE C-4. Summary of Sanitary Outfalls of Radiological Analyses, June 2001
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	2069A			2069F-4			2069I-3			2069K			
Station	WW001			WW006			WW008			WW011			Regulatory
Date Collected:	06/12/01			06/12/01			06/12/01			06/12/01			Limit
Sample ID:	054781			054786			054784			054784			10 CFR 20
Analyte	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	
Actinium-228	12.6 ± 9.8	U	19.9	24.1 ± 18.5	U	26.4	4.65 ± 20.8	U	29.2	9.04 ± 23.9	U	29.3	300,000
Americium-241	-5.87 ± 13.8	U	21.5	-24.8 ± 19.4	U	29.2	2.52 ± 6.23	U	9.75	-43.1 ± 9.72	U	9.88	200
Cerium-144	-12.2 ± 18.8	U	27.7	5.06 ± 19.8	U	34.9	4.5 ± 19.1	U	33	-1.04 ± 18.9	U	32.4	30,000
Cesium-134	1.19 ± 2.46	U	4.52	-0.999 ± 3.29	U	5.75	0.618 ± 3.82	U	6.79	-6.39 ± 4.18	U	6.54	9,000
Cesium-137	1.56 ± 2.82	U	5.21	0.285 ± 3.23	U	5.86	23.6 ± 10		7.65	1.97 ± 3.89	U	7.14	10,000
Chromium-51	17.3 ± 38.5	U	66.4	-16.2 ± 48.7	U	81.7	35.3 ± 46.8	U	82.4	-11.4 ± 48.9	U	81.5	5,000,000
Cobalt-60	0.966 ± 2.91	U	5.6	1.28 ± 3.63	U	6.85	1.77 ± 4.32	U	8.28	-0.719 ± 3.94	U	7.18	30,000
Gross Alpha	4.02 ± 1.78		1.07	2.4 ± 1.76		1.27	1.73 ± 1.76		1.33	4.63 ± 1.85		0.934	NE
Gross Beta	20.3 ± 3.49		0.922	22 ± 2.89		0.864	10.5 ± 1.98		0.89	15 ± 2.48		1	NE
Iron-59	-5.45 ±	U	11.7	1.37 ± 8.48	U	15.6	6.85 ± 7.1	U	17.7	11.7 ± 12	U	22.7	100,000
Lead-212	0.321 ±	U	8.85	0 ± 6.28	U	11.4	0 ± 6.52	U	11.6	6.81 ± 6.91	U	10.7	20,000
Lead-214	2.3 ± 5.51	U	10.1	8.63 ± 10.8	U	12.8	2.81 ± 12.9	U	13.6	1.17 ± 10.2	U	12.9	1,000,000
Potassium-40	11.6 ± 54	U	63.5	84.3 ± 64.7		52	26.8 ± 75.9	U	73.5	62.5 ± 43.9	U	90.6	40,000
Radium-226	7.87 ± 11.1	U	11.5	1.79 ± 11.5	U	11.7	2.68 ± 8.16	U	14.6	11.4 ± 8.97	U	16.6	600
Radium-228	12.6 ± 9.8	U	19.9	24.1 ± 185	U	26.4	4.65 ± 20.8	U	29.2	9.04 ± 23.9	U	29.3	600
Ruthenium-103	-1.32 ± 3.83	U	6.6	-1.14 ± 4.26	U	7.14	-1.06 ± 4.84	U	8.5	-7.9 ± 5.44	U	8.52	300,000
Ruthenium-106	20.4 ± 41.2	U	42.9	34.9 ± 36.3	U	48.7	4.6 ± 37.3	U	66.4	14.9 ± 36.9	U	66.8	30,000
Thorium-231	18.7 ± 15.4	U	27.5	9.96 ± 17.4	U	30.7	-1.62 ± 17.1	U	28.8	-2.09 ± 16.6	U	28.1	300
Thorium-232	0.314 ± 7.13	U	8.63	0 ± 6.13	U	11.1	0 ± 6.36	U	11.3	6.61 ± 6.74	U	10.5	500,000
Thorium-234	57.3 ± 232	U	166	203 ± 174	U	266	48.4 ± 121	U	142	0 ± 112	U	139	50,000
Tritium	-106 ± 213	U	144	-145 ± 212	U	144	-89.8 ± 214	U	144	-202 ± 210	U	144	10,000,000
Uranium-235	26.5 ± 22.2	U	31.7	20.1 ± 20.8	U	36.9	14.4 ± 19.8	U	34.5	11.6 ± 19.2	U	33.4	3,000
Uranium-238	57.3 ± 232	U	166	203 ± 174	U	266	48.4 ± 121	U	96.3	0 ± 112	U	139	3,000
Yttrium-88	0.829 ± 3.02	U	6.2	-0.986 ± 3.83	U	7.03	-2.07 ± 4.93	U	8.63	-1.99 ± 4.13	U	7.21	100,000
Zirconium-95	-2.13 ± 6.34	U	10.7	-0.526 ± 6.56	U	11.8	-5.64 ± 8.96	U	15	-0.631 ± 8.54	U	15	200,000

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

TABLE C-5. Permitted Sanitary Outfalls of Volatile Organic Compounds, June 2001
(All results reported in micrograms per liter [µg/L] unless otherwise noted.)

Permit No:	**2069A**		**2069F**		**2069I**		**2069K**	
Station:	**WW001**		**WW006**		**WW008**		**WW011**	
Date Collected:	**06/12/01**		**06/12/01**		**06/12/01**		**06/12/01**	
Sample ID:	**055741**		**055742**		**055744**		**055745**	
Analyte								
1,1,1-Trichloroethane	0.18	U	0.18	U	0.18	U	0.18	U
1,1,2,2-Tetrachloroethane	0.15	U	0.15	U	0.15	U	0.15	U
1,1,2-Trichloroethane	0.11	U	0.11	U	0.11	U	0.11	U
1,1-Dichloroethane	0.07	U	0.07	U	0.07	U	0.07	U
1,1-Dichloroethylene	0.28	U	0.28	U	0.28	U	0.28	U
1,2-Dichloroethane	0.14	U	0.14	U	0.14	U	0.14	U
1,2-Dichloropropane	0.16	U	0.16	U	0.16	U	0.16	U
2-Butanone	1.48	J	2.48	J	0.81	U	1.99	J
2-Hexanone	0.79	U	0.79	U	0.79	U	0.79	U
4-Methyl-2-pentanone	0.7	U	0.7	U	0.7	U	0.7	U
Acetone	46.5		46.1		173		352	
Benzene	0.14	U	0.14	U	0.14	U	0.14	U
Bromodichloromethane	0.15	U	0.15	U	0.15	U	0.15	U
Bromofluorobenzene	51.5		48.7		49.4		50.3	
Bromoform	0.1	U	0.1	U	0.1	U	0.233	J
Bromomethane	0.24	U	0.24	U	0.24	U	0.24	U
Carbon disulfide	0.9	U	0.9	U	0.9	U	0.9	U
Carbon tetrachloride	0.16	U	0.16	U	0.16	U	0.16	U
Chlorobenzene	0.2	U	0.2	U	0.2	U	0.2	U
Chloroethane	0.32	U	0.32	U	0.32	U	0.32	U
Chloroform	0.17	U	0.17	U	0.17	U	0.17	U
Chloromethane	0.21	U	0.21	U	0.21	U	0.21	U
cis-1,2-Dichloroethylene	0.18	U	0.18	U	0.18	U	0.18	U
cis-1,3-Dichloropropylene	0.18	U	0.18	U	0.18	U	0.18	U
Dibromochloromethane	0.16	U	0.16	U	0.16	U	0.16	U
Dibromofluoromethane	44.5		43.7		44.5		45.1	
Ethylbenzene	0.15	U	0.15	U	0.15	U	0.15	U
Methylene chloride	0.63	U	0.63	U	0.63	U	0.63	U
Styrene	0.15	U	0.15	U	0.15	U	0.15	U
Tetrachloroethylene	0.21	U	0.21	U	0.21	U	0.21	U
Toluene	0.22	U	0.22	U	0.22	U	0.22	U
Toluene-d8	47.8		46.5		47.2		47.7	
trans-1,2-Dichloroethylene	0.31	U	0.31	U	0.31	U	0.31	U
trans-1,3-Dichloropropylene	0.17	U	0.17	U	0.17	U	0.17	U
Trichloroethylene	0.16	U	0.16	U	0.16	U	0.16	U
Vinyl acetate	0.44	U	0.44	U	0.44	U	0.44	U
Vinyl chloride	0.26	U	0.26	U	0.26	U	0.26	U
Xylenes (total)	0.44	U	0.44	U	0.44	U	0.44	U

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

SNL/NM uses the City of Albuquerque's value of 3.2 mg/L as the standard (that value has not been exceeded). This value is derived from the summation of all values greater than 0.01 mg/L for the list of toxic organics as developed by the EPA for each National Categorical Pretreatment Standard. For non-categorical users, the summation of all values above 0.01 mg/L of those listed in 40 CFR 122, Appendix D, Table II, or as directed by the Industrial Waste Engineer. Based on the Sewer Use and Wastewater Control Table, this value should never exceed 3.2 mg/L.

TABLE C-6. Permitted Sanitary Outfalls, October 2001
(All results reported in milligrams per liter [mg/L] unless otherwise noted.)

Permit No:	2069A		2069F		2069G		2069I		2069K		Regulatory Limit
Station:	WW001		WW006		WW007		WW008		WW011		COA
Date Collected:	10/09/01		10/09/01		10/09/01		10/09/01		10/09001		(mg/L)
Sample ID:	056937		056938		056939		056940		056941		
Analyte											
Aluminum	0.0817		0.156		0.0343	U	0.0343	U	0.0592		900
Arsenic	0.0244		0.0185		0.00457	U	0.0182		0.012		0.051
Boron	0.154		0.204		0.00883	J	0.0882		0.185		NE
Cadmium	0.000289	J	0.000251	U	0.000251	U	0.000251	U	0.000251	U	0.5
Chromium	0.00176	J	0.00117	J	0.00211	J	0.00288	J	0.00225	J	4.1
Copper	0.0322		0.0128		0.00267	U	0.0144		0.0133		5.3
Fluoride	0.632		0.435		12		6.55		0.451		36
Lead	0.00391	J	0.00446	J	0.00344	U	0.0062		0.00344	U	1
Molybdenum	0.0165		0.00952	J	0.00109	J	0.0142		0.333		2
Nickel	0.00182	J	0.0107		0.00156	J	0.00264	J	0.00167	J	2
Selenium	0.00799		0.00309	U	0.00309	U	0.00309	U	0.00309	U	0.46
Silver	0.000627	J	0.000361	J	0.000258	J	0.000271	J	0.000288	J	5
Zinc	0.0752		0.0326		0.006		0.145		0.0371		2.2

Permit No:	2069A		2069F		2069G		2069I		2069K		Regulatory Limit
Station:	WW001		WW006		WW007		WW008		WW011		COA
Date Collected:	10/10/01		10/10/01		10/10/01		10/10/01		10/10/01		(mg/L)
Sample ID:	056944		056945		056946		056947		056948		
Analyte											
Aluminum	0.145		0.0868		0.0343	U	0.0343	U	0.0343	U	900
Arsenic	0.0164		0.0167		0.00457	U	0.0135		0.00837		0.051
Boron	0.14		0.198		0.0149	J	0.0779		0.162		NE
Cadmium	0.000675	J	0.000442	J	0.000251	U	0.000255	J	0.000251	U	0.5
Chromium	0.00301	J	0.00264	J	0.00173	J	0.00201	J	0.000781	U	4.1
Copper	0.0364		0.0138		0.00267	U	0.0137		0.0151		5.3
Fluoride	0.563		0.576		12.2		6		0.447		36
Lead	0.00344	U	0.00624		0.00344	U	0.00344	U	0.00344	U	1
Molybdenum	0.059	B	0.012	B	0.00115	BJ	0.013	B	0.647	B	2
Nickel	0.00302	BJ	0.00325	BJ	0.00156	BJ	0.00163	BJ	0.00224	BJ	2
Selenium	0.00309	U	0.00413	J	0.00436	J	0.00309	U	0.00639		0.46
Silver	0.00149	J	0.000998	J	0.000805	J	0.000197	U	0.000249	J	5
Zinc	0.119		0.0269		0.00842		0.108		0.0522		2.2

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

TABLE C-6. Permitted Sanitary Outfalls, October 2001 *(concluded)*
(All results reported in milligrams per liter [mg/L] unless otherwise noted.)

Permit No:	2069A	2069F	2069G	2069I	2069K	Regulatory Limit COA (mg/L)
Station:	WW001	WW006	WW007	WW008	WW011	
Date Collected:	10/08/01	10/08/01	10/10/01	10/08/01		
Sample ID:	055753	055754	055755	055756		
Analyte						
Cyanide, Total	0.0118 B	0.00793 B	0.00289 BU	0.00289 BU	Not Sampled	0.45
Cyanide, Total	0.0121 B	0.00611 B	0.00289 BU	0.00289 BU	Not Sampled	0.45
Cyanide, Total	0.00819 B	0.00632 B	0.00289 BU	0.00291 BJ	Not Sampled	0.45
Cyanide, Total	0.0098 B	0.00846 B	0.00289 BU	0.0059 B	Not Sampled	0.45

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

TABLE C-7. Summary of Sanitary Outfalls of Radiological Analyses, October 2001
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	2069A			2069F-4			2069I-3			2069K			Regulatory Limit 10 CFR 20
Station	WW001			WW006			WW008			WW011			
Date Collected:	10/09/01			10/09/01			10/09/01			10/09/01			
Sample ID:	056937			056938			056940			056941			
Analyte	Activity		MDA	Activity		MDA	Activity		MDA	Activity		MDA	
Actinium-228	0 ± 9.89	U	19.2	0 ± 10.4	U	20.5	0 ± 8.89	U	17.6	4.21 ± 19.6	U	15.1	300000
Americium-241	0 ± 12.1	U	20.4	-1.25 ± 14.4	U	18.9	7.71 ± 10	U	18.7	-9.73 ± 16.3	U	18.1	200
Antimony-124	0.148 ± 3.2	U	5.81	1.04 ± 3.03	U	5.59	0.335 ± 3.1	U	5.53	0.751 ± 2.53	U	4.56	NE
Antimony-125	-3.44 ± 6.43	U	10.9	-4.52 ± 6.27	U	10.9	4.13 ± 6.06	U	11.4	4.3 ± 5.22	U	9.24	NE
Barium-133	-2.84 ± 3.08	U	5.13	0.0275 ± 3.5	U	5.32	2.14 ± 3.21	U	5.11	-0.814 ± 2.72	U	4.01	NE
Beryllium-7	-5.13 ± 28.1	U	48.3	-4.46 ± 24.7	U	44.5	-7.39 ± 25.2	U	44.5	-1.9 ± 21.2	U	36	NE
Bismuth-211	2.61 ± 14.5	U	25.8	8.71 ± 23.4	U	25.3	8.52 ± 29.5	U	20.7	6.55 ± 30.4	U	20.2	NE
Bismuth-212	-6.03 ± 19	U	33.5	11.8 ± 20.2	U	37.8	-5.67 ± 18.9	U	32.6	9.54 ± 17.6	U	28.3	NE
Bismuth-214	2.39 ± 8.68	U	9.88	0 ± 5.44	U	10.5	4.13 ± 5.11	U	9.45	7.58 ± 11.1		6.62	NE
Cadmium-109	5.29 ± 51.8	U	91.1	-25.1 ± 48.3	U	84.7	-25.9 ± 48.2	U	84.2	-7.68 ± 65.3	U	73.7	NE
Cerium-139	1.87 ± 2.59	U	4.07	-0.511 ± 2.24	U	3.88	-1.22 ± 2.24	U	3.79	-0.532 ± 1.78	U	3.08	NE
Cerium-141	2.02 ± 7.49	U	10.5	-1.14 ± 5.53	U	9.65	3.44 ± 5.76	U	10.3	0 ± 7.25	U	7.92	NE
Cerium-144	-5.5 ± 16.2	U	27.4	4.32 ± 14.7	U	26.3	-6.38 ± 14.1	U	24.3	-0.216 ± 11.9	U	20.8	30000
Cesium-134	-0.948 ± 2.44	U	4.31	-0.653 ± 2.32	U	4.08	-1.28 ± 2.43	U	4.14	-1.87 ± 2.24	U	3.29	9000
Cesium-137	-0.533 ± 2.33	U	4.16	-0.179 ± 2.22	U	4	-0.418 ± 2.44	U	4.27	-0.124 ± 1.85	U	3.3	10000
Chromium-51	-2.44 ± 41.1	U	63.9	11.9 ± 36.2	U	63.3	-17.6 ± 35.7	U	58.6	-0.0169 ± 30	U	51.5	5000000
Cobalt-57	-2.29 ± 2	U	3.28	-0.292 ± 1.85	U	3.26	0.739 ± 1.84	U	3.29	-0.426 ± 1.5	U	2.62	NE
Cobalt-60	-1.4 ± 2.74	U	4.78	1.22 ± 2.35	U	4.74	-0.326 ± 2.74	U	4.97	-1.46 ± 1.94	U	3.2	30000
Europium-152	-1.31 ± 6.76	U	11.8	3.1 ± 7.38	U	12.9	5.39 ± 6.15	U	11.7	2.63 ± 5.47	U	9.56	NE
Europium-154	-1.37 ± 7.77	U	12.1	-5.58 ± 6.97	U	11.8	6.28 ± 7.11	U	14.3	2.63 ± 5.29	U	9.8	NE
Gross Alpha	4.42 ± 1.44		1.88	2.85 ± 1.45		2.1	3.9 ± 1.51		2.15	1.75 ± 1.02		1.46	NE
Gross Beta	27 ± 2.58		2.99	30.6 ± 2.55		2.48	9.56 ± 1.9		2.66	13.8 ± 1.85		2.41	NE
Iron-59	3.3 ± 6.9	U	12.8	0 ± 5.25	U	12.3	-2.89 ± 6.29	U	11.1	-2.85 ± 5.27	U	8.93	100000

See notes at end of table.

TABLE C-7. Summary of Sanitary Outfalls of Radiological Analyses, October 2001 *(continued)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	**2069A**			**2069F-4**			**2069I-3**			**2069K**			
Station	**WW001**			**WW006**			**WW008**			**WW011**			**Regulatory**
Date Collected:	**10/09/01**			**10/09/01**			**10/09/01**			**10/09/01**			**Limit**
Sample ID:	**056937**			**056938**			**056940**			**056941**			**10 CFR 20**
Analyte	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	
Lead-211	-22.4 ± 61.5	U	103	20.7 ± 60.2	U	110	-74.2 ± 75	U	99.6	0 ± 89.3	U	92.2	NE
Lead-212	4.87 ± 8.05	U	7.56	0.472 ± 7.38	U	8.31	0.679 ± 6.37	U	7.13	14.3 ± 10.1		5.55	20000
Lead-214	3.82 ± 5.12	U	9.31	3.03 ± 8.13	U	9.35	2.96 ± 10.3	U	10.1	2.28 ± 10.6	U	7.99	1000000
Manganese-54	0.344 ± 2.38	U	4.34	0.519 ± 2.43	U	4.44	-0.464 ± 2.95	U	4.43	0.102 ± 1.91	U	3.4	NE
Mercury-203	1.51 ± 3.51	U	6.34	0.55 ± 3.42	U	5.94	0.141 ± 3.39	U	5.79	0 ± 2.8	U	4.97	NE
Neptunium-237	5.54 ± 17	U	27.1	0 ± 14.6	U	26.6	0.18 ± 14.1	U	25.2	0 ± 21.3	U	21.4	NE
Neptunium-239	-1.02 ± 14.6	U	25.1	3.22 ± 13.2	U	23.6	-4.7 ± 13.6	U	23.6	-0.35 ± 11	U	19.2	NE
Niobium-95	0 ± 3.86	U	7.47	0.224 ± 3.72	U	6.73	0 ± 3.95	U	7.74	1.37 ± 3.27	U	5.24	NE
Potassium-40	0 ± 45.1	U	50.2	20.3 ± 65.4	U	47	0 ± 30.7	U	63	3.98 ± 43.9	U	35.4	40000
Protactinium-231	56 ± 106	U	192	-52.3 ± 112	U	187	-40.7 ± 110	U	182	-2.69 ± 88.9	U	153	NE
Protactinium-233	3.12 ± 4.6	U	8.39	-3.49 ± 4.6	U	7.49	2.36 ± 4.9	U	8.5	-2.39 ± 3.81	U	6.38	NE
Protactinium-234	6.8 ± 20.7	U	37.9	-1.85 ± 16.3	U	29.2	-2.6 ± 18.3	U	33.7	-5.66 ± 17.1	U	25.4	NE
Radium-223	0 ± 86.9	U	85.3	17.5 ± 46.6	U	81.5	17.3 ± 46.9	U	81	-5.54 ± 38.9	U	66.3	NE
Radium-224	0 ± 90.8	U	77.9	0 ± 64	U	74.8	0 ± 49.8	U	79.6	0 ± 114	U	63.1	NE
Radium-226	2.39 ± 8.68	U	9.88	0 ± 5.44	U	10.5	4.13 ± 5.11	U	9.45	7.58 ± 11.1		6.62	600
Radium-228	0 ± 9.89	U	19.2	0 ± 10.4	U	20.5	0 ± 8.89	U	17.6	4.21 ± 19.6	U	15.1	600
Radon-219	-26.6 ± 26.5	U	43.1	4.49 ± 26.9	U	49.7	21.2 ± 27.1	U	50.7	14.1 ± 26.7	U	41.1	NE
Rhodium-106	2.53 ± 22.2	U	40.6	-8.19 ± 22.4	U	39.2	3.88 ± 21.2	U	38.3	-8.06 ± 17.1	U	29.8	NE
Ruthenium-103	-1.86 ± 3.68	U	6.16	-2.7 ± 4.13	U	6.18	0 ± 3.75	U	6.38	-3.5 ± 3.01	U	4.81	300000
Ruthenium-106	5.27 ± 21.9	U	40.5	-8.2 ± 22.4	U	39.2	0.843 ± 21.5	U	38.5	-5.02 ± 17	U	29.9	30000
Selenium-75	0.959 ± 3.26	U	5.91	-0.678 ± 3.41	U	5.81	-0.67 ± 3.37	U	5.7	-2.04 ± 2.83	U	4.75	NE
Sodium-22	-0.479 ± 2.8	U	4.38	-2.04 ± 2.5	U	4.23	2.25 ± 2.56	U	5.15	1.34 ± 1.87	U	3.53	NE
Strontium-85	-15.9 ± 5.25	U	7.4	-22.8 ± 5.14	U	6.35	-22.4 ± 5.05	U	6.16	-6.83 ± 4.14	U	6.57	NE
Thallium-208	0 ± 2.71	U	5.02	0 ± 5.61	U	5.29	0 ± 3.65	U	5.22	0 ± 2.03	U	3.91	NE

See notes at end of table.

TABLE C-7. Summary of Sanitary Outfalls of Radiological Analyses, October 2001 *(concluded)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	2069A			2069F-4			2069I-3			2069K			Regulatory Limit 10 CFR 20
Station	WW001			WW006			WW008			WW011			
Date Collected:	10/09/01			10/09/01			10/09/01			10/09/01			
Sample ID:	056937			056938			056940			056941			
Analyte	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	**Activity**		**MDA**	
Thorium-227	-12.4 ± 26.4	U	46.1	-5.79 ± 26.6	U	45.4	-20.4 ± 26.6	U	43.1	-13.7 ± 22.6	U	38.2	NE
Thorium-231	0.843 ± 11.8	U	21.2	5.05 ± 12.9	U	22.6	-1.3 ± 13.1	U	22.2	7.94 ± 10.7	U	18.9	300
Thorium-234	40.1 ± 156	U	196	7.52 ± 143	U	179	10.5 ± 163	U	156	67.1 ± 225	U	142	50000
Tin-113	-0.222 ± 3.26	U	5.71	2.46 ± 3.39	U	6.06	0.943 ± 3.08	U	5.68	1.03 ± 2.71	U	4.71	NE
Tritium	399 ± 158		226	292 ± 150		226	240 ± 146		226	217 ± 146	U	230	10000000
Uranium-235	-5.54 ±18.4	U	27.5	5.92 ± 14.2	U	25.3	-2.43 ± 14.9	U	25.8	0 ± 18.4	U	22.1	3000
Uranium-238	40.1 ± 156	U	157	7.52 ± 143	U	160	10.5 ± 163	U	156	67.1 ± 225	U	142	3000
Yttrium-88	-0.527 ± 2.97	U	5.57	1.03 ± 3.1	U	6.12	0.524 ± 2.79	U	5.57	1.96 ± 2.33	U	4.65	100000
Zinc-65	-1.12 ± 5.74	U	10.4	0.0901 ± 5.31	U	10	-1.59 ± 6.09	U	9.39	-1.78 ± 4.41	U	6.45	NE
Zirconium-95	4.19 ± 3.94	U	10.1	0 ± 4.81	U	9.5	-1.36 ± 5.22	U	9.03	1.82 ± 3.88	U	7.13	200000

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

TABLE C-8. Permitted Sanitary Outfalls of Volatile Organic Compounds, October 2001
(All results reported in micrograms per liter [μg/L] unless otherwise noted.)

Permit No:	**2069A**		**2069F**		**2069I**		**2069K**	
Station:	**WW001**		**WW006**		**WW008**		**WW011**	
Date Collected:	**10/09/01**		**10/09/01**		**10/09/01**		**10/09/01**	
Sample ID:	**056937**		**056938**		**056940**		**056941**	
Analyte								
1,1,1-Trichloroethane	0.18	U	0.18	U	0.18	U	0.18	U
1,1,2,2-Tetrachloroethane	0.15	U	0.15	U	0.15	U	0.15	U
1,1,2-Trichloroethane	0.11	U	0.11	U	0.11	U	0.11	U
1,1-Dichloroethane	0.07	U	0.07	U	0.07	U	0.07	U
1,1-Dichloroethylene	0.28	U	0.28	U	0.28	U	0.28	U
1,2-Dichloroethane	0.14	U	0.14	U	0.14	U	0.14	U
1,2-Dichloropropane	0.16	U	0.16	U	0.16	U	0.16	U
2-Butanone	0.81	U	0.81	U	0.81	U	0.81	U
2-Hexanone	0.79	U	0.79	U	0.79	U	0.79	U
4-Methyl-2-pentanone	0.7	U	0.7	U	0.7	U	0.7	U
Acetone	37.1		37.2		613		127	
Benzene	0.14	U	0.14	U	0.14	U	0.14	U
Bromodichloromethane	0.15	U	0.15	U	0.15	U	0.15	U
Bromofluorobenzene	58.8		58.3		79.2	H	58.3	
Bromoform	0.1	U	0.1	U	8.79		0.1	U
Bromomethane	0.24	U	0.24	U	0.24	U	0.24	U
Carbon disulfide	0.9	U	0.9	U	0.9	U	0.9	U
Carbon tetrachloride	0.16	U	0.16	U	0.16	U	0.16	U
Chlorobenzene	0.2	U	0.2	U	0.2	U	0.2	U
Chloroethane	0.32	U	0.32	U	0.32	U	0.32	U
Chloroform	0.17	U	0.17	U	0.17	U	0.17	U
Chloromethane	0.21	U	0.21	U	0.21	U	0.21	U
cis-1,2-Dichloroethylene	0.18	U	0.18	U	0.18	U	0.18	U
cis-1,3-Dichloropropylene	0.18	U	0.18	U	0.18	U	0.18	U
Dibromochloromethane	0.16	U	0.16	U	0.16	U	0.16	U
Dibromofluoromethane	53.8		53.7		91.7	H	54.3	
Ethylbenzene	0.15	U	0.15	U	0.15	U	0.15	U
Methylene chloride	1.03	BJ	1.37	BJ	1.89	BJ	1.55	BJ
Styrene	0.15	U	0.15	U	0.15	U	0.15	U
Tetrachloroethylene	0.21	U	0.21	U	0.21	U	0.21	U
Toluene	0.22	U	0.22	U	0.22	U	0.22	U
Toluene-d8	58.2		57.5		82.6	H	55.7	
trans-1,2-Dichloroethylene	0.31	U	0.31	U	0.31	U	0.31	U
trans-1,3-Dichloropropylene	0.17	U	0.17	U	0.17	U	0.17	U
Trichloroethylene	0.16	U	0.16	U	0.16	U	0.16	U
Vinyl chloride	0.26	U	0.26	U	0.26	U	0.26	U
Xylenes (total)	0.44	U	0.44	U	0.44	U	0.44	U

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

TABLE C-9. Summary of Sanitary Outfalls of Radiological Analyses, December 2001
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit Number:	**2069A**		**2069F-4**		**2069I-3**		**2069K**			**Regulatory Limit 10 CFR 20**
Station	**WW001**		**WW006**		**WW008**		**WW011**			
Date Collected:	**06/12/01**		**06/12/01**		**06/12/01**		**06/12/01**			
Sample ID:	**054781**		**054786**		**054784**		**054784**			
Analyte	**Activity**	**MDA**	**Activity**	**MDA**	**Activity**	**MDA**	**Activity**		**MDA**	
Tritium	Not Sampled		Not Sampled		Not Sampled		91.4 ± 232	<CL	146	10,000,000

NOTES: Data was sample only at Station K during December 2001. Analytical analysis of the sample was performed at the on-site laboratory where all analytes were below the detection limit with the exception of Tritium. Tritium results at Station K at noted in the above table.
<CL = Less than critical level.

TABLE C-10. Permitted Sanitary Outfalls, CY 2001

(All results reported in milligrams per liter [mg/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069A	**WW001**	Aluminum	6	0.071	0.046	0.0343	0.145	900
		Arsenic	6	0.018	0.003	0.0155	0.0244	0.051
		Boron	6	0.166	0.041	0.14	0.248	NE
		Cadmium	6	0.000	0.000	0.000289	0.000675	0.5
		Chromium	6	0.001	0.001	0.000781	0.00301	4.1
		Copper	6	0.030	0.006	0.0236	0.0364	5.3
		Cyanide, Total	8	0.009	0.003	0.00276	0.0136	0.45
		Fluoride	6	0.674	0.075	0.563	0.759	36
		Lead	6	0.004	0.000	0.00344	0.00391	1
		Molybdenum	6	0.140	0.273	0.0165	0.697	2
		Nickel	6	0.002	0.001	0.000743	0.00302	2
		Selenium	6	0.004	0.002	0.00309	0.00799	0.46
		Silver	6	0.001	0.000	0.000197	0.00149	5
		Zinc	6	0.097	0.023	0.0608	0.119	2.2
2069F-4	**WW006**	Aluminum	6	0.422	0.757	0.0343	1.96	900
		Arsenic	6	0.016	0.003	0.0127	0.0194	0.051
		Boron	6	0.235	0.087	0.163	0.404	NE
		Cadmium	6	0.001	0.001	0.000251	0.00166	0.5
		Chromium	6	0.002	0.002	0.000781	0.0046	4.1
		Copper	6	0.027	0.030	0.0115	0.0886	5.3
		Cyanide, Total	8	0.005	0.002	0.00276	0.00846	0.45
		Fluoride	6	0.565	0.109	0.435	0.706	36
		Lead	6	0.005	0.002	0.00344	0.00962	1
		Molybdenum	6	0.042	0.032	0.00952	0.0736	2
		Nickel	6	0.005	0.004	0.000743	0.0107	2
		Selenium	6	0.003	0.000	0.00309	0.00413	0.46
		Silver	6	0.001	0.000	0.000197	0.00142	5
		Zinc	6	0.051	0.046	0.0252	0.143	2.2

NOTES: COA = City of Albuquerque
NE = Not established
Std Dev = Standard Deviation

TABLE C-10. Permitted Sanitary Outfalls, CY 2001 *(continued)*
(All results reported in milligrams per liter [mg/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069G-2	**WW007**	Aluminum	6	0.202	0.208	0.0343	0.461	900
		Arsenic	6	0.005	0.000	0.00457	0.00457	0.051
		Boron	6	0.011	0.003	0.00804	0.0162	NE
		Cadmium	6	0.000	0.000	0.000251	0.000251	0.5
		Chromium	6	0.001	0.001	0.000781	0.00215	4.1
		Copper	6	0.004	0.002	0.00267	0.00653	5.3
		Cyanide, Total	8	0.003	0.000	0.00276	0.00289	0.45
		Fluoride	6	11.095	1.817	8.46	12.7	36
		Lead	6	0.003	0.000	0.00344	0.00344	1
		Molybdenum	6	0.001	0.000	0.000594	0.00115	2
		Nickel	6	0.001	0.001	0.000743	0.00261	2
		Selenium	6	0.003	0.001	0.00309	0.00436	0.46
		Silver	6	0.000	0.000	0.000197	0.000805	5
		Zinc	6	0.025	0.040	0.00281	0.105	2.2
2069I-3	**WW008**	Aluminum	6	0.075	0.052	0.0343	0.166	900
		Arsenic	6	0.016	0.002	0.0135	0.0182	0.051
		Boron	6	0.089	0.010	0.0779	0.106	NE
		Cadmium	6	0.000	0.000	0.000251	0.00043	0.5
		Chromium	6	0.001	0.001	0.000781	0.00288	4.1
		Copper	6	0.012	0.004	0.0075	0.017	5.3
		Cyanide, Total	8	0.003	0.001	0.00276	0.0059	0.45
		Fluoride	6	6.062	1.335	4.61	8.43	36
		Lead	6	0.004	0.001	0.00344	0.0062	1
		Molybdenum	6	0.017	0.006	0.0116	0.0254	2
		Nickel	6	0.002	0.001	0.000743	0.0028	2
		Selenium	6	0.003	0.000	0.00309	0.00309	0.46
		Silver	6	0.000	0.000	0.000197	0.000271	5
		Zinc	6	0.131	0.100	0.0391	0.322	2.2

NOTES: COA = City of Albuquerque
NE = Not established
Std Dev = Standard Deviation

TABLE C-10. Permitted Sanitary Outfalls, CY 2001 *(concluded)*
(All results reported in milligrams per liter [mg/L] unless otherwise noted.)

Permit Number	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit COA
2069K	**WW011**	Aluminum	6	0.079	0.060	0.0343	0.161	900
		Arsenic	6	0.014	0.004	0.00837	0.0188	0.051
		Boron	6	0.233	0.105	0.162	0.436	NE
		Cadmium	6	0.000	0.000	0.000251	0.000725	0.5
		Chromium	6	0.002	0.001	0.000781	0.00496	4.1
		Copper	6	0.217	0.433	0.0133	1.1	5.3
		Fluoride	6	0.546	0.126	0.447	0.738	36
		Lead	6	0.004	0.001	0.00344	0.00613	1
		Molybdenum	6	0.452	0.343	0.0304	0.892	2
		Nickel	6	0.003	0.002	0.00167	0.00632	2
		Selenium	6	0.004	0.001	0.00309	0.00639	0.46
		Silver	6	0.001	0.001	0.000249	0.00234	5
		Zinc	6	0.109	0.063	0.0371	0.187	2.2

NOTES: COA = City of Albuquerque
NE = Not established
Std Dev = Standard Deviation

TABLE C-11. Summary of Sanitary Outfalls of Radiological Analyses, CY 2001
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit (10 CFR 20)
2069A	**WW001**	Actinium-228	3	5.507	6.448	0	12.6	300000
		Americium-241	3	-0.727	4.821	-5.87	3.69	200
		Antimony-124	1	0.148		0.148	0.148	NE
		Antimony-125	1	-3.440		-3.44	-3.44	NE
		Barium-133	1	-2.840		-2.84	-2.84	NE
		Beryllium-7	1	-5.130		-5.13	-5.13	NE
		Bismuth-211	1	2.610		2.61	2.61	NE
		Bismuth-212	1	-6.030		-6.03	-6.03	NE
		Bismuth-214	1	2.390		2.39	2.39	NE
		Cadmium-109	1	5.290		5.29	5.29	NE
		Cerium-139	1	1.870		1.87	1.87	NE
		Cerium-141	1	2.020		2.02	2.02	NE
		Cerium-144	3	-4.677	7.967	-12.2	3.67	30000
		Cesium-134	3	-0.706	1.787	-2.36	1.19	9000
		Cesium-137	3	0.729	1.111	-0.533	1.56	10000
		Chromium-51	3	5.022	10.715	-2.44	17.3	5000000
		Cobalt-57	1	-2.290		-2.29	-2.29	NE
		Cobalt-60	3	-0.237	1.184	-1.4	0.966	30000
		Europium-152	1	-1.310		-1.31	-1.31	NE
		Europium-154	1	-1.370		-1.37	-1.37	NE
		Gross Alpha	2	4.220	0.283	4.02	4.42	NE
		Gross Beta	2	23.650	4.738	20.3	27	NE
		Iron-59	3	0.233	4.927	-5.45	3.3	100000
		Lead-211	1	-22.400		-22.4	-22.4	NE
		Lead-212	3	1.730	2.724	0	4.87	20000
		Lead-214	3	3.483	1.056	2.3	4.33	1000000
		Manganese-54	1	0.344		0.344	0.344	NE
		Mercury-203	1	1.510		1.51	1.51	NE
		Neptunium-237	1	5.540		5.54	5.54	NE
		Neptunium-239	1	-1.020		-1.02	-1.02	NE
		Niobium-95	1	0.000		0	0	NE
		Potassium-40	3	20.333	25.832	0	49.4	40000
		Protactinium-231	1	56.000		56	56	NE
		Protactinium-233	1	3.120		3.12	3.12	0
		Protactinium-234	1	6.800		6.8	6.8	0
		Radium-223	1	0.000		0	0	NE
		Radium-224	1	0.000		0	0	NE
		Radium-226	3	3.460	3.984	0.121	7.87	600
		Radium-228	3	5.507	6.448	0	12.6	600
		Radon-219	1	-26.600		-26.6	-26.6	NE
		Rhodium-106	1	2.530		2.53	2.53	0

See notes at end of table.

TABLE C-11. Summary of Sanitary Outfalls of Radiological Analyses, CY 2001 *(continued)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit (10 CFR 20)
2069A	**WW001**	Ruthenium-103	3	-1.000	1.057	-1.86	0.18	300000
		Ruthenium-106	3	3.957	17.138	-13.8	20.4	30000
		Selenium-75	1	0.959		0.959	0.959	NE
		Sodium-22	1	-0.479		-0.479	-0.479	NE
		Strontium-85	1	-15.900		-15.9	-15.9	NE
		Thallium-208	1	0.000		0	0	NE
		Thorium-227	1	-12.400		-12.4	-12.4	NE
		Thorium-231	3	5.374	11.736	-3.42	18.7	300
		Thorium-232	2	0.157	0.222	0	0.314	500000
		Thorium-234	3	32.467	29.403	0	57.3	50000
		Tin-113	1	-0.222		-0.222	-0.222	NE
		Tritium	3	90.833	270.282	-106	399	10000000
		Uranium-235	3	11.187	16.067	-5.54	26.5	3000
		Uranium-238	3	32.467	29.403	0	57.3	3000
		Yttrium-88	3	-0.413	1.189	-1.54	0.829	100000
		Zinc-65	1	-1.120		-1.12	-1.12	NE
		Zirconium-95	3	0.917	3.166	-2.13	4.19	200000

See notes at end of table.

TABLE C-11. Summary of Sanitary Outfalls of Radiological Analyses, CY 2001 *(continued)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit (10 CFR 20)
2069F-4	**WW006**	Actinium-228	3	9.923	12.600	0	24.1	300000
		Americium-241	3	-7.863	14.784	-24.8	2.46	200
		Antimony-124	1	1.040		1.04	1.04	NE
		Antimony-125	1	-4.520		-4.52	-4.52	NE
		Barium-133	1	0.028		0.0275	0.0275	NE
		Beryllium-7	1	-4.460		-4.46	-4.46	NE
		Bismuth-211	1	8.710		8.71	8.71	NE
		Bismuth-212	1	11.800		11.8	11.8	NE
		Bismuth-214	1	0.000		0	0	NE
		Cadmium-109	1	-25.100		-25.1	-25.1	NE
		Cerium-139	1	-0.511		-0.511	-0.511	NE
		Cerium-141	1	-1.140		-1.14	-1.14	NE
		Cerium-144	3	4.420	0.596	3.88	5.06	30000
		Cesium-134	3	-0.562	0.488	-0.999	-0.0352	9000
		Cesium-137	3	-0.371	0.771	-1.22	0.285	10000
		Chromium-51	3	-6.000	15.552	-16.2	11.9	5000000
		Cobalt-57	1	-0.292		-0.292	-0.292	NE
		Cobalt-60	3	0.596	1.133	-0.712	1.28	30000
		Europium-152	1	3.100		3.1	3.1	NE
		Europium-154	1	-5.580		-5.58	-5.58	NE
		Gross Alpha	2	2.625	0.318	2.4	2.85	NE
		Gross Beta	2	26.300	6.081	22	30.6	NE
		Iron-59	3	0.216	1.062	-0.721	1.37	100000
		Lead-211	1	20.700		20.7	20.7	NE
		Lead-212	3	1.924	2.933	0	5.3	20000
		Lead-214	3	4.930	3.205	3.03	8.63	1000000
		Manganese-54	1	0.519		0.519	0.519	NE
		Mercury-203	1	0.550		0.55	0.55	NE
		Neptunium-237	1	0.000		0	0	NE
		Neptunium-239	1	3.220		3.22	3.22	NE
		Niobium-95	1	0.224		0.224	0.224	NE
		Potassium-40	3	46.200	33.699	20.3	84.3	40000
		Protactinium-231	1	-52.300		-52.3	-52.3	NE
		Protactinium-233	1	-3.490		-3.49	-3.49	NE
		Protactinium-234	1	-1.850		-1.85	-1.85	NE
		Radium-223	1	17.500		17.5	17.5	NE
		Radium-224	1	0.000		0	0	NE
		Radium-226	3	2.800	3.419	0	6.61	600
		Radium-228	3	9.923	12.600	0	24.1	600
		Radon-219	1	4.490		4.49	4.49	NE
		Rhodium-106	1	-8.190		-8.19	-8.19	NE

See notes at end of table.

TABLE C-11. Summary of Sanitary Outfalls of Radiological Analyses, CY 2001 *(continued)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit (10 CFR 20)
2069F-4	**WW006**	Ruthenium-103	3	-2.347	1.074	-3.2	-1.14	300000
		Ruthenium-106	3	11.050	21.915	-8.2	34.9	30000
		Selenium-75	1	-0.678		-0.678	-0.678	NE
		Sodium-22	1	-2.040		-2.04	-2.04	NE
		Strontium-85	1	-22.800		-22.8	-22.8	NE
		Thallium-208	1	0.000		0	0	NE
		Thorium-227	1	-5.790		-5.79	-5.79	NE
		Thorium-231	3	8.670	3.178	5.05	11	300
		Thorium-232	2	2.625	3.712	0	5.25	500000
		Thorium-234	3	110.173	98.110	7.52	203	50000
		Tin-113	1	2.460		2.46	2.46	NE
		Tritium	3	26.000	233.476	-145	292	10000000
		Uranium-235	3	9.780	9.031	3.32	20.1	3000
		Uranium-238	3	110.173	98.110	7.52	203	3000
		Yttrium-88	3	0.076	1.012	-0.986	1.03	100000
		Zinc-65	1	0.090		0.0901	0.0901	NE
		Zirconium-95	3	0.118	0.711	-0.526	0.881	200000

See notes at end of table.

TABLE C-11. Summary of Sanitary Outfalls of Radiological Analyses, CY 2001 *(continued)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit (10 CFR 20)
2069I-3	**WW008**	Actinium-228	3	1.550	2.685	0	4.65	300000
		Americium-241	3	2.653	4.991	-2.27	7.71	200
		Antimony-124	1	0.335		0.335	0.335	NE
		Antimony-125	1	4.130		4.13	4.13	NE
		Barium-133	1	2.140		2.14	2.14	NE
		Beryllium-7	1	-7.390		-7.39	-7.39	NE
		Bismuth-211	1	8.520		8.52	8.52	NE
		Bismuth-212	1	-5.670		-5.67	-5.67	NE
		Bismuth-214	1	4.130		4.13	4.13	NE
		Cadmium-109	1	-25.900		-25.9	-25.9	NE
		Cerium-139	1	-1.220		-1.22	-1.22	NE
		Cerium-141	1	3.440		3.44	3.44	NE
		Cerium-144	3	1.517	6.906	-6.38	6.43	30000
		Cesium-134	3	-0.407	0.958	-1.28	0.618	9000
		Cesium-137	3	7.827	13.664	-0.418	23.6	10000
		Chromium-51	3	1.867	29.084	-17.6	35.3	5000000
		Cobalt-57	1	0.739		0.739	0.739	NE
		Cobalt-60	3	1.168	1.302	-0.326	2.06	30000
		Europium-152	1	5.390		5.39	5.39	NE
		Europium-154	1	6.280		6.28	6.28	NE
		Gross Alpha	2	2.815	1.534	1.73	3.9	NE
		Gross Beta	2	10.030	0.665	9.56	10.5	NE
		Iron-59	3	2.140	4.878	-2.89	6.85	100000
		Lead-211	1	-74.200		-74.2	-74.2	NE
		Lead-212	3	0.226	0.392	0	0.679	20000
		Lead-214	3	2.720	0.295	2.39	2.96	1000000
		Manganese-54	1	-0.464		-0.464	-0.464	NE
		Mercury-203	1	0.141		0.141	0.141	NE
		Neptunium-237	1	0.180		0.18	0.18	NE
		Neptunium-239	1	-4.700		-4.7	-4.7	NE
		Niobium-95	1	0.000		0	0	NE
		Potassium-40	3	8.933	15.473	0	26.8	40000
		Protactinium-231	1	-40.700		-40.7	-40.7	NE
		Protactinium-233	1	2.360		2.36	2.36	NE
		Protactinium-234	1	-2.600		-2.6	-2.6	NE
		Radium-223	1	17.300		17.3	17.3	NE
		Radium-224	1	0.000		0	0	NE
		Radium-226	3	4.473	1.987	2.68	6.61	600
		Radium-228	3	1.550	2.685	0	4.65	600
		Radon-219	1	21.200		21.2	21.2	NE
		Rhodium-106	1	3.880		3.88	3.88	NE

See notes at end of table.

TABLE C-11. Summary of Sanitary Outfalls of Radiological Analyses, CY 2001 *(continued)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit (10 CFR 20)
2069I-3	**WW008**	Ruthenium-103	3	-0.880	0.805	-1.58	0	300000
		Ruthenium-106	3	-0.946	6.624	-8.28	4.6	30000
		Selenium-75	1	-0.670		-0.67	-0.67	NE
		Sodium-22	1	2.250		2.25	2.25	NE
		Strontium-85	1	-22.400		-22.4	-22.4	NE
		Thallium-208	1	0.000		0	0	NE
		Thorium-227	1	-20.400		-20.4	-20.4	NE
		Thorium-231	3	2.310	6.532	-1.62	9.85	300
		Thorium-232	2	0.000	0.000	0	0	500000
		Thorium-234	3	45.933	34.267	10.5	78.9	50000
		Tin-113	1	0.943		0.943	0.943	NE
		Tritium	3	26.067	185.485	-89.8	240	10000000
		Uranium-235	3	9.323	10.210	-2.43	16	3000
		Uranium-238	3	45.933	34.267	10.5	78.9	3000
		Yttrium-88	3	-0.446	1.415	-2.07	0.524	100000
		Zinc-65	1	-1.590		-1.59	-1.59	NE
		Zirconium-95	3	-2.444	2.815	-5.64	-0.333	200000

See notes at end of table.

TABLE C-11. Summary of Sanitary Outfalls of Radiological Analyses, CY 2001 *(continued)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit (10 CFR 20)
2069K	**WW011**	Actinium-228	3	6.520	2.422	4.21	9.04	300000
		Americium-241	3	-17.230	23.054	-43.1	1.14	200
		Antimony-124	1	0.751		0.751	0.751	NE
		Antimony-125	1	4.300		4.3	4.3	NE
		Barium-133	1	-0.814		-0.814	-0.814	NE
		Beryllium-7	1	-1.900		-1.9	-1.9	NE
		Bismuth-211	1	6.550		6.55	6.55	NE
		Bismuth-212	1	9.540		9.54	9.54	NE
		Bismuth-214	1	7.580		7.58	7.58	NE
		Cadmium-109	1	-7.680		-7.68	-7.68	NE
		Cerium-139	1	-0.532		-0.532	-0.532	NE
		Cerium-141	1	0.000		0	0	NE
		Cerium-144	3	-1.079	0.883	-1.98	-0.216	30000
		Cesium-134	3	-3.081	2.899	-6.39	-0.984	9000
		Cesium-137	3	0.559	1.222	-0.169	1.97	10000
		Chromium-51	3	-8.006	6.944	-12.6	-0.0169	5000000
		Cobalt-57	1	-0.426		-0.426	-0.426	NE
		Cobalt-60	3	-0.930	0.462	-1.46	-0.612	30000
		Europium-152	1	2.630		2.63	2.63	NE
		Europium-154	1	2.630		2.63	2.63	NE
		Gross Alpha	2	3.190	2.036	1.75	4.63	NE
		Gross Beta	2	14.400	0.849	13.8	15	NE
		Iron-59	3	2.183	8.246	-2.85	11.7	100000
		Lead-211	1	0.000		0	0	NE
		Lead-212	3	7.610	6.328	1.72	14.3	20000
		Lead-214	3	3.173	2.569	1.17	6.07	1000000
		Manganese-54	1	0.102		0.102	0.102	NE
		Mercury-203	1	0.000		0	0	NE
		Neptunium-237	1	0.000		0	0	NE
		Neptunium-239	1	-0.350		-0.35	-0.35	NE
		Niobium-95	1	1.370		1.37	1.37	NE
		Potassium-40	3	35.293	29.475	3.98	62.5	40000
		Protactinium-231	1	-2.690		-2.69	-2.69	NE
		Protactinium-233	1	-2.390		-2.39	-2.39	NE
		Protactinium-234	1	-5.660		-5.66	-5.66	NE
		Radium-223	1	-5.540		-5.54	-5.54	NE
		Radium-224	1	0.000		0	0	NE
		Radium-226	3	6.356	5.754	0.0881	11.4	600
		Radium-228	3	6.520	2.422	4.21	9.04	600
		Radon-219	1	14.100		14.1	14.1	NE
		Rhodium-106	1	-8.060		-8.06	-8.06	NE

See notes at end of table.

TABLE C-11. Summary of Sanitary Outfalls of Radiological Analyses, CY 2001 *(concluded)*
(All results reported in picocuries per liter [pCi/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum	Regulatory Limit (10 CFR 20)
2069K	**WW011**	Ruthenium-103	3	-4.487	3.042	-7.9	-2.06	300000
		Ruthenium-106	3	3.441	10.293	-5.02	14.9	30000
		Selenium-75	1	-2.040		-2.04	-2.04	NE
		Sodium-22	1	1.340		1.34	1.34	NE
		Strontium-85	1	-6.830		-6.83	-6.83	NE
		Thallium-208	1	0.000		0	0	NE
		Thorium-227	1	-13.700		-13.7	-13.7	NE
		Thorium-231	3	1.117	5.913	-2.5	7.94	300
		Thorium-232	2	4.155	3.472	1.7	6.61	500000
		Thorium-234	3	22.367	38.740	0	67.1	50000
		Tin-113	1	1.030		1.03	1.03	NE
		Tritium	4	11.425	182.034	-202	217	10000000
		Uranium-235	3	8.400	7.343	0	13.6	3000
		Uranium-238	3	22.367	38.740	0	67.1	3000
		Yttrium-88	3	0.293	2.046	-1.99	1.96	100000
		Zinc-65	1	-1.780		-1.78	-1.78	NE
		Zirconium-95	3	1.156	1.565	-0.631	2.28	200000

NOTES: NE = Not established
CFR = Code of Federal Regulations

TABLE C-12. Permitted Sanitary Outfalls of Volatile Organic Compounds, CY 2001
(All results reported in micrograms per liter [µg/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum
2069A	**WW001**	1,1,1-Trichloroethane	2	0.180	0.000	0.18	0.18
		1,1,2,2-Tetrachloroethane	2	0.150	0.000	0.15	0.15
		1,1,2-Trichloroethane	2	0.110	0.000	0.11	0.11
		1,1-Dichloroethane	2	0.070	0.000	0.07	0.07
		1,1-Dichloroethylene	2	0.280	0.000	0.28	0.28
		1,2-Dichloroethane	2	0.140	0.000	0.14	0.14
		1,2-Dichloropropane	2	0.160	0.000	0.16	0.16
		2-Butanone	2	1.145	0.474	0.81	1.48
		2-Hexanone	2	0.790	0.000	0.79	0.79
		4-Methyl-2-pentanone	2	0.700	0.000	0.7	0.7
		Acetone	2	41.800	6.647	37.1	46.5
		Benzene	2	0.140	0.000	0.14	0.14
		Bromodichloromethane	2	0.150	0.000	0.15	0.15
		Bromofluorobenzene	2	55.150	5.162	51.5	58.8
		Bromoform	2	0.100	0.000	0.1	0.1
		Bromomethane	2	0.240	0.000	0.24	0.24
		Carbon disulfide	2	0.900	0.000	0.9	0.9
		Carbon tetrachloride	2	0.160	0.000	0.16	0.16
		Chlorobenzene	2	0.200	0.000	0.2	0.2
		Chloroethane	2	0.320	0.000	0.32	0.32
		Chloroform	2	0.170	0.000	0.17	0.17
		Chloromethane	2	0.210	0.000	0.21	0.21
		cis-1,2-Dichloroethylene	2	0.180	0.000	0.18	0.18
		cis-1,3-Dichloropropylene	2	0.180	0.000	0.18	0.18
		Dibromochloromethane	2	0.160	0.000	0.16	0.16
		Dibromofluoromethane	2	49.150	6.576	44.5	53.8
		Ethylbenzene	2	0.150	0.000	0.15	0.15
		Methylene chloride	2	0.830	0.283	0.63	1.03
		Styrene	2	0.150	0.000	0.15	0.15
		Tetrachloroethylene	2	0.210	0.000	0.21	0.21
		Toluene	2	0.220	0.000	0.22	0.22
		Toluene-d8	2	53.000	7.354	47.8	58.2
		trans-1,2-Dichloroethylene	2	0.310	0.000	0.31	0.31
		trans-1,3-Dichloropropylene	2	0.170	0.000	0.17	0.17
		Trichloroethylene	2	0.160	0.000	0.16	0.16
		Vinyl acetate	1	0.440		0.44	0.44
		Vinyl chloride	2	0.260	0.000	0.26	0.26
		Xylenes (total)	2	0.440	0.000	0.44	0.44

NOTES: Std Dev = Standard Deviation

TABLE C-12. Permitted Sanitary Outfalls of Volatile Organic Compounds, CY 2001 *(continued)*
(All results reported in micrograms per liter [µg/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum
2069F-4	WW006	1,1,1-Trichloroethane	2	0.180	0.000	0.18	0.18
		1,1,2,2-Tetrachloroethane	2	0.150	0.000	0.15	0.15
		1,1,2-Trichloroethane	2	0.110	0.000	0.11	0.11
		1,1-Dichloroethane	2	0.070	0.000	0.07	0.07
		1,1-Dichloroethylene	2	0.280	0.000	0.28	0.28
		1,2-Dichloroethane	2	0.140	0.000	0.14	0.14
		1,2-Dichloropropane	2	0.160	0.000	0.16	0.16
		2-Butanone	2	1.645	1.181	0.81	2.48
		2-Hexanone	2	0.790	0.000	0.79	0.79
		4-Methyl-2-pentanone	2	0.700	0.000	0.7	0.7
		Acetone	2	41.650	6.293	37.2	46.1
		Benzene	2	0.140	0.000	0.14	0.14
		Bromodichloromethane	2	0.150	0.000	0.15	0.15
		Bromofluorobenzene	2	53.500	6.788	48.7	58.3
		Bromoform	2	0.100	0.000	0.1	0.1
		Bromomethane	2	0.240	0.000	0.24	0.24
		Carbon disulfide	2	0.900	0.000	0.9	0.9
		Carbon tetrachloride	2	0.160	0.000	0.16	0.16
		Chlorobenzene	2	0.200	0.000	0.2	0.2
		Chloroethane	2	0.320	0.000	0.32	0.32
		Chloroform	2	0.170	0.000	0.17	0.17
		Chloromethane	2	0.210	0.000	0.21	0.21
		cis-1,2-Dichloroethylene	2	0.180	0.000	0.18	0.18
		cis-1,3-Dichloropropylene	2	0.180	0.000	0.18	0.18
		Dibromochloromethane	2	0.160	0.000	0.16	0.16
		Dibromofluoromethane	2	48.700	7.071	43.7	53.7
		Ethylbenzene	2	0.150	0.000	0.15	0.15
		Methylene chloride	2	1.000	0.523	0.63	1.37
		Styrene	2	0.150	0.000	0.15	0.15
		Tetrachloroethylene	2	0.210	0.000	0.21	0.21
		Toluene	2	0.220	0.000	0.22	0.22
		Toluene-d8	2	52.000	7.778	46.5	57.5
		trans-1,2-Dichloroethylene	2	0.310	0.000	0.31	0.31
		trans-1,3-Dichloropropylene	2	0.170	0.000	0.17	0.17
		Trichloroethylene	2	0.160	0.000	0.16	0.16
		Vinyl acetate	1	0.440		0.44	0.44
		Vinyl chloride	2	0.260	0.000	0.26	0.26
		Xylenes (total)	2	0.440	0.000	0.44	0.44

NOTES: Std Dev = Standard Deviation

TABLE C-12. Permitted Sanitary Outfalls of Volatile Organic Compounds, CY 2001 *(continued)*
(All results reported in micrograms per liter [µg/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum
2069I-3	**WW008**	1,1,1-Trichloroethane	2	0.180	0.000	0.18	0.18
		1,1,2,2-Tetrachloroethane	2	0.150	0.000	0.15	0.15
		1,1,2-Trichloroethane	2	0.110	0.000	0.11	0.11
		1,1-Dichloroethane	2	0.070	0.000	0.07	0.07
		1,1-Dichloroethylene	2	0.280	0.000	0.28	0.28
		1,2-Dichloroethane	2	0.140	0.000	0.14	0.14
		1,2-Dichloropropane	2	0.160	0.000	0.16	0.16
		2-Butanone	2	0.810	0.000	0.81	0.81
		2-Hexanone	2	0.790	0.000	0.79	0.79
		4-Methyl-2-pentanone	2	0.700	0.000	0.7	0.7
		Acetone	2	393.000	311.127	173	613
		Benzene	2	0.140	0.000	0.14	0.14
		Bromodichloromethane	2	0.150	0.000	0.15	0.15
		Bromofluorobenzene	2	64.300	21.072	49.4	79.2
		Bromoform	2	4.445	6.145	0.1	8.79
		Bromomethane	2	0.240	0.000	0.24	0.24
		Carbon disulfide	2	0.900	0.000	0.9	0.9
		Carbon tetrachloride	2	0.160	0.000	0.16	0.16
		Chlorobenzene	2	0.200	0.000	0.2	0.2
		Chloroethane	2	0.320	0.000	0.32	0.32
		Chloroform	2	0.170	0.000	0.17	0.17
		Chloromethane	2	0.210	0.000	0.21	0.21
		cis-1,2-Dichloroethylene	2	0.180	0.000	0.18	0.18
		cis-1,3-Dichloropropylene	2	0.180	0.000	0.18	0.18
		Dibromochloromethane	2	0.160	0.000	0.16	0.16
		Dibromofluoromethane	2	68.100	33.375	44.5	91.7
		Ethylbenzene	2	0.150	0.000	0.15	0.15
		Methylene chloride	2	1.260	0.891	0.63	1.89
		Styrene	2	0.150	0.000	0.15	0.15
		Tetrachloroethylene	2	0.210	0.000	0.21	0.21
		Toluene	2	0.220	0.000	0.22	0.22
		Toluene-d8	2	64.900	25.032	47.2	82.6
		trans-1,2-Dichloroethylene	2	0.310	0.000	0.31	0.31
		trans-1,3-Dichloropropylene	2	0.170	0.000	0.17	0.17
		Trichloroethylene	2	0.160	0.000	0.16	0.16
		Vinyl acetate	1	0.440		0.44	0.44
		Vinyl chloride	2	0.260	0.000	0.26	0.26
		Xylenes (total)	2	0.440	0.000	0.44	0.44

NOTES: Std Dev = Standard Deviation

TABLE C-12. Permitted Sanitary Outfalls of Volatile Organic Compounds, CY 2001 *(concluded)*
(All results reported in micrograms per liter [μg/L] unless otherwise noted.)

Permit No	Station	Analyte	Sample Size	Mean	Std Dev	Minimum	Maximum
2069K	**WW011**	1,1,1-Trichloroethane	2	0.180	0.000	0.18	0.18
		1,1,2,2-Tetrachloroethane	2	0.150	0.000	0.15	0.15
		1,1,2-Trichloroethane	2	0.110	0.000	0.11	0.11
		1,1-Dichloroethane	2	0.070	0.000	0.07	0.07
		1,1-Dichloroethylene	2	0.280	0.000	0.28	0.28
		1,2-Dichloroethane	2	0.140	0.000	0.14	0.14
		1,2-Dichloropropane	2	0.160	0.000	0.16	0.16
		2-Butanone	2	1.400	0.834	0.81	1.99
		2-Hexanone	2	0.790	0.000	0.79	0.79
		4-Methyl-2-pentanone	2	0.700	0.000	0.7	0.7
		Acetone	2	239.500	159.099	127	352
		Benzene	2	0.140	0.000	0.14	0.14
		Bromodichloromethane	2	0.150	0.000	0.15	0.15
		Bromofluorobenzene	2	54.300	5.657	50.3	58.3
		Bromoform	2	0.167	0.094	0.1	0.233
		Bromomethane	2	0.240	0.000	0.24	0.24
		Carbon disulfide	2	0.900	0.000	0.9	0.9
		Carbon tetrachloride	2	0.160	0.000	0.16	0.16
		Chlorobenzene	2	0.200	0.000	0.2	0.2
		Chloroethane	2	0.320	0.000	0.32	0.32
		Chloroform	2	0.170	0.000	0.17	0.17
		Chloromethane	2	0.210	0.000	0.21	0.21
		cis-1,2-Dichloroethylene	2	0.180	0.000	0.18	0.18
		cis-1,3-Dichloropropylene	2	0.180	0.000	0.18	0.18
		Dibromochloromethane	2	0.160	0.000	0.16	0.16
		Dibromofluoromethane	2	49.700	6.505	45.1	54.3
		Ethylbenzene	2	0.150	0.000	0.15	0.15
		Methylene chloride	2	1.090	0.651	0.63	1.55
		Styrene	2	0.150	0.000	0.15	0.15
		Tetrachloroethylene	2	0.210	0.000	0.21	0.21
		Toluene	2	0.220	0.000	0.22	0.22
		Toluene-d8	2	51.700	5.657	47.7	55.7
		trans-1,2-Dichloroethylene	2	0.310	0.000	0.31	0.31
		trans-1,3-Dichloropropylene	2	0.170	0.000	0.17	0.17
		Trichloroethylene	2	0.160	0.000	0.16	0.16
		Vinyl acetate	1	0.440		0.44	0.44
		Vinyl chloride	2	0.260	0.000	0.26	0.26
		Xylenes (total)	2	0.440	0.000	0.44	0.44

NOTES: Std Dev = Standard Deviation

APPENDIX D

2001 Groundwater Contaminant Concentration Trends

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CONTENTS

TABLES

FIGURES

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D.1 INTRODUCTION

Appendix D provides statistical information and graphical representation of groundwater contaminants that exceed the regulatory limit for the specific analyte during Fiscal Year (FY) 2001. The FY 2001 data is presented in the context of historical values for the groundwater analyte concentrations at specific well locations. The summary statistics are provided to evaluate the significance of the exceedence of the regulatory limit during the FY 2001 reporting period in light of the monitoring history for the analyte. In addition to the average (Avg), median (Med), and minimum/maximum (Min/Max) values of the historical monitoring data, measures of the scatter of the data are provided as standard deviation (Std Dev, SD) and the coefficient of variation (CV). The CV statistic is a normalization of the Std Dev of a data set by the Avg value of the set. This allows for comparison of the amount of scatter among different data sets for the same analyte as obtained from different monitor wells. The concentration values are plotted on graphs to provide a visual representation to determine the significance of the current contaminant values in context of the historical data for the well. The +1 SD and -1 SD lines are plotted on the graphs to illustrate extent of Std Dev from the Avg value of the data set. Trend lines are constructed on the graph using linear or second order polynomial regression analysis. Each data set was tested for linear or non-linear fit with the better of the two used to illustrate the data trend. The significance that can be attributed to these trend lines is related to the number of data points and the scatter of the data. Under ideal conditions, the trend lines can be used to project future or expected data values.

Perchloroethylene (PCE)

Groundwater samples collected from monitor well TA2-W-26 exceeded the maximum contaminant level (MCL) for PCE of 5 micrograms per liter (μg/L) in FY 2001. During previous years sampling yielded results lower than the MCL. Table D-1 lists the statistical summaries for PCE in groundwater samples obtained from monitor well TA2-W-26. Figure D-1 is a plot of the data collected since 1998. PCE concentrations are clearly on the rise at this location.

Trichloroethene (TCE)

Four Environmental Restoration (ER) Project wells contained TCE concentrations above the MCL of 5 μg/L during at least one sampling event in FY 2001. Table D-2 shows the summary statistics of TCE concentrations for wells in which the standard was exceeded.

Figures D-2 through D-5 show the sampling history for TCE concentrations for wells TA2-W-26, WYO-1, WYO-2, and LWDS-MW1. TA2-W-26, WYO-1, and WYO-2 are Tijeras Arroyo Groundwater (TAG) wells. LWDS-MW1 is located in Technical Area V (TA-V). As shown in Figure D-2, the trend line for TA2-W-26 indicates a continuing decrease in TCE concentrations over time. TCE concentrations in wells WYO-1, WYO-2, and LWDS-MW1 have historically increased; however, the non-linear trend lines for each of these wells show that concentrations may have peaked and appear to be leveling off or decreasing. These trends continued during FY 2001. The WYO-1 and WYO-2 wells were plugged and abandoned during the current FY because of suspected cross contamination from the shallow WYO-2 completion to the regional WYO-1. The wells were installed in the same borehole. Two new wells (WYO-3 and WYO-4) were installed approximately 300 feet (ft) west of the old well locations. No data is currently available for the new wells.

Nitrate

During FY 2001, groundwater samples from 12 ER Project wells had nitrate concentrations in at least one sampling period that exceeded the MCL of 10 milligrams per liter (mg/L). Table D-3 shows the summary statistics of nitrate concentrations from samples collected from wells in the three ER operable units, Canyons, TAG, and TA-V.

For the TAG investigational unit the monitor wells with elevated nitrates are grouped in Table D-3 into those completed in a shallow groundwater zone and one well completed in the

TABLE D-1. Summary Statistics of Wells with PCE Concentrations Greater Than the MCL of 5 μg/L in FY 2001

Project Name	Well ID	Analyte	Sample Size	Avg	Med	Std Dev	Min	Max	Range	CV	-1 Std Dev	+1 Std Dev
TAG	TA2-W-26	PCE*	12	3.16	2.4	1.6	1.6	6.1	4.5	0.49	1.60	4.72

NOTE: PCE = Perchloroethylene
Med = median
Min = minimum
Max = maximum
Std Dev = standard deviation
TA-V = Technical Area V
μg/L = microgram per liter
MCL = maximum contaminant level
CV = coefficient of variance
Avg = average
TAG = Tijeras Arroyo Groundwater
*data recorded in database as Tetrachloroethene

TABLE D-2. Summary Statistics of Wells with TCE Concentrations Greater Than the MCL of 5 μg/L in FY 2001

Project Name	Well ID	Analyte	Sample Size	Avg	Med	Std Dev	Min	Max	Range	CV	-1 Std Dev	+1 Std Dev
Tijeras Arroyo	TA2-W-26	TCE	13	8.05	8.50	1.08	6.2	9.6	3.4	0.13	6.97	9.13
	WYO-1	TCE	20	5.33	5.60	1.05	2.9	6.8	3.9	0.20	4.28	6.38
	WYO-2	TCE	19	6.03	6.30	1.05	3.7	7.5	3.8	0.17	4.98	7.07
TA-V	LWDS-MW1	TCE	18	18.88	18.7	3.03	14	23	9	0.16	15.85	21.91

NOTE: TCE = Trichloroethene
Med = median
Min = minimum
Max = maximum
Std Dev = standard deviation
TA-V = Technical Area V
μg/L = microgram per liter
MCL = maximum contaminant level
CV = coefficient of variance
Avg = average
TAG = Tijeras Arroyo Groundwater

TABLE D-3. Summary Statistics of Wells with Nitrate Concentrations Greater Than the MCL of 10 mg/L in FY 2001

Project Name		Well ID	Analyte	Sample Size	Avg	Med	Std Dev	Min	Max	Range	CV	-1 Std Dev	+1 Std Dev
Canyons		CYN-MW1D	Nitrate as N	11	14.31	15.70	2.80	10	18.2	8.2	0.20	11.51	17.11
		CYN-MW3	Nitrate as N	8	12.35	12.3	1.34	9.8	14.4	4.6	0.11	11.01	13.69
TAG	Shallow	TA1-W-03	Nitrate as N	13	7.19	7	1.89	3.9	11	7.1	0.26	5.30	9.09
		TA2-SW1-320	Nitrate as N	20	27.62	27.62	6.05	20	44	24	0.22	21.57	33.67
		TA2-W-19	Nitrate as N	14	9.09	7.8	4.70	5.4	24	18.6	0.52	4.39	13.78
		TJA-2	Nitrate as N	20	8.49	8	2.05	4.7	14	9.3	0.24	6.44	10.54
		TJA-5	Nitrate as N	10	8.49	7.85	2.88	4.1	14	9.9	0.34	5.61	11.37
		TJA-7	Nitrate as N	3	40	40	1	39	41	2	0.03	39.00	41.00
	Regional	TJA-4	Nitrate as N	10	27.70	27	4.40	20	34	14	0.16	23.30	32.10
TA-V		AVN-1	Nitrate as N	19	8.47	8.8	2.48	2.8	13	10.2	0.29	5.99	10.95
		AVN-2	Nitrate as N	18	9.35	9.1	2.61	4.1	16	11.9	0.28	6.74	11.96
		LWDS-MW1	Nitrate as N	19	12.25	12	2.88	8.4	18	9.6	0.24	9.37	15.14

NOTE: mg/L = milligram per liter
MCL = maximum contaminant level
CV = coefficient of variance
Avg = average
TAG = Tijeras Arroyo Groundwater
Med = median
Min = minimum
Max = maximum
Std Dev = standard deviation
TA-V = Technical Area V

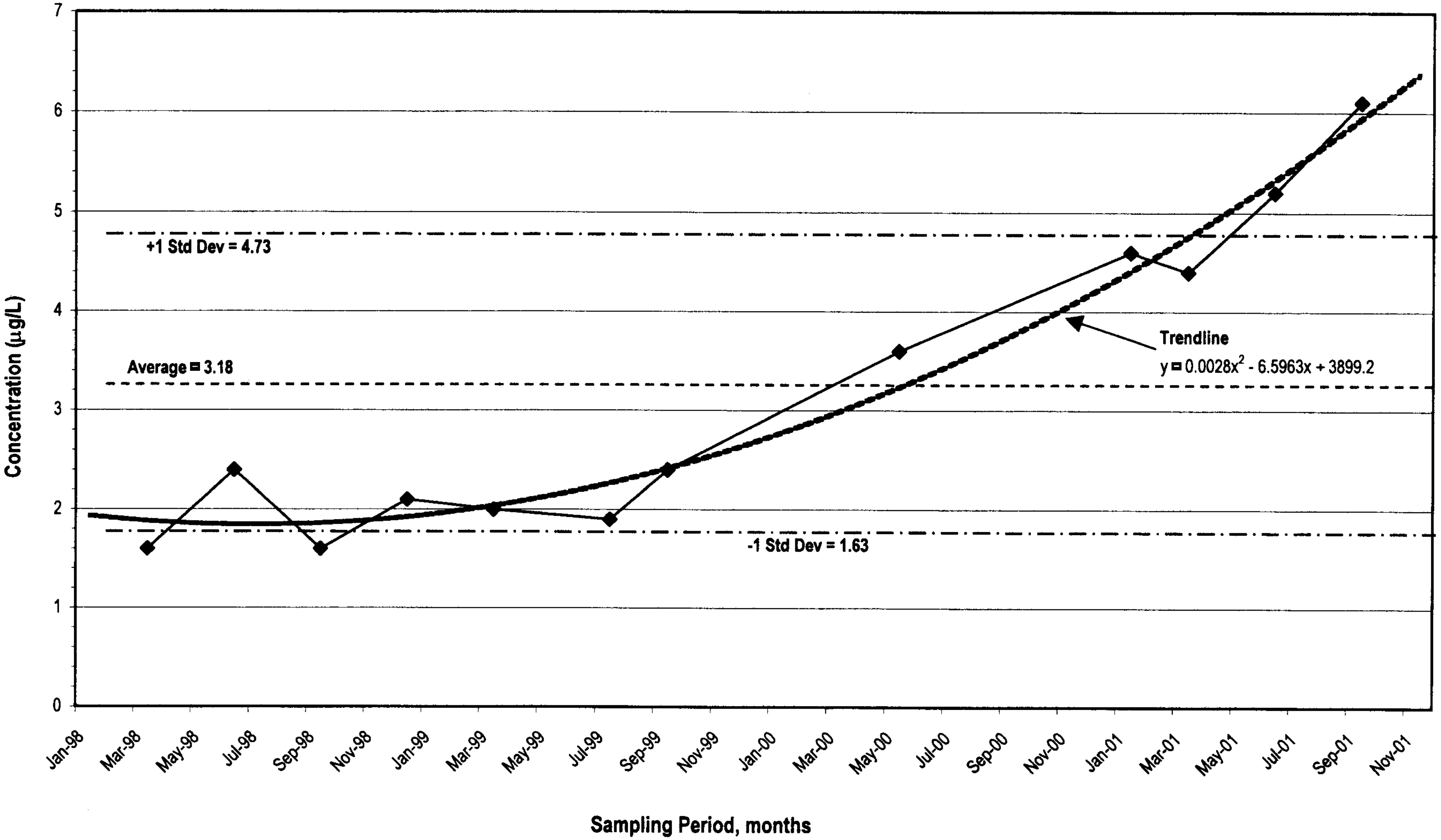

FIGURE D-1. PCE Concentrations, TA2-W-26

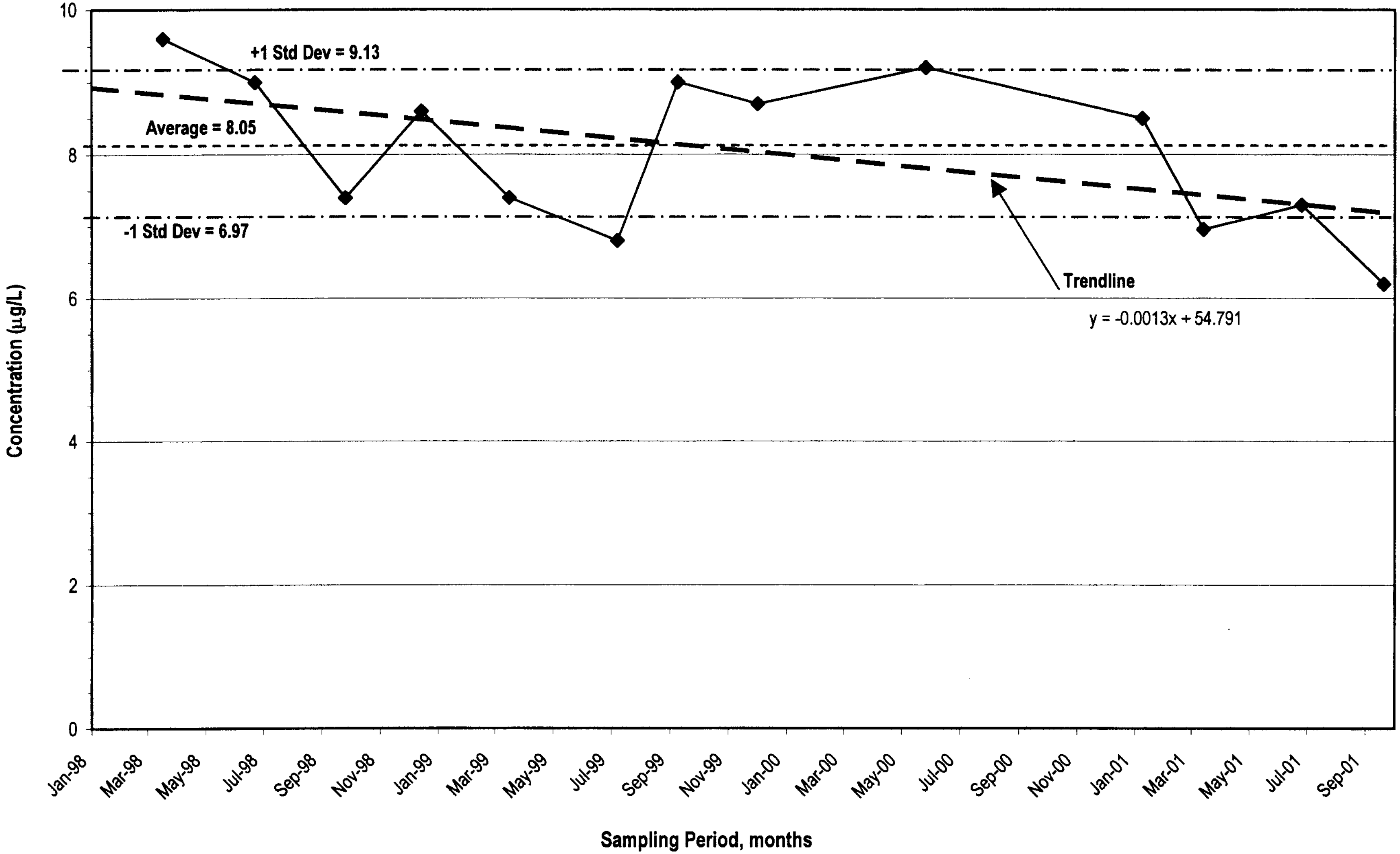

FIGURE D-2. TCE Concentrations, TA2-W-26

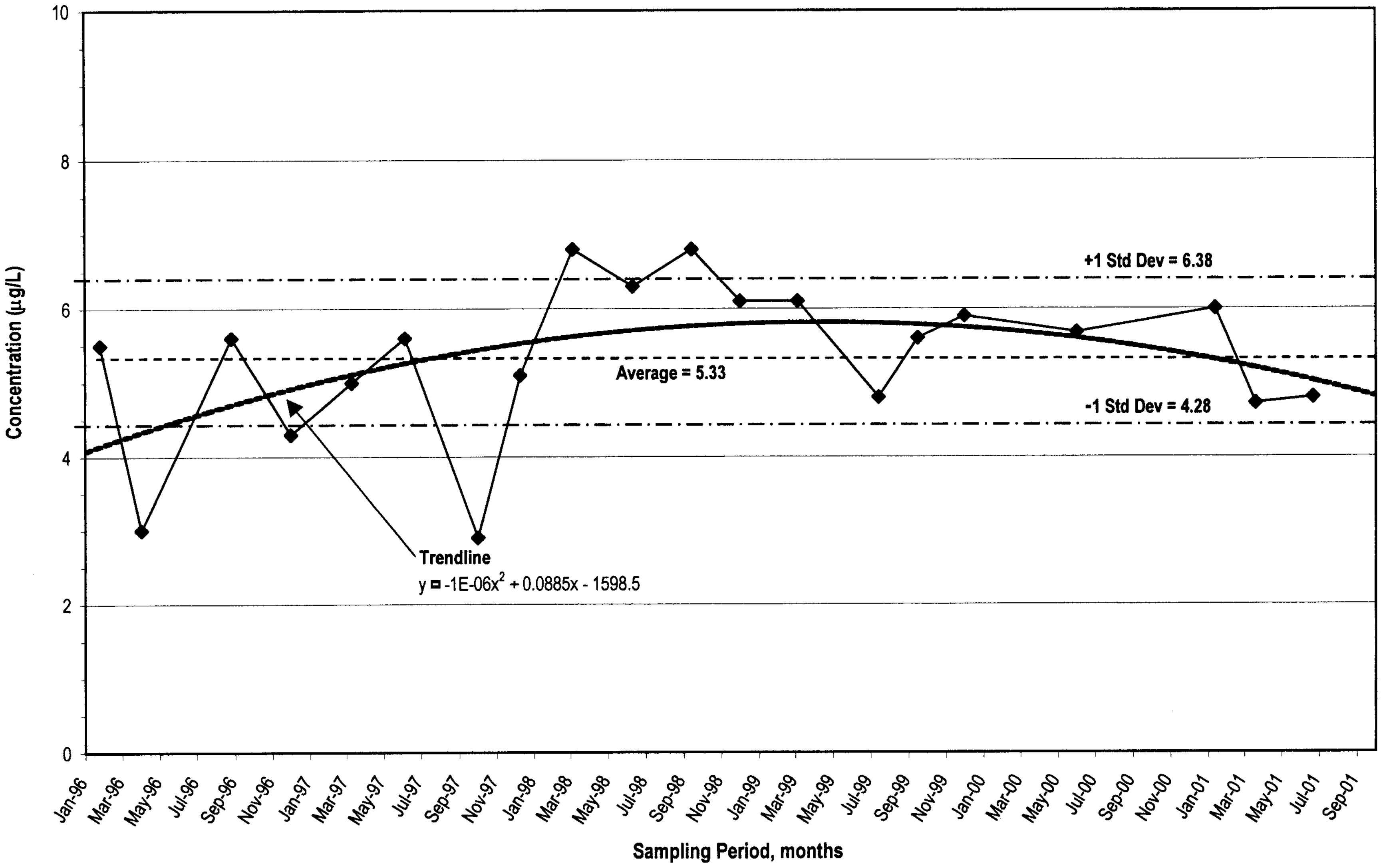

FIGURE D-3. TCE Concentrations, WYO-1

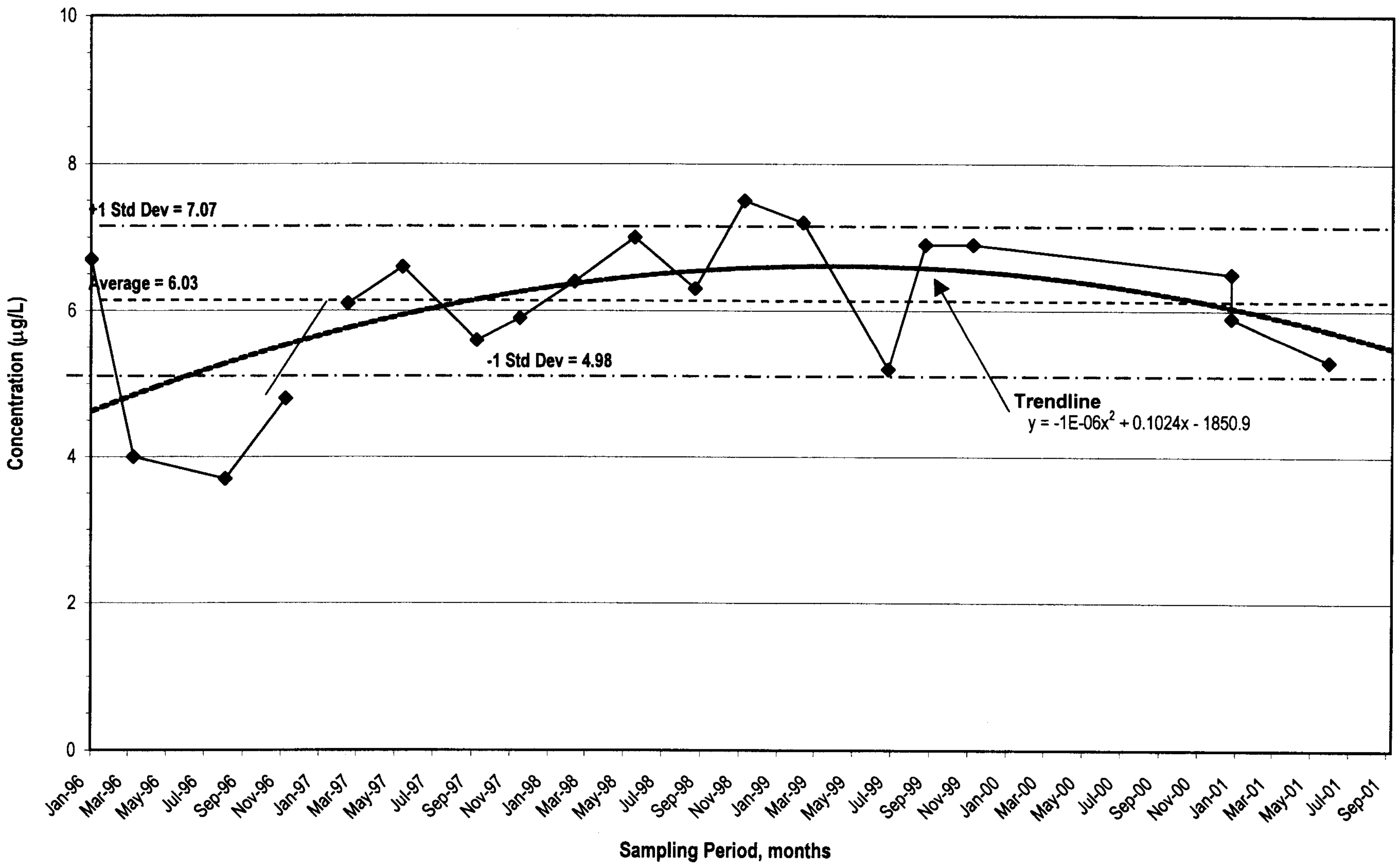

FIGURE D-4. TCE Concentrations, WYO-2

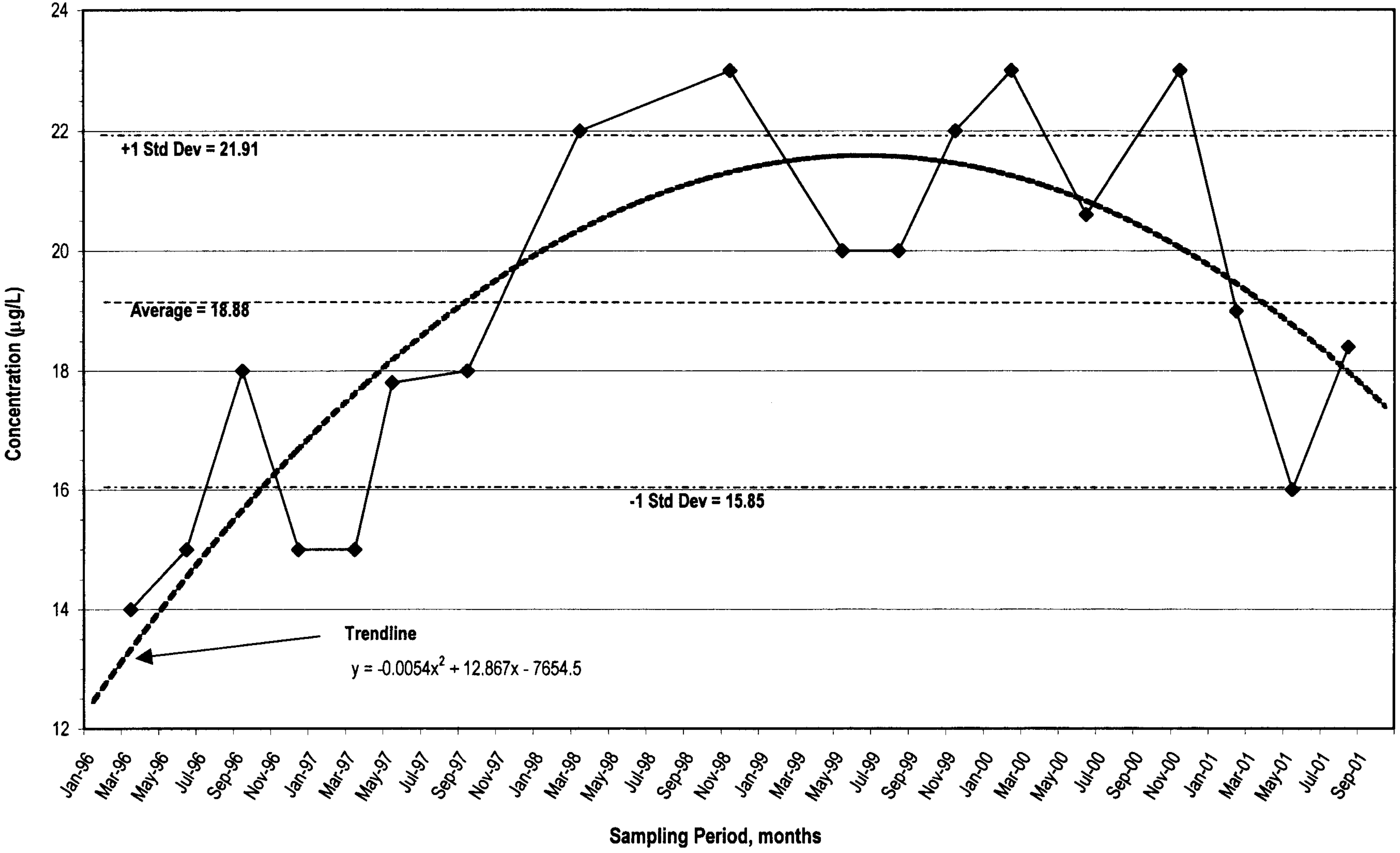

FIGURE D-5. TCE Concentrations, LWDS-MW1 regional aquifer. Figures D-6 through D-17 show the history of nitrate concentrations of the wells listed in Table D-3. In some of the monitor wells, the significance is not the amount of the nitrate concentration in excess of the standard but the trend demonstrated by the data.

Figure D-6 and D-7 illustrate the data for the two monitor wells at the Canyon site. The trend of nitrate concentrations at CYN-MW1D shows increasing concentrations over the last three years. The trend line for CYN-MW3 appears to be almost level, although the average concentration at 12.35 mg/L exceeds the MCL of 10 mg/L.

The average nitrate concentrations for monitor wells completed in the shallow water zone associated with the TAG are less than the MCL. However, for at least one groundwater sampling event in FY 2001 the nitrate concentration for TA1-W-03, TA2-W-19, TJA-2, TJA-5, TA2-SW1-320, and TJA-7 exceeded the MCL. Nitrate concentrations in TA2-SW1-320 and TJA-7 routinely exceeded the MCL. The nitrate concentration history for wells in the shallow groundwater zone exceeding the MCL during FY 2001 is shown in Figures D-8 to D-13. All of the listed wells demonstrate a slightly increasing trend for nitrate concentrations. The trend line for TJA-7 is based on only three data points and may not be reliable as an indicator of future values.

Only one regional well (TJA-4) in the TAG investigation area exceeded the nitrate standard during FY 2001. Nitrate concentrations obtained from this well have consistently exceeded the MCL and the trend (as illustrated in Figure D-14) demonstrates that the values are continuing to increase.

Three monitor wells in the TA-V ER investigational area (AVN-1, AVN-2, and LWDS-MW1) had levels of nitrate that exceeded the MCL.

The nitrate data for AVN-1 and AVN-2 are shown in Figures D-15 and D-16. The wells are 20 ft apart and AVN-1 is screened 75 ft lower than AVN-2 in the aquifer. The statistics for both wells are very similar with an occasional exceedance of the MCL. The historical data indicated a slight increase in nitrate concentrations in both wells.

The other well in TA-V with nitrate concentrations exceeding the MCL is LWDS-MW1. This well is associated with a seepage pit within TA-V. As illustrated in Figure D-17, nitrate concentrations have been above the 10 mg/L MCL for most of the samples collected over the past five years. The historical trend is increasing, although the data collected in FY 2001 has demonstrated a systematic decrease throughout the year.

Uranium-234 (U-234)

Two Groundwater Protection Program (GWPP) surveillance wells (TRE-1 and EOD Hill) were identified as having U-234 activities greater than the U.S. Department of Energy (DOE) drinking water guideline of 20 picocurie per liter (pCi/L), as shown in Table D-4. The U.S. Environmental Protection Agency (EPA) drinking water MCL is a mass based concentration of 30 μg/L, which is equivalent to 27 pCi/L using an average mass-to-activity ratio of 1.11 as assumed by the EPA. None of these wells exceed the EPA's new standard for uranium. The wells are located east of the Tijeras Fault Zone where uranium concentrations in groundwater are naturally elevated. The numbers for these wells are consistent with background activities for U-234 in this geologic setting. U-234 activities for TRE-1 and EOD Hill are illustrated in Figure D-18 and Figure D-19, respectively.

Due to the limited number of data points, the trend line calculations are uncertain. Since these data represent background values, the trend lines should be level and reflect average values.

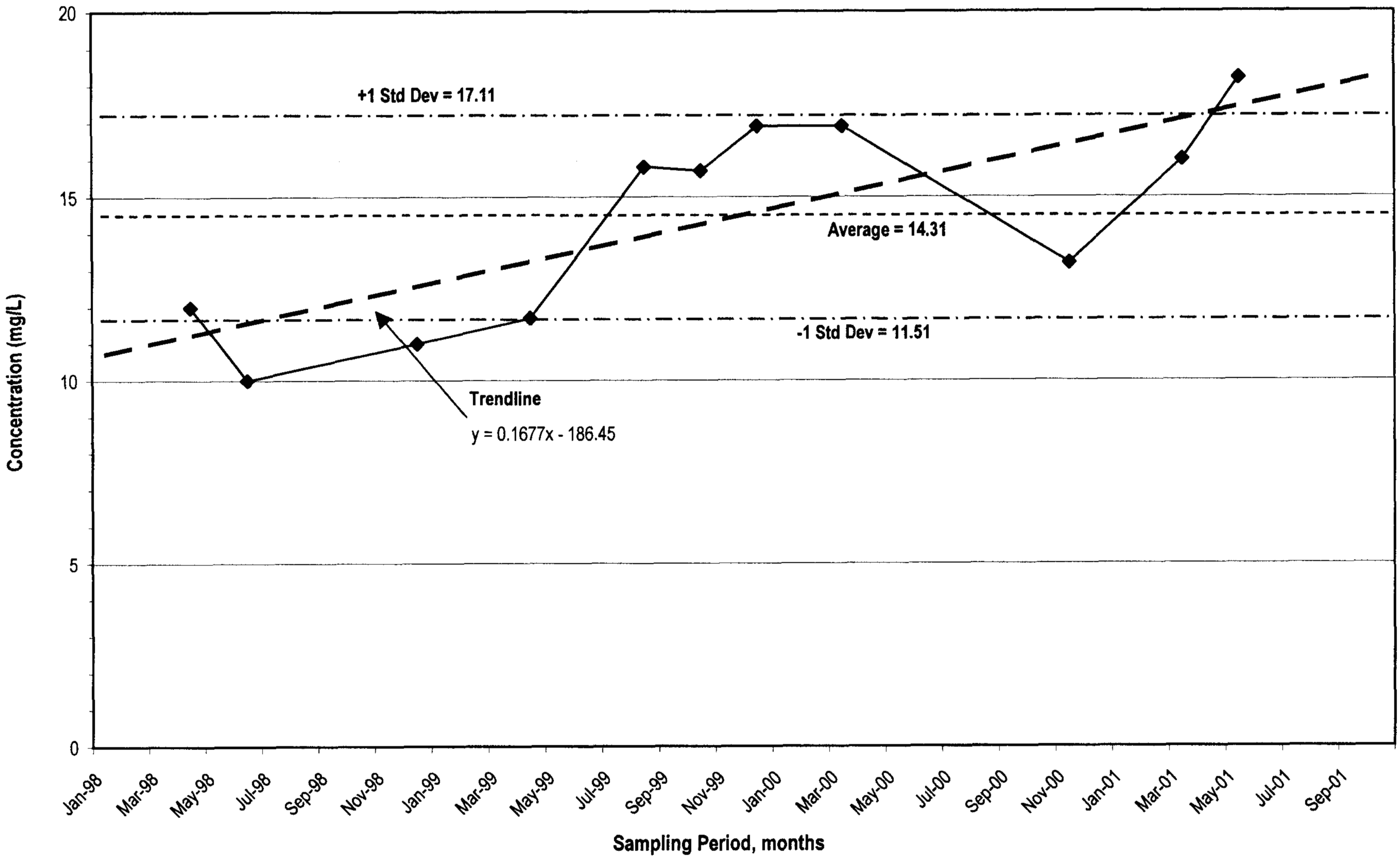

FIGURE D-6. Nitrate Concentrations, CYN-MW1D

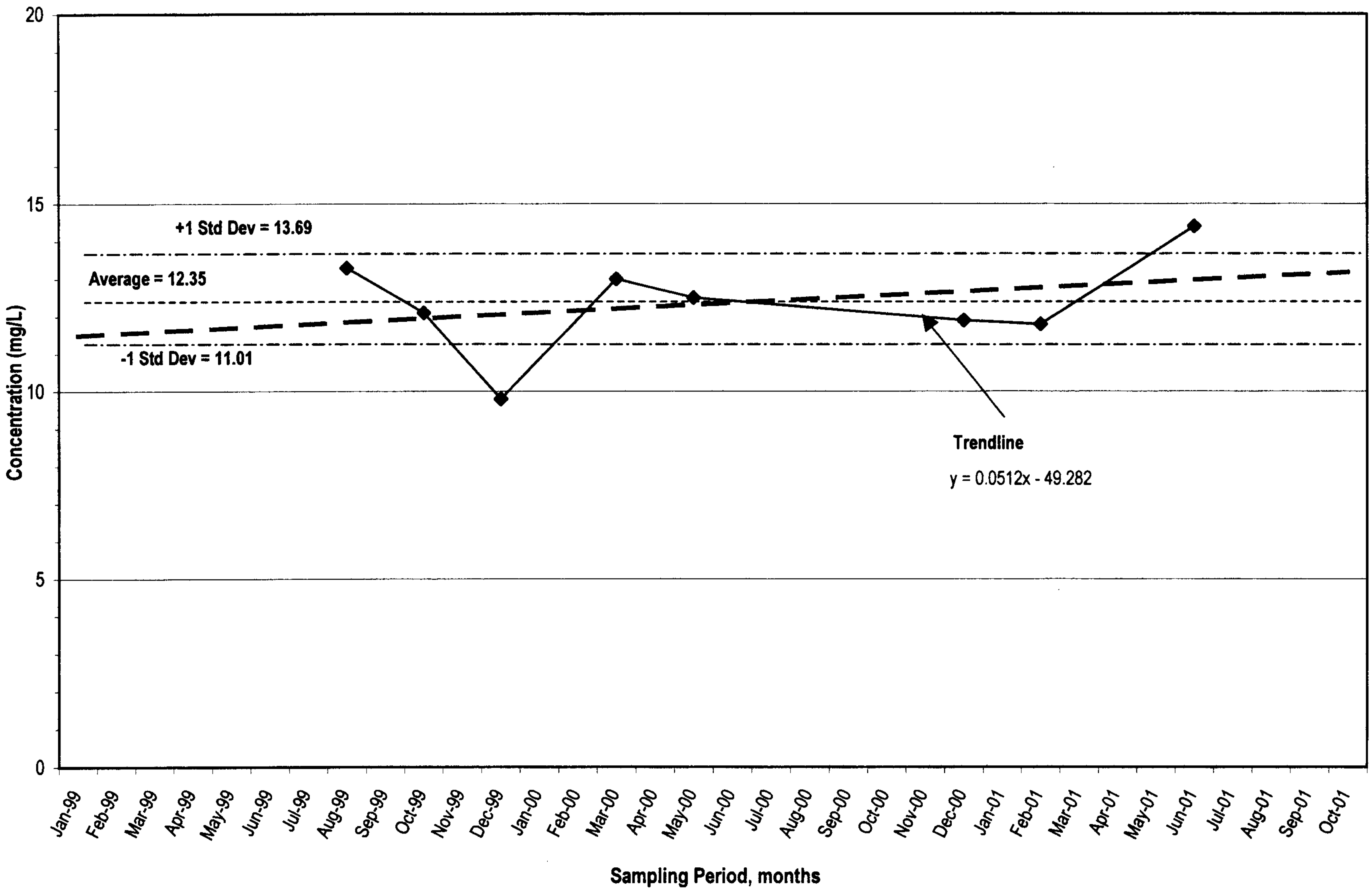

FIGURE D-7. Nitrate Concentrations, CYN-MW3

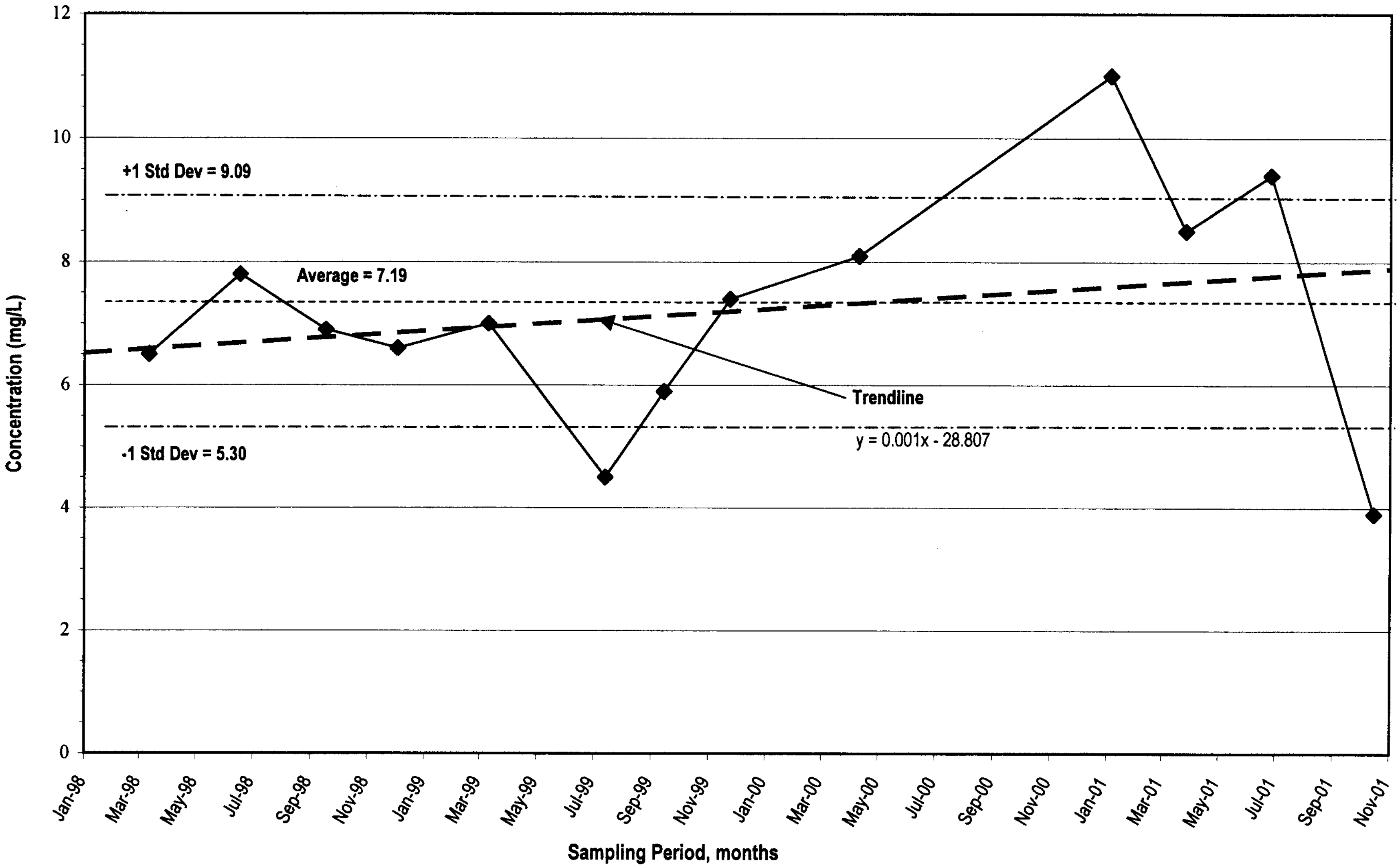

FIGURE D-8. Nitrate Concentrations, TA1-W-03

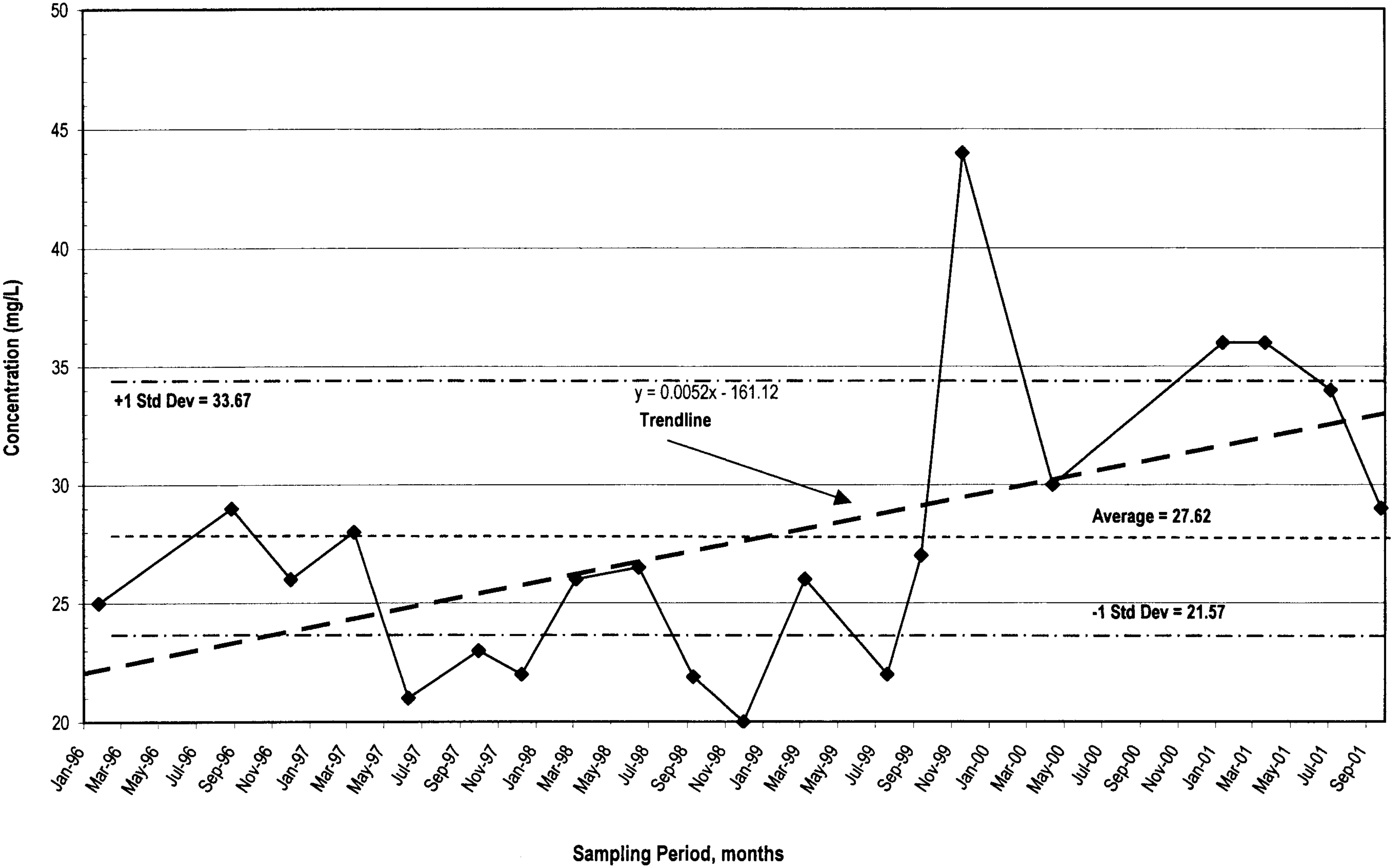

FIGURE D-9. Nitrate Concentrations, TA2-SW1-320

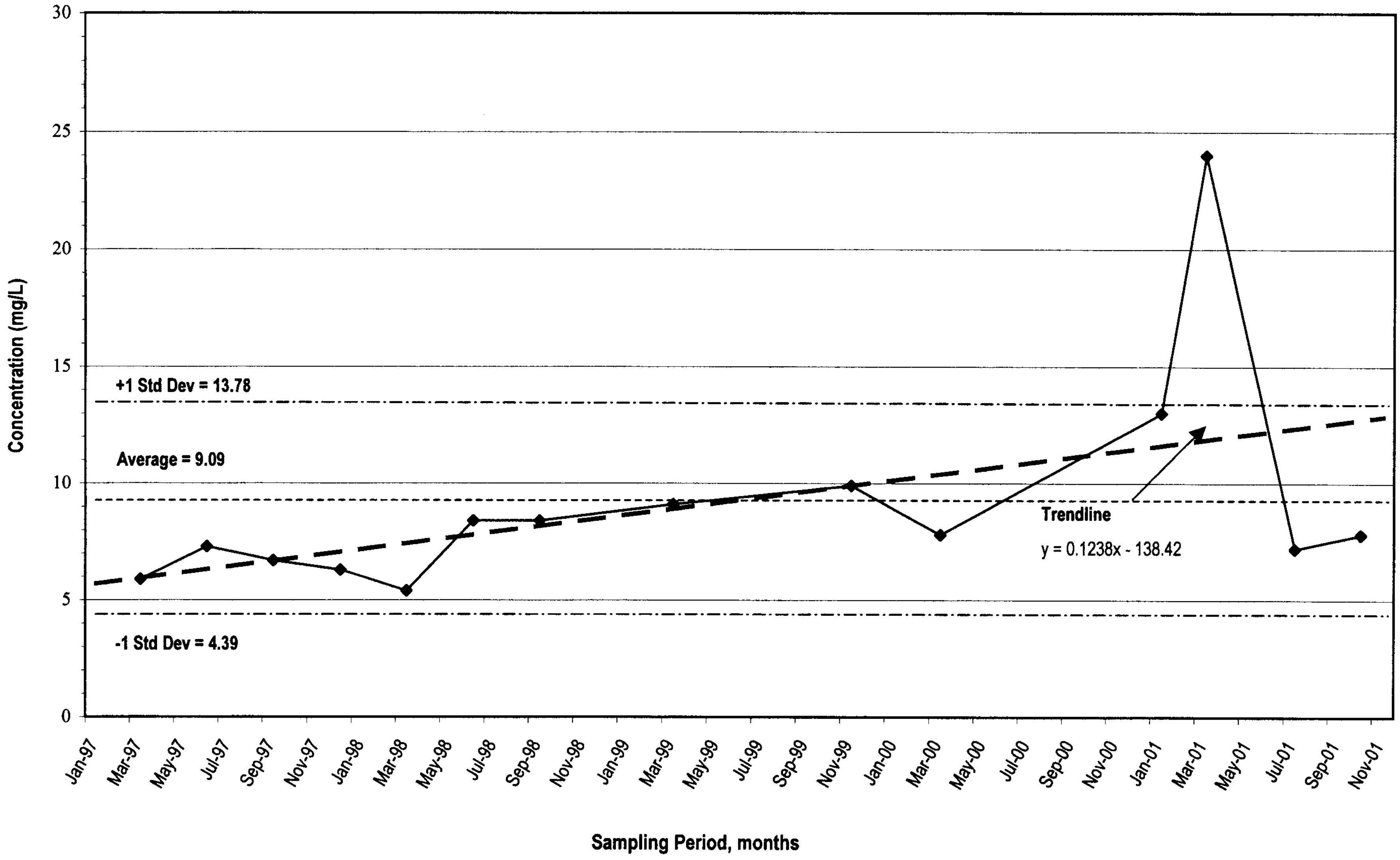

FIGURE D-10. Nitrate Concentrations, TA2-W-19

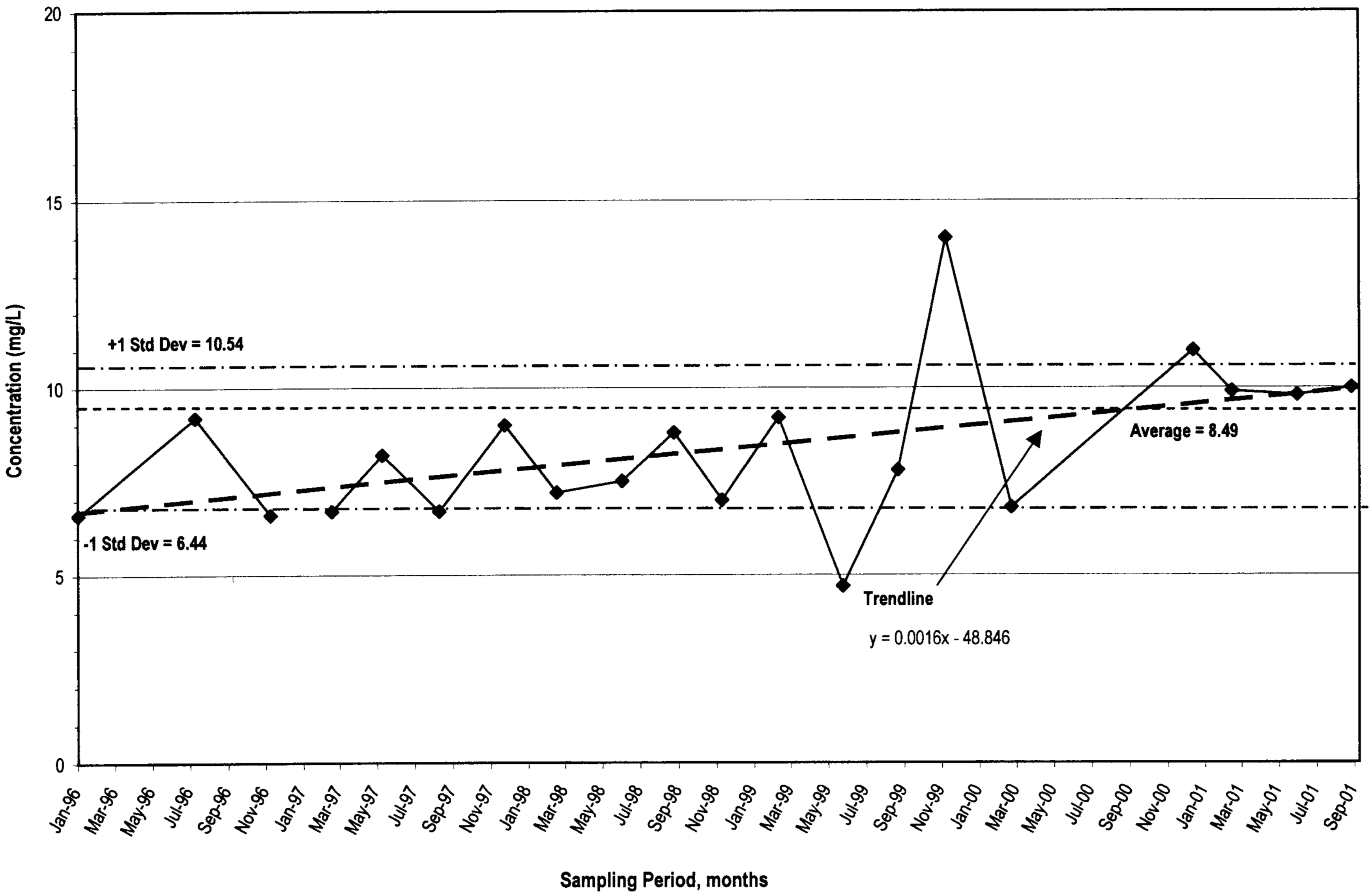

FIGURE D-11. Nitrate Concentrations, TJA-2

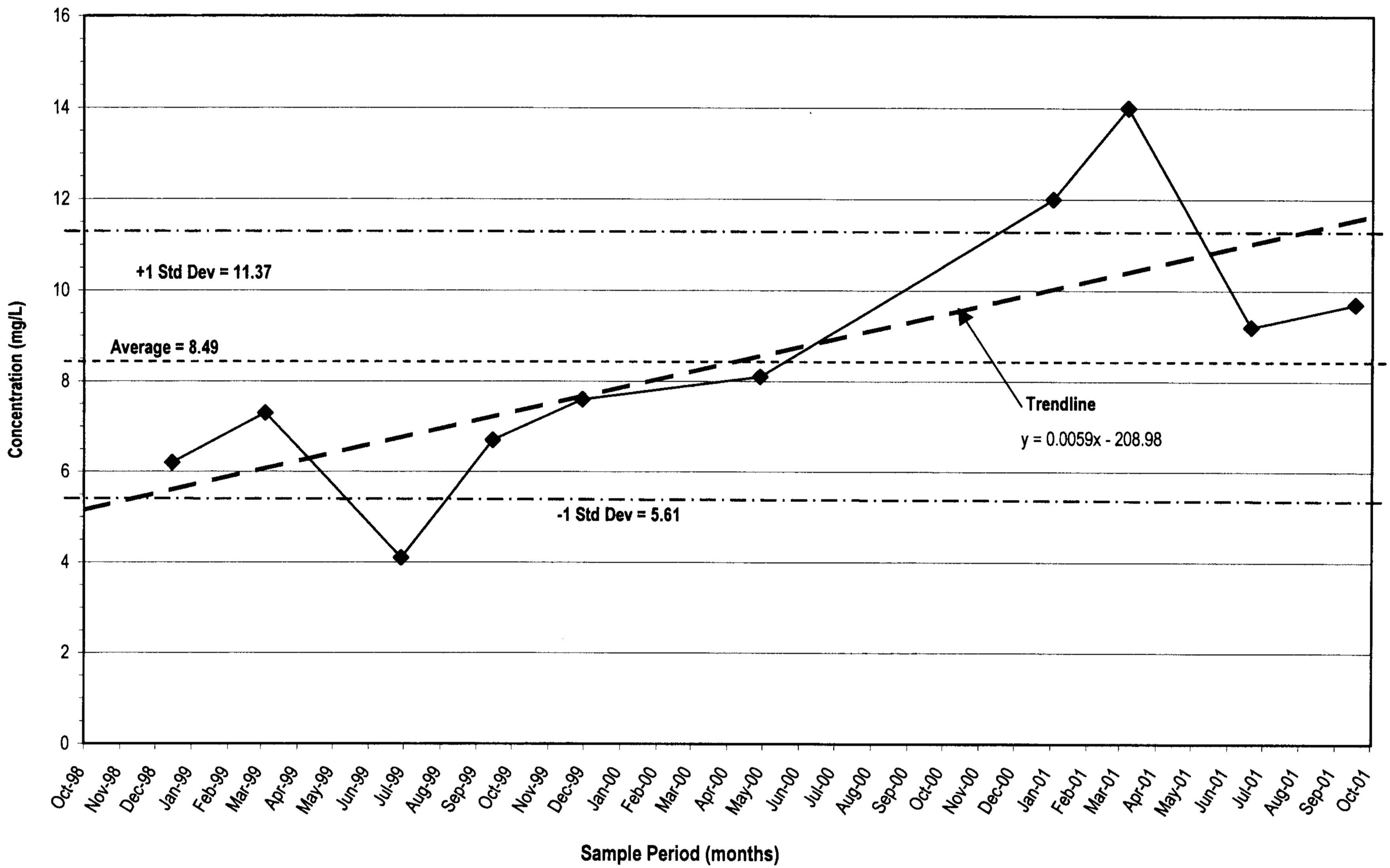

FIGURE D-12. Nitrate Concentrations, TJA-5

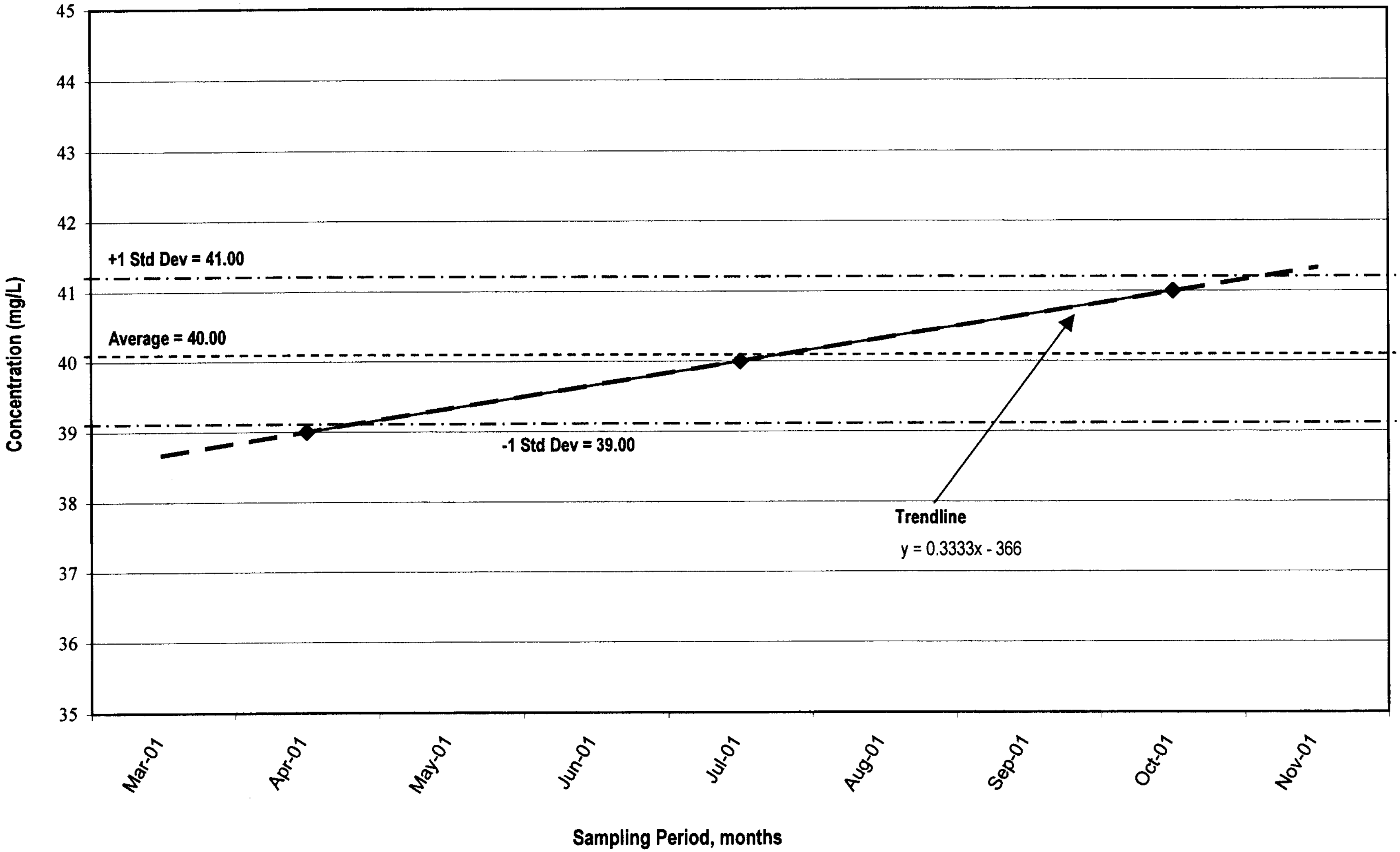

FIGURE D-13. Nitrate Concentrations, TJA-7

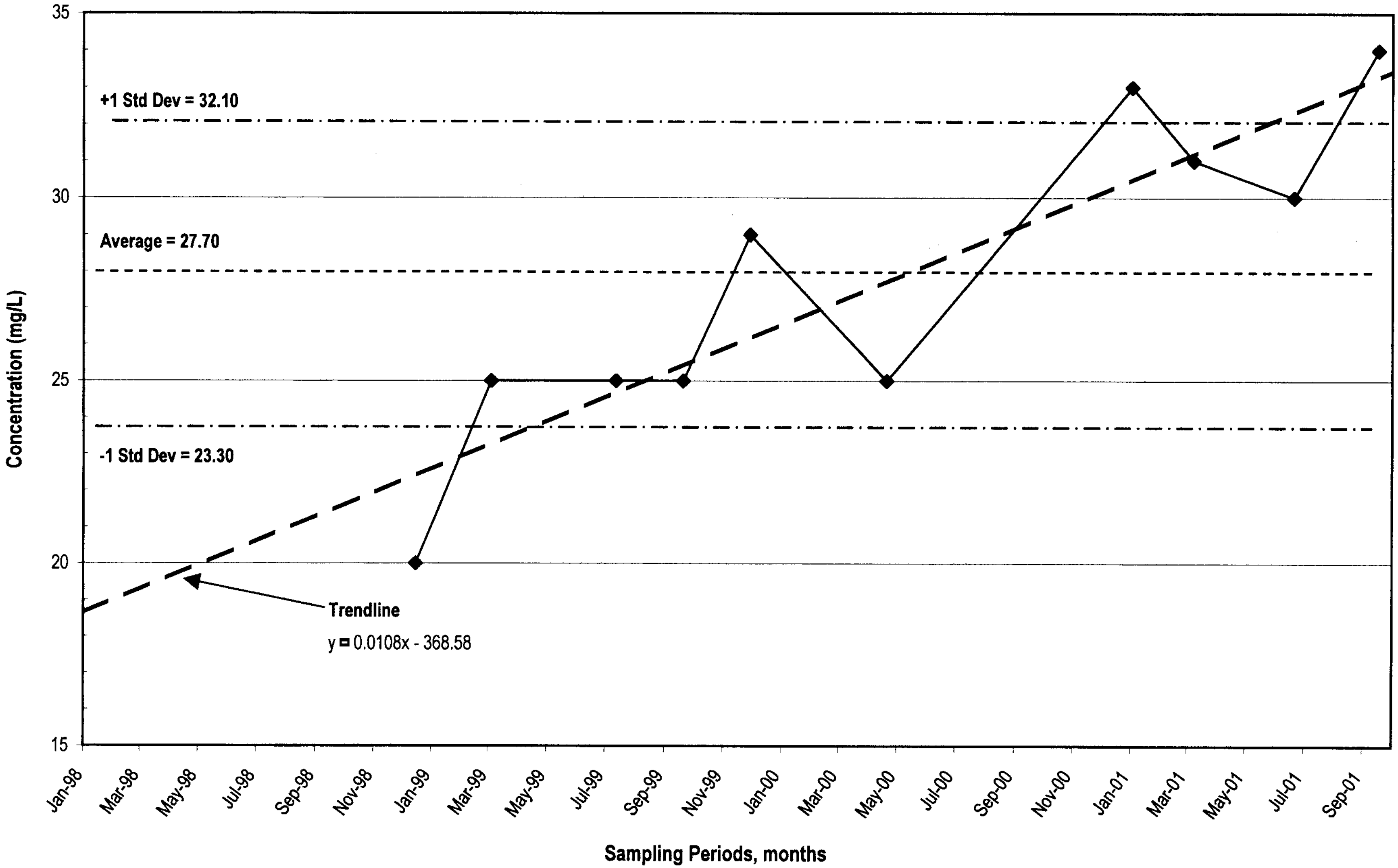

FIGURE D-14. Nitrate Concentrations, TJA-4

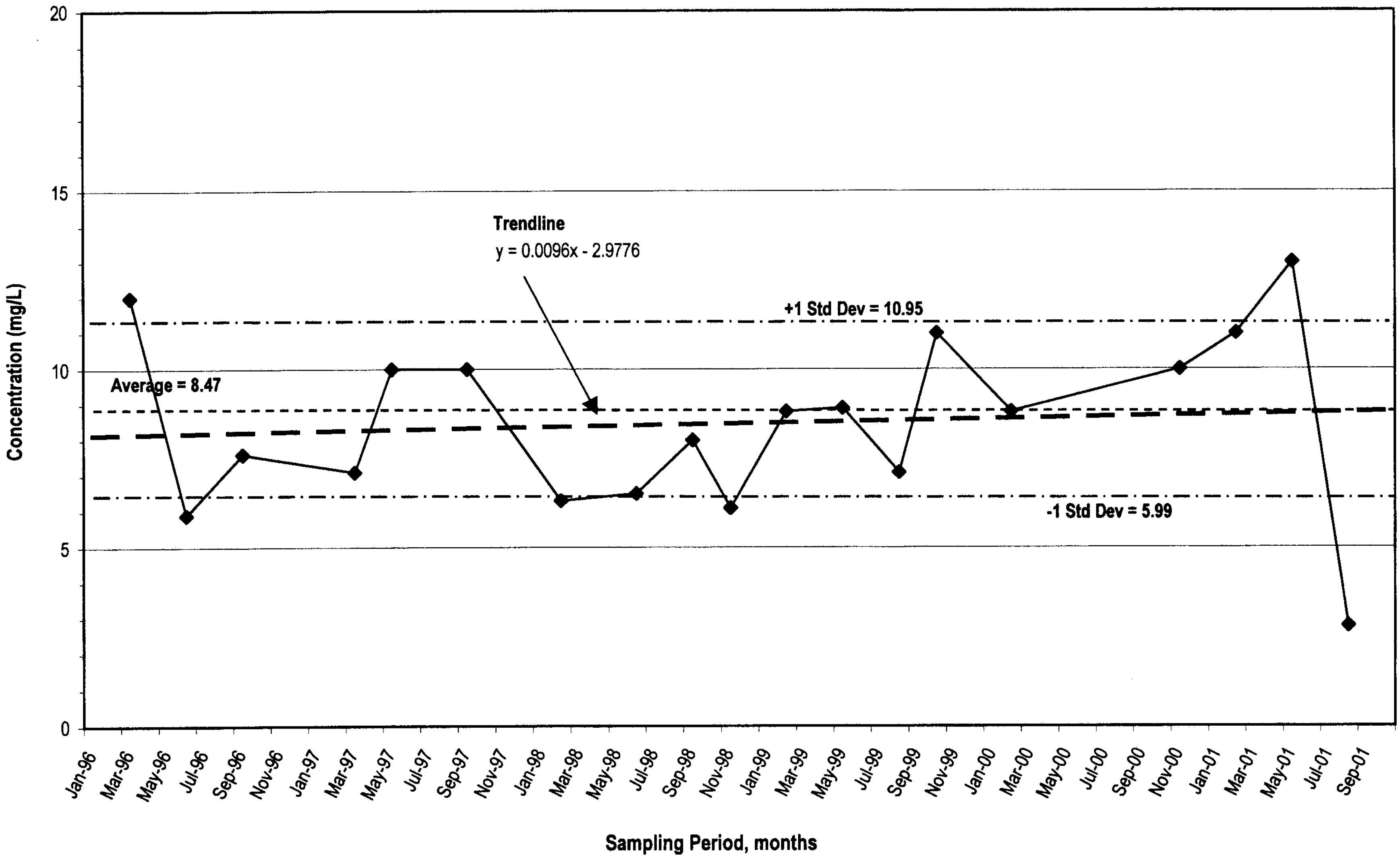

FIGURE D-15. Nitrate Concentrations, AVN-1

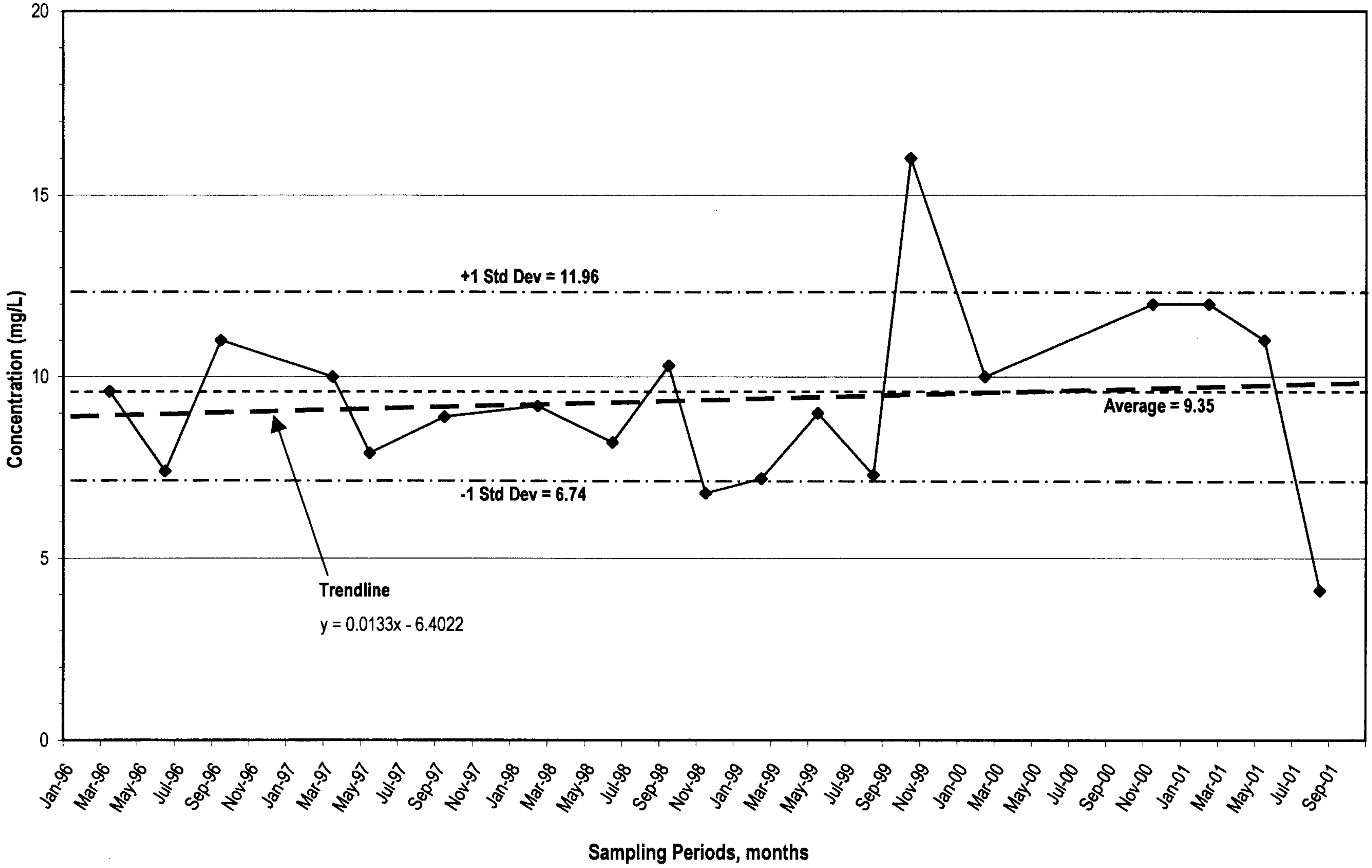

FIGURE D-16. Nitrate Concentrations, AVN-2

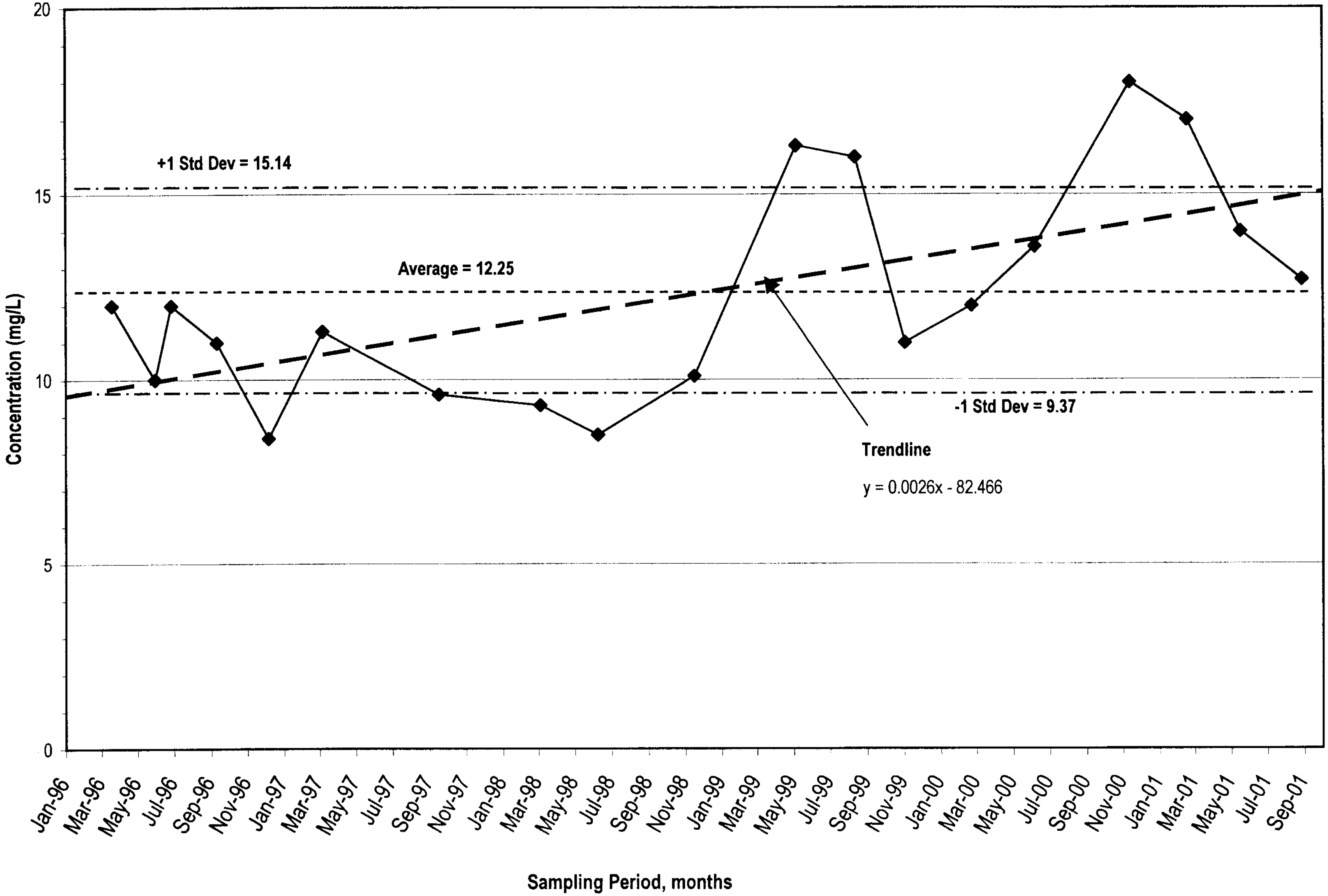

FIGURE D-17. Nitrate Concentrations, LWDS-MW1

TABLE D-4. Summary Statistics of Wells with Uranium-234 Activity Greater Than the MCL of 20 pCi/L in FY 2001

Project Name	Well ID	Analyte	Sample Size	Avg	Med	Std Dev	Min	Max	Range	CV	-1 Std Dev	+1 Std Dev
GWPP	EOD	Uranium-234	3	62.57	61.6	9.99	53.1	73	19.9	0.16	52.58	72.55
	TRE-1	Uranium-234	5	22.18	22.1	1.42	20.5	23.8	3.3	0.06	20.76	23.60

NOTE: pCi/L = picocurie per liter
CV = coefficient of variance
Avg = average
MCL = maximum contaminant level
GWPP = Groundwater Protection Program
Med = median
Min = minimum
Max = maximum
Std Dev = standard deviation

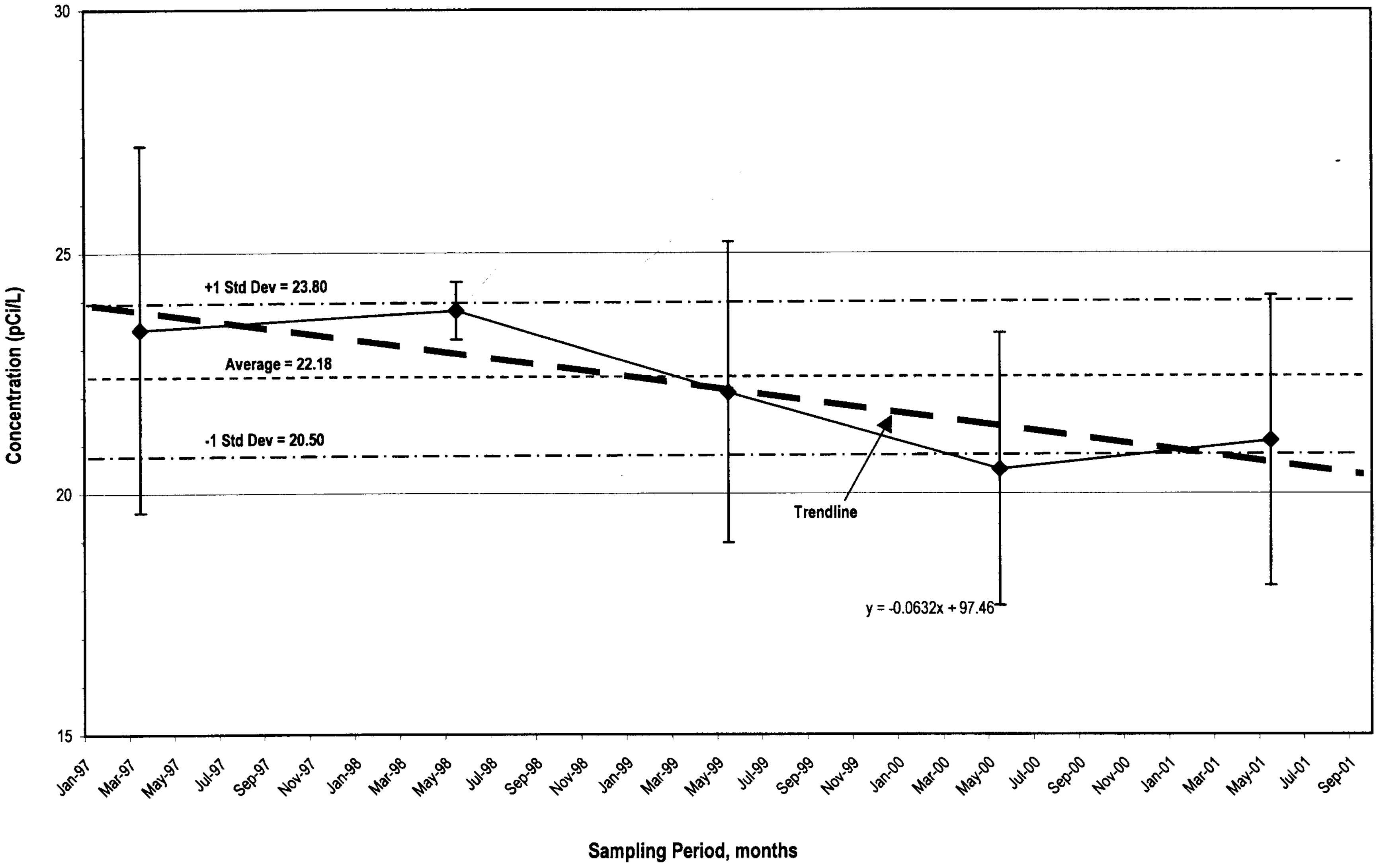

FIGURE D-18. Uranium-243 Concentrations, TRE-1

Nickel

Analysis of groundwater samples from four ER wells identified nickel concentrations greater than the drinking water MCL of 0.1 mg/L. Two wells (CWL-MW2A and CWL-MW4) are located at the Chemical Waste Landfill (CWL) and the two other wells (MWL-MW1 and MWL-MW2) are located at the Mixed Waste Landfill (MWL). Nickel is not a contaminant of concern at either site. Field observations and laboratory tests have demonstrated corrosion of the type of stainless steel used in the screens under groundwater immersion conditions. All four of the wells with high nickel concentrations have stainless steel well screens. The nickel, as well as trace chromium in these wells, appears to be the result of the corrosion of the well screens since both nickel and chromium are defining components of stainless steel.

Statistical summaries of nickel concentrations for these wells are listed in Table D-5 and are illustrated in Figures D-20 through D-23.

The trend lines for CWL-MW2A, CWL-MW4, and MWl-MW1 are illustrated in Figures D-20 through D-22 and suggest that the nickel concentration values have peaked and are declining. In contrast, the trend demonstrated for MWL-MW2 in Figure D-23 is toward increasing nickel concentrations.

Selenium

Selenium is a naturally occurring metal in groundwater at Kirtland Air Force Base (KAFB). The shallow or perched groundwater concentrations of selenium appear to be higher than the concentration values obtained from the regional aquifer. The only well where selenium concentrations in groundwater exceed the MCL value of 50 μg/L is TA1-W-03, a shallow groundwater completion. Table D-6 is a statistical summary of the available selenium data for TA1-W-03.

Figure D-24 shows selenium concentrations for TA1-W-03. The data shows considerable scatter so the trend line is difficult to interpret. As it is currently reported, the trend line shows a modest decrease in selenium values over the sampling history.

TABLE D-5. Summary Statistics of Wells with Nickel Concentrations Greater Than the MCL of 0.1 mg/L in FY 2001

Project Name	Well ID	Analyte	Sample Size	Avg	Med	Std Dev	Min	Max	Range	CV	-1 Std Dev	+1 Std Dev
CWL	CWL-MW2A	Nickel	9	0.426	0.37	0.229	0.063	0.78	0.717	0.539	0.196	0.655
	CWL-MW4	Nickel	16	1.219	1.255	0.657	0.23	2.71	2.48	0.539	0.562	1.875
MWL	MWL-MW1	Nickel	6	0.330	0.297	0.140	0.145	0.5	0.355	0.423	0.191	0.470
	MWL-MW2	Nickel	6	0.038	0.005	0.054	0.00342	0.124	0.12058	1.406	-0.016	0.092

NOTE: mg/L = milligram per liter
MCL = maximum contaminant level
CV = coefficient of variance
Avg = average
CWL = Chemical Waste Landfill
Med = median
Min = minimum
Max = maximum
Std Dev = standard deviation
MWL = Mixed Waste Landfill

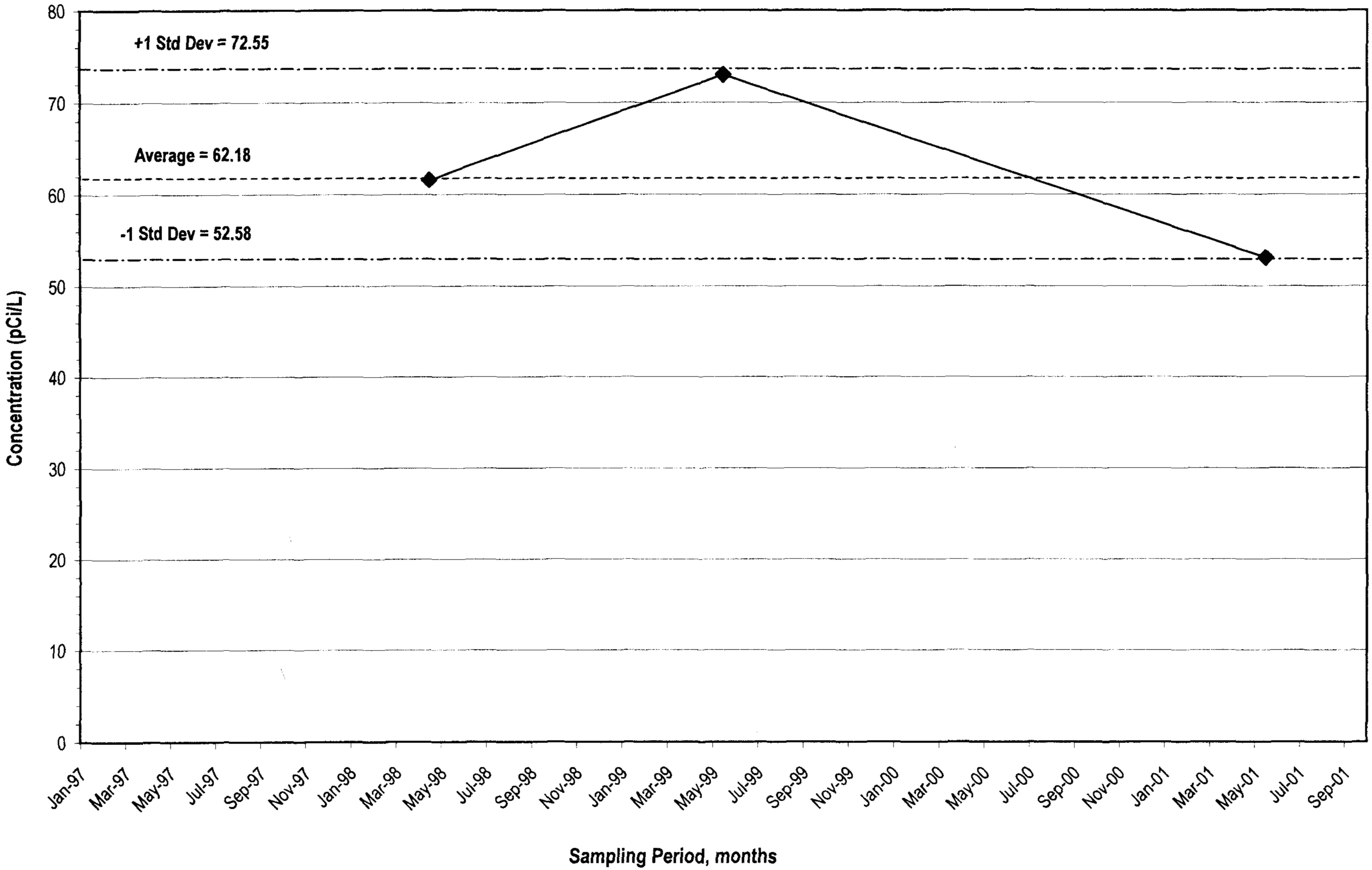

FIGURE D-19. Uranium-234 Concentrations, EOD Hill

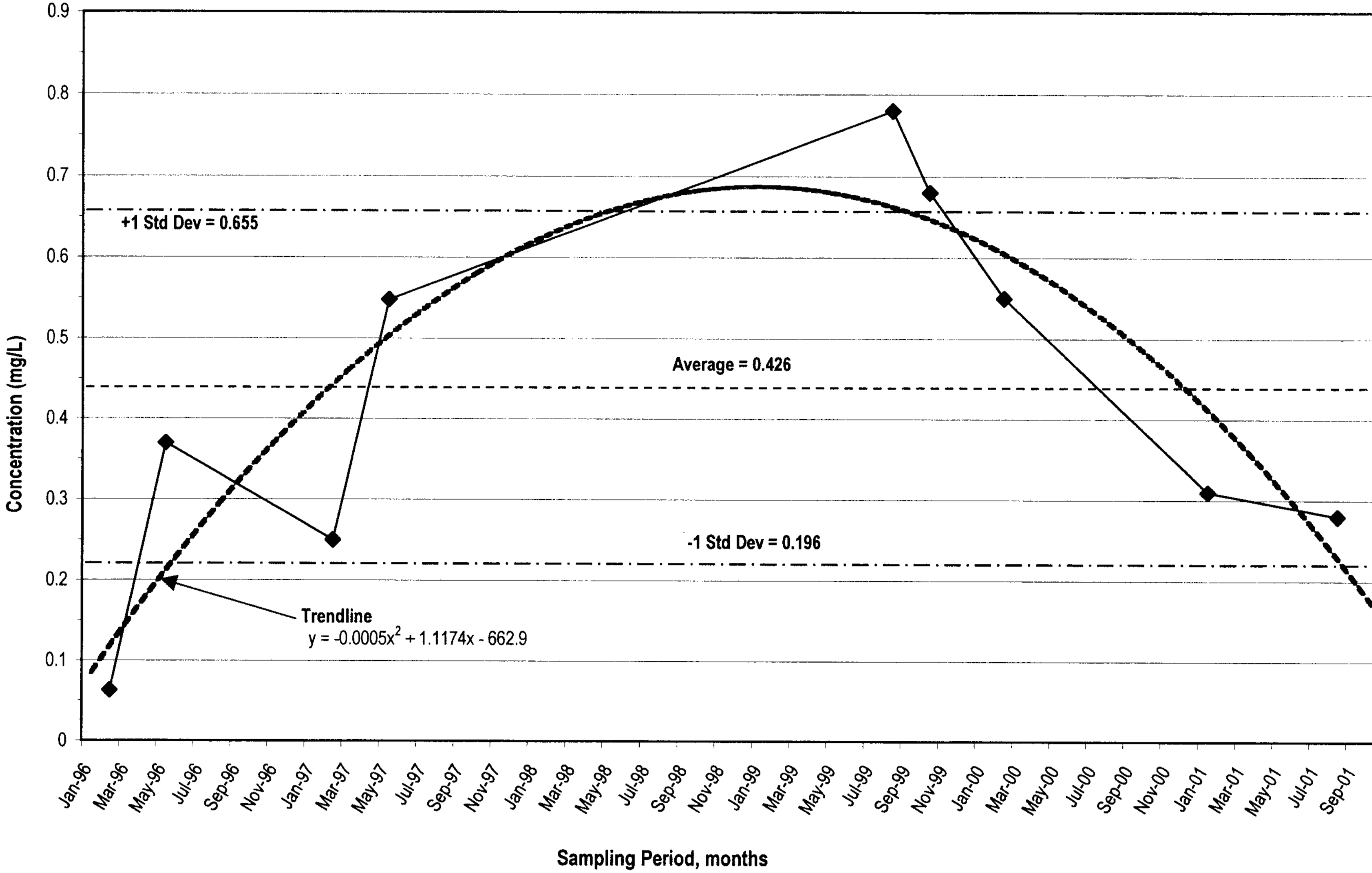

FIGURE D-20. Nickel Concentrations, CWL-MW2A

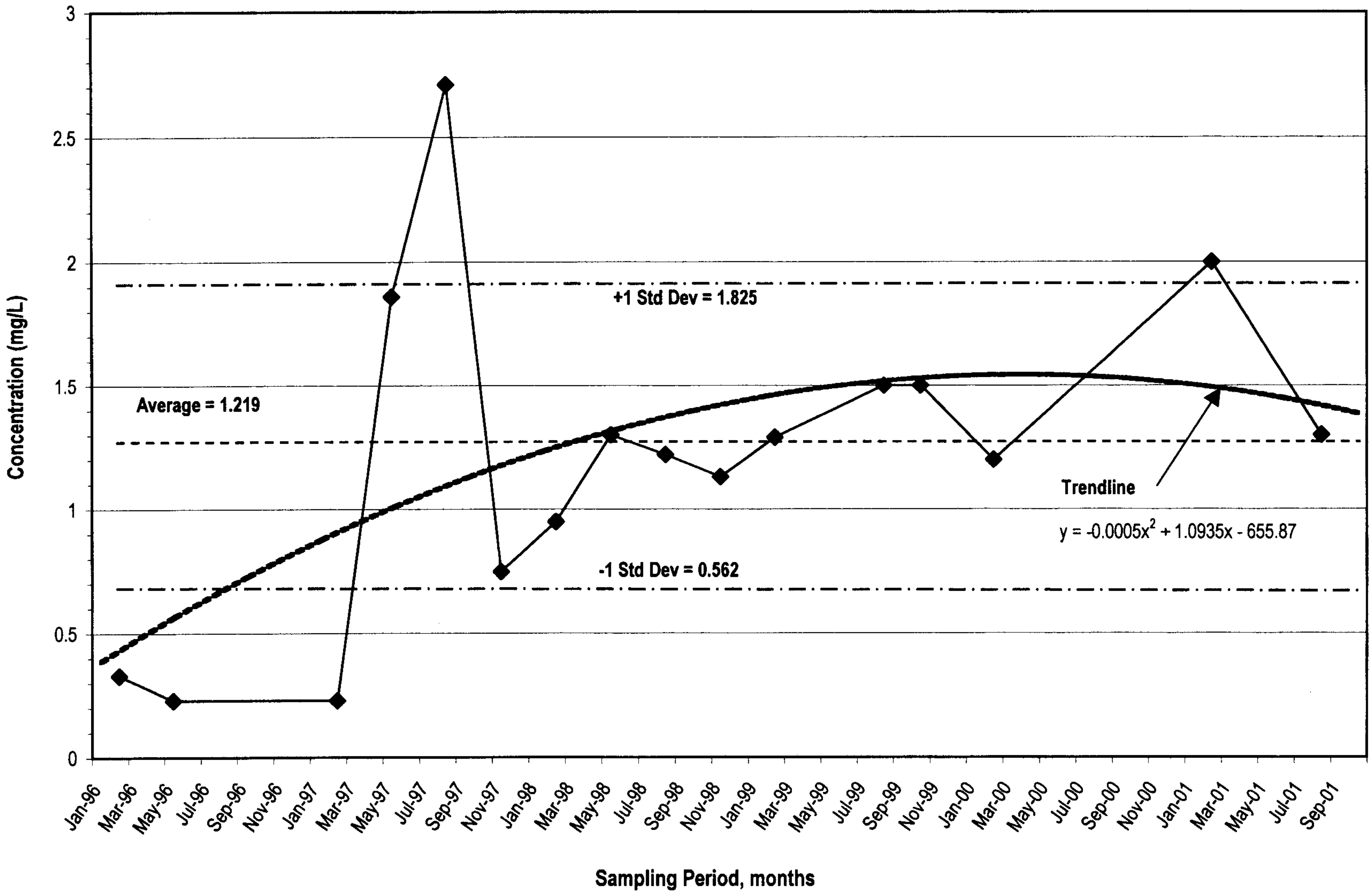

FIGURE D-21. Nickel Concentrations, CWL-MW4

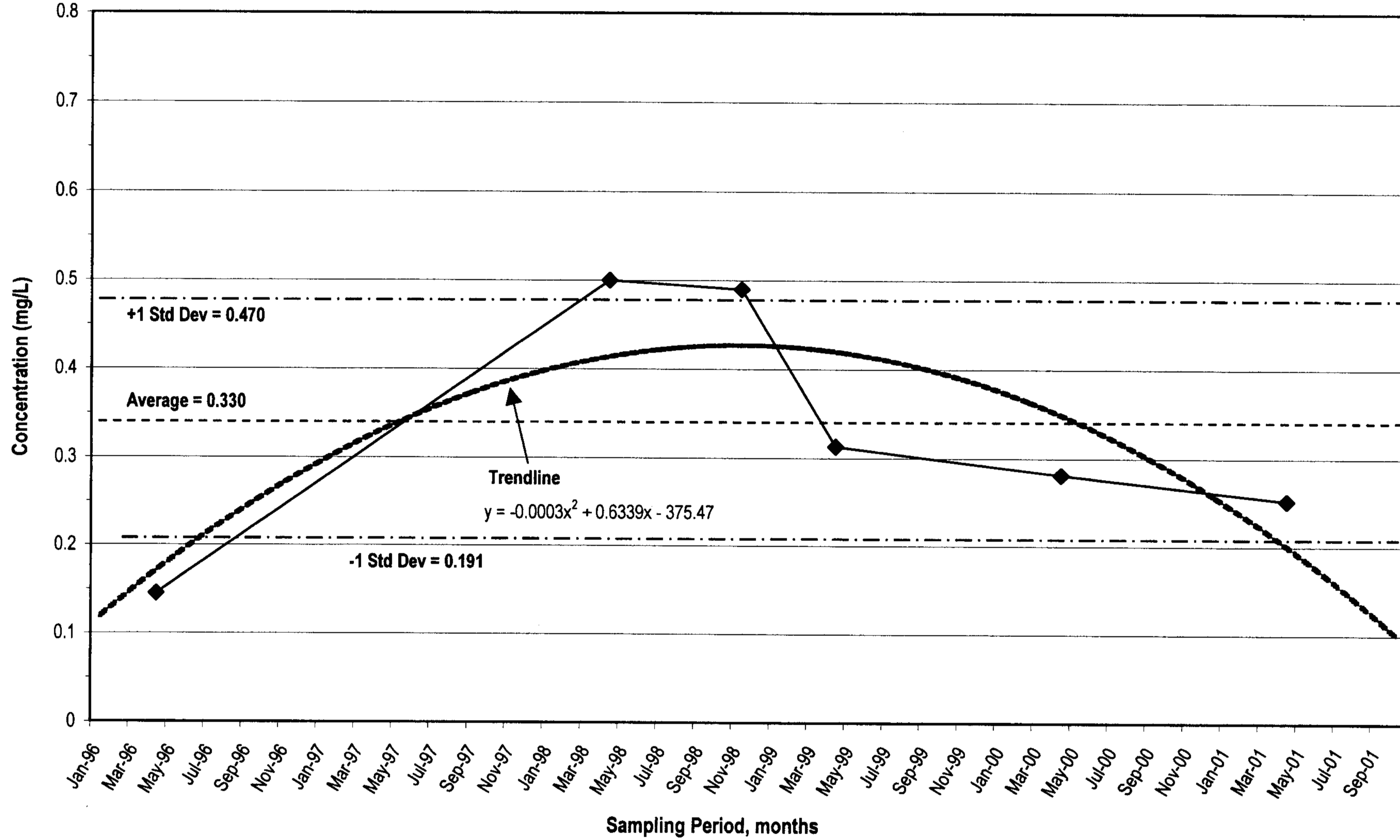

FIGURE D-22. Nickel Concentrations, MWL-MW1

TABLE D-6. Summary Statistics for Well with Selenium Concentrations Greater Than the MCL of 50 µg/L in FY 2001

Project Name	Well ID	Analyte	Sample Size	Avg	Med	Std Dev	Min	Max	Range	CV	-1 Std Dev	+1 Std Dev
TAG	TA1-W-03	Selenium	13	46.29	49	17.0	4.8	74	69.2	0.37	29.32	63.27

NOTE: µg/L = microgram per liter
MCL = maximum contaminant level
CV = coefficient of variance
Avg = average
TAG = Tijeras Arroyo Groundwater
Med = median
Min = minimum
Max = maximum
Std Dev = standard deviation

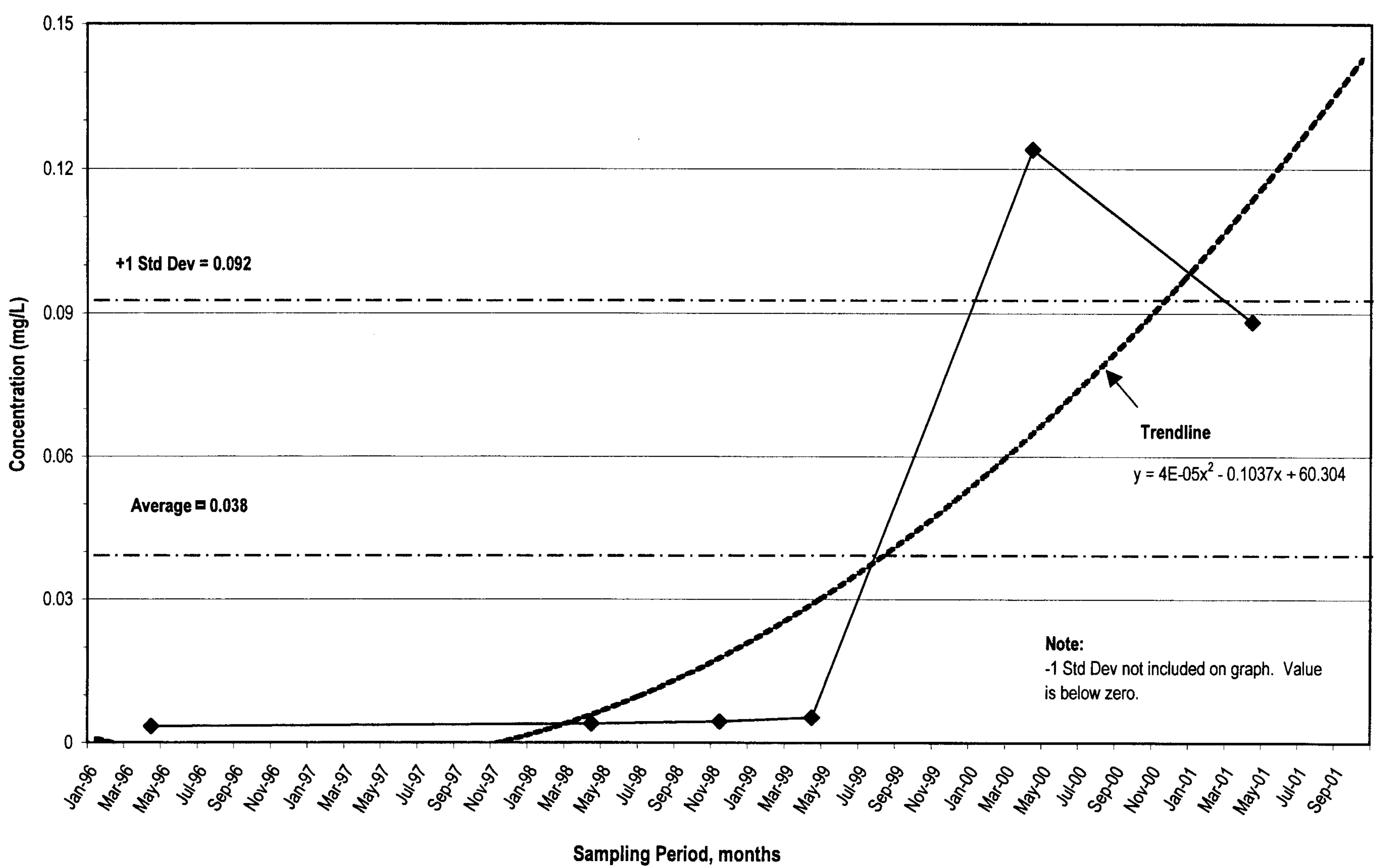

FIGURE D-23. Nickel Concentrations, MWL-MW2

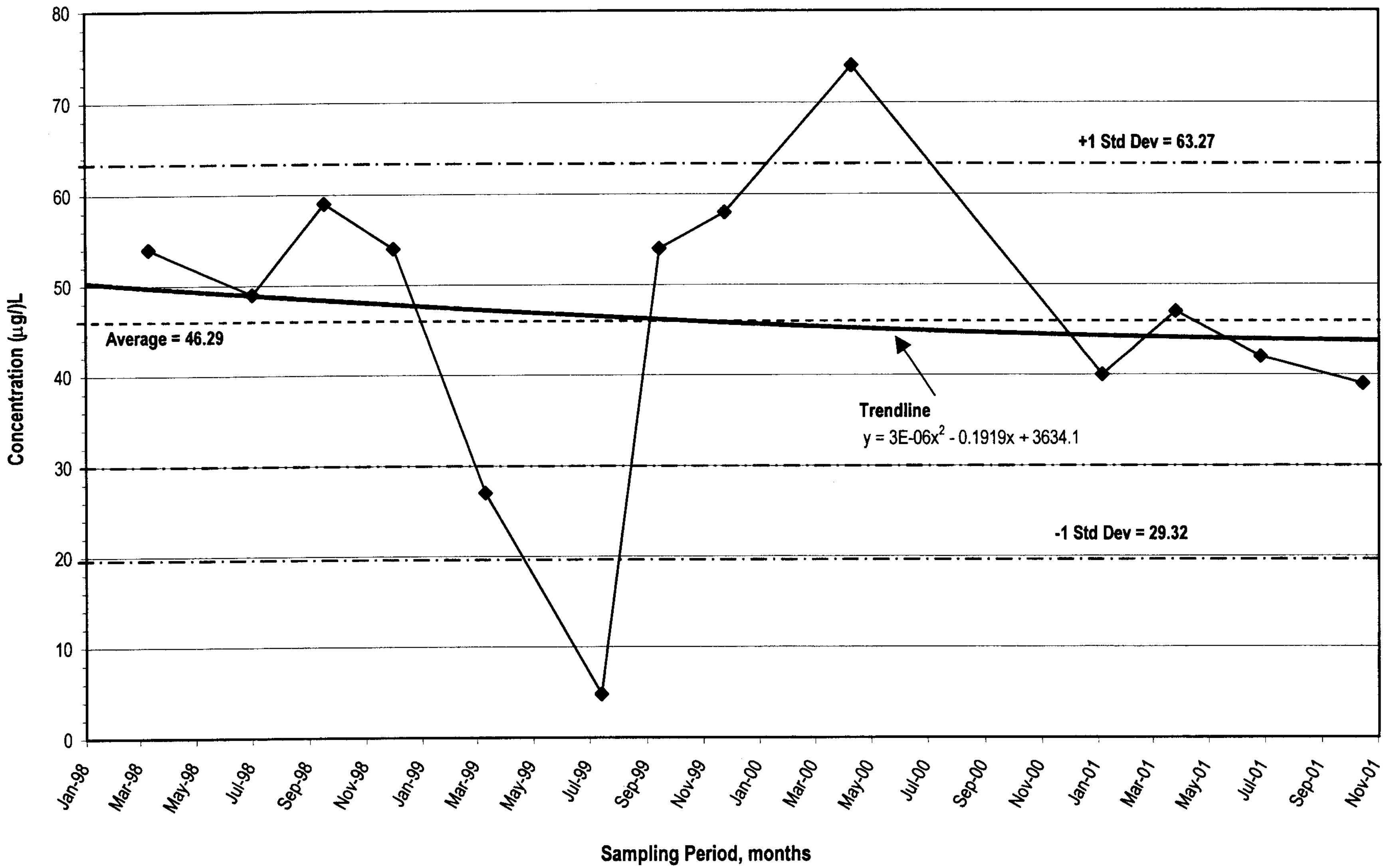

FIGURE D-24. Selenium Concentrations, TA1-W-03

APPENDIX E

2001 Terrestrial Surveillance Results

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CONTENTS

TABLES

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TABLE E-1. Radiological Results by Location for Calendar Year 2001, Soil

Location Type	Location	Cesium-137 (pCi/g) Activity		Decision Level	Detection Limit	Tritium (pCi/mL) Activity		Decision Level	Detection Limit	Total Uranium (μg/g) Concentration	Decision Level	Detection Limit
Community	8	0.0132 ± 0.0285	U	0.0258	0.0554	-0.0409 ± 0.144	U	0.122	0.249	0.584	0.00335	0.0394
	9	0.525 ± 0.106		0.0355	0.0757	-0.0221 ± 0.159	U	0.139	0.284	0.637	0.00337	0.0396
	10	0.31 ± 0.0703		0.0249	0.0536	-0.0462 ± 0.149	U	0.126	0.258	0.585	0.00337	0.0396
	11	0.095 ± 0.0502		0.0206	0.0448	-0.933 ± 0.609	U	0.529	1.080	0.531	0.00335	0.0394
	25	0.0357 ± 0.0323		0.0162	0.0347	-0.0562 ± 0.145	U	0.123	0.251	0.556	0.00337	0.0396
	62	0.283 ± 0.0696		0.0215	0.0458	-0.0661 ± 0.150	U	0.128	0.261	1.24	0.00338	0.0398
Perimeter	4	0.0698 ± 0.0347		0.0182	0.0378	-0.0154 ± 0.184	U	0.155	0.316	0.369	0.00337	0.0396
	5	0.308 ± 0.061		0.0152	0.0326	0 ± 0.197	U	0.165	0.338	0.275	0.00338	0.0398
	12	1.54 ± 0.203		0.0234	0.0497	1.74 ± 0.159		0.0756	0.158	0.533	0.00333	0.0392
	16	0.081 ± 0.0384		0.0224	0.0474	2.64 ± 0.305		0.163	0.341	1.05	0.00333	0.0392
	19	0.395 ± 0.0941		0.0321	0.068	4.70 ± 0.553		0.298	0.622	0.644	0.00335	0.0394
	58	0.123 ± 0.0481		0.0133	0.0493	1.630 ± 0.247		0.147	0.306	0.954	0.00339	0.0398
	59	0.144 ± 0.0544		0.0117	0.0424	0.685 ± 0.165		0.111	0.232	0.598	0.00334	0.0393
	60	0.0306 ± 0.0384	U	0.0354	0.0755	-0.266 ± 0.285	U	0.245	0.501	0.628	0.00337	0.0396
	61	0.0181 ± 0.0287	U	0.0263	0.0571	-0.329 ± 0.198	U	0.174	0.355	0.521	0.00333	0.0392
	63	0.604 ± 0.102		0.0212	0.0452	0.317 ± 0.104		0.0748	0.156	0.557	0.00333	0.0392
	64	0.573 ± 0.113		0.0302	0.0639	-0.446 ± 0.348	U	0.301	0.614	1.08	0.00333	0.0392
	65E	0.116 ± 0.0414		0.0106	0.0391	1.82 ± 0.23		0.128	0.267	1.24	0.00333	0.0392
	80	0.0496 ± 0.0314		0.0211	0.0452	0.0866 ± 0.0939	U	0.0751	0.157	0.72	0.00334	0.0393

See notes at end of table.

TABLE E-1. Radiological Results by Location for Calendar Year 2001, Soil *(concluded)*

Location Type	Location	Cesium-137 (pCi/g) Activity		Decision Level	Detection Limit	Tritium (pCi/mL) Activity		Decision Level	Detection Limit	Total Uranium (μg/g) Concentration	Decision Level	Detection Limit
On-site	1	0.226 ± 0.0543		0.0203	0.0427	0.034 ± 0.159	U	0.133	0.271	0.744	0.00338	0.0398
	3	0.268 ± 0.0635		0.0292	0.0624	0.962 ± 0.193		0.125	0.261	0.527	0.00338	0.0398
	6	0.238 ± 0.0419		0.014	0.0294	0.129 ± 0.171	U	0.140	0.287	0.518	0.00336	0.0395
	7	0.422 ± 0.101		0.0262	0.0561	0.180 ± 0.40	U	0.332	0.678	1.87	0.00333	0.0392
	20	0.328 ± 0.0491		0.0147	0.0309	-0.122 ± 0.356	U	0.302	0.615	0.605	0.0034	0.04
	33	0.365 ± 0.0945		0.0325	0.0697	0.186 ± 0.106		0.0808	0.169	0.871	0.0034	0.04
	34	0.119 ± 0.0557		0.0262	0.0564	0.170 ± 0.0963		0.0737	0.154	0.877	0.00333	0.0392
	35	0.341 ± 0.08		0.0257	0.0538	0.378 ± 0.161		0.127	0.259	0.426	0.00339	0.0398
	41	0.191 ± 0.049		0.0168	0.0358	0.438 ± 0.475	U	0.390	0.795	0.414	0.00334	0.0393
	42	0.06144 ± 0.0481		0.0351	0.07355	0.3258 ± 0.413	U	0.340	0.697	0.2127	0.003335	0.03925
	43	0.0926 ± 0.0504		0.0211	0.0442	0.196 ± 0.204	U	0.167	0.341	0.529	0.00333	0.0392
	45	0.512 ± 0.0686		0.015	0.0319	0.105 ± 0.450	U	0.375	0.766	0.503	0.00339	0.0399
	46	0.234 ± 0.0674		0.0268	0.0576	4.31 ± 0.385		0.181	0.378	0.708	0.00337	0.0396
	49	0.257 ± 0		0.017	0.0853	1.61 ± 0.232		0.136	0.283	0.687	0.00333	0.0392
	51	0.00435 ± 0.0204	U	0.0179	0.0383	0.103 ± 0.179	U	0.148	0.303	0.524	0.0034	0.04
	52	0.0751 ± 0.0256		0.013	0.0273	0.262 ± 0.171	U	0.136	0.279	0.538	0.00335	0.0394
	54	0.152 ± 0.0397		0.0162	0.0346	0.120 ± 0.119	U	0.0973	0.199	0.389	0.00336	0.0395
	55	0.871 ± 0.119		0.0155	0.033	0.0242 ± 0.182	U	0.152	0.310	0.586	0.00337	0.0396
	56	-0.000637 ± 0.03	U	0.0257	0.055	0.181 ± 0.169	U	0.136	0.281	0.593	0.00334	0.0393
	57	0 ± 0.0216	U	0.00959	0.02	-0.333 ± 0.237	U	0.206	0.420	1.02	0.0034	0.04
	66	0.381 ± 0.0536		0.0151	0.0319	-0.0242 ± 174	U	0.147	0.300	0.451	0.00338	0.0398
	76	0.141 ± 0.0567		0.0299	0.0634	0.0955 ± 0.199	U	0.165	0.338	0.427	0.00339	0.0398
	77	0.426 ± 0.0678		0.019	0.04	-0.0355 ± 0.151	U	0.127	0.260	0.494	0.00337	0.0397
	78	0.564 ± 0.0973		0.0265	0.0565	0.661 ± 0.168		0.115	0.239	0.376	0.00337	0.0397

NOTES: pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter
μg/g = microgram per gram
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.

TABLE E-2. Radiological Results by Location for Calendar Year 2001, Sediment

Location Type	Location	Cesium-137 (pCi/g) Activity		Decision Level	Detection Limit	Tritium (pCi/mL) Activity		Decision Level	Detection Limit	Total Uranium (µg/g) Concentration	Decision Level	Detection Limit
Community	8	0.11 ± 0.0394		0.0245	0.0537	-0.0833 ± 0.133	U	0.114	0.233	0.541	0.0034	0.04
	11	0.0847 ± 0.0533		0.0335	0.072	-0.129 ± 0.123	U	0.106	0.216	0.416	0.00334	0.0393
	68	0.00513 ± 0.0377	U	0.0285	0.0608	-0.0983 ± 0.139	U	0.119	0.244	0.861	0.00333	0.0392
Perimeter	60	-0.00247 ± 0.0262	U	0.022	0.0476	-0.911 ± 0.479	U	0.420	0.857	0.775	0.00339	0.0398
	65E	0.00638 ± 0.0242	U	0.0219	0.0464	6.91 ± 0.874		0.486	1.010	1.07	0.00333	0.0392
	73	0.0989 ± 0.0467		0.0159	0.034	-0.436 ± 0.411	U	0.354	0.721	0.959	0.0034	0.04
On-site	72	0.0639 ± 0.0413		0.0265	0.0557	0.404 ± 0.109		0.075	0.156	0.843	0.00333	0.0392
	74	-0.0012 ± 0.0116	U	0.0103	0.0215	-0.215 ± 0.384	U	0.327	0.667	0.954	0.00333	0.0392
	75	0.143 ± 0.031		0.0126	0.0265	0.050 ± 0.263	U	0.219	0.455	0.902	0.00336	0.0395

NOTES: pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter
µg/g = microgram per gram
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.

TABLE E-3. Radiological Results by Location for Calendar Year 2001, Vegetation

Location Type	Location	Cesium-137 (pCi/g) Activity		Decision Level	Detection Limit	Tritium (pCi/mL) Activity		Decision Level	Detection Limit	Total Uranium (μg/g) Concentration		Decision Level	Detection Limit
Community	11	0.144 ± 0.101	U	0.0828	0.171	0.0716 ± 0.240	U	0.198	0.412	0.0216	J	0.00339	0.0399
	8	0.0163 ± 0.0696	U	0.0552	0.115	0.406 ± 0.255	U	0.198	0.412	0.0112	J	0.00339	0.0398
	9	0.114 ± 0.108	U	0.0813	0.168	0.281 ± 0.240	U	0.191	0.397	0.00454	J	0.00335	0.0394
Perimeter	12	0.0437 ± 0.0422	U	0.0334	0.0701	0.0709 ± 0.237	U	0.196	0.408	0.00456	J	0.00337	0.0397
	4	0.00636 ± 0.0533	U	0.0372	0.0781	0.0769 ± 0.240	U	0.198	0.412	0.00768	J	0.00335	0.0394
	60	0.0241 ± 0.0506	U	0.0358	0.0746	0.0501 ± 0.223	U	0.185	0.385	0.0128	J	0.0034	0.04
On-site	33	-0.00797 ± 0.0564	U	0.0446	0.0926	-0.018 ± 0.237	U	0.200	0.415	0.0135	J	0.00337	0.0397
	34	0.0292 ± 0.0517	U	0.0419	0.0878	0.0903 ± 0.229	U	0.189	0.393	0.00863	J	0.00333	0.0392
	35	-0.0317 ± 0.0529	U	0.0395	0.0828	-0.136 ± 0.24	U	0.207	0.431	0.0182	J	0.0034	0.04
	45	0.0389 ± 0.041	U	0.0343	0.0715	0.0829 ± 0.237	U	0.195	0.407	0.0197	J	0.00335	0.0394
	46	-0.0171 ± 0.0508	U	0.0393	0.0822	0.201 ± 0.244	U	0.197	0.409	0.0151	J	0.00337	0.0397
	51	0.0184 ± 0.0479	U	0.0376	0.079	-0.041 ± 0.233	U	0.197	0.411	0.0122	J	0.00339	0.0398
	52	-0.012 ± 0.0537	U	0.0423	0.0878	0.0053 ± 0.233	U	0.195	0.406	0.0277	J	0.00336	0.0395
	55	0.0218 ± 0.0437	U	0.0365	0.078	0.096 ± 0.258	U	0.213	0.443	0.0305	J	0.00337	0.0396
	6	0.0553 ± 0.239	U	0.0691	0.144	-0.0295 ± 0.227	U	0.192	0.400	0.0167	J	0.00335	0.0394

NOTES: pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter
ug/g = microgram per gram
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.

TABLE E-4. Non-radiological Results for Community Locations in Calendar Year 2001, Soil
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	8				9				10			
		Result		Decision Level	Detection Limit	Result		Decision Level	Detection Limit	Result		Decision Level	Detection Limit
Community	Aluminum	5010		2.02	4.72	12500		1.95	4.55	12200		2.04	4.76
	Antimony	0.447	U	0.447	0.943	0.431	U	0.431	0.909	0.451	U	0.451	0.952
	Arsenic	2.4		0.258	0.472	4.36		0.249	0.455	3.02		0.261	0.476
	Barium	147		0.028	0.472	165		0.027	0.455	123		0.0283	0.476
	Beryllium	0.312	J	0.0145	0.472	0.679		0.0139	0.455	0.668		0.0146	0.476
	Cadmium	0.565		0.0245	0.472	0.372	J	0.0236	0.455	0.352	J	0.0247	0.476
	Calcium	14400	B	3.67	9.43	30300	B	3.53	9.09	19200	B	3.7	9.52
	Chromium	6.21		0.411	0.472	15.3		0.396	0.455	13.5		0.415	0.476
	Cobalt	3.53		0.103	0.472	6.13		0.099	0.455	6.03		0.104	0.476
	Copper	9.74	B	0.0474	0.472	14.2	B	0.0457	0.455	10.3	B	0.0479	0.476
	Iron	7310		3.69	4.72	13300		3.56	4.55	12900		3.73	4.76
	Lead	13.5		0.321	0.472	27.9		0.31	0.455	10.7		0.324	0.476
	Magnesium	2660	B	0.58	1.89	4330	B	0.559	1.82	2930	B	0.586	1.9
	Manganese	208		0.0451	0.943	306		0.0435	0.909	506		0.228	4.76
	Mercury	0.00443	U	0.00443	0.00974	0.00799	J	0.00423	0.00929	0.00539	J	0.00446	0.0098
	Nickel	5.76		0.188	0.472	12.7		0.181	0.455	12.4		0.189	0.476
	Potassium	1840	B	8.17	47.2	2370	B	7.87	45.5	2380	B	8.24	47.6
	Selenium	0.255	U	0.255	0.472	0.418	J	0.246	0.455	0.574		0.257	0.476
	Silver	0.109	U	0.109	0.472	0.105	U	0.105	0.455	0.11	U	0.11	0.476
	Sodium	140	B	2.36	9.43	61.8	B	2.27	9.09	44.7	B	2.38	9.52
	Thallium	0.891	U	0.891	0.943	0.858	U	0.858	0.909	0.899	U	0.899	0.952
	Vanadium	15.7		0.112	0.472	28.2		0.108	0.455	25.2		0.113	0.476
	Zinc	67	B	0.246	0.472	55.8	B	0.237	0.455	35.4	B	0.248	0.476

See notes at end of table.

TABLE E-4. Non-radiological Results for Community Locations in Calendar Year 2001, Soil *(concluded)*

Location Type	Analyte	11				25				62			
		Result		Decision Level	Detection Limit	Result		Decision Level	Detection Limit	Result		Decision Level	Detection Limit
Community	Aluminum	3170		2.06	4.81	3860		2.14	5	13700		2.08	4.85
	Antimony	0.456	U	0.456	0.962	0.474	U	0.474	1	0.46	U	0.46	0.971
	Arsenic	1.9		0.263	0.481	3		0.274	0.5	3.78		0.266	0.485
	Barium	122		0.0285	0.481	117		0.0297	0.5	189		0.0288	0.485
	Beryllium	0.21	J	0.0147	0.481	0.244	J	0.0153	0.5	0.753		0.0149	0.485
	Cadmium	0.121	J	0.0249	0.481	0.429	J	0.0259	0.5	0.408	J	0.0252	0.485
	Chromium	5.5		0.419	0.481	5.43		0.436	0.5	16.7		0.423	0.485
	Cobalt	2.49		0.105	0.481	2.41		0.109	0.5	8.06		0.106	0.485
	Copper	4.18	B	0.0483	0.481	6.24	B	0.0503	0.5	13.1	B	0.0488	0.485
	Iron	6640		3.76	4.81	6240		3.91	5	15200		3.8	4.85
	Lead	5.22		0.327	0.481	8.22		0.341	0.5	11.1		0.331	0.485
	Magnesium	1800	B	0.592	1.92	1710	B	0.615	2	4260	B	0.597	1.94
	Manganese	265		0.046	0.962	234		0.0479	1	531		0.232	4.85
	Mercury	0.00442	U	0.00442	0.00971	0.00394	U	0.00394	0.00866	0.0085	J	0.00445	0.00979
	Nickel	4.4		0.191	0.481	5.62		0.199	0.5	16.7		0.193	0.485
	Potassium	1230	B	8.32	48.1	913	B	1.73	10	3480	B	8.4	48.5
	Selenium	0.26	U	0.26	0.481	0.27	U	0.27	0.5	0.364	J	0.262	0.485
	Silver	0.111	U	0.111	0.481	0.116	U	0.116	0.5	0.112	U	0.112	0.485
	Thallium	0.908	U	0.908	0.962	0.944	U	0.944	1	0.917	U	0.917	0.971
	Vanadium	16.7		0.114	0.481	14.1		0.119	0.5	28.8		0.115	0.485
	Zinc	18.8	B	0.25	0.481	27	B	0.26	0.5	51.3	B	0.253	0.485

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

TABLE E-5. Non-radiological Results for Perimeter Locations in Calendar Year 2001, Soil
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	4				5				12			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
Perimeter	Aluminum	6400		2.14	5	4690		2.12	4.95	15500		2.12	4.95
	Antimony	0.474	U	0.474	1	0.534	J	0.469	0.99	0.469	U	0.469	0.99
	Arsenic	2.96		0.274	0.5	1.49		0.271	0.495	3.95		0.271	0.495
	Barium	93.1	B	0.0297	0.5	46.6	B	0.0294	0.495	174	B	0.0294	0.495
	Beryllium	0.3	J	0.0153	0.5	0.249	J	0.0152	0.495	0.648		0.0152	0.495
	Cadmium	0.187	J	0.0259	0.5	0.167	J	0.0257	0.495	0.44	J	0.0257	0.495
	Chromium	6.33		0.436	0.5	5.78		0.432	0.495	14.1		0.432	0.495
	Cobalt	2.41		0.109	0.5	2.17		0.108	0.495	6.69		0.108	0.495
	Copper	5.35	B	0.0503	0.5	4.44	B	0.0498	0.495	18	B	0.0498	0.495
	Iron	6020		3.91	5	5720		3.88	4.95	14700	B	3.88	4.95
	Lead	5.59		0.341	0.5	6.53		0.337	0.495	18.9		0.337	0.495
	Magnesium	2380	B	0.615	2	1180	B	0.609	1.98	4440	B	0.609	1.98
	Manganese	111		0.0479	1	126		0.0474	0.99	364	B	0.0474	0.99
	Mercury	0.00835	HJ	0.00455	0.01	0.00435	HU	0.00435	0.00955	0.0248		0.00448	0.00984
	Nickel	5.41		0.199	0.5	4.06		0.197	0.495	11.4		0.197	0.495
	Potassium	2260	B	4.33	25	1270	B	4.28	24.8	3160	B	8.57	49.5
	Selenium	0.325	J	0.27	0.5	0.268	U	0.268	0.495	0.774	B	0.268	0.495
	Silver	0.116	U	0.116	0.5	0.114	U	0.114	0.495	0.114	U	0.114	0.495
	Thallium	2.36	U	2.36	2.5	2.34	U	2.34	2.48	4.67	U	4.67	4.95
	Vanadium	14.7		0.119	0.5	11.9		0.118	0.495	30.2		0.118	0.495
	Zinc	20.7	B	0.26	0.5	23.1	B	0.258	0.495	51.7	B	0.258	0.495

See notes at end of table.

TABLE E-5. Non-radiological Results for Perimeter Locations in Calendar Year 2001, Soil *(continued)*
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

		16				19				58			
Location Type	**Analyte**	**Result**		**Decision Level**	**Detection Limit**	**Results**		**Decision Level**	**Detection Limit**	**Results**		**Decision Level**	**Detection Limit**
Perimeter	Aluminum	12700		1.95	4.55	12700		2.08	4.85	11500		2.08	4.85
	Antimony	0.431	U	0.431	0.909	0.46	U	0.46	0.971	0.46	U	0.46	0.971
	Arsenic	3.16		0.249	0.455	4		0.266	0.485	3.21		0.266	0.485
	Barium	145	B	0.027	0.455	106	B	0.0288	0.485	149	B	0.0288	0.485
	Beryllium	0.626		0.0139	0.455	0.54		0.0149	0.485	0.495		0.0149	0.485
	Cadmium	0.303	J	0.0236	0.455	0.381	J	0.0252	0.485	0.9		0.0252	0.485
	Chromium	11.1		0.396	0.455	18.6		0.423	0.485	10.8		0.423	0.485
	Cobalt	8.11		0.099	0.455	6.42		0.106	0.485	4.49		0.106	0.485
	Copper	12.5	B	0.0457	0.455	16	B	0.0488	0.485	12.3	B	0.0488	0.485
	Iron	20400	B	17.8	22.7	14700	B	3.8	4.85	14300	B	3.8	4.85
	Lead	11.2		0.31	0.455	18.5		0.331	0.485	18.3		0.331	0.485
	Magnesium	5080	B	0.559	1.82	4440	B	0.597	1.94	4150	B	0.597	1.94
	Manganese	409	B	0.0435	0.909	309	B	0.0465	0.971	224	B	0.0465	0.971
	Mercury	0.0105		0.00446	0.0098	0.0198		0.00433	0.00952	0.0181		0.00423	0.00929
	Nickel	10.4		0.181	0.455	13.4		0.193	0.485	8.26		0.193	0.485
	Potassium	3500	B	7.87	45.5	3130	B	8.4	48.5	2950	B	8.4	48.5
	Selenium	0.732	B	0.246	0.455	0.8	B	0.262	0.485	0.66	B	0.262	0.485
	Silver	0.105	U	0.105	0.455	0.112	U	0.112	0.485	0.112	U	0.112	0.485
	Thallium	4.29	U	4.29	4.55	0.917	U	0.917	0.971	0.917	U	0.917	0.971
	Vanadium	36.8		0.108	0.455	28.8		0.115	0.485	30.5		0.115	0.485
	Zinc	53.3	B	0.237	0.455	46.6	B	0.253	0.485	49.9	B	0.253	0.485

See notes at end of table.

TABLE E-5. Non-radiological Results for Perimeter Locations in Calendar Year 2001, Soil *(continued)*
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	59 Result		59 Decision Level	59 Detection Limit	60 Results		60 Decision Level	60 Detection Limit	61 Results		61 Decision Level	61 Detection Limit
Perimeter	Aluminum	7130		1.95	4.55	10700		2.14	5	6060		2.14	5
	Antimony	0.431	U	0.431	0.909	0.474	U	0.474	1	0.474	U	0.474	1
	Arsenic	2.79		0.249	0.455	3.17		0.274	0.5	3.48		0.274	0.5
	Barium	159	B	0.027	0.455	167		0.0297	0.5	183		0.0297	0.5
	Beryllium	0.341	J	0.0139	0.455	0.577		0.0153	0.5	0.317	J	0.0153	0.5
	Cadmium	0.266	J	0.0236	0.455	0.311	J	0.0259	0.5	0.247	J	0.0259	0.5
	Chromium	7.7		0.396	0.455	11.4		0.436	0.5	5.75		0.436	0.5
	Cobalt	3.29		0.099	0.455	5.83		0.109	0.5	2.79		0.109	0.5
	Copper	7.97	B	0.0457	0.455	13	B	0.0503	0.5	7.08	B	0.0503	0.5
	Iron	9650	B	3.56	4.55	13200		3.91	5	7010		3.91	5
	Lead	16.8		0.31	0.455	8.68		0.341	0.5	9.28		0.341	0.5
	Magnesium	3040	B	0.559	1.82	4410	B	0.615	2	2870	B	0.615	2
	Manganese	145	B	0.0435	0.909	328		0.0479	1	137		0.0479	1
	Mercury	0.0148		0.00401	0.00882	0.00431	U	0.00431	0.00948	0.00438	U	0.00438	0.00962
	Nickel	5.71		0.181	0.455	11.2		0.199	0.5	5.26		0.199	0.5
	Potassium	1630	B	7.87	45.5	3680	B	8.66	50	1540	B	8.66	50
	Selenium	0.438	BJ	0.246	0.455	0.285	J	0.27	0.5	0.27	U	0.27	0.5
	Silver	0.105	U	0.105	0.455	0.116	U	0.116	0.5	0.116	U	0.116	0.5
	Thallium	0.858	U	0.858	0.909	0.944	U	0.944	1	1.29		0.944	1
	Vanadium	22.7		0.108	0.455	25.6		0.119	0.5	20.5		0.119	0.5
	Zinc	35.3	B	0.237	0.455	42.1	B	0.26	0.5	25.5	B	0.26	0.5

See notes at end of table.

TABLE E-5. Non-radiological Results for Perimeter Locations in Calendar Year 2001, Soil *(continued)*
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	63				64				65E			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
Perimeter	Aluminum	13000		2.14	5	12300		1.97	4.59	14000		1.95	4.55
	Antimony	0.474	U	0.474	1	0.435	U	0.435	0.917	0.431	U	0.431	0.909
	Arsenic	3.55		0.274	0.5	2.98		0.251	0.459	3.7		0.249	0.455
	Barium	156	B	0.0297	0.5	119	B	0.0272	0.459	145	B	0.027	0.455
	Beryllium	0.6		0.0153	0.5	0.6		0.0141	0.459	0.639		0.0139	0.455
	Cadmium	0.327	J	0.0259	0.5	0.124	J	0.0238	0.459	0.365	J	0.0236	0.455
	Chromium	14.3		0.436	0.5	9.75		0.4	0.459	12.2		0.396	0.455
	Cobalt	5.52		0.109	0.5	8.91		0.0999	0.459	7.91		0.099	0.455
	Copper	10	B	0.0503	0.5	16.6	B	0.0461	0.459	14.6	B	0.0457	0.455
	Iron	13000	B	3.91	5	21700		18	22.9	23900	B	17.8	22.7
	Lead	10.8		0.341	0.5	16.7		0.312	0.459	13.3		0.31	0.455
	Magnesium	3820	B	0.615	2	7140	B	0.564	1.83	6800	B	0.559	1.82
	Manganese	357	B	0.0479	1	638		0.219	4.59	527	B	0.218	4.55
	Mercury	0.0133		0.00373	0.00821	0.0106	H	0.00409	0.00898	0.00757	HJ	0.00453	0.00995
	Nickel	11.3		0.199	0.5	11.4		0.182	0.459	11.7		0.181	0.455
	Potassium	2670	B	8.66	50	3760	B	7.94	45.9	4510	B	7.87	45.5
	Selenium	0.729	B	0.27	0.5	1.52		0.248	0.459	0.539	B	0.246	0.455
	Silver	0.116	U	0.116	0.5	0.106	U	0.106	0.459	0.105	U	0.105	0.455
	Thallium	0.944	U	0.944	1	0.866	U	0.866	0.917	4.29	U	4.29	4.55
	Vanadium	26.6		0.119	0.5	35.1		0.109	0.459	41.2		0.108	0.455
	Zinc	39.4	B	0.26	0.5	77.9	B	0.239	0.459	67.8	B	0.237	0.455

See notes at end of table.

TABLE E-5. Non-radiological Results for Perimeter Locations in Calendar Year 2001, Soil *(concluded)*
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	80			
		Result		Decision Level	Detection Limit
Perimeter	Aluminum	15900		2.04	4.76
	Antimony	0.451	U	0.451	0.952
	Arsenic	3.79		0.261	0.476
	Barium	171	B	0.0283	0.476
	Beryllium	0.705		0.0146	0.476
	Cadmium	0.379	J	0.0247	0.476
	Chromium	17.9		0.415	0.476
	Cobalt	5.78		0.104	0.476
	Copper	11	B	0.0479	0.476
	Iron	13700	B	3.73	4.76
	Lead	9.63		0.324	0.476
	Magnesium	4530	B	0.586	1.9
	Manganese	319	B	0.0456	0.952
	Mercury	0.0114		0.00433	0.00951
	Nickel	13.8		0.189	0.476
	Potassium	3060	B	8.24	47.6
	Selenium	0.532	B	0.257	0.476
	Silver	0.11	U	0.11	0.476
	Thallium	0.899	U	0.899	0.952
	Vanadium	28.5		0.113	0.476
	Zinc	40.9	B	0.248	0.476

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

TABLE E-6. Non-radiological Results for On-Site Locations in Calendar Year 2001, Soil

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

Location Type	Analyte	1				3				6			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
On-site	Aluminum	10100		2.06	4.81	10000		2.14	5	11900		1.95	4.55
	Antimony	0.456	U	0.456	0.962	0.474	U	0.474	1	0.431	U	0.431	0.909
	Arsenic	2.58		0.263	0.481	4.09		0.274	0.5	3.12		0.249	0.455
	Barium	135	B	0.0285	0.481	190	B	0.0297	0.5	103	B	0.027	0.455
	Beryllium	0.482		0.0147	0.481	0.436	J	0.0153	0.5	0.618		0.0139	0.455
	Cadmium	0.504		0.0249	0.481	0.257	J	0.0259	0.5	0.349	J	0.0236	0.455
	Chromium	9.92		0.419	0.481	9.85		0.436	0.5	11.2		0.396	0.455
	Cobalt	5.38		0.105	0.481	3.41		0.109	0.5	4.69		0.099	0.455
	Copper	11.5	B	0.0483	0.481	6.69	B	0.0503	0.5	26.2	B	0.0457	0.455
	Iron	12600		3.76	4.81	9450	B	3.91	5	10700		3.56	4.55
	Lead	10.2		0.327	0.481	11.6		0.341	0.5	11.1		0.31	0.455
	Magnesium	4440	B	0.592	1.92	4130	B	0.615	2	2850	B	0.559	1.82
	Manganese	354		0.046	0.962	154	B	0.0479	1	202		0.0435	0.909
	Mercury	0.00433	U	0.00433	0.00952	0.0114		0.00414	0.00909	0.015		0.00407	0.00896
	Nickel	9.58		0.191	0.481	7.37		0.199	0.5	12		0.181	0.455
	Potassium	4170	B	8.32	48.1	2250	B	8.66	50	1400	B	3.93	22.7
	Selenium	0.26	U	0.26	0.481	0.337	BJ	0.27	0.5	0.246	U	0.246	0.455
	Silver	0.111	U	0.111	0.481	0.116	U	0.116	0.5	0.37	J	0.105	0.455
	Thallium	4.54	U	4.54	4.81	0.944	U	0.944	1	2.15	U	2.15	2.27
	Vanadium	25.6		0.114	0.481	24.6		0.119	0.5	20.3		0.108	0.455
	Zinc	48.4	B	0.25	0.481	29.6	B	0.26	0.5	37.7	B	0.237	0.455

See notes at end of table.

TABLE E-6. Non-radiological Results for On-Site Locations in Calendar Year 2001, Soil *(continued)*

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

Location Type	Analyte	7				20				33			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
On-site	Aluminum	7080		2.14	5	7670		2.14	5	11300		2.14	5
	Antimony	0.49	J	0.474	1	0.474	U	0.474	1	0.538	J	0.474	1
	Arsenic	2.35		0.274	0.5	2.73		0.274	0.5	6.89		0.274	0.5
	Barium	66.6	B	0.0297	0.5	103	B	0.0297	0.5	117	B	0.0297	0.5
	Beryllium	0.394	J	0.0153	0.5	0.413	J	0.0153	0.5	1.34		0.0153	0.5
	Cadmium	0.291	J	0.0259	0.5	2.03		0.0259	0.5	0.654		0.0259	0.5
	Chromium	8.38		0.436	0.5	11.7		0.436	0.5	13.7		0.436	0.5
	Cobalt	3.92		0.109	0.5	4.83		0.109	0.5	5.68		0.109	0.5
	Copper	7.21	B	0.0503	0.5	11.3	B	0.0503	0.5	11.2	B	0.0503	0.5
	Iron	8580		3.91	5	14100		3.91	5	12800	B	3.91	5
	Lead	8.87		0.341	0.5	74		0.341	0.5	15.6		0.341	0.5
	Magnesium	2080	B	0.615	2	3430	B	0.615	2	4420	B	0.615	2
	Manganese	206		0.0479	1	251		0.0479	1	368	B	0.0479	1
	Mercury	0.0123	H	0.00399	0.00876	0.00798	J	0.00399	0.00877	0.0167		0.0044	0.00966
	Nickel	6.67		0.199	0.5	10.4		0.199	0.5	12.7		0.199	0.5
	Potassium	1910	B	4.33	25	2260	B	8.66	50	3360	B	8.66	50
	Selenium	0.277	J	0.27	0.5	0.963		0.27	0.5	0.866	B	0.27	0.5
	Silver	0.116	U	0.116	0.5	0.185	J	0.116	0.5	0.116	U	0.116	0.5
	Thallium	2.36	U	2.36	2.5	0.944	U	0.944	1	0.944	U	0.944	1
	Vanadium	17.1		0.119	0.5	24		0.119	0.5	26.5		0.119	0.5
	Zinc	26.7	B	0.26	0.5	37.2	B	0.26	0.5	82.3	B	0.26	0.5

See notes at end of table.

TABLE E-6. Non-radiological Results for On-Site Locations in Calendar Year 2001, Soil *(continued)*
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	34				35				41			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
On-site	Aluminum	11900		2.06	4.81	7220		2.14	5	7470		2.1	4.9
	Antimony	0.456	U	0.456	0.962	0.474	U	0.474	1	0.465	U	0.465	0.98
	Arsenic	5.18		0.263	0.481	2.38		0.274	0.5	2.26		0.269	0.49
	Barium	180	B	0.0285	0.481	65.6	B	0.0297	0.5	71	B	0.0291	0.49
	Beryllium	0.602		0.0147	0.481	0.372	J	0.0153	0.5	0.429	J	0.015	0.49
	Cadmium	0.656		0.0249	0.481	0.262	J	0.0259	0.5	0.271	J	0.0254	0.49
	Chromium	13.4		0.419	0.481	8.17		0.436	0.5	8.31		0.428	0.49
	Cobalt	5.75		0.105	0.481	3		0.109	0.5	3.08		0.107	0.49
	Copper	12.2	B	0.0483	0.481	6.49	B	0.0503	0.5	6.86	B	0.0493	0.49
	Iron	13200	B	3.76	4.81	7810		3.91	5	8040		3.84	4.9
	Lead	16.4		0.327	0.481	8.46		0.341	0.5	10.5		0.334	0.49
	Magnesium	3390	B	0.592	1.92	1920	B	0.615	2	2330	B	0.603	1.96
	Manganese	281	B	0.046	0.962	176		0.0479	1	157		0.0469	0.98
	Mercury	0.0182		0.00432	0.00949	0.0118		0.00455	0.01	0.0101	H	0.00406	0.00893
	Nickel	13.2		0.191	0.481	6.18		0.199	0.5	6.51		0.195	0.49
	Potassium	2010	B	8.32	48.1	2100	B	4.33	25	2280	B	4.24	24.5
	Selenium	0.749	B	0.26	0.481	0.29	J	0.27	0.5	0.265	U	0.265	0.49
	Silver	0.111	U	0.111	0.481	0.116	U	0.116	0.5	0.113	U	0.113	0.49
	Thallium	0.908	U	0.908	0.962	2.36	U	2.36	2.5	2.31	U	2.31	2.45
	Vanadium	27		0.114	0.481	15.2		0.119	0.5	16.6		0.116	0.49
	Zinc	38	B	0.25	0.481	26.9	B	0.26	0.5	35.1	B	0.255	0.49

See notes at end of table.

TABLE E-6. Non-radiological Results for On-Site Locations in Calendar Year 2001, Soil *(continued)*

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

Location Type	Analyte	42 Result		42 Decision Level	42 Detection Limit	43 Results		43 Decision Level	43 Detection Limit	45 Results		45 Decision Level	45 Detection Limit
On-site	Aluminum	3662		2.045	4.77	6750		2.14	5	5820		1.99	4.63
	Antimony	0.452	U	0.452	0.9535	0.474	U	0.474	1	0.439	U	0.439	0.926
	Arsenic	1.3815		0.261	0.477	3.28		0.274	0.5	1.88		0.254	0.463
	Barium	42.55	B	0.0283	0.477	60.8	B	0.0297	0.5	57.5	B	0.0275	0.463
	Beryllium	0.228	J	0.01465	0.477	0.366	J	0.0153	0.5	0.3	J	0.0142	0.463
	Cadmium	0.1375	J	0.02475	0.477	0.217	J	0.0259	0.5	0.262	J	0.024	0.463
	Chromium	4.135		0.416	0.477	7.29		0.436	0.5	6.8		0.404	0.463
	Cobalt	1.6615		0.10395	0.477	2.83		0.109	0.5	2.49		0.101	0.463
	Copper	5.02	B	0.04795	0.477	6.83	B	0.0503	0.5	5.11	B	0.0465	0.463
	Iron	3989		3.735	4.77	7380		3.91	5	6610		3.62	4.63
	Lead	3.288		0.3245	0.477	5.96		0.341	0.5	7.77		0.315	0.463
	Magnesium	1565.5	B	0.5865	1.905	2030	B	0.615	2	1580	B	0.57	1.85
	Manganese	79.05		0.04565	0.9535	128		0.0479	1	147		0.0443	0.926
	Mercury	0.005685	HJ	0.003965	0.00871	0.00787	HJ	0.00417	0.00916	0.00814	HJ	0.00406	0.00892
	Nickel	3.615		0.1895	0.477	6.02		0.199	0.5	5.13		0.184	0.463
	Potassium	3280	B	10.535	60.95	2150	B	4.33	25	1580	B	4.01	23.1
	Selenium	0.3145	U	0.258	0.477	0.27	U	0.27	0.5	0.25	U	0.25	0.463
	Silver	0.11	U	0.11	0.477	0.116	U	0.116	0.5	0.107	U	0.107	0.463
	Thallium	0.8915	U	0.8915	0.944	2.36	U	2.36	2.5	2.19	U	2.19	2.31
	Vanadium	8.7445		0.1135	0.477	16.6		0.119	0.5	13.5		0.11	0.463
	Zinc	16.55	B	0.2485	0.477	25.6	B	0.26	0.5	22.6	B	0.241	0.463

See notes at end of table.

TABLE E-6. Non-radiological Results for On-Site Locations in Calendar Year 2001, Soil *(continued)*
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	46 Result		46 Decision Level	46 Detection Limit	49 Results		49 Decision Level	49 Detection Limit	51 Results		51 Decision Level	51 Detection Limit
On-site	Aluminum	11300		2.04	4.76	9960		2.14	5	6470		2.14	5
	Antimony	0.451	U	0.451	0.952	0.474	U	0.474	1	0.474	U	0.474	1
	Arsenic	3.4		0.261	0.476	2.56		0.274	0.5	2.63		0.274	0.5
	Barium	114	B	0.0283	0.476	100	B	0.0297	0.5	87.1	B	0.0297	0.5
	Beryllium	0.491		0.0146	0.476	0.47	J	0.0153	0.5	0.349	J	0.0153	0.5
	Cadmium	0.344	J	0.0247	0.476	0.292	J	0.0259	0.5	0.259	J	0.0259	0.5
	Chromium	11.5		0.415	0.476	11.3		0.436	0.5	6.92		0.436	0.5
	Cobalt	5.32		0.104	0.476	4.95		0.109	0.5	2.75		0.109	0.5
	Copper	11.6	B	0.0479	0.476	9.24	B	0.0503	0.5	7.08	B	0.0503	0.5
	Iron	16400	B	3.73	4.76	14100	B	3.91	5	6220		3.91	5
	Lead	9.36		0.324	0.476	12.6		0.341	0.5	6.77		0.341	0.5
	Magnesium	3950	B	0.586	1.9	3990	B	0.615	2	2270	B	0.615	2
	Manganese	255	B	0.0456	0.952	270	B	0.0479	1	121		0.0479	1
	Mercury	0.0194		0.0042	0.00923	0.0295		0.00407	0.00896	0.0136	H	0.00396	0.00871
	Nickel	9.44		0.189	0.476	8.84		0.199	0.5	6.03		0.199	0.5
	Potassium	3570	B	8.24	47.6	3020	B	8.66	50	1370	B	4.33	25
	Selenium	0.818	B	0.257	0.476	1.11	B	0.27	0.5	0.27	U	0.27	0.5
	Silver	0.11	U	0.11	0.476	0.116	U	0.116	0.5	0.116	U	0.116	0.5
	Thallium	0.899	U	0.899	0.952	0.944	U	0.944	1	2.36	U	2.36	2.5
	Vanadium	33.5		0.113	0.476	26.7		0.119	0.5	14.4		0.119	0.5
	Zinc	44.6	B	0.248	0.476	38.4	B	0.26	0.5	43.9	B	0.26	0.5

See notes at end of table.

TABLE E-6. Non-radiological Results for On-Site Locations in Calendar Year 2001, Soil *(continued)*

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

Location Type	Analyte	52				54				55			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
On-site	Aluminum	11700		2.04	4.76	6870		2.02	4.72	7510		2.14	5
	Antimony	0.451	U	0.451	0.952	0.447	U	0.447	0.943	0.474	U	0.474	1
	Arsenic	3.77		0.261	0.476	2.26		0.258	0.472	2.65		0.274	0.5
	Barium	134	B	0.0283	0.476	75.1	B	0.028	0.472	83.7	B	0.0297	0.5
	Beryllium	0.601		0.0146	0.476	0.34	J	0.0145	0.472	0.38	J	0.0153	0.5
	Cadmium	0.388	J	0.0247	0.476	0.655		0.0245	0.472	0.326	J	0.0259	0.5
	Chromium	11		0.415	0.476	6.92		0.411	0.472	7.94		0.436	0.5
	Cobalt	4.17		0.104	0.476	2.88		0.103	0.472	2.95		0.109	0.5
	Copper	10.7	B	0.0479	0.476	6.71	B	0.0474	0.472	6.72	B	0.0503	0.5
	Iron	10300		3.73	4.76	7100		3.69	4.72	8010		3.91	5
	Lead	10.1		0.324	0.476	8.72		0.321	0.472	10.3		0.341	0.5
	Magnesium	3430	B	0.586	1.9	1900	B	0.58	1.89	2720	B	0.615	2
	Manganese	179		0.0456	0.952	138		0.0451	0.943	179		0.0479	1
	Mercury	0.0142		0.00455	0.01	0.0071	J	0.00438	0.00963	0.0138	H	0.00391	0.00858
	Nickel	9.39		0.189	0.476	7.11		0.188	0.472	6.33		0.199	0.5
	Potassium	2230	B	4.12	23.8	1580	B	4.08	23.6	2220	B	4.33	25
	Selenium	0.257	U	0.257	0.476	0.255	U	0.255	0.472	0.27	U	0.27	0.5
	Silver	0.394	J	0.11	0.476	0.109	U	0.109	0.472	0.116	U	0.116	0.5
	Thallium	2.25	U	2.25	2.38	2.23	U	2.23	2.36	2.36	U	2.36	2.5
	Vanadium	22.5		0.113	0.476	15.2		0.112	0.472	16.2		0.119	0.5
	Zinc	42.3	B	0.248	0.476	27.2	B	0.246	0.472	29.5	B	0.26	0.5

See notes at end of table.

TABLE E-6. Non-radiological Results for On-Site Locations in Calendar Year 2001, Soil *(continued)*
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	56				57				66			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
On-site	Aluminum	5230		1.95	4.55	8110		2.1	4.9	8810		2.14	5
	Antimony	0.46	J	0.431	0.909	0.482	J	0.465	0.98	0.474	U	0.474	1
	Arsenic	2.94		0.249	0.455	3.9		0.269	0.49	2.93		0.274	0.5
	Barium	106	B	0.027	0.455	178	B	0.0291	0.49	85.5	B	0.0297	0.5
	Beryllium	0.274	J	0.0139	0.455	0.401	J	0.015	0.49	0.521		0.0153	0.5
	Cadmium	0.311	J	0.0236	0.455	0.16	J	0.0254	0.49	0.322	J	0.0259	0.5
	Chromium	9.15		0.396	0.455	8.72		0.428	0.49	9.4		0.436	0.5
	Cobalt	4.04		0.099	0.455	5.36		0.107	0.49	3.85		0.109	0.5
	Copper	9.76	B	0.0457	0.455	10.9	B	0.0493	0.49	8.77	B	0.0503	0.5
	Iron	7750		3.56	4.55	13700		3.84	4.9	9230		3.91	5
	Lead	9.22		0.31	0.455	9.51		0.334	0.49	9.49		0.341	0.5
	Magnesium	2190	B	0.559	1.82	4590	B	0.603	1.96	2870	B	0.615	2
	Manganese	115		0.0435	0.909	203		0.0469	0.98	203		0.0479	1
	Mercury	0.00455	U	0.00455	0.01	0.00705	J	0.00431	0.00948	0.00752	HJ	0.0045	0.00988
	Nickel	7.27		0.181	0.455	7.92		0.195	0.49	7.96		0.199	0.5
	Potassium	1020	B	3.93	22.7	1900	B	8.49	49	2340	B	4.33	25
	Selenium	0.246	U	0.246	0.455	0.672		0.265	0.49	0.313	J	0.27	0.5
	Silver	0.105	U	0.105	0.455	0.113	U	0.113	0.49	0.116	U	0.116	0.5
	Thallium	0.858	U	0.858	0.909	0.926	U	0.926	0.98	2.36	U	2.36	2.5
	Vanadium	18.9		0.108	0.455	31.8		0.116	0.49	18.9		0.119	0.5
	Zinc	56.8	B	0.237	0.455	56.8	B	0.255	0.49	31.7	B	0.26	0.5

See notes at end of table.

TABLE E-6. Non-radiological Results for On-Site Locations in Calendar Year 2001, Soil *(concluded)*
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	76 Result		76 Decision Level	76 Detection Limit	77 Results		77 Decision Level	77 Detection Limit	78 Results		78 Decision Level	78 Detection Limit
On-site	Aluminum	7970		2.14	5	11000		2.14	5	7570		1.97	4.59
	Antimony	0.474	U	0.474	1	0.568	J	0.474	1	0.435	U	0.435	0.917
	Arsenic	2.11		0.274	0.5	3.39		0.274	0.5	2.46		0.251	0.459
	Barium	68.5	B	0.0297	0.5	154	B	0.0297	0.5	69.6	B	0.0272	0.459
	Beryllium	0.394	J	0.0153	0.5	0.532		0.0153	0.5	0.381	J	0.0141	0.459
	Cadmium	0.265	J	0.0259	0.5	0.368	J	0.0259	0.5	0.211	J	0.0238	0.459
	Chromium	8.5		0.436	0.5	10		0.436	0.5	9.7		0.4	0.459
	Cobalt	3.2		0.109	0.5	4.14		0.109	0.5	3.73		0.0999	0.459
	Copper	6.77	B	0.0503	0.5	9.76	B	0.0503	0.5	7.57	B	0.0461	0.459
	Iron	8610		3.91	5	9760		3.91	5	10000	B	3.59	4.59
	Lead	8.11		0.341	0.5	12.4		0.341	0.5	8.42		0.312	0.459
	Magnesium	2080	B	0.615	2	3760	B	0.615	2	2540	B	0.564	1.83
	Manganese	155		0.0479	1	222		0.0479	1	217	B	0.0439	0.917
	Mercury	0.0117	H	0.00407	0.00896	0.0144	H	0.00435	0.00957	0.00851	J	0.00414	0.00909
	Nickel	6.54		0.199	0.5	8.9		0.199	0.5	7.4		0.182	0.459
	Potassium	2110	B	4.33	25	3190	B	8.66	50	2010	B	7.94	45.9
	Selenium	0.515		0.27	0.5	0.27	U	0.27	0.5	0.529	B	0.248	0.459
	Silver	0.116	U	0.116	0.5	0.116	U	0.116	0.5	0.106	U	0.106	0.459
	Thallium	2.36	U	2.36	2.5	4.72	U	4.72	5	4.33	U	4.33	4.59
	Vanadium	17.6		0.119	0.5	20.1		0.119	0.5	17.9		0.109	0.459
	Zinc	25.4	B	0.26	0.5	36.8	B	0.26	0.5	27.7	B	0.239	0.459

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

TABLE E-7. Non-radiological Results for Community Locations in Calendar Year 2001, Vegetation

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

Location Type	Analyte	8				11				68			
		Result		Decision Level	Detection Limit	Result		Decision Level	Detection Limit	Result		Decision Level	Detection Limit
Community	Aluminum	6510		1.97	4.59	3520		2.14	5	3940		2.06	4.81
	Antimony	0.435	U	0.435	0.917	0.474	U	0.474	1	1.09		0.456	0.962
	Arsenic	2.36		0.251	0.459	1.56		0.274	0.5	8.5		0.263	0.481
	Barium	153		0.0272	0.459	105		0.0297	0.5	104		0.0285	0.481
	Beryllium	0.404	J	0.0141	0.459	0.212	J	0.0153	0.5	0.296	J	0.0147	0.481
	Cadmium	0.24	J	0.0238	0.459	0.0943	J	0.0259	0.5	0.259	J	0.0249	0.481
	Calcium	20100	B	3.57	9.17	10800	B	3.89	10	81800	B	18.7	48.1
	Chromium	6.9		0.4	0.459	4.51		0.436	0.5	6.3		0.419	0.481
	Cobalt	3.78		0.0999	0.459	2.09		0.109	0.5	2.99		0.105	0.481
	Copper	7.82	B	0.0461	0.459	4.15	B	0.0503	0.5	5.3	B	0.0483	0.481
	Iron	8360		3.59	4.59	5950		3.91	5	7050		3.76	4.81
	Lead	6.47		0.312	0.459	4.18		0.341	0.5	6.28		0.327	0.481
	Magnesium	3600	B	0.564	1.83	1830	B	0.615	2	2130	B	0.592	1.92
	Manganese	265		0.0439	0.917	139		0.0479	1	230		0.046	0.962
	Mercury	0.00341	U	0.00341	0.0075	0.00407	U	0.00407	0.00896	0.00436	U	0.00436	0.00958
	Nickel	7.48		0.182	0.459	3.79		0.199	0.5	7.36		0.191	0.481
	Potassium	1370	B	7.94	45.9	735	B	1.73	10	675	B	1.66	9.62
	Selenium	0.248	U	0.248	0.459	0.27	U	0.27	0.5	0.26	U	0.26	0.481
	Silver	0.106	U	0.106	0.459	0.116	U	0.116	0.5	0.111	U	0.111	0.481
	Sodium	186	B	2.29	9.17	93.6	B	2.5	10	52.1	B	2.4	9.62
	Thallium	0.866	U	0.866	0.917	0.944	U	0.944	1	0.908	U	0.908	0.962
	Vanadium	16.1		0.109	0.459	13.2		0.119	0.5	13.7		0.114	0.481
	Zinc	26.8	B	0.239	0.459	17.5	B	0.26	0.5	21	B	0.25	0.481

NOTES: B = The analyte was found in the blank above the effective decision level (organics), or the effective detection limit (inorganics).

J = Estimated value, the analyte concentration fell above the effective decision level and below the effective detection limit.

H = Holding time exceeded.

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

TABLE E-8. Non-radiological Results for Perimeter Locations in Calendar Year 2001, Sediment
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	60				65E				73			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
Perimeter	Aluminum	5000		1.95	4.55	4400		1.95	4.55	9630		1.97	4.59
	Antimony	0.431	U	0.431	0.909	0.431	U	0.431	0.909	0.435	U	0.435	0.917
	Arsenic	2.31		0.249	0.455	1.2		0.249	0.455	2.81		0.251	0.459
	Barium	106		0.027	0.455	44.5	B	0.027	0.455	123	B	0.0272	0.459
	Beryllium	0.279	J	0.0139	0.455	0.274	J	0.0139	0.455	0.474		0.0141	0.459
	Cadmium	0.194	J	0.0236	0.455	0.178	J	0.0236	0.455	0.117	J	0.0238	0.459
	Chromium	7.08		0.396	0.455	4.83		0.396	0.455	9.82		0.4	0.459
	Cobalt	4.21		0.099	0.455	3.94		0.099	0.455	5.92		0.0999	0.459
	Copper	7.22	B	0.0457	0.455	7.89	B	0.0457	0.455	11.8	B	0.0461	0.459
	Iron	11500		3.56	4.55	11000	B	3.56	4.55	16900		3.59	4.59
	Lead	5.23		0.31	0.455	3.41		0.31	0.455	11.3		0.312	0.459
	Magnesium	2600	B	0.559	1.82	2460	B	0.559	1.82	4700	B	0.564	1.83
	Manganese	215		0.0435	0.909	196	B	0.0435	0.909	337		0.0439	0.917
	Mercury	0.00438	U	0.00438	0.00962	0.00435	HU	0.00435	0.00955	0.00722	HJ	0.00423	0.0093
	Nickel	6.31		0.181	0.455	4.41		0.181	0.455	9.8		0.182	0.459
	Potassium	1330	B	7.87	45.5	1190	B	7.87	45.5	3150	B	7.94	45.9
	Selenium	0.246	U	0.246	0.455	0.348	BJ	0.246	0.455	0.993		0.248	0.459
	Silver	0.105	U	0.105	0.455	0.105	U	0.105	0.455	0.106	U	0.106	0.459
	Thallium	0.858	U	0.858	0.909	0.858	U	0.858	0.909	0.866	U	0.866	0.917
	Vanadium	23.8		0.108	0.455	22.1		0.108	0.455	28.4		0.109	0.459
	Zinc	26.8	B	0.237	0.455	25.4	B	0.237	0.455	46.4	B	0.239	0.459

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

TABLE E-9. Non-radiological Results for On-Site Locations in Calendar Year 2001, Sediment
(All results reported in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	72				74				75			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
On-site	Aluminum	13100		2.14	5	5520		1.95	4.55	10300		1.95	4.55
	Antimony	0.474	U	0.474	1	0.431	U	0.431	0.909	0.431	U	0.431	0.909
	Arsenic	6.5		0.274	0.5	1.82		0.249	0.455	3.51		0.249	0.455
	Barium	168	B	0.0297	0.5	82.5	B	0.027	0.455	131	B	0.027	0.455
	Beryllium	1.08		0.0153	0.5	0.334	J	0.0139	0.455	0.556		0.0139	0.455
	Cadmium	0.278	J	0.0259	0.5	0.376	J	0.0236	0.455	0.429	J	0.0236	0.455
	Chromium	13.6		0.436	0.5	6.63		0.396	0.455	11.9		0.396	0.455
	Cobalt	5.46		0.109	0.5	4.65		0.099	0.455	5.94		0.099	0.455
	Copper	12.1	B	0.0503	0.5	6.86	B	0.0457	0.455	15.3	B	0.0457	0.455
	Iron	12900	B	3.91	5	12300		3.56	4.55	11800		3.56	4.55
	Lead	12.1		0.341	0.5	5.2		0.31	0.455	13.4		0.31	0.455
	Magnesium	5240	B	0.615	2	3160	B	0.559	1.82	4820	B	0.559	1.82
	Manganese	268	B	0.0479	1	238		0.0435	0.909	319		0.0435	0.909
	Mercury	0.00885	J	0.0042	0.00923	0.00395	U	0.00395	0.00868	0.00634	HJ	0.00419	0.00922
	Nickel	11.5		0.199	0.5	5.82		0.181	0.455	11.5		0.181	0.455
	Potassium	2800	B	8.66	50	1750	B	7.87	45.5	2140	B	3.93	22.7
	Selenium	0.461	BJ	0.27	0.5	0.246	U	0.246	0.455	0.246	U	0.246	0.455
	Silver	0.116	U	0.116	0.5	0.105	U	0.105	0.455	0.105	U	0.105	0.455
	Thallium	0.944	U	0.944	1	0.858	U	0.858	0.909	2.15	U	2.15	2.27
	Vanadium	31.1		0.119	0.5	27.2		0.108	0.455	26.5		0.108	0.455
	Zinc	43.8	B	0.26	0.5	32.7	B	0.237	0.455	44.4	B	0.237	0.455

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

TABLE E-10. Non-radiological Results for Community Locations in Calendar Year 2001, Vegetation
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Analyte	8				9				11			
		Result		Decision Level	Detection Limit	Result		Decision Level	Detection Limit	Result		Decision Level	Detection Limit
Community	Aluminum	59.9		1.95	4.55	28.5		2.14	5	94.8		1.95	4.55
	Antimony	0.431	U	0.431	0.909	0.474	U	0.474	1	0.431	U	0.431	0.909
	Arsenic	0.249	U	0.249	0.455	0.274	U	0.274	0.5	0.264	J	0.249	0.455
	Barium	7.36	B	0.027	0.455	26.2	B	0.0297	0.5	2.37	B	0.027	0.455
	Beryllium	0.0139	U	0.0139	0.455	0.0153	U	0.0153	0.5	0.0139	U	0.0139	0.455
	Cadmium	0.0468	BJ	0.0236	0.455	0.0592	BJ	0.0259	0.5	0.18	BJ	0.0236	0.455
	Calcium	923	B	3.53	9.09	1940	B	3.89	10	4830	B	35.3	90.9
	Chromium	0.396	U	0.396	0.455	0.436	U	0.436	0.5	0.396	U	0.396	0.455
	Cobalt	0.099	U	0.099	0.455	0.109	U	0.109	0.5	0.099	U	0.099	0.455
	Copper	2.58	B	0.0457	0.455	2.63	B	0.0503	0.5	1.58	B	0.0457	0.455
	Iron	70.3		3.56	4.55	43.3		3.91	5	153		3.56	4.55
	Lead	0.31	U	0.31	0.455	0.341	U	0.341	0.5	0.31	U	0.31	0.455
	Magnesium	234	B	0.559	1.82	478	B	0.615	2	1480	B	0.559	1.82
	Manganese	43		0.0435	0.909	43.9		0.0479	1	41.4		0.0435	0.909
	Mercury	0.00401	U	0.00401	0.00881	0.00411	U	0.00411	0.00904	0.00416	U	0.00416	0.00913
	Nickel	0.944		0.181	0.455	0.237	J	0.199	0.5	0.446	J	0.181	0.455
	Potassium	7040	B	15.7	90.9	7040	B	17.3	100	6620	B	15.7	90.9
	Selenium	0.246	U	0.246	0.455	0.405	J	0.27	0.5	0.259	J	0.246	0.455
	Silver	0.105	BU	0.105	0.455	0.116	BU	0.116	0.5	0.105	BU	0.105	0.455
	Sodium	27.9	B	2.27	9.09	190	B	2.5	10	5970	B	2.27	9.09
	Thallium	0.944	U	0.944	1	0.935	U	0.935	0.99	0.891	U	0.891	0.943
	Vanadium	0.137	J	0.108	0.455	0.119	U	0.119	0.5	0.237	J	0.108	0.455
	Zinc	6.43	B	0.237	0.455	14.1	B	0.26	0.5	10.9	B	0.237	0.455

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

TABLE E-11. Non-radiological Results for Perimeter Locations in Calendar Year 2001, Vegetation

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

Location Type	Analyte	4				12				60			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
Perimeter	Aluminum	145		2.12	4.95	34.3		2.14	5	66.3		2.04	4.76
	Antimony	0.469	U	0.469	0.99	0.474	U	0.474	1	0.451	U	0.451	0.952
	Arsenic	0.463	J	0.271	0.495	0.317	J	0.274	0.5	0.449	J	0.261	0.476
	Barium	14.7	B	0.0294	0.495	7.53	B	0.0297	0.5	6.95	B	0.0283	0.476
	Beryllium	0.0152	U	0.0152	0.495	0.0153	U	0.0153	0.5	0.0146	U	0.0146	0.476
	Cadmium	0.0291	BJ	0.0257	0.495	0.0297	J	0.0259	0.5	0.236	BJ	0.0247	0.476
	Chromium	0.432	U	0.432	0.495	0.436	U	0.436	0.5	0.415	U	0.415	0.476
	Cobalt	0.108	U	0.108	0.495	0.109	U	0.109	0.5	0.104	U	0.104	0.476
	Copper	4.77	B	0.0498	0.495	4.92	B	0.0503	0.5	3.42	B	0.0479	0.476
	Iron	137		3.88	4.95	48.8		3.91	5	99.6		3.73	4.76
	Lead	0.337	U	0.337	0.495	0.341	U	0.341	0.5	0.328	J	0.324	0.476
	Magnesium	675	B	0.609	1.98	758	B	0.615	2	3000	B	0.586	1.9
	Manganese	9.99		0.0474	0.99	10.8		0.0479	1	35.7		0.0456	0.952
	Mercury	0.00425	HU	0.00425	0.00935	0.00419	U	0.00419	0.00922	0.00374	U	0.00374	0.00822
	Nickel	0.32	J	0.197	0.495	0.412	J	0.199	0.5	0.38	J	0.189	0.476
	Potassium	5640	B	17.1	99	11800	B	21.6	125	24000	B	82.4	476
	Selenium	0.543		0.268	0.495	0.857		0.27	0.5	0.257	U	0.257	0.476
	Silver	0.114	BU	0.114	0.495	0.116	U	0.116	0.5	0.11	BU	0.11	0.476
	Thallium	0.874	U	0.874	0.926	0.944	U	0.944	1	0.883	U	0.883	0.935
	Vanadium	0.261	J	0.118	0.495	0.119	U	0.119	0.5	0.148	J	0.113	0.476
	Zinc	19.3	B	0.258	0.495	13.9	B	0.26	0.5	7.21	B	0.248	0.476

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

TABLE E-12. Non-radiological Results for On-Site Locations in Calendar Year 2001, Vegetation

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

See notes at end of table.

Location Type	Analyte	6				33				34			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
On-Site	Aluminum	217		2.14	5	27.2		2.06	4.81	199		2.02	4.72
	Antimony	0.474	U	0.474	1	0.456	U	0.456	0.962	0.447	U	0.447	0.943
	Arsenic	0.312	J	0.274	0.5	0.459	J	0.263	0.481	0.333	J	0.258	0.472
	Barium	13.8	B	0.0297	0.5	3.05	B	0.0285	0.481	9.55	B	0.028	0.472
	Beryllium	0.0193	J	0.0153	0.5	0.0147	U	0.0147	0.481	0.0145	U	0.0145	0.472
	Cadmium	0.141	BJ	0.0259	0.5	0.0936	J	0.0249	0.481	0.0245	U	0.0245	0.472
	Chromium	1.53		0.436	0.5	0.419	U	0.419	0.481	0.424	J	0.411	0.472
	Cobalt	1.45		0.109	0.5	0.105	U	0.105	0.481	0.103	U	0.103	0.472
	Copper	23.5	B	0.0503	0.5	0.934	B	0.0483	0.481	1.38	B	0.0474	0.472
	Iron	207		3.91	5	35.8		3.76	4.81	190		3.69	4.72
	Lead	0.477	J	0.341	0.5	0.327	U	0.327	0.481	0.321	U	0.321	0.472
	Magnesium	1020	B	0.615	2	680	B	0.592	1.92	317	B	0.58	1.89
	Manganese	15.6		0.0479	1	12.5		0.046	0.962	15.2		0.0451	0.943
	Mercury	0.00455	U	0.00455	0.01	0.00414	HU	0.00414	0.0091	0.00425	HU	0.00425	0.00935
	Nickel	6.56		0.199	0.5	0.356	J	0.191	0.481	0.364	J	0.188	0.472
	Potassium	10200	B	43.3	250	7480	B	16.6	96.2	3790	B	8.17	47.2
	Selenium	0.403	J	0.27	0.5	0.298	J	0.26	0.481	0.702		0.255	0.472
	Silver	0.342	BJ	0.116	0.5	0.111	U	0.111	0.481	0.109	U	0.109	0.472
	Thallium	0.917	U	0.917	0.971	0.908	U	0.908	0.962	0.891	U	0.891	0.943
	Vanadium	0.364	J	0.119	0.5	0.114	U	0.114	0.481	0.368	J	0.112	0.472
	Zinc	35.2	B	0.26	0.5	16.8	B	0.25	0.481	10.6	B	0.26	0.5

TABLE E-12. Non-radiological Results for On-Site Locations in Calendar Year 2001, Vegetation *(continued)*

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

See notes at end of table.

Location Type	Analyte	35 Result	45 Decision Level	46 Detection Limit	Results	Decision Level	Detection Limit	Results	Decision Level	Detection Limit			
On-Site	Aluminum	590		2.08	4.85	75.9		2.12	4.95	364		2.02	4.72
	Antimony	0.46	U	0.46	0.971	0.469	U	0.469	0.99	0.447	U	0.447	0.943
	Arsenic	0.506		0.266	0.485	0.271	U	0.271	0.495	0.383	J	0.258	0.472
	Barium	12.6	B	0.0288	0.485	8.46	B	0.0294	0.495	24	B	0.028	0.472
	Beryllium	0.0304	J	0.0149	0.485	0.0152	U	0.0152	0.495	0.0179	J	0.0145	0.472
	Cadmium	0.0426	BJ	0.0252	0.485	0.0579	BJ	0.0257	0.495	0.0245	U	0.0245	0.472
	Chromium	0.78		0.423	0.485	0.432	U	0.432	0.495	0.425	J	0.411	0.472
	Cobalt	0.121	J	0.106	0.485	0.108	U	0.108	0.495	0.131	J	0.103	0.472
	Copper	5	B	0.0488	0.485	4.18	B	0.0498	0.495	4.94	B	0.0474	0.472
	Iron	533		3.8	4.85	82.6		3.88	4.95	381		3.69	4.72
	Lead	0.617		0.331	0.485	0.404	J	0.337	0.495	0.597		0.321	0.472
	Magnesium	1260	B	0.597	1.94	883	B	0.609	1.98	1080	B	0.58	1.89
	Manganese	17.4		0.0465	0.971	10.3		0.0474	0.99	22.7		0.0451	0.943
	Mercury	0.00423	U	0.00423	0.00929	0.00346	HU	0.00346	0.00761	0.00427	U	0.00427	0.00939
	Nickel	0.885		0.193	0.485	0.461	J	0.197	0.495	0.701		0.188	0.472
	Potassium	8350	B	16.8	97.1	7080	B	17.1	99	6010	B	16.3	94.3
	Selenium	1.04		0.262	0.485	0.438	J	0.268	0.495	0.749		0.255	0.472
	Silver	0.112	BU	0.112	0.485	0.114	BU	0.114	0.495	0.109	U	0.109	0.472
	Thallium	0.908	U	0.908	0.962	0.858	U	0.858	0.909	0.891	U	0.891	0.943
	Vanadium	0.96		0.115	0.485	0.143	J	0.118	0.495	0.637		0.112	0.472
	Zinc	7.91	B	0.253	0.485	10	B	0.258	0.495	19.3	B	0.246	0.472

TABLE E-12. Non-radiological Results for On-Site Locations in Calendar Year 2001, Vegetation *(concluded)*

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

Location Type	Analyte	51				52				55			
		Result		Decision Level	Detection Limit	Results		Decision Level	Detection Limit	Results		Decision Level	Detection Limit
On-Site	Aluminum	937		2.14	5	420		2.14	5	380		2	4.67
	Antimony	0.474	U	0.474	1	0.474	U	0.474	1	0.443	U	0.443	0.935
	Arsenic	0.565		0.274	0.5	0.571		0.274	0.5	0.772		0.256	0.467
	Barium	29.7	B	0.0297	0.5	11.3	B	0.0297	0.5	25	B	0.0277	0.467
	Beryllium	0.0515	J	0.0153	0.5	0.0497	J	0.0153	0.5	0.0193	J	0.0143	0.467
	Cadmium	0.0871	BJ	0.0259	0.5	0.0996	BJ	0.0259	0.5	0.224	BJ	0.0242	0.467
	Chromium	1.45		0.436	0.5	0.68		0.436	0.5	0.783		0.408	0.467
	Cobalt	0.295	J	0.109	0.5	0.153	J	0.109	0.5	0.105	J	0.102	0.467
	Copper	3.23	B	0.0503	0.5	3.22	B	0.0503	0.5	5.01	B	0.047	0.467
	Iron	891		3.91	5	409		3.91	5	374		3.66	4.67
	Lead	1.51		0.341	0.5	0.719		0.341	0.5	0.654		0.318	0.467
	Magnesium	753	B	0.615	2	938	B	0.615	2	857	B	0.575	1.87
	Manganese	24		0.0479	1	49		0.0479	1	21		0.0447	0.935
	Mercury	0.00412	HU	0.00412	0.00905	0.00349	U	0.00349	0.00766	0.00427	HU	0.00427	0.00939
	Nickel	1.4		0.199	0.5	0.654		0.199	0.5	0.574		0.186	0.467
	Potassium	4350	B	17.3	100	5510	B	17.3	100	8000	B	16.2	93.5
	Selenium	0.27	U	0.27	0.5	0.348	J	0.27	0.5	0.253	U	0.253	0.467
	Silver	0.116	BU	0.116	0.5	0.147	BJ	0.116	0.5	0.108	BU	0.108	0.467
	Thallium	0.917	U	0.917	0.971	1.43		0.917	0.971	0.935	U	0.935	0.99
	Vanadium	1.89		0.119	0.5	0.792		0.119	0.5	0.802		0.111	0.467
	Zinc	18.2	B	0.26	0.5	22.2	B	0.26	0.5	23.5	B	0.243	0.467

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

TABLE E-13. Radiological Replicate Results for Calendar Year 2001, Soil

Location Type	Location	Sample ID	Analyte	Units	Activity		Decision Level	Detection Limit	Average	Std Dev	CV
Community	**11**	055596-001	Cesium-137	pCi/g	0.095 ± 0.0502		0.0206	0.0448	0.0575	0.0506	87.93%
		055596-002	Cesium-137	pCi/g	0 ± 0.0686	U	0.0249	0.0534			
		055596-003	Cesium-137	pCi/g	0.0775 ± 0.0505		0.0215	0.0474			
		055596-001	Tritium	pCi/mL	-0.933 ± 0.609	U	0.529	1.08	-0.55667	0.331666	-59.58%
		055596-002	Tritium	pCi/mL	-0.43 ± 0.483	U	0.414	0.843			
		055596-003	Tritium	pCi/mL	-0.307 ± 0.35	U	0.3	0.612			
		055596-001	Uranium	µg/g	0.531		0.00335	0.0394	0.575	0.047286	8.22%
		055596-002	Uranium	µg/g	0.569		0.00333	0.0392			
		055596-003	Uranium	µg/g	0.625		0.00336	0.0395			
Perimeter	**64**	055555-001	Cesium-137	pCi/g	0.573 ± 0.113		0.0302	0.0639	0.586667	0.03086	5.26%
		055555-002	Cesium-137	pCi/g	0.565 ± 0.0984		0.0247	0.0528			
		055555-003	Cesium-137	pCi/g	0.622 ± 0.0959		0.0243	0.0514			
		055555-001	Tritium	pCi/mL	-0.446 ± 0.348	U	0.301	0.614	4.824667	4.737916	98.20%
		055555-002	Tritium	pCi/mL	8.73 ± 0.772		0.361	0.752			
		055555-003	Tritium	pCi/mL	6.19 ± 0.532		0.244	0.509			
		055555-001	Uranium	µg/g	1.08		0.00333	0.0392	0.977	0.099242	10.16%
		055555-002	Uranium	µg/g	0.882		0.00333	0.0392			
		055555-003	Uranium	µg/g	0.969		0.00337	0.0396			

See notes at end of table.

TABLE E-13. Radiological Replicate Results for Calendar Year 2001, Soil *(concluded)*

Location Type	Location	Sample ID	Analyte	Units	Activity		Decision Level	Detection Limit	Average	Std Dev	CV
On-site	**20**	055569-001	Cesium-137	pCi/g	0.328 ± 0.0491		0.0147	0.0309	0.291333	0.032146	11.03%
		055569-002	Cesium-137	pCi/g	0.268 ± 0.0713		0.0284	0.0597			
		055569-003	Cesium-137	pCi/g	0.278 ± 0.0421		0.0112	0.0234			
		055569-001	Tritium	pCi/mL	-0.122 ± 0.356	U	0.302	0.615	-0.19467	0.067352	-34.60%
		055569-002	Tritium	pCi/mL	-0.255 ± 0.414	U	0.353	0.719			
		055569-003	Tritium	pCi/mL	-0.207 ± 0.201	U	0.174	0.355			
		055569-001	Uranium	µg/g	0.605		0.0034	0.04	0.604	0.001	0.17%
		055569-002	Uranium	µg/g	0.603		0.00335	0.0394			
		055569-003	Uranium	µg/g	0.604		0.00337	0.0396			
	33	055544-001	Cesium-137	pCi/g	0.365 ± 0.0945		0.0325	0.0697	0.323333	0.038188	11.81%
		055544-002	Cesium-137	pCi/g	0.29 ± 0.0815		0.0307	0.0656			
		055544-003	Cesium-137	pCi/g	0.315 ± 0.0612		0.0223	0.047			
		055544-001	Tritium	pCi/mL	0.186 ± 0.106		0.0808	0.169	0.494667	0.428581	86.64%
		055544-002	Tritium	pCi/mL	0.314 ± 0.103		0.0741	0.155			
		055544-003	Tritium	pCi/mL	0.984 ± 0.171		0.107	0.223			
		055544-001	Uranium	µg/g	0.871		0.0034	0.04	0.844667	0.033471	3.96%
		055544-002	Uranium	µg/g	0.856		0.00333	0.0391			
		055544-003	Uranium	µg/g	0.807		0.00335	0.0394			

NOTES: pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter
µg/g = microgram per gram
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.
Std Dev = standard deviaition
CV = coefficient of variation

TABLE E-14. Radiological Replicate Results for Calendar Year 2001, Sediment

Location Type	Location	Sample ID	Analyte	Units	Activity		Decision Level	Detection Limit	Average	Std Dev	CV
Community	**11**	055598-001	Cesium-137	pCi/g	0.0847 ± 0.0533		0.0335	0.072	0.079233	0.049726	62.76%
		055598-002	Cesium-137	pCi/g	0.027 ± 0.0443	U	0.04	0.0849			
		055598-003	Cesium-137	pCi/g	0.126 ± 0.0457		0.0212	0.0461			
		055598-001	Tritium	pCi/mL	-0.129 ± 0.123	U	0.106	0.216	-0.061	0.061609	-101.00%
		055598-002	Tritium	pCi/mL	-0.0089 ± 0.232	U	0.195	0.405			
		055598-003	Tritium	pCi/mL	-0.0451 ± 0.233	U	0.197	0.411			
		055598-001	Uranium	μg/g	0.416		0.00334	0.0393	0.466	0.044034	9.45%
		055598-002	Uranium	μg/g	0.499		0.0034	0.04			
		055598-003	Uranium	μg/g	0.483		0.0034	0.04			
On-site	**74**	055508-001	Cesium-137	pCi/g	-0.0012 ± 0.0116	U	0.0103	0.0215	0.014567	0.013823	94.89%
		055508-002	Cesium-137	pCi/g	0.0203 ± 0.0251	U	0.0237	0.0511			
		055508-003	Cesium-137	pCi/g	0.0246 ± 0.0377	U	0.0148	0.0312			
		055508-001	Tritium	pCi/mL	-0.215 ± 0.384	U	0.327	0.667	0.319333	0.463293	145.08%
		055508-002	Tritium	pCi/mL	0.564 ± 0.541	U	0.442	0.903			
		055508-003	Tritium	pCi/mL	0.609 ± 0.537	U	0.437	0.893			
		055508-001	Uranium	μg/g	0.954		0.00333	0.0392	1.195333	0.45486	38.05%
		055508-002	Uranium	μg/g	0.912		0.00338	0.0398			
		055508-003	Uranium	μg/g	1.72		0.0034	0.04			

NOTES: pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter
μg/g = microgram per gram
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.
Std Dev = standard deviaition
CV = coefficient of variation

TABLE E-15. Radiological Replicate Results for Calendar Year 2001, Vegetation

Location Type	Location	Sample ID	Analyte	Units	Activity		Decision Level	Detection Limit	Average	Std Dev	CV
Community	**11**	055597-001	Cesium-137	pCi/g	0.144 ± 0.101	U	0.0828	0.171	0.052433	0.079577	151.77%
		055597-002	Cesium-137	pCi/g	0.0133 ± 0.0493	U	0.0399	0.0835			
		055597-003	Cesium-137	pCi/g	0 ± 0.0678	U	0.0581	0.12			
		055597-001	Tritium	pCi/mL	0.0716 ± 0.24	U	0.198	0.412	0.0287	0.060422	210.53%
		055597-002	Tritium	pCi/mL	0.0549 ± 0.222	U	0.184	0.383			
		055597-003	Tritium	pCi/mL	-0.0404 ± 0.23	U	0.195	0.405			
		055597-001	Uranium	µg/g	0.0216	J	0.00339	0.0399	0.018533	0.002838	15.31%
		055597-002	Uranium	µg/g	0.016	J	0.0034	0.04			
		055597-003	Uranium	µg/g	0.018	J	0.00333	0.0392			
On-site	**33**	055546-001	Cesium-137	pCi/g	-0.00797 ± 0.0564	U	0.0446	0.0926	-0.00382	0.016154	-422.52%
		055546-002	Cesium-137	pCi/g	-0.0175 ± 0.0496	U	0.0374	0.0783			
		055546-003	Cesium-137	pCi/g	0.014 ± 0.0425	U	0.0345	0.0718			
		055546-001	Tritium	pCi/mL	-0.018 ± 0.237	U	0.2	0.415	0.106667	0.111791	104.80%
		055546-002	Tritium	pCi/mL	0.198 ± 0.24	U	0.194	0.403			
		055546-003	Tritium	pCi/mL	0.14 ± 0.237	U	0.194	0.403			
		055546-001	Uranium	µg/g	0.0135	J	0.00337	0.0397	0.01052	0.003247	30.86%
		055546-002	Uranium	µg/g	0.011	J	0.0034	0.04			
		055546-003	Uranium	µg/g	0.00706	J	0.00333	0.0392			

NOTES: pCi/g = picocurie per gram
pCi/mL = picocurie per milliliter
µg/g = microgram per gram
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.
Std Dev = standard deviaition
CV = coefficient of variation

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
Community	**11**	055596-001	Aluminum	3170		2.06	4.81	2993	204	6.82%
		055596-002	Aluminum	3040		2	4.67			
		055596-003	Aluminum	2770		2.06	4.81			
		055596-001	Antimony	0.456	U	0.456	0.962	0.452	0.008	1.66%
		055596-002	Antimony	0.443	U	0.443	0.935			
		055596-003	Antimony	0.456	U	0.456	0.962			
		055596-001	Arsenic	1.9		0.263	0.481	1.76	0.14	7.66%
		055596-002	Arsenic	1.63		0.256	0.467			
		055596-003	Arsenic	1.76		0.263	0.481			
		055596-001	Barium	122		0.0285	0.481	120	5	4.12%
		055596-002	Barium	123		0.0277	0.467			
		055596-003	Barium	114		0.0285	0.481			
		055596-001	Beryllium	0.21	J	0.0147	0.481	0.21	0.01	4.22%
		055596-002	Beryllium	0.21	J	0.0143	0.467			
		055596-003	Beryllium	0.195	J	0.0147	0.481			
		055596-001	Cadmium	0.121	J	0.0249	0.481	0.110	0.011	9.58%
		055596-002	Cadmium	0.1	J	0.0242	0.467			
		055596-003	Cadmium	0.109	J	0.0249	0.481			
		055596-001	Chromium	5.5		0.419	0.481	5.2	0.4	6.98%
		055596-002	Chromium	5.32		0.408	0.467			
		055596-003	Chromium	4.8		0.419	0.481			
		055596-001	Cobalt	2.49		0.105	0.481	2.45	0.10	4.17%
		055596-002	Cobalt	2.52		0.102	0.467			
		055596-003	Cobalt	2.33		0.105	0.481			
		055596-001	Copper	4.18	B	0.0483	0.481	4.03	0.21	5.16%
		055596-002	Copper	4.11	B	0.047	0.467			
		055596-003	Copper	3.79	B	0.0483	0.481			
		055596-001	Iron	6640		3.76	4.81	6420	347	5.40%
		055596-002	Iron	6600		3.66	4.67			
		055596-003	Iron	6020		3.76	4.81			
		055596-001	Lead	5.22		0.327	0.481	5.07	0.25	4.90%
		055596-002	Lead	5.2		0.318	0.467			
		055596-003	Lead	4.78		0.327	0.481			

See notes at end of table.

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
Community *(concluded)*	**11**	055596-001	Magnesium	1800	B	0.592	1.92	1767	76	4.29%
		055596-002	Magnesium	1820	B	0.575	1.87			
		055596-003	Magnesium	1680	B	0.592	1.92			
		055596-001	Manganese	265		0.046	0.962	270	6	2.26%
		055596-002	Manganese	269		0.0447	0.935			
		055596-003	Manganese	277		0.046	0.962			
		055596-001	Mercury	0.00442	U	0.00442	0.00971	0.0044	0.0001	1.58%
		055596-002	Mercury	0.0043	U	0.0043	0.00945			
		055596-003	Mercury	0.00442	U	0.00442	0.00971			
		055596-001	Nickel	4.4		0.191	0.481	4.48	0.34	7.63%
		055596-002	Nickel	4.85		0.186	0.467			
		055596-003	Nickel	4.18		0.191	0.481			
		055596-001	Potassium	1230	B	8.32	48.1	1109	168	15.16%
		055596-002	Potassium	1180	B	8.09	46.7			
		055596-003	Potassium	917	B	1.66	9.62			
		055596-001	Selenium	0.26	U	0.26	0.481	0.26	0.01	3.05%
		055596-002	Selenium	0.274	J	0.253	0.467			
		055596-003	Selenium	0.26	U	0.26	0.481			
		055596-001	Silver	0.111	U	0.111	0.481	0.110	0.002	1.57%
		055596-002	Silver	0.108	U	0.108	0.467			
		055596-003	Silver	0.111	U	0.111	0.481			
		055596-001	Thallium	0.908	U	0.908	0.962	0.900	0.014	1.60%
		055596-002	Thallium	0.883	U	0.883	0.935			
		055596-003	Thallium	0.908	U	0.908	0.962			
		055596-001	Vanadium	16.7		0.114	0.481	15.7	1.1	7.06%
		055596-002	Vanadium	15.8		0.111	0.467			
		055596-003	Vanadium	14.5		0.114	0.481			
		055596-001	Zinc	18.8	B	0.25	0.481	19.0	1.5	7.95%
		055596-002	Zinc	20.6	B	0.243	0.467			
		055596-003	Zinc	17.6	B	0.25	0.481			

See notes at end of table.

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
Perimeter	**64**	055555-001	Aluminum	12300		1.97	4.59	12700	872	6.86%
		055555-002	Aluminum	13700		2.1	4.9			
		055555-003	Aluminum	12100		2	4.67			
		055555-001	Antimony	0.435	U	0.435	0.917	0.448	0.016	3.47%
		055555-002	Antimony	0.465	U	0.465	0.98			
		055555-003	Antimony	0.443	U	0.443	0.935			
		055555-001	Arsenic	2.98		0.251	0.459	2.97	0.03	0.89%
		055555-002	Arsenic	2.99		0.269	0.49			
		055555-003	Arsenic	2.94		0.256	0.467			
		055555-001	Barium	119	B	0.0272	0.459	113	8	7.02%
		055555-002	Barium	116	B	0.0291	0.49			
		055555-003	Barium	104	B	0.0277	0.467			
		055555-001	Beryllium	0.6		0.0141	0.459	0.6	0.0	4.95%
		055555-002	Beryllium	0.6		0.015	0.49			
		055555-003	Beryllium	0.55		0.0143	0.467			
		055555-001	Cadmium	0.124	J	0.0238	0.459	0.300	0.155	51.54%
		055555-002	Cadmium	0.414	J	0.0254	0.49			
		055555-003	Cadmium	0.362	J	0.0242	0.467			
		055555-001	Chromium	9.75		0.4	0.459	10.17	0.81	7.97%
		055555-002	Chromium	11.1		0.428	0.49			
		055555-003	Chromium	9.65		0.408	0.467			
		055555-001	Cobalt	8.91		0.0999	0.459	9.10	1.12	12.33%
		055555-002	Cobalt	10.3		0.107	0.49			
		055555-003	Cobalt	8.08		0.102	0.467			
		055555-001	Copper	16.6	B	0.0461	0.459	15.6	1.0	6.17%
		055555-002	Copper	15.4	B	0.0493	0.49			
		055555-003	Copper	14.7	B	0.047	0.467			
		055555-001	Iron	21700		18	22.9	23867	2201	9.22%
		055555-002	Iron	26100	B	19.2	24.5			
		055555-003	Iron	23800	B	18.3	23.4			
		055555-001	Lead	16.7		0.312	0.459	16.0	0.6	3.98%
		055555-002	Lead	15.6		0.334	0.49			
		055555-003	Lead	15.6		0.318	0.467			

See notes at end of table.

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
Perimeter *(concluded)*	**64**	055555-001	Magnesium	7140	B	0.564	1.83	6990	304	4.35%
		055555-002	Magnesium	7190	B	0.603	1.96			
		055555-003	Magnesium	6640	B	0.575	1.87			
		055555-001	Manganese	638		0.219	4.59	624	22	3.48%
		055555-002	Manganese	635	B	0.235	4.9			
		055555-003	Manganese	599	B	0.224	4.67			
		055555-001	Mercury	0.0106	H	0.00409	0.00898	0.0118	0.0014	11.79%
		055555-002	Mercury	0.0114		0.00419	0.00922			
		055555-003	Mercury	0.0133		0.00413	0.00908			
		055555-001	Nickel	11.4		0.182	0.459	10.9	0.8	7.55%
		055555-002	Nickel	11.3		0.195	0.49			
		055555-003	Nickel	9.93		0.186	0.467			
		055555-001	Potassium	3760	B	7.94	45.9	3793	202	5.33%
		055555-002	Potassium	4010	B	8.49	49			
		055555-003	Potassium	3610	B	8.09	46.7			
		055555-001	Selenium	1.52		0.248	0.459	1.114	0.352	31.58%
		055555-002	Selenium	0.899	B	0.265	0.49			
		055555-003	Selenium	0.923	B	0.253	0.467			
		055555-001	Silver	0.106	U	0.106	0.459	0.109	0.004	3.31%
		055555-002	Silver	0.113	U	0.113	0.49			
		055555-003	Silver	0.108	U	0.108	0.467			
		055555-001	Thallium	0.866	U	0.866	0.917	3.30	2.11	63.98%
		055555-002	Thallium	4.63	U	4.63	4.9			
		055555-003	Thallium	4.41	U	4.41	4.67			
		055555-001	Vanadium	35.1		0.109	0.459	38.8	3.9	10.11%
		055555-002	Vanadium	42.9		0.116	0.49			
		055555-003	Vanadium	38.3		0.111	0.467			
		055555-001	Zinc	77.9	B	0.239	0.459	77.6	3.9	4.97%
		055555-002	Zinc	81.3	B	0.255	0.49			
		055555-003	Zinc	73.6	B	0.243	0.467			

See notes at end of table.

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil (*continued*)
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result	Decision Level	Detection Limit	Average	Std Dev	CV
On-Site	**20**	055569-001	Aluminum	7670	2.14	5	7700	52	0.67%
		055569-002	Aluminum	7670	2.12	4.95			
		055569-003	Aluminum	7760	1.99	4.63			
		055569-001	Antimony	0.474 U	0.474	1	0.5	0.0	4.11%
		055569-002	Antimony	0.469 U	0.469	0.99			
		055569-003	Antimony	0.439 U	0.439	0.926			
		055569-001	Arsenic	2.73	0.274	0.5	2.88	0.14	4.90%
		055569-002	Arsenic	3.01	0.271	0.495			
		055569-003	Arsenic	2.9	0.254	0.463			
		055569-001	Barium	103 B	0.0297	0.5	97.6	4.9	5.00%
		055569-002	Barium	93.5 B	0.0294	0.495			
		055569-003	Barium	96.3 B	0.0275	0.463			
		055569-001	Beryllium	0.413 J	0.0153	0.5	0.409	0.012	2.96%
		055569-002	Beryllium	0.395 J	0.0152	0.495			
		055569-003	Beryllium	0.418 J	0.0142	0.463			
		055569-001	Cadmium	2.03	0.0259	0.5	2.03	0.49	24.14%
		055569-002	Cadmium	2.52	0.0257	0.495			
		055569-003	Cadmium	1.54	0.024	0.463			
		055569-001	Chromium	11.7	0.436	0.5	11.6	0.4	3.60%
		055569-002	Chromium	11.9	0.432	0.495			
		055569-003	Chromium	11.1	0.404	0.463			
		055569-001	Cobalt	4.83	0.109	0.5	4.76	0.06	1.34%
		055569-002	Cobalt	4.72	0.108	0.495			
		055569-003	Cobalt	4.72	0.101	0.463			
		055569-001	Copper	11.3 B	0.0503	0.5	11	0.3	2.41%
		055569-002	Copper	10.9 B	0.0498	0.495			
		055569-003	Copper	10.8 B	0.0465	0.463			
		055569-001	Iron	14100	3.91	5	14200	265	1.86%
		055569-002	Iron	14000	3.88	4.95			
		055569-003	Iron	14500	3.62	4.63			
		055569-001	Lead	74	0.341	0.5	47.9	22.8	47.60%
		055569-002	Lead	31.6	0.337	0.495			
		055569-003	Lead	38.2	0.315	0.463			

See notes at end of table.

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site *(concluded)*	**20**	055569-001	Magnesium	3430	B	0.615	2	3350	98	2.94%
		055569-002	Magnesium	3240	B	0.609	1.98			
		055569-003	Magnesium	3380	B	0.57	1.85			
		055569-001	Manganese	251		0.0479	1	246	4	1.69%
		055569-002	Manganese	243		0.0474	0.99			
		055569-003	Manganese	245		0.0443	0.926			
		055569-001	Mercury	0.00798	J	0.00399	0.00877	0.0076	0.0006	7.39%
		055569-002	Mercury	0.00775	J	0.00418	0.00919			
		055569-003	Mercury	0.00692	J	0.00412	0.00905			
		055569-001	Nickel	10.4		0.199	0.5	10.2	0.3	3.22%
		055569-002	Nickel	9.83		0.197	0.495			
		055569-003	Nickel	10.4		0.184	0.463			
		055569-001	Potassium	2260	B	8.66	50	2197	65	2.96%
		055569-002	Potassium	2200	B	8.57	49.5			
		055569-003	Potassium	2130	B	8.01	46.3			
		055569-001	Selenium	0.963		0.27	0.5	1.02	0.06	5.79%
		055569-002	Selenium	1.01		0.268	0.495			
		055569-003	Selenium	1.08		0.25	0.463			
		055569-001	Silver	0.185	J	0.116	0.5	0.135	0.043	31.89%
		055569-002	Silver	0.114	U	0.114	0.495			
		055569-003	Silver	0.107	U	0.107	0.463			
		055569-001	Thallium	0.944	U	0.944	1	0.918	0.038	4.15%
		055569-002	Thallium	0.935	U	0.935	0.99			
		055569-003	Thallium	0.874	U	0.874	0.926			
		055569-001	Vanadium	24		0.119	0.5	24.3	0.8	3.43%
		055569-002	Vanadium	23.6		0.118	0.495			
		055569-003	Vanadium	25.2		0.11	0.463			
		055569-001	Zinc	37.2	B	0.26	0.5	35.4	1.6	4.49%
		055569-002	Zinc	34.4	B	0.258	0.495			
		055569-003	Zinc	34.5	B	0.241	0.463			

See notes at end of table.

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site	**33**	055544-001	Aluminum	11300		2.14	5	11600	889	7.66%
		055544-002	Aluminum	12600		2.14	5			
		055544-003	Aluminum	10900		2.12	4.95			
		055544-001	Antimony	0.538	J	0.474	1	0.494	0.038	7.79%
		055544-002	Antimony	0.474	U	0.474	1			
		055544-003	Antimony	0.469	U	0.469	0.99			
		055544-001	Arsenic	6.89		0.274	0.5	7.38	0.98	13.25%
		055544-002	Arsenic	8.51		0.274	0.5			
		055544-003	Arsenic	6.75		0.271	0.495			
		055544-001	Barium	117	B	0.0297	0.5	123	9	6.90%
		055544-002	Barium	133	B	0.0297	0.5			
		055544-003	Barium	120	B	0.0294	0.495			
		055544-001	Beryllium	1.34		0.0153	0.5	1.32	0.07	5.17%
		055544-002	Beryllium	1.37		0.0153	0.5			
		055544-003	Beryllium	1.24		0.0152	0.495			
		055544-001	Cadmium	0.654		0.0259	0.5	0.616	0.033	5.42%
		055544-002	Cadmium	0.593		0.0259	0.5			
		055544-003	Cadmium	0.6		0.0257	0.495			
		055544-001	Chromium	13.7		0.436	0.5	13.7	0.6	4.03%
		055544-002	Chromium	14.2		0.436	0.5			
		055544-003	Chromium	13.1		0.432	0.495			
		055544-001	Cobalt	5.68		0.109	0.5	5.71	0.12	2.16%
		055544-002	Cobalt	5.85		0.109	0.5			
		055544-003	Cobalt	5.61		0.108	0.495			
		055544-001	Copper	11.2	B	0.0503	0.5	12.6	1.5	11.53%
		055544-002	Copper	14.1	B	0.0503	0.5			
		055544-003	Copper	12.5	B	0.0498	0.495			
		055544-001	Iron	12800	B	3.91	5	13100	520	3.97%
		055544-002	Iron	13700	B	3.91	5			
		055544-003	Iron	12800	B	3.88	4.95			

See notes at end of table.

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site *(continued)*	**33**	055544-001	Lead	15.6		0.341	0.5	15.7	0.3	1.69%
		055544-002	Lead	16		0.341	0.5			
		055544-003	Lead	15.5		0.337	0.495			
		055544-001	Magnesium	4420	B	0.615	2	4530	157	3.47%
		055544-002	Magnesium	4710	B	0.615	2			
		055544-003	Magnesium	4460	B	0.609	1.98			
		055544-001	Manganese	368	B	0.0479	1	353	13	3.78%
		055544-002	Manganese	346	B	0.0479	1			
		055544-003	Manganese	344	B	0.0474	0.99			
		055544-001	Mercury	0.0167		0.0044	0.00966	0.0181	0.0013	7.22%
		055544-002	Mercury	0.0193		0.00425	0.00935			
		055544-003	Mercury	0.0182		0.00433	0.00952			
		055544-001	Nickel	12.7		0.199	0.5	12.7	0.4	2.76%
		055544-002	Nickel	13.1		0.199	0.5			
		055544-003	Nickel	12.4		0.197	0.495			
		055544-001	Potassium	3360	B	8.66	50	3483	164	4.72%
		055544-002	Potassium	3670	B	8.66	50			
		055544-003	Potassium	3420	B	8.57	49.5			
		055544-001	Selenium	0.866	B	0.27	0.5	0.639	0.199	31.16%
		055544-002	Selenium	0.557	B	0.27	0.5			
		055544-003	Selenium	0.494	BJ	0.268	0.495			
		055544-001	Silver	0.116	U	0.116	0.5	0.115	0.001	1.00%
		055544-002	Silver	0.116	U	0.116	0.5			
		055544-003	Silver	0.114	U	0.114	0.495			
		055544-001	Thallium	0.944	U	0.944	1	0.941	0.005	0.55%
		055544-002	Thallium	0.944	U	0.944	1			
		055544-003	Thallium	0.935	U	0.935	0.99			

See notes at end of table.

TABLE E-16. Non-radiological Replicate Results for Calendar Year 2001, Soil *(concluded)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site *(concluded)*	**33**	055544-001	Vanadium	26.5		0.119	0.5	26.6	1.6	6.03%
		055544-002	Vanadium	28.2		0.119	0.5			
		055544-003	Vanadium	25		0.118	0.495			
		055544-001	Zinc	82.3	B	0.26	0.5	81.8	0.4	0.51%
		055544-002	Zinc	81.7	B	0.26	0.5			
		055544-003	Zinc	81.5	B	0.258	0.495			

NOTES: B = The analyte was found in the blank above the effective decision level (organics), or the effective detection limit (inorganics).
J = Estimated value, the analyte concentration fell above the effective decision level and below the effective detection limit.
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.
CV = coefficient of variation
Std Dev = standard deviation

TABLE E-17. Non-radiological Replicate Results for Calendar Year 2001, Sediment
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
Community	**11**	055598-001	Aluminum	3520		2.14	5	3757	601	16.00%
		055598-002	Aluminum	3310		2.14	5			
		055598-003	Aluminum	4440		1.99	4.63			
		055598-001	Antimony	0.474	U	0.474	1	0.462	0.020	4.37%
		055598-002	Antimony	0.474	U	0.474	1			
		055598-003	Antimony	0.439	U	0.439	0.926			
		055598-001	Arsenic	1.56		0.274	0.5	1.68	0.32	19.20%
		055598-002	Arsenic	1.44		0.274	0.5			
		055598-003	Arsenic	2.05		0.254	0.463			
		055598-001	Barium	105		0.0297	0.5	114.8	26.7	23.25%
		055598-002	Barium	94.4		0.0297	0.5			
		055598-003	Barium	145		0.0275	0.463			
		055598-001	Beryllium	0.212	J	0.0153	0.5	0.233	0.040	17.28%
		055598-002	Beryllium	0.207	J	0.0153	0.5			
		055598-003	Beryllium	0.279	J	0.0142	0.463			
		055598-001	Cadmium	0.0943	J	0.0259	0.5	0.126	0.045	35.68%
		055598-002	Cadmium	0.107	J	0.0259	0.5			
		055598-003	Cadmium	0.178	J	0.024	0.463			
		055598-001	Chromium	4.51		0.436	0.5	4.97	1.09	21.95%
		055598-002	Chromium	4.19		0.436	0.5			
		055598-003	Chromium	6.22		0.404	0.463			
		055598-001	Cobalt	2.09		0.109	0.5	2.26	0.35	15.56%
		055598-002	Cobalt	2.02		0.109	0.5			
		055598-003	Cobalt	2.66		0.101	0.463			
		055598-001	Copper	4.15	B	0.0503	0.5	4.45	0.72	16.24%
		055598-002	Copper	3.92	B	0.0503	0.5			
		055598-003	Copper	5.27	B	0.0465	0.463			
		055598-001	Iron	5950		3.91	5	6420	1103	17.18%
		055598-002	Iron	5630		3.91	5			
		055598-003	Iron	7680		3.62	4.63			
		055598-001	Lead	4.18		0.341	0.5	4.71	0.57	12.19%
		055598-002	Lead	4.63		0.341	0.5			
		055598-003	Lead	5.32		0.315	0.463			

See notes at end of table.

TABLE E-17. Non-radiological Replicate Results for Calendar Year 2001, Sediment *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
Community *(concluded)*	**11**	055598-001	Magnesium	1830	B	0.615	2	2027	394	19.43%
		055598-002	Magnesium	1770	B	0.615	2			
		055598-003	Magnesium	2480	B	0.57	1.85			
		055598-001	Manganese	139		0.0479	1	144	21	14.89%
		055598-002	Manganese	125		0.0479	1			
		055598-003	Manganese	167		0.0443	0.926			
		055598-001	Mercury	0.00407	U	0.00407	0.00896	0.0040	0.0001	1.81%
		055598-002	Mercury	0.00397	U	0.00397	0.00872			
		055598-003	Mercury	0.00393	U	0.00393	0.00863			
		055598-001	Nickel	3.79		0.199	0.5	4.22	0.78	18.39%
		055598-002	Nickel	3.76		0.199	0.5			
		055598-003	Nickel	5.12		0.184	0.463			
		055598-001	Potassium	735	B	1.73	10	776.7	106.8	13.75%
		055598-002	Potassium	697	B	1.73	10			
		055598-003	Potassium	898	B	1.6	9.26			
		055598-001	Selenium	0.27	U	0.27	0.5	0.431	0.193	44.72%
		055598-002	Selenium	0.379	J	0.27	0.5			
		055598-003	Selenium	0.645		0.25	0.463			
		055598-001	Silver	0.116	U	0.116	0.5	0.113	0.005	4.60%
		055598-002	Silver	0.116	U	0.116	0.5			
		055598-003	Silver	0.107	U	0.107	0.463			
		055598-001	Thallium	0.944	U	0.944	1	0.921	0.040	4.39%
		055598-002	Thallium	0.944	U	0.944	1			
		055598-003	Thallium	0.874	U	0.874	0.926			
		055598-001	Vanadium	13.2		0.119	0.5	14.0	2.5	18.17%
		055598-002	Vanadium	11.9		0.119	0.5			
		055598-003	Vanadium	16.8		0.11	0.463			
		055598-001	Zinc	17.5	B	0.26	0.5	19.0	3.2	16.76%
		055598-002	Zinc	16.9	B	0.26	0.5			
		055598-003	Zinc	22.7	B	0.241	0.463			

See notes at end of table.

TABLE E-17. Non-radiological Replicate Results for Calendar Year 2001, Sediment *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site	**74**	055508-001	Aluminum	5520		1.95	4.55	5123	346	6.76%
		055508-002	Aluminum	4970		2.04	4.76			
		055508-003	Aluminum	4880		2	4.67			
		055508-001	Antimony	0.431	U	0.431	0.909	0.442	0.010	2.28%
		055508-002	Antimony	0.451	U	0.451	0.952			
		055508-003	Antimony	0.443	U	0.443	0.935			
		055508-001	Arsenic	1.82		0.249	0.455	2.12	0.27	12.58%
		055508-002	Arsenic	2.33		0.261	0.476			
		055508-003	Arsenic	2.21		0.256	0.467			
		055508-001	Barium	82.5	B	0.027	0.455	76.9	10.0	12.95%
		055508-002	Barium	65.4	B	0.0283	0.476			
		055508-003	Barium	82.8	B	0.0277	0.467			
		055508-001	Beryllium	0.334	J	0.0139	0.455	0.314	0.018	5.84%
		055508-002	Beryllium	0.31	J	0.0146	0.476			
		055508-003	Beryllium	0.298	J	0.0143	0.467			
		055508-001	Cadmium	0.376	J	0.0236	0.455	0.216	0.144	66.66%
		055508-002	Cadmium	0.177	J	0.0247	0.476			
		055508-003	Cadmium	0.0958	J	0.0242	0.467			
		055508-001	Chromium	6.63		0.396	0.455	7.94	1.47	18.52%
		055508-002	Chromium	9.53		0.415	0.476			
		055508-003	Chromium	7.66		0.408	0.467			
		055508-001	Cobalt	4.65		0.099	0.455	5.92	1.22	20.59%
		055508-002	Cobalt	7.08		0.104	0.476			
		055508-003	Cobalt	6.03		0.102	0.467			
		055508-001	Copper	6.86	B	0.0457	0.455	7.81	1.00	12.78%
		055508-002	Copper	8.85	B	0.0479	0.476			
		055508-003	Copper	7.72	B	0.047	0.467			
		055508-001	Iron	12300		3.56	4.55	17500	4927	28.16%
		055508-002	Iron	22100		18.6	23.8			
		055508-003	Iron	18100		3.66	4.67			
		055508-001	Lead	5.2		0.31	0.455	5.26	0.09	1.66%
		055508-002	Lead	5.36		0.324	0.476			
		055508-003	Lead	5.22		0.318	0.467			

See notes at end of table.

TABLE E-17. Non-radiological Replicate Results for Calendar Year 2001, Sediment *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site *(continued)*	**74**	055508-001	Magnesium	3160	B	0.559	1.82	3113	45	1.45%
		055508-002	Magnesium	3070	B	0.586	1.9			
		055508-003	Magnesium	3110	B	0.575	1.87			
		055508-001	Manganese	238		0.0435	0.909	238	8	3.36%
		055508-002	Manganese	246		0.0456	0.952			
		055508-003	Manganese	230		0.0447	0.935			
		055508-001	Mercury	0.00395	U	0.00395	0.00868	0.0042	0.0002	5.57%
		055508-002	Mercury	0.0044	U	0.0044	0.00968			
		055508-003	Mercury	0.00429	U	0.00429	0.00942			
		055508-001	Nickel	5.82		0.181	0.455	6.48	0.67	10.26%
		055508-002	Nickel	7.15		0.189	0.476			
		055508-003	Nickel	6.48		0.186	0.467			
		055508-001	Potassium	1750	B	7.87	45.5	1587	142	8.96%
		055508-002	Potassium	1490	B	8.24	47.6			
		055508-003	Potassium	1520	B	8.09	46.7			
		055508-001	Selenium	0.246	U	0.246	0.455	0.81	0.49	60.41%
		055508-002	Selenium	1.13		0.257	0.476			
		055508-003	Selenium	1.04		0.253	0.467			
		055508-001	Silver	0.105	U	0.105	0.455	0.108	0.003	2.34%
		055508-002	Silver	0.11	U	0.11	0.476			
		055508-003	Silver	0.108	U	0.108	0.467			
		055508-001	Thallium	0.858	U	0.858	0.909	0.880	0.021	2.35%
		055508-002	Thallium	0.899	U	0.899	0.952			
		055508-003	Thallium	0.883	U	0.883	0.935			

See notes at end of table.

TABLE E-17. Non-radiological Replicate Results for Calendar Year 2001, Sediment *(concluded)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site *(concluded)*	**74**	055508-001	Vanadium	27.2		0.108	0.455	34.3	8.3	24.09%
		055508-002	Vanadium	43.4		0.113	0.476			
		055508-003	Vanadium	32.4		0.111	0.467			
		055508-001	Zinc	32.7	B	0.237	0.455	31.0	1.7	5.32%
		055508-002	Zinc	31	B	0.248	0.476			
		055508-003	Zinc	29.4	B	0.243	0.467			

NOTES: B = The analyte was found in the blank above the effective decision level (organics), or the effective detection limit (inorganics).
J = Estimated value, the analyte concentration fell above the effective decision level and below the effective detection limit.
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.
CV = coefficient of variation
Std Dev = standard deviation

TABLE E-18. Non-radiological Replicate Results for Calendar Year 2001, Vegetation
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
Community	**11**	055597-001	Aluminum	94.8		1.95	4.55	49.0	40.1	81.85%
		055597-002	Aluminum	20.5		1.99	4.63			
		055597-003	Aluminum	31.6		2.06	4.81			
		055597-001	Antimony	0.431	U	0.431	0.909	0.442	0.013	2.89%
		055597-002	Antimony	0.439	U	0.439	0.926			
		055597-003	Antimony	0.456	U	0.456	0.962			
		055597-001	Arsenic	0.264	J	0.249	0.455	0.260	0.006	2.12%
		055597-002	Arsenic	0.254	U	0.254	0.463			
		055597-003	Arsenic	0.263	U	0.263	0.481			
		055597-001	Barium	2.37	B	0.027	0.455	1.74	0.79	45.18%
		055597-002	Barium	1.99	B	0.0275	0.463			
		055597-003	Barium	0.859	B	0.0285	0.481			
		055597-001	Beryllium	0.0139	U	0.0139	0.455	0.0143	0.0004	2.83%
		055597-002	Beryllium	0.0142	U	0.0142	0.463			
		055597-003	Beryllium	0.0147	U	0.0147	0.481			
		055597-001	Cadmium	0.18	BJ	0.0236	0.455	0.099	0.072	72.73%
		055597-002	Cadmium	0.0443	BJ	0.024	0.463			
		055597-003	Cadmium	0.0717	BJ	0.0249	0.481			
		055597-001	Chromium	0.396	U	0.396	0.455	0.406	0.012	2.87%
		055597-002	Chromium	0.404	U	0.404	0.463			
		055597-003	Chromium	0.419	U	0.419	0.481			
		055597-001	Cobalt	0.099	U	0.099	0.455	0.102	0.003	3.00%
		055597-002	Cobalt	0.101	U	0.101	0.463			
		055597-003	Cobalt	0.105	U	0.105	0.481			
		055597-001	Copper	1.58	B	0.0457	0.455	1.39	0.23	16.84%
		055597-002	Copper	1.47	B	0.0465	0.463			
		055597-003	Copper	1.13	B	0.0483	0.481			
		055597-001	Iron	153		3.56	4.55	77.4	65.7	84.87%
		055597-002	Iron	34.3		3.62	4.63			
		055597-003	Iron	44.9		3.76	4.81			

See notes at end of table.

TABLE E-18. Non-radiological Replicate Results for Calendar Year 2001, Vegetation *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
Community *(concluded)*	**11**	055597-001	Lead	0.31	U	0.31	0.455	0.317	0.009	2.75%
		055597-002	Lead	0.315	U	0.315	0.463			
		055597-003	Lead	0.327	U	0.327	0.481			
		055597-001	Magnesium	1480	B	0.559	1.82	1500	221	14.71%
		055597-002	Magnesium	1730	B	0.57	1.85			
		055597-003	Magnesium	1290	B	0.592	1.92			
		055597-001	Manganese	41.4		0.0435	0.909	32.6	8.4	25.64%
		055597-002	Manganese	24.8		0.0443	0.926			
		055597-003	Manganese	31.5		0.046	0.962			
		055597-001	Mercury	0.00416	U	0.00416	0.00913	0.0040	0.0005	12.03%
		055597-002	Mercury	0.00433	U	0.00433	0.00951			
		055597-003	Mercury	0.00343	U	0.00343	0.00755			
		055597-001	Nickel	0.446	J	0.181	0.455	0.274	0.149	54.55%
		055597-002	Nickel	0.184	U	0.184	0.463			
		055597-003	Nickel	0.191	U	0.191	0.481			
		055597-001	Potassium	6620	B	15.7	90.9	5827	1140	19.57%
		055597-002	Potassium	4520	B	16	92.6			
		055597-003	Potassium	6340	B	16.6	96.2			
		055597-001	Selenium	0.259	J	0.246	0.455	0.26	0.01	2.15%
		055597-002	Selenium	0.25	U	0.25	0.463			
		055597-003	Selenium	0.26	U	0.26	0.481			
		055597-001	Silver	0.105	BU	0.105	0.455	0.108	0.003	2.84%
		055597-002	Silver	0.107	BU	0.107	0.463			
		055597-003	Silver	0.111	BU	0.111	0.481			
		055597-001	Thallium	0.891	U	0.891	0.943	0.886	0.025	2.87%
		055597-002	Thallium	0.858	U	0.858	0.909			
		055597-003	Thallium	0.908	U	0.908	0.962			
		055597-001	Vanadium	0.237	J	0.108	0.455	0.154	0.072	46.98%
		055597-002	Vanadium	0.11	U	0.11	0.463			
		055597-003	Vanadium	0.114	U	0.114	0.481			
		055597-001	Zinc	10.9	B	0.237	0.455	9.7	1.4	14.78%
		055597-002	Zinc	10.2	B	0.241	0.463			
		055597-003	Zinc	8.13	B	0.25	0.481			

See notes at end of table.

TABLE E-18. Non-radiological Replicate Results for Calendar Year 2001, Vegetation *(continued)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site	**33**	055546-001	Aluminum	27.2		2.06	4.81	49.5	30.7	62.08%
		055546-002	Aluminum	36.7		2.02	4.72			
		055546-003	Aluminum	84.5		2.08	4.85			
		055546-001	Antimony	0.456	U	0.456	0.962	0.454	0.007	1.47%
		055546-002	Antimony	0.447	U	0.447	0.943			
		055546-003	Antimony	0.46	U	0.46	0.971			
		055546-001	Arsenic	0.459	J	0.263	0.481	0.398	0.081	20.37%
		055546-002	Arsenic	0.306	J	0.258	0.472			
		055546-003	Arsenic	0.429	J	0.266	0.485			
		055546-001	Barium	3.05	B	0.0285	0.481	3.06	1.54	50.38%
		055546-002	Barium	1.52	B	0.028	0.472			
		055546-003	Barium	4.6	B	0.0288	0.485			
		055546-001	Beryllium	0.0147	U	0.0147	0.481	0.0147	0.0002	1.36%
		055546-002	Beryllium	0.0145	U	0.0145	0.472			
		055546-003	Beryllium	0.0149	U	0.0149	0.485			
		055546-001	Cadmium	0.0936	J	0.0249	0.481	0.0667	0.0370	55.47%
		055546-002	Cadmium	0.0245	U	0.0245	0.472			
		055546-003	Cadmium	0.0819	J	0.0252	0.485			
		055546-001	Chromium	0.419	U	0.419	0.481	0.418	0.006	1.46%
		055546-002	Chromium	0.411	U	0.411	0.472			
		055546-003	Chromium	0.423	U	0.423	0.485			
		055546-001	Cobalt	0.105	U	0.105	0.481	0.105	0.002	1.46%
		055546-002	Cobalt	0.103	U	0.103	0.472			
		055546-003	Cobalt	0.106	U	0.106	0.485			
		055546-001	Copper	0.934	B	0.0483	0.481	1.18	0.37	31.15%
		055546-002	Copper	1	B	0.0474	0.472			
		055546-003	Copper	1.6	B	0.0488	0.485			
		055546-001	Iron	35.8		3.76	4.81	63.7	39.6	62.07%
		055546-002	Iron	46.4		3.69	4.72			
		055546-003	Iron	109		3.8	4.85			
		055546-001	Lead	0.327	U	0.327	0.481	0.416	0.150	36.12%
		055546-002	Lead	0.589		0.321	0.472			
		055546-003	Lead	0.331	U	0.331	0.485			

See notes at end of table.

TABLE E-18. Non-radiological Replicate Results for Calendar Year 2001, Vegetation *(concluded)*
(All units in milligrams per kilogram [mg/kg] unless otherwise specified.)

Location Type	Location	Sample ID	Analyte	Result		Decision Level	Detection Limit	Average	Std Dev	CV
On-Site *(concluded)*	**33**	055546-001	Magnesium	680	B	0.592	1.92	671	159	23.74%
		055546-002	Magnesium	507	B	0.58	1.89			
		055546-003	Magnesium	825	B	0.597	1.94			
		055546-001	Manganese	12.5		0.046	0.962	13.9	2.0	14.06%
		055546-002	Manganese	13		0.0451	0.943			
		055546-003	Manganese	16.1		0.0465	0.971			
		055546-001	Mercury	0.00414	HU	0.00414	0.0091	0.0040	0.0001	2.89%
		055546-002	Mercury	0.00391	HU	0.00391	0.00858			
		055546-003	Mercury	0.00406	HU	0.00406	0.00893			
		055546-001	Nickel	0.356	J	0.191	0.481	0.639	0.255	39.91%
		055546-002	Nickel	0.711		0.188	0.472			
		055546-003	Nickel	0.851		0.193	0.485			
		055546-001	Potassium	7480	B	16.6	96.2	6423	982	15.28%
		055546-002	Potassium	5540	B	16.3	94.3			
		055546-003	Potassium	6250	B	16.8	97.1			
		055546-001	Selenium	0.298	J	0.26	0.481	0.534	0.233	43.62%
		055546-002	Selenium	0.541		0.255	0.472			
		055546-003	Selenium	0.764		0.262	0.485			
		055546-001	Silver	0.111	U	0.111	0.481	0.111	0.002	1.38%
		055546-002	Silver	0.109	U	0.109	0.472			
		055546-003	Silver	0.112	U	0.112	0.485			
		055546-001	Thallium	0.908	U	0.908	0.962	0.905	0.013	1.46%
		055546-002	Thallium	0.891	U	0.891	0.943			
		055546-003	Thallium	0.917	U	0.917	0.971			
		055546-001	Vanadium	0.114	U	0.114	0.481	0.163	0.087	53.13%
		055546-002	Vanadium	0.112	U	0.112	0.472			
		055546-003	Vanadium	0.263	J	0.115	0.485			
		055546-001	Zinc	16.8	B	0.25	0.481	13.3	7.1	53.30%
		055546-002	Zinc	5.15	B	0.243	0.467			
		055546-003	Zinc	18	B	0.253	0.485			

NOTES: B = The analyte was found in the blank above the effective decision level (organics), or the effective detection limit (inorganics).
J = Estimated value, the analyte concentration fell above the effective decision level and below the effective detection limit.
H = Holding time exceeded.
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.
CV = coefficient of variation
Std Dev = standard deviation

TABLE E-19. Summary TLD Results for Calendar Year 2001, SNL/NM

Location Class	Units	Number of Locations	Total Exposure	Std Dev.	Minimum	Maximum	Number of Days
Community	mR	12	87.33	10.27	76.20	105.0	358
Perimeter*	mR	6	91.80	9.43	82.10	107.6	358
On-Site*	mR	13	90.96	4.14	83.90	97.3	358
Operational	mR	2	114.85	30.05	93.60	136.10	358

NOTES: *Results in 1st Quarter were low due to thermoluminescent dosimeter (TLD) being removed early and therefore showed less exposure. Values not indicative of regular exposure and were not included in summary statistics.
mR = Milliroentgen
Std Dev = standard deviation

TABLE E-20. TLD Measurements by Quarter and Location Class for Calendar Year, 2001

Location Class	Location Number	Units	1st Quarter (78 Days)		2nd Quarter (90 Days)		3rd Quarter (89 Days)		4th Quarter (101 Days)		Yearly (358 Days)	
			Exposure	Error	Exposure	Error	Exposure	Error	Exposure	Error	Exposure	Error
Community	10	mR	20.3	1.2	24.1	1.2	29	0.9	31.1	2.6	104.5	3.2
	11	mR	19.3	1.6	16.5	1.6	18.8	1.4	22.1	1.3	76.7	3.0
	21	mR	21.1	1.1	18.9	1.1	21.8	0.9	26.4	2.4	88.2	3.0
	22	mR	18.6	1.1	18.4	1.1	19.5	0.8	23.9	2.8	80.4	3.3
	23	mR	19.4	1.1	18.9	1.1	21.1	0.9	23	1	82.4	2.1
	24	mR	17.7	1.8	17.3	1.8	19.5	1.7	21.7	2.3	76.2	3.8
	25	mR	17.6	0.9	18.3	0.9	20.9	0.6	24.4	3.3	81.2	3.6
	26	mR	23.3	1.1	24.6	1.1	27.6	0.9	29.5	2.2	105	2.8
	27	mR	20.6	1.3	22.3	1.3	22.8	1.1	24.7	2.5	90.4	3.3
	28	mR	18.9	1.3	18.8	1.3	21.2	1.1	22.4	1.8	81.3	2.8
	29	mR	19.6	0.9	18.8	0.9	20.6	0.6	23.6	2.9	82.6	3.2
	30	mR	22.6	1.6	22.6	1.6	25.9	1.5	28	2.7	99.1	3.8
Perimeter	4	mR	19.6	1.8	21.7	0.7	23.3	0.9	25.3	2.7	89.9	3.4
	5	mR	18.6	1.1	19.8	2.1	21.3	0.7	22.4	2.6	82.1	3.6
	16	mR	22.5	2.3	26.5	1.6	27.5	0.6	31.1	2.5	107.6	3.8
	18	mR	19.7	2	21.8	2.3	22.6	1	24.1	3.1	88.2	4.5
	19	mR	20.7	1.1	23.8	2	25.9	0.9	27.6	2.5	98	3.5
	39	mR	3.5*	1.3	21.5	1.9	23.1	1.4	25	2	73.1	3.4
	40	mR	18	1.7	20.7	1.5	21.8	0.6	24.5	2.5	85	3.4

See notes at end of table.

TABLE E-20. TLD Measurements by Quarter and Location Class for Calendar Year, 2001 *(concluded)*

Location Class	Location Number	Units	1st Quarter (78 Days)		2nd Quarter (90 Days)		3rd Quarter (89 Days)		4th Quarter (101 Days)		Yearly (358 Days)	
			Exposure	Error	Exposure	Error	Exposure	Error	Exposure	Error	Exposure	Error
On-Site	1	mR	20.1	2	22.6	1.2	24.6	1	26.1	2.1	93.4	3.3
	2NW	mR	18.6	1	20.3	0.6	22.2	2.1	22.8	1.6	83.9	2.9
	3	mR	19	2	24.4	1.5	24	0.6	26.7	2.8	94.1	3.8
	6	mR	20	1.1	23.1	0.6	23.3	0.5	23.7	1.9	90.1	2.3
	7	mR	21.1	1.5	24.3	1.4	24.7	0.8	27.2	3.9	97.3	4.5
	20	mR	4.1*	1.1	23.6	2.7	24.9	0.9	26.5	3.2	79.1	4.4
	31	mR	18	2.1	20.9	1.9	22.8	0.5	24.8	3.5	86.5	4.5
	41	mR	19.7	1.9	20.8	1.4	23.5	0.9	24.8	2.6	88.8	3.6
	42	mR	18.5	1	20.7	1.1	22.6	0.9	23.7	3.2	85.5	3.6
	43	mR	19.5	2.5	20.5	2.1	22.3	1	25.6	1	87.9	3.6
	46	mR	19.9	2	21.8	1.2	24.3	1.1	26.3	3	92.3	4.0
	47	mR	19.8	1.9	21.9	0.7	26.6	1.6	26.9	2.1	95.2	3.3
	48	mR	21	1	24.4	1	23.8	0.5	25.1	1.6	94.3	2.2
	66	mR	20.4	2.1	22.7	2.2	23.9	0.6	26.2	2.2	93.2	3.8
Operational	45	mR	28.2	1.9	30.7	1.3	34.8	0.8	42.4	1.9	136.1	3.1
	45E	mR	21.5	3.7	22.5	1.2	24.1	0.8	25.5	3	93.6	5.0

NOTES: *Results in 1st Quarter are low due to thermoluminescent dosimeter (TLD) being removed early and therefore showing less exposure. Values not indicative of regular exposure and were not included in summary statistics.
mR = Milliroentgen